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2001

Radioactive Effluent Release Report

SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION

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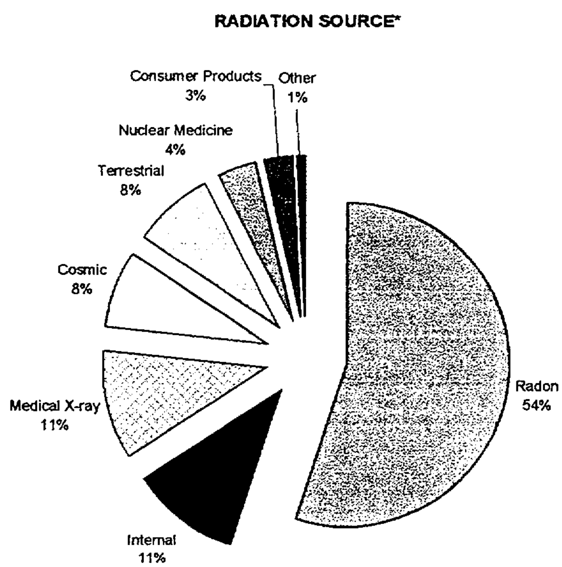
Report Summary

During 2001, as in all previous years, operation of the South Texas Project created no adverse effects or health risks. The maximum radiation exposure calculated for a hypothetical person living at the boundary of the South Texas Project during 2001 due to operation of the South Texas Project was less than one millirem. For reference, this dose may be compared to the average annual radiation exposure of 360 millirem to people in the United States from all sources. Natural radiation sources in the environment contribute most of the radiation exposure to people; nuclear power operations contribute less than one millirem.

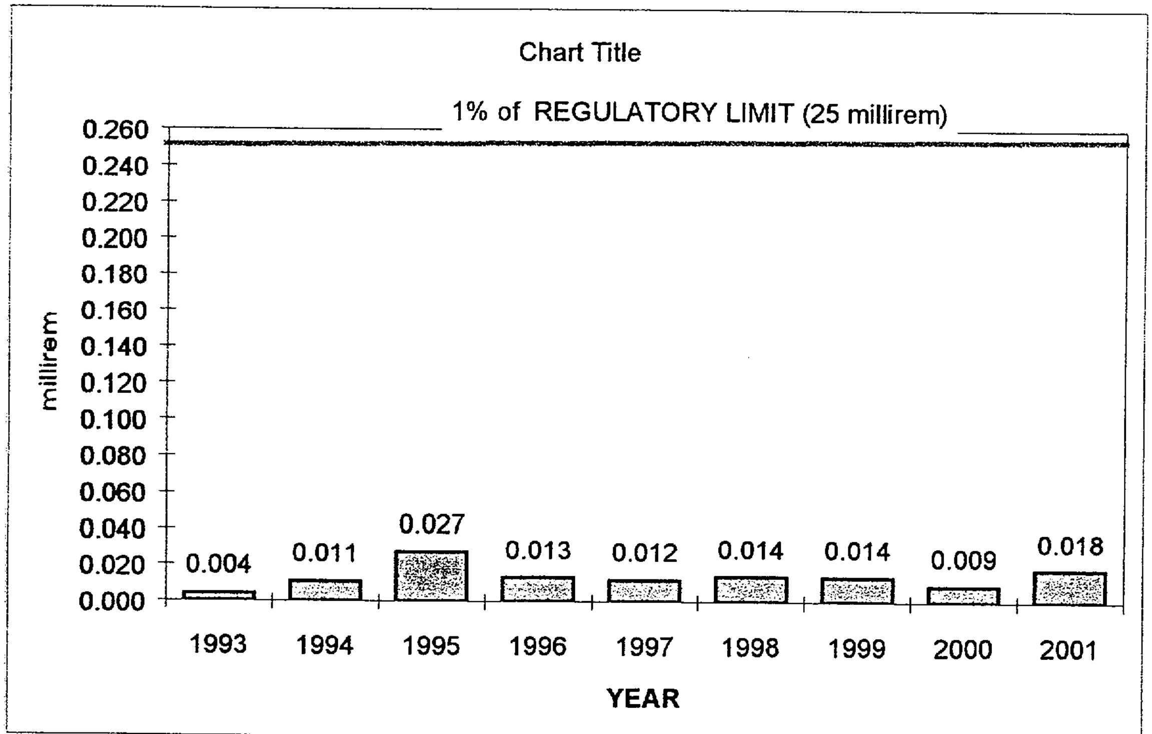


*NCRP (1987). National Council on Radiation Protection and Measurements, *Ionizing Radiation Exposure of the Population of the United States*, (Bethesda, Maryland), NCRP Report No. 93.

During 2001, the total body dose to the most exposed individual from radioactive effluents and direct radiation was 0.018 millirem. This total represents approximately 0.07% of the limits of 40 C.F.R. §190. This theoretical individual, an adult, resides in the South by South-West Sector, approximately 4,000 meters (2.5 miles) from the site. For dose calculating purposes, this theoretical individual is characterized as the most exposed with regard to food consumption, occupancy, and other uses of the areas in the plant vicinity. This theoretical individual is not a real person and the dose model assumes that this theoretical individual may consume the maximum amount of food with all the food being grown or grazed at the residence. This theoretical individual receives shoreline exposure from Little Robbins Slough for 12 hours per year and consumes 21 kilograms (48 pounds) of fish taken from Little Robbins Slough. This theoretical individual receives a submersion dose from noble gases and dose from inhaled radioactive particulates, radioiodines, and tritium. This adult consumes 64 kilograms (150 pounds) of vegetables grown at the residence and consumes 110 kilograms (250 pounds) of meat from livestock grazed at the residence.

Releases to the environment at the South Texas Project Electric Generating Station have historically been and continue to be well below regulatory limits as shown in the following table. Members of the public received negligible additional radiation due to the operation of the South Texas Project. This Radioactive Effluent Release Report summarizes the data describing the radioactive liquid and gaseous releases from the South Texas Project Electric Generating Station during 2001. The radioactive effluents from the South Texas Project are effectively monitored and controlled in accordance with regulatory requirements.

THEORETICAL TOTAL BODY DOSE FOR ALL PATHWAYS



Liquid and gaseous discharges from the South Texas Project are continuously monitored for radioactive content. Samples are also collected from ventilation systems and liquid discharges and analyzed for radioactivity. The sample and analysis methods are verified and augmented using an environmental laboratory. Radioactivity monitors continuously sample the ventilation exhaust systems. On the liquid discharge lines, radioactivity monitors automatically divert or isolate liquid effluents if the radioactivity is higher than expected. These monitors are also equipped with remote alarm indications in the control rooms and health physics offices.

The radiation monitors, and the sampling and analysis program, provide an accurate determination of the type and quantity of radioactive materials released in plant effluents. Liquid effluents are directed to the Main Cooling Reservoir that is located entirely within the site boundary. The South Texas Project continues to aggressively pursue the reduction of radioactive material in liquid effluents consistent with prudent industry practices.

Each year, the effluent monitoring results are summarized in this report and a hypothetical radiation dose to the population in the surrounding area is calculated based on gaseous radioactive effluents, meteorological conditions and liquid radioactive effluents. The hypothetical dose assumes all credible paths for radioactivity to reach a member of the public, such as consumption of vegetables from a garden, fish from the river, inhalation, and direct exposure. The highest potential hypothetical dose to an individual at the site boundary was calculated to be less than 1 millirem which is significantly less than an average person receives from natural sources annually. The information presented in this report demonstrates that plant operation is consistently controlled to ensure that radioactive effluents remain below regulatory limits and to ensure protection of the public and the environment.

INTRODUCTION

This Radioactive Effluent Release Report is submitted for the period January 1, 2001, through December 31, 2001, in accordance with Appendix A of License Nos. NPF-76 and NPF-80, Technical Specifications and the Offsite Dose Calculation Manual.

A single submittal is made for both units combining those sections that are common. Separate tables of releases and release totals are included where separate processing systems exist.

This report includes an annual summary of hourly meteorological measurements taken during each quarter. This data appears as tables of wind direction and wind speed by atmospheric stability class. All assessments of radiation doses are performed in accordance with the Offsite Dose Calculation Manual.

Minimal quantities of radioactivity were released during 2001. Liquid effluents are discharged to the on-site Main Cooling Reservoir and subsequently released offsite. The radioactivity released in liquids beyond the site boundary was estimated using the South Texas Project Electric Generating Station Offsite Dose Calculation Manual. Solid radioactive waste is shipped offsite for disposal. The following table is a brief summary of the radioactive effluents and solid waste attributable to the station.

TYPE OF RADIOACTIVE MATERIAL	EFFLUENT TYPE	DESTINATION	VOLUME CUBIC METER	CURIES
NOBLE GAS	GAS	OFFSITE	6.0E+09	6.4E+2
PARTICULATE AND IODINES	GAS	OFFSITE	6.0E+09	1.3E-02
TRITIUM	GAS	OFFSITE	6.0E+09	1.1E+02
TRITIUM	LIQUID	OFFSITE	4.8E+06	2.7E+02
FISSION AND ACTIVATION PRODUCTS	LIQUID	OFFSITE	4.8E+06	1.0E-03
TRITIUM	LIQUID	ON-SITE	4.5E+04	2.1E+03
FISSION AND ACTIVATION PRODUCTS[(1)]	LIQUID	ON-SITE	4.5E+04	1.5E-01
SPENT RESINS AND FILTERS	SOLID	FOR BURIAL	3.3E+01	4.9E+02
DRY COMPRESSIBLE WASTE	SOLID	FOR BURIAL	2.1E+01	9.6E-01
OTHER WASTE (SECONDARY RESIN, CHARCOAL, AND FILTER CAKE)	SOLID	FOR BURIAL	0.0E+00	0.0E+00

[(1)]Excludes 3.1 curies of dissolved and entrained gases.

Tritium was the largest contributor to the offsite doses from radioactive effluents both liquid and gaseous. The offsite doses are well below any regulatory limit and significantly less than the average annual radiation exposure to people in the United States from all sources (360 millirem).

Supplemental Information for Effluent and Waste Disposal

Supplemental Information for Effluent and Waste Disposal

The South Texas Project Electric Generating Station is located on 49,800,000 square meters (12,300 acres) in Matagorda County, Texas, approximately 24,000 meters (15 miles) southwest of Bay City along the west bank of the Colorado River. The South Texas Project is jointly owned by Reliant Energy HL&P, Central Power & Light Company, the City of Austin, and the City of San Antonio. Until late 1997, Reliant Energy HL&P was the designated licensee for the owners. On November 14, 1997, the station owners changed the licensee to STP Nuclear Operating Company which is responsible for implementation of the Radioactive Effluent Control Program.

The South Texas Project Electric Generating Station consists of two 1,250 megawatt-electric Westinghouse pressurized water reactors. Unit 1 received a low-power testing license on August 21, 1987, obtained initial criticality on March 8, 1988, and was declared commercially operational on August 25, 1988. Unit 2 received a low-power testing license on December 16, 1988, obtained initial criticality on March 12, 1989, and was declared commercially operational on June 19, 1989. Both units together produce enough electricity to serve over one million homes.

Regulatory Limits

Fission and Activation Gases

The **air dose** due to noble gases released in gaseous effluents from each unit to areas at and beyond the Site Boundary shall be limited to the following:

During any calendar quarter: Less than or equal to 5 millirads for gamma radiation and less than or equal to 10 millirads for beta radiation, and

During any calendar year: Less than or equal to 10 millirads for gamma radiation and less than or equal to 20 millirads for beta radiation.

Iodines and Particulates, Half-Lives > 8 days

The **dose** to a Member of the Public from Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than eight days in gaseous effluents released, from each unit, to areas at and beyond the Site Boundary shall be limited to the following:

During any calendar quarter: Less than or equal to 7.5 millirems to any organ; and

During any calendar year: Less than or equal to 15 millirems to any organ.

Liquid Effluents

The **dose or dose commitment** to a Member of the Public from radioactive materials in liquid effluents released from each unit to Unrestricted Areas shall be limited to:

During any calendar quarter: Less than or equal to 1.5 millirems to the whole body and to less than or equal to 5 millirems to any organ; and

During any calendar year: Less than or equal to 3 millirems to the whole body and to less than or equal to 10 millirems to any organ.

Effluent Concentrations Limits

Gaseous Effluents

The **dose rate** due to radioactive materials released in gaseous effluents from the site to areas at and beyond the Site Boundary shall be limited to the following:

For noble gases: Less than or equal to 500 millirems/year to the whole body and less than or equal to 3000 millirems/year to the skin; and

For Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than eight days: Less than or equal to 1500 millirems/year to any organ.

Liquid Effluents

The concentration of radioactive material released in liquid effluents to Unrestricted Areas shall be limited to 10 times the concentrations specified in 10CFR, Part 20, Appendix B, Table II, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-04 microcurie/milliliter total activity.

Average Energy (Million Electron Volts/Disintegration

The **Average Energy** (or E-bar) shall be the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration for the isotopes other than Iodines, with half-lives greater than 15 minutes, making up at least 95% of the total non-iodine activity in the coolant. The following average energy values are based on grab sample analyses from both reactor coolant systems with Unit 1 being collected during September of 2001 and with Unit 2's sample being collected during October of 2001.

E-bar (Million Electron Volts/Disintegration)	0.275 *	Unit 1
	0.216 *	Unit 2

* Includes tritium

The average energy (E-bar) values of the radionuclide mixture in gaseous releases of fission and activation gases are based on noble gases released during the reporting period.

E-bar (Million Electron Volts/Disintegration)	0.186	Unit 1
	0.403	Unit 2

Measurement and Approximations of Total Activity

The following discussions detail the methods used to measure and approximate total activity for the following:

Gaseous Effluents: Fission and Activation Gases, Iodines and Particulates
Liquid Effluents

Tables A3-1 and A4-1 of the South Texas Project Electric Generating Station Offsite Dose Calculation Manual give sampling frequencies and lower limit of detection requirements for the analysis of liquid and gaseous effluent streams.

Gaseous Effluents

Analytical Methods For Batch Gaseous Releases

Monthly pre-release grab samples are collected from the plant Reactor Containment Building atmosphere. These samples are analyzed on a Gamma Spectroscopy System utilizing high purity germanium detectors for noble gas, iodine and particulate activity. Tritium specific radioactivities are measured using Liquid Scintillation Counting techniques.

The radionuclide concentrations obtained are used in conjunction with the gross noble gas release rate monitoring data collected by the radiation monitoring system to estimate the release rate of each radionuclide in the effluent streams. The noble gas release rate data collected by the unit vent radiation monitor is quantified and reported as continuous mode of release. The data from the unit vent radiation monitor in conjunction with the grab sample results of the Reactor Containment Building atmosphere are used to quantify the radioactivity released.

Analytical Methods For Continuous Gaseous Releases

Periodic noble gas and tritium grab samples are taken from the continuous release points such as the Unit Vent. Secondary liquid grab samples in conjunction with the mass of the secondary coolant lost are used for quantifying secondary steam releases. Continuous sampling for particulates and iodine is also performed on the effluent streams. These samples are analyzed for tritium and gamma radionuclides, as described above for batch releases. Strontium-89, Strontium-90, and gross alpha analyses were performed by the on-site Radiological Services Laboratory.

Using noble gas grab sample results and the gross noble gas release rate monitor, the noble gases in effluent streams are quantified by the plant radiation monitoring system.

Liquid Effluents

Analytical Methods For Liquid Releases

Liquid batch releases include waste liquid treated by the liquid waste processing system and secondary regenerative waste. Liquid effluents resulting from primary to secondary leakage or other plant operations are continuously monitored and are tracked as continuous releases. For batch releases, representative pre-release grab samples are taken and analyzed in accordance with Table A3-1 of the Offsite Dose Calculation Manual. For continuous releases, representative samples are collected weekly and analyzed. Radionuclide analyses are performed using a Gamma Spectroscopy System. Aliquots of each pre-release batch sample and of representative samples for continuous releases are composited in accordance with the requirements in Table A3-1 of the Offsite Dose Calculation Manual. Tritium concentrations are determined using Liquid Scintillation Counting techniques. Dissolved and entrained gas concentrations are determined by counting grab samples on the Gamma Spectroscopy System. Strontium-89, Strontium-90, gross alpha, and Iron-55 determinations are performed by the on-site Radiological Services Laboratory. The radionuclide concentrations obtained are used with the total volume for each batch release.

Batch Releases

Liquid and gaseous summaries are compiled from permits generated using a computer-based effluent management system and plant procedures. Liquid batch releases are accounted for by individual permits. Gaseous batch releases are accounted for by monthly permits and consist of reactor containment purges for the purpose of reducing radioactivity concentrations. Batch times represent the actual period of releases and the periods that the purge valves were open.

Liquid (Unit 1)

Liquid (Unit 1)	Quarter 1	Quarter 2	Quarter 3	Quarter 4
a. Number of batch releases	21	34	28	26
b. Total time period for batch releases (minutes)	1285	2229	1820	1582
c. Maximum time period for a batch release (minutes)	75	94	68	71
d. Average time period for batch releases (minutes)	61	66	65	61
e. Minimum time period for a batch release (minutes)	43	46	50	44

Gaseous (Unit 1)

Gaseous (Unit 1)	Quarter 1	Quarter 2	Quarter 3	Quarter 4
a. Number of batch releases	1	0	0	7
b. Total time period for batch releases (minutes)	120	0	0	26280
c. Maximum time period for a batch release (minutes)	120	0	0	9300
d. Average time period for batch releases (minutes)	120	0	0	4380
e. Minimum time period for a batch release (minutes)	120	0	0	180

Liquid (Unit 2)

Liquid (Unit 2)	Quarter 1	Quarter 2	Quarter 3	Quarter 4
a. Number of batch releases	64	42	14	21
b. Total time period for batch releases (minutes)	4355	2316	895	1223
c. Maximum time period for a batch release (minutes)	80	91	94	66
d. Average time period for batch releases (minutes)	68	55	64	58
e. Minimum time period for a batch release (minutes)	48	21	26	33

Gaseous (Unit 2)

Gaseous (Unit 2)	Quarter 1	Quarter 2	Quarter 3	Quarter 4
a. Number of batch releases	18	1	0	0
b. Total time period for batch releases (minutes)	24300	420	0	0
c. Maximum time period for a batch release (minutes)	8880	420	0	0
d. Average time period for batch releases (minutes)	2025	420	0	0
e. Minimum time period for a batch release (minutes)	120	420	0	0

Abnormal (Unplanned) Releases

No abnormal releases occurred during this reporting period.

Estimate of Total Error

Estimate of Error for Liquid Effluents

The **maximum error** associated with volume and flow measurements, based upon plant calibration practice, is estimated to be ± 1.27%. The error associated with the flow measurement is small in relation to the counting uncertainty of the radionuclide concentration analysis.

The **average uncertainty** associated with counting measurements is 10% or less at the 95% confidence level.

The **error** associated with dilution volume is estimated to be ± 10%.

Estimate of Error for Gaseous Effluents

The **maximum error** associated with monitor readings, sample flow, vent flow, sample collection, monitor calibration and laboratory procedures are collectively estimated to be:

Fission and Activation Gases Low Activity (less than 10 microcurie per second)	± 100%
Fission and Activation Gases High Activity (greater than or equal to 10 microcurie per second)	± 20%
Iodines	± 25%
Particulates	± 25%
Tritium	± 50%

The **average uncertainty** associated with counting measurements is 10% or less at the 95% confidence level for fission and activation gases, iodines, particulates and tritium.

Estimate of Error for Solid Radioactive Waste

The **error** associated in determining the volume of solid radioactive waste shipments is estimated to be ± 1%. The **error** associated in determining the filter media, spent primary resins, and spent secondary resins radioactivity is estimated to be within a factor of two of the real value and is due primarily to waste stream sampling uncertainty. The **error** associated in determining the radioactivity of other solid radioactive waste shipments is estimated to be within a factor of three of the real value.

Solid Waste Shipments

A total of seventeen shipments of radioactive filter media, spent resins, dry active and other wastes were made during the reporting period. A summary of the data is provided in the Section 6, Solid Waste and Irradiated Fuel Shipments.

Radiological Impact on Man

The data for the period January 1, 2001, through December 31, 2001, is provided in the Dose Accumulation (Section 7) and the Summary of Direct Radiation Table 8-1 (Section 8). The following dilution factors and dilution water flows were used for assessing the radiation doses due to radioactive liquid effluents released to unrestricted areas.

Receptor Location	ODCM[1] Dilution Factor	Dilution Water Flow Cubic Feet/Second	Dilution Water Flow Liters/Year	Dilution Water Flow Liters/Quarter
Colorado River	1.00E+00	6.00E+02	5.36E+11	1.34E+11
Matagorda Bay	1.63E+02	9.78E+04	8.73E+13	2.18E+13
Little Robbins Slough Area	3.05E-02	1.83E+01	1.63E+10	4.08E+09

(1) Offsite Dose Calculation Manual factor

The dilution water flow used to estimate the individual dose due to ingestion of saltwater fish and saltwater invertebrates (shrimp) harvested from the Colorado River was 5.36E+11 liters per year for the years of 1989 through 2001. The dilution water flow used to estimate the individual dose due to ingestion of saltwater fish and saltwater invertebrates harvested from the Matagorda Bay was 8.73E+13 liters per year for the years of 1993 through 2001 as the result of a diversion channel that routes the Colorado River into Matagorda Bay. The dilution water flow used to estimate the individual dose due to ingestion of freshwater fish from the Little Robbins Slough Area was 1.63E+10 liters per year for the years 1989 through 2001. These dilution water flows were also used for estimating individual dose due to shoreline deposits. The radioactivity reported in the Liquid Effluent tables is the amount released to the Main Cooling Reservoir and does not contribute to dose until the radioactivity is released to unrestricted areas. In order to estimate the doses due to liquid effluents, the radioactivity reported must be adjusted by the values listed in the Offsite Dose Calculation Manual, Table B4-1, "Radionuclide Fraction Leaving STPEGS Via Liquid Routes".

Meteorological Data

The **2001 meteorological data** is presented in the form of joint frequency tables. Each quarter contains eight tables, one for each stability class and one for all classes combined.

A second set of joint frequency tables is provided for time periods when the reactor containment building fans were operating to remove radioactivity from the containment for personnel protection reasons. These containment purges are classified as batch releases. No batches are reported for the third quarter since no containment purges were performed.

Lower Limit of Detection

The **Lower Limit of Detection** (an a priori limit) is defined as the smallest concentration of radioactive material in a sample that will yield a net count above system background that will be detected with 95% probability, and only a 5% probability of falsely concluding that a blank observation represents a "real" signal. A zero (0) value in the attached tables indicates no activity detected.

Dose to Member of the Public

Dose to Member of the Public from Direct Radiation

The Offsite Dose Calculation Manual includes the direct radiation from plant structures as a component to the dose to a hypothetical, highest exposed Member of the Public located off site due to plant operations. The only source of plant related direct radiation in 2001 originated from radioactive waste storage tanks south of Units 1 and 2 and the movement of radioactive waste in the same area.

The Offsite Dose Calculation Manual allows measurements made near the plant structures to be used in these calculations following suitable adjustments for distance and exposure time. In 2001, Thermoluminescent Dosimeters were placed along the protected area fence surrounding Units 1 and 2 of the South Texas Project as pictured in Figure 8-1 of Section 8. The results of these measurements are summarized in Table 8-1 of Section 8. The table shows that in 2001 only two Thermoluminescent Dosimeter stations measured more exposure than typical of natural background determined prior to operation in the vicinity of the South Texas Project. These two stations were both located south of the units where the reservoir shields off site members of the public. Hence no dose due to direct radiation in 2001 was delivered to a Member of the Public located off site.

A hypothetical Member of the Public inside the site boundary but outside the protected area fence could receive approximately 0.52 millirem from direct radiation if they spent 2000 hours a year near the protected area fence south of Unit 2. This value assumes that a site worker meeting the definition of a Member of the Public spends 2000 hours of the year near Station #7 (see Figure 8-1 of Section 8) where the direct radiation exposure rate is 0.00026 mR/hr.

Dose to Member of the Public from Radioactive Effluents

During 2001, the total body dose to the most exposed individual from radioactive effluents and direct radiation was 0.018 millirem. This total represents approximately 0.07% of the limits of 40 C.F.R. §190. This theoretical individual, an adult, resides in the South by South-West Sector, approximately 4,000 meters (2.5 miles) from the site. For dose calculating purposes, this theoretical individual is characterized as the most exposed with regard to food consumption, occupancy, and other uses of the areas in the plant vicinity. This theoretical individual is not a real person and the dose model assumes that this theoretical individual may consume the maximum amount of food with all the food being grown or grazed at the residence. This theoretical individual receives shoreline exposure from Little Robbins Slough for 12 hours per year and consumes 21 kilograms (48 pounds) of fish taken from Little Robbins Slough. This theoretical individual receives a submersion dose from noble gases and dose from inhaled radioactive particulates, radioiodines, and tritium. This adult consumes 64 kilograms (150 pounds) of vegetables grown at the residence and consumes 110 kilograms (250 pounds) of meat from livestock grazed at the residence.

A hypothetical Member of the Public outside the protected area fence but inside the site boundary could receive approximately 0.37 millirem from radioactive effluents due to inhalation and immersion. This dose plus the direct radiation dose would yield 0.89 millirem, a small fraction of 10 C.F.R. §20.1301 annual limit.

Sewage Sludge Land Farming

Sewage sludge removed from the West Sanitary Waste Treatment System was beneficially land applied onsite during 2001. This beneficial land application is not a radioactive effluent and is only reported to document this activity. The amount of radioactivity contained in the sludge was approximately 160 microcuries. This includes Cobalt-58, Cobalt-60 and tritium. In accordance with Texas Natural Resource Conservation Commission Registration No. 710645, the sludge is incorporated into the soil after application. A soil sample collected from the area in December 2001 indicated no activity above background, confirming that the concentration in the soil is below the limits established in Title 25 of the Texas Administrative Code Section 289.202 (ddd).

Technical Specifications and Offsite Dose Calculation Manual Controls Reporting Requirements

Offsite Dose Calculation Manual Changes (reference, Technical Specifications, 6.13)

The ODCM was revised based on recommendations from the users. The methods used to calculate offsite dose in this revision remain the same as in the previous version. Since the 2000 revision was issued, a minor error was identified in the LLD formulas of Part A and some changes were suggested for the environmental monitoring stations listed in Section 5. In addition, changes were made to prepare for Technical Specifications changes.

Editorial Changes:

References to the "Annual Radioactive Effluent Release Reports" were revised to "Radioactive Effluent Release Report". This editorial change is not annotated with change bars in the revised ODCM.

Corrected Section number "4.11.3" to "4.12.3" in Part A (typographical error).

Removed reference to "magnetic tape" and replaced with the term "electronic form (computer media)" in Part A, Section 6.9.1.4 since magnetic tape drives are becoming obsolete.

Substituted the words "estimated from Figure 6 of Regulatory Guide 1.111 and are used in" in place of "calculated using" in the notes for Table B4-5 to clarify the meaning.

Note (4) to Table A5-1 was expanded to explicitly list the "non-drinking water" LLD for I-131.

Replaced "the time specified in the ACTION" with "30 days" in Part A, sections 3.3.3.10 and 3.3.3.11 since the action statements all indicate 30 days anyway.

Replaced the term "12 months" with "calendar year" to make Section 6.9.1.4 parallel to Section 6.9.1.3 in Part A.

Changes based on Technical Specification:

Removed reference to Technical Specification 6.8.3h from Part A, Section 1.10 of the ODCM since part of this Technical Specification now resides in the ODCM.

Moved Technical Specification 6.8.3h to Part A of the ODCM as Section 6.8.3. This change is consistent with the proposed change to the Technical Specifications planned for implementation in April of 2002.

LLD Calculations:

Tables A3-1, A4-1, and A5-1 lacked a term in the LLD formula. The factor "K" should have been "K / T" where T is the count time (minutes) of the background. The factor "K" must have units of minutes^{-1} to be added to the background count rate which also has units of minutes^{-1}.

Radiological Environmental Monitoring Program:

Added "VB" sample type to Table B5-2.

Added ground water (WG) sample station code "251" to Table B5-3.

Effluent Monitoring:

A note #2 was added to Table 4.3-8 allowing channel checks on the liquid waste processing discharge monitor to be performed once per 24 hours on days when releases are made.

Added a paragraph to section B3.1 (page B3-5) acknowledging that improvements in radioactive waste treatment processes may drop the concentration for gamma emitting nuclides below the minimum sensitivity of the liquid waste monitor.

Annual Land Use Census (reference, Offsite Dose Calculation Manual Controls, 3.12.2.a)

The Land Use Census did not identify any new locations for dose calculations.

Radioactive Waste Treatment System Design Modification Description (reference, Offsite Dose Calculation Manual Controls, 6.15)

No major design modifications were made to the gaseous, liquid, or solid radioactive waste treatment systems during this reporting period.

Inoperable Effluent Monitoring Instrumentation Explanation (reference, Offsite Dose Calculation Manual Controls, 6.9.1.4)

For 2001, inoperable liquid effluent monitoring instruments were corrected within the time specified in Sections 3.3.3.10 of Offsite Dose Calculation Manual Controls.

For 2001, inoperable gaseous effluent monitoring instruments were corrected within the time specified in Sections 3.3.3.11 of Offsite Dose Calculation Manual Controls.

Gas Storage Tank Curie Limit Violation Description (reference, Offsite Dose Calculation Manual Controls, 6.9.1.4)

The Reactor Coolant System Vacuum Degassing System was not used during this reporting period. Therefore, the quantity of radioactive material in the Reactor Coolant System Vacuum Degassing System Storage Tanks did not exceed the limits set forth in Section 3.11.2.6 of Technical Specifications.

Unprotected Outdoor Tank Curie Limit Violation Description (reference, Offsite Dose Calculation Manual Controls, 6.9.1.4)

There are no Unprotected Outdoor Tanks at South Texas Project Electric Generating Station.

Abnormal (Unplanned) Release Description (reference, Offsite Dose Calculation Manual, 6.9.1.4)

No abnormal (unplanned) releases occurred during this reporting period.

Radioactive Waste Process Control Program Changes (reference, Technical Specifications, 6.13)

There were no changes to the Radioactive Waste Process Control Program during this reporting period.

GASEOUS EFFLUENTS

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
ALL AIRBORNE EFFLUENTS

Unit: 1

Starting : 1-Jan-2001 Ending : 30-Jun-2001

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	1.036E+02	1.572E+02	100
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	1.330E+01	2.000E+01	
3. PERCENT OF LIMIT (2.70E+05 uCi/sec)	%	4.940E-03	7.410E-03	
B. RADIOIODINES				
1. TOTAL IODINE-131 + IODINE-133	CURIES	1.202E-04	9.365E-05	25
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	1.550E-05	1.190E-05	
3. PERCENT OF LIMIT (4.00E-02 uCi/sec)	%	3.860E-02	2.980E-02	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	0.000E+00	2.044E-06	25
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	0.000E+00	2.600E-07	
3. PERCENT OF LIMIT (3.00E-01 uCi/sec)	%	0.000E+00	8.660E-05	
4. GROSS ALPHA RADIOACTIVITY	CURIES	0.000E+00	0.000E+00	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	1.195E+01	4.712E+00	50
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	1.540E+00	5.990E-01	
3. PERCENT OF LIMIT (1.80E+05 uCi/sec)	%	8.540E-04	3.330E-04	

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
Unit 1

REPORT CATEGORY: SEMIANNUAL AIRBORNE GROUND LEVEL CONTINUOUS AND BATCH RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY: FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD: QUARTER # 1 AND QUARTER # 2 YEAR 2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	**UNIT**	**QUARTER 1**	**QUARTER 2**	**QUARTER 1**	**QUARTER 2**
FISSION GASES					
Krypton-85	CURIES	0.00E+00	7.15E-02	0.00E+00	0.00E+00
Krypton-85M	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xenon-133	CURIES	1.04E+02	1.57E+02	5.67E-02	0.00E+00
Xenon-133M	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xenon-135	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.04E+02	1.57E+02	5.67E-02	0.00E+00
IODINES					
Iodine-131	CURIES	3.98E-05	2.84E-05	3.37E-08	0.00E+00
Iodine-133	CURIES	8.03E-05	6.52E-05	7.71E-08	0.00E+00
TOTAL FOR PERIOD	CURIES	1.20E-04	9.36E-05	1.11E-07	0.00E+00
PARTICULATES					
Cobalt-58	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cobalt-60	CURIES	0.00E+00	2.04E-06	0.00E+00	0.00E+00
Chrome-51	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron-59	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese-54	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Niobium-95	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony-122	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Technitium-99M	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zirconium-95	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	0.00E+00	2.04E-06	0.00E+00	0.00E+00
OTHER					
Hydrogen-3 (Tritium)	CURIES	1.19E+01	4.71E+00	2.58E-02	0.00E+00
TOTAL FOR PERIOD	CURIES	1.19E+01	4.71E+00	2.58E-02	0.00E+00

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
ALL AIRBORNE EFFLUENTS

Unit: 1

Starting : 1-Jul-2001 Ending : 31-Dec-2001

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	1.565E+02	1.162E+02	100
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	1.970E+01	1.460E+01	
3. PERCENT OF LIMIT (2.70E+05 uCi/sec)	%	7.290E-03	5.410E-03	
B. RADIOIODINES				
1. TOTAL IODINE-131 + IODINE-133	CURIES	1.226E-04	7.313E-03	25
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	1.540E-05	9.200E-04	
3. PERCENT OF LIMIT (4.00E-02 uCi/sec)	%	3.860E-02	2.300E+00	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	0.000E+00	9.000E-04	25
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	0.000E+00	1.130E-04	
3. PERCENT OF LIMIT (3.00E-01 uCi/sec)	%	0.000E+00	3.770E-02	
4. GROSS ALPHA RADIOACTIVITY	CURIES	0.000E+00	0.000E+00	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	8.058E+00	4.419E+00	50
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	1.010E+00	5.560E-01	
3. PERCENT OF LIMIT (1.80E+05 uCi/sec)	%	5.630E-04	3.090E-04	

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
Unit 1

REPORT CATEGORY: SEMIANNUAL AIRBORNE GROUND LEVEL CONTINUOUS AND BATCH RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY: FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD: QUARTER # 3 AND QUARTER # 4 YEAR 2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	**UNIT**	**QUARTER 3**	**QUARTER 4**	**QUARTER 3**	**QUARTER 4**
FISSION GASES					
Krypton-85	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Krypton-85M	CURIES	0.00E+00	1.06E+01	0.00E+00	0.00E+00
Xenon-133	CURIES	1.56E+02	4.50E+01	0.00E+00	5.96E+01
Xenon-133M	CURIES	0.00E+00	1.06E-01	0.00E+00	0.00E+00
Xenon-135	CURIES	0.00E+00	1.54E-02	0.00E+00	8.42E-01
TOTAL FOR PERIOD	CURIES	1.56E+02	5.57E+01	0.00E+00	6.05E+01
IODINES					
Iodine-131	CURIES	3.28E-05	5.64E-04	0.00E+00	6.50E-03
Iodine-133	CURIES	8.98E-05	2.12E-05	0.00E+00	2.23E-04
TOTAL FOR PERIOD	CURIES	1.23E-04	5.85E-04	0.00E+00	6.73E-03
PARTICULATES					
Cobalt-58	CURIES	0.00E+00	2.09E-05	0.00E+00	2.87E-04
Cobalt-60	CURIES	0.00E+00	1.27E-06	0.00E+00	2.42E-05
Chrome-51	CURIES	0.00E+00	2.25E-05	0.00E+00	4.76E-04
Iron-59	CURIES	0.00E+00	5.66E-08	0.00E+00	1.70E-05
Manganese-54	CURIES	0.00E+00	7.31E-07	0.00E+00	1.43E-05
Niobium-95	CURIES	0.00E+00	8.39E-07	0.00E+00	2.12E-05
Antimony-122	CURIES	0.00E+00	0.00E+00	0.00E+00	5.28E-07
Technitium-99M	CURIES	0.00E+00	0.00E+00	0.00E+00	3.84E-07
Zirconium-95	CURIES	0.00E+00	7.53E-07	0.00E+00	1.25E-05
TOTAL FOR PERIOD	CURIES	0.00E+00	4.70E-05	0.00E+00	8.53E-04
OTHER					
Hydrogen-3 (Tritium)	CURIES	8.06E+00	2.74E+00	0.00E+00	1.68E+00
TOTAL FOR PERIOD	CURIES	8.06E+00	2.74E+00	0.00E+00	1.68E+00

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
ALL AIRBORNE EFFLUENTS

Unit: 2

Starting : 1-Jan-2001 Ending : 30-Jun-2001

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	7.460E+01	1.745E+01	100
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	9.590E+00	2.220E+00	
3. PERCENT OF LIMIT (2.70E+05 uCi/sec)	%	3.550E-03	8.220E-04	
B. RADIOIODINES				
1. TOTAL IODINE-131 + IODINE-133	CURIES	3.915E-03	1.619E-05	25
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	5.030E-04	2.060E-06	
3. PERCENT OF LIMIT (4.00E-02 uCi/sec)	%	1.260E+00	5.150E-03	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	4.187E-04	3.794E-05	25
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	5.380E-05	4.830E-06	
3. PERCENT OF LIMIT (3.00E-01 uCi/sec)	%	1.790E-02	1.610E-03	
4. GROSS ALPHA RADIOACTIVITY	CURIES	0.000E+00	0.000E+00	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	2.784E+01	6.987E+00	50
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	3.580E+00	8.890E-01	
3. PERCENT OF LIMIT (1.80E+05 uCi/sec)	%	1.990E-03	4.940E-04	

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
Unit 2

REPORT CATEGORY: SEMIANNUAL AIRBORNE GROUND LEVEL CONTINUOUS AND BATCH RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY: FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD: QUARTER # 1 AND QUARTER # 2 YEAR 2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	**UNIT**	**QUARTER 1**	**QUARTER 2**	**QUARTER 1**	**QUARTER 2**
FISSION GASES					
Argon-41	CURIES	0.00E+00	0.00E+00	1.46E+01	9.21E-02
Krypton-85	CURIES	1.00E+01	9.11E-03	0.00E+00	0.00E+00
Xenon-133	CURIES	2.85E+01	1.74E+01	2.15E+01	0.00E+00
Xenon-135	CURIES	5.37E-06	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	3.85E+01	1.74E+01	3.61E+01	9.21E-02
IODINES					
Iodine-131	CURIES	3.33E-04	1.54E-05	3.48E-03	7.95E-07
Iodine-133	CURIES	2.44E-06	0.00E+00	9.62E-05	0.00E+00
TOTAL FOR PERIOD	CURIES	3.35E-04	1.54E-05	3.58E-03	7.95E-07
PARTICULATES					
Cobalt-58	CURIES	5.77E-05	3.67E-05	2.30E-04	6.30E-08
Cobalt-60	CURIES	3.14E-06	1.11E-06	2.16E-05	0.00E+00
Chrome-51	CURIES	1.27E-05	0.00E+00	7.05E-05	0.00E+00
Cesium-134	CURIES	7.59E-08	1.52E-08	1.58E-08	7.30E-11
Cesium-136	CURIES	4.74E-09	0.00E+00	0.00E+00	0.00E+00
Cesium-137	CURIES	6.76E-08	1.33E-08	1.25E-08	5.99E-11
Manganese-54	CURIES	8.65E-07	2.18E-09	2.84E-06	0.00E+00
Sodium-24	CURIES	5.35E-10	0.00E+00	1.05E-09	0.00E+00
Niobium-95	CURIES	2.32E-06	0.00E+00	1.33E-05	0.00E+00
Ruthenium-103	CURIES	3.62E-10	0.00E+00	0.00E+00	0.00E+00
Zirconium-95	CURIES	1.19E-06	0.00E+00	2.68E-06	0.00E+00
TOTAL FOR PERIOD	CURIES	7.81E-05	3.79E-05	3.41E-04	6.31E-08
OTHER					
Hydrogen-3 (Tritium)	CURIES	8.07E+00	6.98E+00	1.98E+01	5.36E-03
TOTAL FOR PERIOD	CURIES	8.07E+00	6.98E+00	1.98E+01	5.36E-03

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
ALL AIRBORNE EFFLUENTS

Unit: 2

Starting : 1-Jul-2001 Ending : 31-Dec-2001

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	4.836E+00	9.856E+00	100
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	6.080E-01	1.240E+00	
3. PERCENT OF LIMIT (2.70E+05 uCi/sec)	%	2.250E-04	4.590E-04	
B. RADIOIODINES				
1. TOTAL IODINE-131 + IODINE-133	CURIES	0.000E+00	6.101E-06	25
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	0.000E+00	7.680E-07	
3. PERCENT OF LIMIT (4.00E-02 uCi/sec)	%	0.000E+00	1.920E-03	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	6.082E-06	2.839E-06	25
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	7.650E-07	3.570E-07	
3. PERCENT OF LIMIT (3.00E-01 uCi/sec)	%	2.550E-04	1.190E-04	
4. GROSS ALPHA RADIOACTIVITY	CURIES	0.000E+00	0.000E+00	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	2.538E+01	2.035E+01	50
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/sec	3.190E+00	2.560E+00	
3. PERCENT OF LIMIT (1.80E+05 uCi/sec)	%	1.770E-03	1.420E-03	

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
Unit 2

REPORT CATEGORY: SEMIANNUAL AIRBORNE GROUND LEVEL CONTINUOUS AND BATCH RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY: FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD: QUARTER # 3 AND QUARTER # 4 YEAR 2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	**UNIT**	**QUARTER 3**	**QUARTER 4**	**QUARTER 3**	**QUARTER 4**
FISSION GASES					
Argon-41	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xenon-133	CURIES	4.84E+00	9.86E+00	0.00E+00	0.00E+00
Xenon-135	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	4.84E+00	9.86E+00	0.00E+00	0.00E+00
IODINES					
Iodine-131	CURIES	0.00E+00	6.10E-06	0.00E+00	0.00E+00
Iodine-133	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	0.00E+00	6.10E-06	0.00E+00	0.00E+00
PARTICULATES					
Cobalt-58	CURIES	6.08E-06	1.49E-06	0.00E+00	0.00E+00
Cobalt-60	CURIES	0.00E+00	1.34E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	6.08E-06	2.84E-06	0.00E+00	0.00E+00
OTHER					
Hydrogen-3 (Tritium)	CURIES	2.54E+01	2.03E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.54E+01	2.03E+01	0.00E+00	0.00E+00

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY

Unit 1 plus 2 Total

REPORT CATEGORY: ANNUAL AIRBORNE GROUND LEVEL RELEASES. TOTALS FOR EACH NUCLIDE RELEASED. FOR ALL OF 2001

NUCLIDES RELEASED	UNIT	UNIT 1 2001	UNIT 2 2001	TOTAL 2001
FISSION GASES				
Argon-41	CURIES	0.000E+00	1.467E+01	1.467E+01
Krypton-85	CURIES	7.151E-02	1.004E+01	1.011E+01
Krypton-85M	CURIES	1.060E+01	0.000E+00	1.060E+01
Xenon-133	CURIES	5.218E+02	8.195E+01	6.038E+02
Xenon-133M	CURIES	1.061E-01	0.000E+00	1.061E-01
Xenon-135	CURIES	8.573E-01	5.367E-06	8.573E-01
TOTAL FOR PERIOD	CURIES	5.335E+02	1.067E+02	6.401E+02
IODINES				
Iodine-131	CURIES	7.170E-03	3.839E-03	1.101E-02
Iodine-133	CURIES	4.792E-04	9.865E-05	5.779E-04
TOTAL FOR PERIOD	CURIES	7.649E-03	3.937E-03	1.159E-02
PARTICULATES				
Cobalt-58	CURIES	3.074E-04	3.318E-04	6.392E-04
Cobalt-60	CURIES	2.752E-05	2.716E-05	5.469E-05
Chrome-51	CURIES	4.986E-04	8.325E-05	5.819E-04
Cesium-134	CURIES	0.000E+00	1.070E-07	1.070E-07
Cesium-136	CURIES	0.000E+00	4.742E-09	4.742E-09
Cesium-137	CURIES	0.000E+00	9.337E-08	9.337E-08
Iron-59	CURIES	1.709E-05	0.000E+00	1.709E-05
Manganese-54	CURIES	1.508E-05	3.702E-06	1.878E-05
Sodium-24	CURIES	0.000E+00	1.589E-09	1.589E-09
Niobium-95	CURIES	2.209E-05	1.561E-05	3.769E-05
Ruthenium-103	CURIES	0.000E+00	3.622E-10	3.622E-10
Antimony-122	CURIES	5.277E-07	0.000E+00	5.277E-07
Technitium-99M	CURIES	3.839E-07	0.000E+00	3.839E-07
Zirconium-95	CURIES	1.327E-05	3.871E-06	1.714E-05
TOTAL FOR PERIOD	CURIES	9.020E-04	4.656E-04	1.368E-03
OTHER				
Hydrogen-3 (Tritium)	CURIES	2.910E+01	8.053E+01	1.096E+02
TOTAL FOR PERIOD	CURIES	2.910E+01	8.053E+01	1.096E+02

LIQUID EFFLUENTS

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
ALL LIQUID EFFLUENTS
Unit: 1
Starting : 1-Jan-2001 Ending : 30-Jun-2001

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	7.469E-03	1.181E-02	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	4.535E-09	3.677E-09	
3. PERCENT OF EC* LIMIT (FRACTIONAL)	%	7.800E-03	7.382E-03	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	4.240E+02	3.059E+02	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	2.574E-04	9.527E-05	
3. % OF LIMIT (1.00E-02 uCi/mL)	%	2.574E+00	9.527E-01	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	2.905E-02	1.684E-02	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	1.764E-08	5.243E-09	
3. PERCENT OF LIMIT (2.00E-04 uCi/mL)	%	8.818E-03	2.621E-03	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.000E+00	0.000E+00	10
E. WASTE VOL RELEASED				
1. TOTAL PRE-DILUTION VOLUME	LITERS	2.950E+06	4.443E+06	1
2. BATCH PRE-DILUTION VOLUME	LITERS	9.880E+05	1.834E+06	1
F. VOLUME OF DILUTION WATER USED**	LITERS	1.644E+09	3.207E+09	10

*EC= Effluent Concentration

**"Volume of dilution water used" means the volume of water circulated through the main condenser during the actual time of release. Liquid effluent releases ultimately dilute into the volume of the onsite main cooling reservoir and then into offsite water bodies as described in Section 2, subsection Radiological Impact on Man of this report.

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
Unit 1

REPORT CATEGORY: SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY: ALL RADIONUCLIDES
REPORTING PERIOD: QUARTER # 1 AND QUARTER # 2 YEAR 2001

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDES RELEASED	**UNIT**	**QUARTER 1**	**QUARTER 2**	**QUARTER 1**	**QUARTER 2**
ALL NUCLIDES					
Silver-110M	CURIES	0.00E+00	0.00E+00	3.35E-05	1.51E-04
Beryllium-7	CURIES	0.00E+00	0.00E+00	8.22E-05	0.00E+00
Cobalt-57	CURIES	0.00E+00	0.00E+00	2.71E-06	3.44E-06
Cobalt-58	CURIES	0.00E+00	0.00E+00	5.28E-04	1.94E-04
Cobalt-60	CURIES	0.00E+00	0.00E+00	1.97E-03	7.29E-03
Chrome-51	CURIES	0.00E+00	0.00E+00	5.26E-05	0.00E+00
Cesium-134	CURIES	0.00E+00	0.00E+00	1.71E-04	5.79E-04
Cesium-137	CURIES	0.00E+00	0.00E+00	3.04E-04	1.03E-03
Iron-55	CURIES	0.00E+00	0.00E+00	3.46E-03	6.52E-03
Iron-59	CURIES	0.00E+00	0.00E+00	4.86E-06	2.29E-06
Hydrogen-3 (Tritium)	CURIES	1.51E-01	1.26E-01	4.24E+02	6.37E+02
Iodine-131	CURIES	0.00E+00	0.00E+00	1.36E-06	0.00E+00
Iodine-133	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Krypton-85	CURIES	0.00E+00	0.00E+00	1.74E-02	5.40E-03
Manganese-54	CURIES	0.00E+00	0.00E+00	3.86E-04	7.77E-04
Niobium-95	CURIES	0.00E+00	0.00E+00	5.16E-05	1.54E-05
Rubidium-86	CURIES	0.00E+00	0.00E+00	0.00E+00	7.79E-06
Antimony-124	CURIES	0.00E+00	0.00E+00	0.00E+00	1.34E-05
Antimony-125	CURIES	0.00E+00	0.00E+00	3.73E-04	4.61E-03
Tin-117M	CURIES	0.00E+00	0.00E+00	2.15E-05	3.56E-04
Strontium-89	CURIES	0.00E+00	0.00E+00	0.00E+00	3.94E-05
Strontium-90	CURIES	0.00E+00	0.00E+00	1.86E-05	3.83E-05
Technitium-99M	CURIES	0.00E+00	0.00E+00	0.00E+00	8.25E-06
Telurium-125M	CURIES	0.00E+00	0.00E+00	0.00E+00	8.49E-03
Xenon-131M	CURIES	0.00E+00	0.00E+00	1.05E-03	1.62E-04
Xenon-133	CURIES	0.00E+00	0.00E+00	1.06E-02	3.25E-02
Xenon-133M	CURIES	0.00E+00	0.00E+00	0.00E+00	2.37E-04
Xenon-135	CURIES	0.00E+00	0.00E+00	0.00E+00	9.16E-05
Zirconium-95	CURIES	0.00E+00	0.00E+00	9.35E-06	0.00E+00
TOTAL FOR PERIOD	CURIES	1.51E-01	1.26E-01	4.24E+02	6.37E+02

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
ALL LIQUID EFFLUENTS

Unit: 1

Starting : 1-Jul-2001 Ending : 31-Dec-2001

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	1.831E-02	1.782E-02	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	5.861E-09	8.785E-09	
3. PERCENT OF EC* LIMIT (FRACTIONAL)	%	8.096E-03	1.923E-02	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	3.310E+02	1.170E+02	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	1.060E-04	5.769E-05	
3. % OF LIMIT (1.00E-02 uCi/mL)	%	1.060E+00	5.769E-01	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	2.155E-02	1.951E-01	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	6.896E-09	9.621E-08	
3. PERCENT OF LIMIT (2.00E-04 uCi/mL)	%	3.448E-03	4.811E-02	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.000E+00	0.000E+00	10
E. WASTE VOL RELEASED				
1. TOTAL PRE-DILUTION VOLUME	LITERS	4.543E+06	3.235E+06	1
2. BATCH PRE-DILUTION VOLUME	LITERS	1.549E+06	1.229E+06	1
F. VOLUME OF DILUTION WATER USED**	LITERS	3.120E+09	2.025E+09	10

*EC= Effluent Concentration

**"Volume of dilution water used" means the volume of water circulated through the main condenser during the actual time of release. Liquid effluent releases ultimately dilute into the volume of the onsite main cooling reservoir and then into offsite water bodies as described in Section 2, subsection Radiological Impact on Man of this report.

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
Unit 1

REPORT CATEGORY: SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY: ALL RADIONUCLIDES
REPORTING PERIOD: QUARTER # 3 AND QUARTER # 4 YEAR 2001

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
ALL NUCLIDES					
Silver-110M	CURIES	0.00E+00	0.00E+00	9.50E-05	4.73E-05
Beryllium-7	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cobalt-57	CURIES	0.00E+00	0.00E+00	0.00E+00	3.33E-06
Cobalt-58	CURIES	0.00E+00	0.00E+00	2.59E-05	3.27E-03
Cobalt-60	CURIES	0.00E+00	0.00E+00	3.99E-03	1.91E-03
Chrome-51	CURIES	0.00E+00	0.00E+00	0.00E+00	2.11E-03
Cesium-134	CURIES	0.00E+00	0.00E+00	2.21E-04	5.48E-05
Cesium-137	CURIES	0.00E+00	0.00E+00	4.17E-04	1.03E-04
Iron-55	CURIES	0.00E+00	0.00E+00	2.99E-03	5.86E-03
Iron-59	CURIES	0.00E+00	0.00E+00	2.29E-06	1.11E-04
Hydrogen-3 (Tritium)	CURIES	8.10E-02	2.03E-02	3.31E+02	1.17E+02
Iodine-131	CURIES	0.00E+00	0.00E+00	0.00E+00	2.72E-03
Iodine-133	CURIES	0.00E+00	0.00E+00	0.00E+00	2.97E-06
Krypton-85	CURIES	0.00E+00	0.00E+00	2.46E-03	3.80E-02
Manganese-54	CURIES	0.00E+00	0.00E+00	3.48E-04	3.35E-04
Niobium-95	CURIES	0.00E+00	0.00E+00	0.00E+00	1.96E-04
Rubidium-86	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony-124	CURIES	0.00E+00	0.00E+00	2.79E-06	9.20E-05
Antimony-125	CURIES	0.00E+00	0.00E+00	3.81E-03	6.78E-04
Tin-117M	CURIES	0.00E+00	0.00E+00	2.69E-04	2.68E-05
Strontium-89	CURIES	0.00E+00	0.00E+00	3.94E-05	1.72E-04
Strontium-90	CURIES	0.00E+00	0.00E+00	1.65E-05	2.71E-05
Technitium-99M	CURIES	0.00E+00	0.00E+00	8.25E-06	0.00E+00
Telurium-125M	CURIES	0.00E+00	0.00E+00	6.08E-03	0.00E+00
Xenon-131M	CURIES	0.00E+00	0.00E+00	1.62E-04	1.06E-02
Xenon-133	CURIES	0.00E+00	0.00E+00	1.87E-02	1.46E-01
Xenon-133M	CURIES	0.00E+00	0.00E+00	1.52E-04	5.31E-04
Xenon-135	CURIES	0.00E+00	0.00E+00	7.94E-05	2.72E-05
Zirconium-95	CURIES	0.00E+00	0.00E+00	0.00E+00	1.01E-04
TOTAL FOR PERIOD	CURIES	8.10E-02	2.03E-02	3.31E+02	1.17E+02

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
ALL LIQUID EFFLUENTS

Unit: 2

Starting : 1-Jan-2001 Ending : 30-Jun-2001

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	3.948E-02	2.092E-02	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	7.427E-09	6.131E-09	
3. PERCENT OF EC* LIMIT (FRACTIONAL)	%	1.381E-02	1.191E-02	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	3.035E+02	7.967E+01	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	5.709E-05	2.335E-05	
3. % OF LIMIT (1.00E-02 uCi/mL)	%	5.709E-01	2.335E-01	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	2.794E+00	1.055E-02	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	5.255E-07	3.092E-09	
3. PERCENT OF LIMIT (2.00E-04 uCi/mL)	%	2.628E-01	1.546E-03	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.000E+00	0.000E+00	10
E. WASTE VOL RELEASED				
1. TOTAL PRE-DILUTION VOLUME	LITERS	8.136E+06	6.657E+06	1
2. BATCH PRE-DILUTION VOLUME	LITERS	3.237E+06	1.910E+06	1
F. VOLUME OF DILUTION WATER USED**	LITERS	5.308E+09	3.405E+09	10

*EC= Effluent Concentration

**"Volume of dilution water used" means the volume of water circulated through the main condenser during the actual time of release. Liquid effluent releases ultimately dilute into the volume of the onsite main cooling reservoir and then into offsite water bodies as described in Section 2, subsection Radiological Impact on Man of this report.

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
Unit 2

REPORT CATEGORY: SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY: ALL RADIONUCLIDES
REPORTING PERIOD: QUARTER # 1 AND QUARTER # 2 YEAR 2001

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDES RELEASED	**UNIT**	**QUARTER 1**	**QUARTER 2**	**QUARTER 1**	**QUARTER 2**
ALL NUCLIDES					
Silver-110M	CURIES	0.00E+00	0.00E+00	7.18E-06	1.58E-05
Beryllium-7	CURIES	0.00E+00	0.00E+00	0.00E+00	5.54E-05
Cobalt-57	CURIES	0.00E+00	0.00E+00	1.15E-04	4.51E-05
Cobalt-58	CURIES	1.71E-04	3.53E-05	2.59E-03	2.27E-03
Cobalt-60	CURIES	0.00E+00	0.00E+00	9.99E-03	2.99E-03
Chrome-51	CURIES	0.00E+00	0.00E+00	3.67E-04	2.78E-04
Cesium-134	CURIES	3.59E-04	5.09E-05	8.66E-04	1.08E-03
Cesium-136	CURIES	1.58E-05	0.00E+00	5.52E-06	0.00E+00
Cesium-137	CURIES	2.89E-04	4.44E-05	9.57E-04	9.81E-04
Iron-55	CURIES	0.00E+00	0.00E+00	8.29E-03	6.92E-03
Iron-59	CURIES	0.00E+00	0.00E+00	9.78E-05	2.15E-05
Hydrogen-3 (Tritium)	CURIES	5.22E-01	7.00E-02	3.03E+02	7.96E+01
Iodine-131	CURIES	2.95E-04	0.00E+00	3.20E-04	3.63E-04
Iodine-132	CURIES	2.48E-05	0.00E+00	0.00E+00	0.00E+00
Iodine-133	CURIES	2.92E-04	0.00E+00	0.00E+00	0.00E+00
Iodine-134	CURIES	9.58E-07	0.00E+00	0.00E+00	0.00E+00
Iodine-135	CURIES	3.90E-05	0.00E+00	0.00E+00	0.00E+00
Krypton-85	CURIES	0.00E+00	0.00E+00	3.40E-01	7.32E-03
Krypton-85M	CURIES	0.00E+00	0.00E+00	4.56E-04	0.00E+00
Manganese-54	CURIES	4.93E-07	7.26E-07	1.97E-03	4.67E-04
Sodium-24	CURIES	5.30E-07	0.00E+00	0.00E+00	0.00E+00
Niobium-95	CURIES	0.00E+00	0.00E+00	6.66E-05	9.15E-05
Niobium-97	CURIES	0.00E+00	0.00E+00	9.37E-06	0.00E+00
Ruthenium-103	CURIES	1.21E-07	0.00E+00	0.00E+00	0.00E+00
Antimony-122	CURIES	0.00E+00	0.00E+00	1.36E-05	0.00E+00
Antimony-124	CURIES	0.00E+00	0.00E+00	2.12E-04	3.38E-04
Antimony-125	CURIES	0.00E+00	0.00E+00	9.00E-03	4.84E-03
Tin-117M	CURIES	0.00E+00	0.00E+00	1.07E-05	0.00E+00
Strontium-89	CURIES	0.00E+00	0.00E+00	2.32E-05	1.50E-05
Strontium-90	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Technitium-99M	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Telurium-125M	CURIES	0.00E+00	0.00E+00	3.13E-03	0.00E+00
Telurium-132	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xenon-131M	CURIES	0.00E+00	0.00E+00	4.06E-02	1.41E-03

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY

Unit 2

REPORT CATEGORY: SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.

TYPE OF ACTIVITY: ALL RADIONUCLIDES

REPORTING PERIOD: QUARTER # 1 AND QUARTER # 2 YEAR 2001

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDES RELEASED	**UNIT**	**QUARTER 1**	**QUARTER 2**	**QUARTER 1**	**QUARTER 2**
Xenon-133	CURIES	0.00E+00	0.00E+00	2.36E+00	1.79E-03
Xenon-133M	CURIES	0.00E+00	0.00E+00	2.94E-02	0.00E+00
Xenon-135	CURIES	0.00E+00	0.00E+00	2.37E-02	3.07E-05
Zirconium-95	CURIES	0.00E+00	0.00E+00	2.34E-05	1.81E-05
Zirconium-97	CURIES	0.00E+00	0.00E+00	1.37E-05	0.00E+00
TOTAL FOR PERIOD	CURIES	5.24E-01	7.01E-02	3.06E+02	7.96E+01

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
SEMIANNUAL SUMMATION OF ALL RELEASES BY QUARTER
ALL LIQUID EFFLUENTS
Unit: 2

Starting : 1-Jul-2001 Ending : 31-Dec-2001

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	1.381E-02	1.663E-02	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	8.955E-09	9.619E-09	
3. PERCENT OF EC* LIMIT (FRACTIONAL)	%	7.269E-03	5.571E-03	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	1.692E+02	3.630E+02	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	1.097E-04	2.100E-04	
3. % OF LIMIT (1.00E-02 uCi/mL)	%	1.097E+00	2.100E+00	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	9.996E-05	3.198E-03	10
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/mL	6.482E-11	1.850E-09	
3. PERCENT OF LIMIT (2.00E-04 uCi/mL)	%	3.241E-05	9.251E-04	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.000E+00	0.000E+00	10
E. WASTE VOL RELEASED				
1. TOTAL PRE-DILUTION VOLUME	LITERS	1.119E+07	3.792E+06	1
2. BATCH PRE-DILUTION VOLUME	LITERS	6.787E+05	9.527E+05	1
F. VOLUME OF DILUTION WATER USED**	LITERS	1.531E+09	1.725E+09	10

*EC= Effluent Concentration

**"Volume of dilution water used" means the volume of water circulated through the main condenser during the actual time of release. Liquid effluent releases ultimately dilute into the volume of the onsite main cooling reservoir and then into offsite water bodies as described in Section 2, subsection Radiological Impact on Man of this report.

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY
Unit 2

REPORT CATEGORY: SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY: ALL RADIONUCLIDES
REPORTING PERIOD: QUARTER # 3 AND QUARTER # 4 YEAR 2001

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDES RELEASED	**UNIT**	**QUARTER 3**	**QUARTER 4**	**QUARTER 3**	**QUARTER 4**
ALL NUCLIDES					
Silver-110M	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium-7	CURIES	0.00E+00	0.00E+00	0.00E+00	1.00E-04
Cobalt-57	CURIES	0.00E+00	0.00E+00	4.72E-05	9.49E-06
Cobalt-58	CURIES	0.00E+00	0.00E+00	3.48E-03	1.68E-03
Cobalt-60	CURIES	0.00E+00	0.00E+00	1.95E-03	1.18E-03
Chrome-51	CURIES	0.00E+00	0.00E+00	1.36E-04	1.20E-04
Cesium-134	CURIES	0.00E+00	0.00E+00	7.33E-06	3.81E-05
Cesium-136	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cesium-137	CURIES	0.00E+00	0.00E+00	1.18E-05	4.47E-05
Iron-55	CURIES	0.00E+00	0.00E+00	3.37E-03	3.77E-03
Iron-59	CURIES	0.00E+00	0.00E+00	0.00E+00	5.80E-06
Hydrogen-3 (Tritium)	CURIES	2.49E-01	6.78E-02	1.69E+02	3.63E+02
Iodine-131	CURIES	0.00E+00	0.00E+00	5.42E-05	1.33E-05
Iodine-132	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodine-133	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodine-134	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodine-135	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Krypton-85	CURIES	0.00E+00	0.00E+00	0.00E+00	5.37E-04
Krypton-85M	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese-54	CURIES	0.00E+00	0.00E+00	1.71E-03	7.74E-04
Sodium-24	CURIES	0.00E+00	0.00E+00	2.20E-06	0.00E+00
Niobium-95	CURIES	0.00E+00	0.00E+00	2.09E-04	1.83E-05
Niobium-97	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ruthenium-103	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony-122	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony-124	CURIES	0.00E+00	0.00E+00	1.84E-05	3.71E-05
Antimony-125	CURIES	0.00E+00	0.00E+00	2.65E-03	8.39E-03
Tin-117M	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Strontium-89	CURIES	0.00E+00	0.00E+00	3.33E-05	2.22E-05
Strontium-90	CURIES	0.00E+00	0.00E+00	1.18E-05	5.47E-06
Technitium-99M	CURIES	0.00E+00	0.00E+00	8.94E-06	0.00E+00
Telurium-125M	CURIES	0.00E+00	0.00E+00	0.00E+00	4.10E-04
Telurium-132	CURIES	0.00E+00	0.00E+00	0.00E+00	5.95E-06
Xenon-131M	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY

Unit 2

REPORT CATEGORY: SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES. TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY: ALL RADIONUCLIDES
REPORTING PERIOD: QUARTER # 3 AND QUARTER # 4 YEAR 2001

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDES RELEASED	**UNIT**	**QUARTER 3**	**QUARTER 4**	**QUARTER 3**	**QUARTER 4**
Xenon-133	CURIES	0.00E+00	0.00E+00	1.00E-04	2.59E-03
Xenon-133M	CURIES	0.00E+00	0.00E+00	0.00E+00	7.14E-05
Xenon-135	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zirconium-95	CURIES	0.00E+00	0.00E+00	1.11E-04	6.92E-06
Zirconium-97	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.49E-01	6.78E-02	1.69E+02	3.63E+02

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY

Unit 1 plus 2 Total

REPORT CATEGORY: ANNUAL LIQUID RELEASES. TOTALS FOR EACH NUCLIDE RELEASED. FOR ALL OF 2001

NUCLIDES RELEASED	UNIT	UNIT 1 2001	UNIT 2 2001	TOTAL 2001
ALL NUCLIDES				
Silver-110M	CURIES	2.320E-04	2.300E-05	2.550E-04
Beryllium-7	CURIES	8.220E-05	1.550E-04	2.380E-04
Cobalt-57	CURIES	9.480E-06	2.170E-04	2.260E-04
Cobalt-58	CURIES	3.990E-03	1.020E-02	1.420E-02
Cobalt-60	CURIES	1.120E-02	1.610E-02	2.730E-02
Chrome-51	CURIES	2.160E-03	9.010E-04	3.060E-03
Cesium-134	CURIES	8.050E-04	2.370E-03	3.180E-03
Cesium-136	CURIES	0.000E+00	2.130E-05	2.130E-05
Cesium-137	CURIES	1.430E-03	2.310E-03	3.740E-03
Iron-55	CURIES	1.580E-02	2.230E-02	3.820E-02
Iron-59	CURIES	1.180E-04	1.250E-04	2.430E-04
Hydrogen-3 (Tritium)	CURIES	1.180E+03	9.150E+02	2.090E+03
Iodine-131	CURIES	2.720E-03	1.050E-03	3.770E-03
Iodine-132	CURIES	0.000E+00	2.480E-05	2.480E-05
Iodine-133	CURIES	2.970E-06	2.920E-04	2.950E-04
Iodine-134	CURIES	0.000E+00	9.580E-07	9.580E-07
Iodine-135	CURIES	0.000E+00	3.900E-05	3.900E-05
Krypton-85	CURIES	6.080E-02	3.480E-01	4.080E-01
Krypton-85M	CURIES	0.000E+00	4.560E-04	4.560E-04
Manganese-54	CURIES	1.500E-03	4.920E-03	6.420E-03
Sodium-24	CURIES	0.000E+00	2.730E-06	2.730E-06
Niobium-95	CURIES	2.630E-04	3.850E-04	6.480E-04
Niobium-97	CURIES	0.000E+00	9.370E-06	9.370E-06
Rubidium-86	CURIES	7.790E-06	0.000E+00	7.790E-06
Ruthenium-103	CURIES	0.000E+00	1.210E-07	1.210E-07
Antimony-122	CURIES	0.000E+00	1.360E-05	1.360E-05
Antimony-124	CURIES	1.050E-04	6.050E-04	7.110E-04
Antimony-125	CURIES	5.660E-03	2.490E-02	3.050E-02
Tin-117M	CURIES	4.040E-04	1.070E-05	4.150E-04
Strontium-89	CURIES	2.110E-04	9.370E-05	3.050E-04
Strontium-90	CURIES	8.400E-05	1.730E-05	1.010E-04
Technitium-99M	CURIES	8.250E-06	8.940E-06	1.720E-05
Telurium-125M	CURIES	8.490E-03	3.540E-03	1.200E-02
Telurium-132	CURIES	0.000E+00	5.950E-06	5.950E-06
Xenon-131M	CURIES	1.180E-02	4.200E-02	5.380E-02
Xenon-133	CURIES	1.890E-01	2.360E+00	2.550E+00

SOUTH TEXAS PROJECT NUCLEAR OPERATING COMPANY

Unit 1 plus 2 Total

REPORT CATEGORY: ANNUAL LIQUID RELEASES. TOTALS FOR EACH NUCLIDE RELEASED. FOR ALL OF 2001

NUCLIDES RELEASED	UNIT	UNIT 1 2001	UNIT 2 2001	TOTAL 2001
ALL NUCLIDES				
Xenon-133M	CURIES	7.680E-04	2.950E-02	3.020E-02
Xenon-135	CURIES	1.190E-04	2.370E-02	2.380E-02
Zirconium-95	CURIES	1.100E-04	1.590E-04	2.700E-04
Zirconium-97	CURIES	0.000E+00	1.370E-05	1.370E-05
TOTAL	CURIES	1.180E+03	9.179E+02	2.093E+03
TOTAL Noble Gases	CURIES	2.625E-01	2.804E+00	3.066E+00
TOTAL Excluding Tritium & Noble Gases	CURIES	5.539E-02	9.081E-02	1.462E-01

Solid Waste and Irradiated Fuel Shipments

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

1. Type of Waste	Units	12-Month Period Shipped	12-Month Period Buried	Est. Total Error, %	
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3 Ci	3.3E+01 4.93E+02	3.3E+01 4.93E+02	-1.0E+00 -5.0E+01	+1.0E+00 +1.0E+02
b. Dry compressible waste, contaminated equip., etc.	m^3 Ci	3.53E+02 1.06E+00	2.1E+01 9.62E-01	-1.0E+00 -6.6E+01	+1.0E+00 +2.0E+02
c. Irradiated components, control rods, etc.	m^3 Ci	0.00E+00 0.00E+00	0.00E+00 0.00E+00	N/A	N/A
d. Other (low level secondary resin, sludge)	m^3 Ci	2.39E+01 4.10E-02	0.00E+00 0.00E+00	-1.0E+00 -5.0E+01	+1.0E+00 +1.0E+02

2. Estimate of major nuclide composition (by type of waste)

a. Spent resins, filters, evaporator bottoms, etc.		
Nickel-63	%	3.34E+01
Iron-55	%	3.16E+01
Cesium-137	%	1.08E+01
Cobalt-60	%	1.08E+01
Cesium-134	%	6.00E+00
Tritium	%	2.40E+00
Cobalt-57	%	1.70E+00
Manganese-54	%	1.60E+00
Cobalt-58	%	1.10E+00
b. Dry compressible waste, contaminated equip., etc.		
Cobalt-58	%	3.72E+01
Iron-55	%	2.10E+01
Cromium-51	%	1.82E+01
Nickel-63	%	7.90E+00
Cobalt-60	%	4.70E+00
Niobium-95	%	2.70E+00
Zirconium-95	%	2.70E+00
Antimony-124	%	1.80E+00
Manganese-54	%	1.20E+00
c. N/A	N/A	N/A
d. Other (secondary DE and HVAC charcoal)		
Tritium	%	8.94E+01
Cobalt-60	%	6.70E+00
Cesium-137	%	2.10E+00
Cobalt-58	%	1.00E+00
Manganese-54	%	7.00E-01
Niobium-95	%	1.00E-01

3. Solid Waste Disposition:

Number of Shipments	Mode of Transportation	Destination
9	Truck	Chem-Nuclear Systems Barnwell Waste Management Facility 740 Osborn Rd. Barnwell, SC 29812
7	Truck	GTS-Duratek 1560 Bear Creek Road Oak Ridge, TN 37830
1	Truck	GTS-Duratek Gallaher Road Facility 628 Gallaher Rd. Kingston, TN 37763

4. Class of Solid Waste:
   A, B & C

5. Type of Containers Used for Shipment:
   Strong Tight, High-Integrity Containers, Type A and B casks

6. Solidifying Agent:
   N/A

B. IRRADIATED FUEL SHIPMENTS (Disposal)
   No shipments made during this period.

DOSE ACCUMULATIONS

STP NUCLEAR OPERATING COMPANY
SUMMARY OF MAXIMUM INDIVIDUAL DOSES
Unit: 1
TOTAL ACCUMULATION FOR PERIODS: for LIQUID, GASEOUS AND AIR
Starting: 1-Jan-2001 Ending: 31-Dec-2001

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (m) (TOWARD)	% OF APPLICABLE LIMIT	LIMIT (mrad or mrem)
LIQUID	TOTAL BODY	6.85E-03	ADULT	RECEPTOR 3(5)	2.28E-01	3.0
LIQUID	GI-TRACT	6.96E-03	ADULT	RECEPTOR 3(5)	6.96E-02	10.0
NOBLE GAS	AIR DOSE (gamma-mrad)	7.00E-03		1720m NW	7.00E-02	10.0
NOBLE GAS	AIR DOSE (beta-mrad)	2.00E-02		1720m NW	1.00E-01	20.0
NOBLE GAS	TOTAL BODY	4.13E-03	ALL(1)	1720m NW	8.26E-02	5.0
NOBLE GAS	TOTAL BODY	1.10E-03	ALL(2)	4000m WSW	2.20E-02	5.0
NOBLE GAS	SKIN	1.17E-02	ALL(1)	1720m NW	7.79E-02	15.0
NOBLE GAS	SKIN	3.11E-03	ALL(2)	4000m WSW	2.07E-02	15.0
IODINE, PARTICULATES & TRITIUM	THYROID	4.00E-02	CHILD(1)	1720m NW	2.67E-01	15.0
IODINE, PARTICULATES & TRITIUM	THYROID	1.18E-02	CHILD(2)	4000m WSW	7.87E-02	15.0

SUMMARY OF POPULATION DOSES FOR 2001			
EFFLUENT	APPLICABLE ORGAN	ESTIMATED POPULATION DOSE (person-rem)	AVERAGE DOSE TO POPULATION (rem per person)
LIQUID	TOTAL BODY	2.2E-03	1.0E-07(3)
GASEOUS	TOTAL BODY	7.9E-03	9.3E-07(4)

NOTES:

(1)Doses were calculated for HYPOTHETICAL receptors at the site boundary.
(2)Highest dose for REAL individual or receptor.
(3) Calculation based on a population of 303,500 for shore line exposure and for salt water invertebrate ingestion and 18,500 for salt water sport fish ingestion.
(4) Calculation based on a population of 299,000 within fifty (50) miles of South Texas Project Electric Generating Station.
(5)Receptor 3 is an individual ingesting fresh water sport fish and receiving shoreline exposure from the Little Robbins Slough Area.

STP NUCLEAR OPERATING COMPANY
SUMMARY OF MAXIMUM INDIVIDUAL DOSES
Unit: 2
TOTAL ACCUMULATION FOR PERIODS:
for LIQUID, GASEOUS, AND AIR
Starting: 1-Jan-2001 Ending: 31-Dec-2001

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (m) (TOWARD)	% OF APPLICABLE LIMIT	LIMIT (mrad or mrem)
LIQUID	TOTAL BODY	5.32E-03	ADULT	RECEPTOR 3(5)	1.77E-01	3.0
LIQUID	GI-TRACT	5.54E-03	ADULT	RECEPTOR 3(5)	5.54E-02	10.0
NOBLE GAS	AIR DOSE (gamma-mrad)	5.72E-03		2160m W	5.72E-02	10.0
NOBLE GAS	AIR DOSE (beta-mrad)	3.60E-03		2160m W	1.80E-02	20.0
NOBLE GAS	TOTAL BODY	3.77E-03	ALL(1)	2160m W	7.54E-02	5.0
NOBLE GAS	TOTAL BODY	1.22E-03	ALL(2)	4000m WSW	2.45E-02	5.0
NOBLE GAS	SKIN	6.60E-03	ALL(1)	2160m W	4.40E-02	15.0
NOBLE GAS	SKIN	2.21E-03	ALL(2)	4000m WSW	1.47E-02	15.0
IODINE, PARTICULATES & TRITIUM	THYROID	3.48E-02	CHILD(1)	1850m WNW	2.32E-01	15.0
IODINE, PARTICULATES & TRITIUM	THYROID	6.71E-03	CHILD(2)	4000m WSW	4.48E-02	15.0

SUMMARY OF POPULATION DOSES FOR 2001			
EFFLUENT	APPLICABLE ORGAN	ESTIMATED POPULATION DOSE (person-rem)	AVERAGE DOSE TO POPULATION (rem per person)
LIQUID	TOTAL BODY	1.9E-03	8.5E-08(3)
GASEOUS	TOTAL BODY	1.6E-02	1.7E-06(4)

NOTES:

(1) Doses were calculated for HYPOTHETICAL receptors at the site boundary.

(2) Highest dose for REAL individual or receptor.

(3) Calculation based on a population of 303,500 for shore line exposure and for salt water invertebrate ingestion and 18,500 for salt water sport fish ingestion.

(4) Calculation based on a population of 299,000 within fifty (50) miles of South Texas Project Electric Generating Station.

(5) Receptor 3 is an individual ingesting fresh water sport fish and receiving shoreline exposure from the Little Robbins Slough Area.

STP NUCLEAR OPERATING COMPANY
SUMMARY OF MAXIMUM INDIVIDUAL DOSES
Unit: 1 PLUS 2
TOTAL ACCUMULATION FOR PERIODS:
for LIQUID, GASEOUS, AND AIR
Starting: 1-Jan-2001 Ending: 31-Dec-2001

EFFLUENT	APPLICABLE ORGAN	UNIT 1 ESTIMATED DOSE (mrem)	UNIT 2 ESTIMATED DOSE (mrem)	TOTAL 1+2 ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (m) (TOWARD)
LIQUID	TOTAL BODY	6.85E-03	5.32E-03	1.22E-02	ADULT	RECEPTOR 3(5)
LIQUID	GI-TRACT	6.96E-03	5.54E-03	1.25E-02	ADULT	RECEPTOR 3(5)
NOBLE GAS	AIR DOSE (gamma-mrad)	7.00E-03	3.42E-03	1.04E-02		1720m NW
NOBLE GAS	AIR DOSE (beta-mrad)	2.00E-02	3.10E-03	2.31E-02		1720m NW
NOBLE GAS	TOTAL BODY	4.13E-03	2.23E-03	6.35E-03	ALL(1)	1720m NW
NOBLE GAS	TOTAL BODY	1.10E-03	1.22E-03	2.32E-03	ALL(2)	4000m WSW
NOBLE GAS	SKIN	1.17E-02	4.20E-03	1.59E-02	ALL(1)	1720m NW
NOBLE GAS	SKIN	3.11E-03	2.21E-03	5.32E-03	ALL(2)	4000m WSW
IODINE, PARTICULATES & TRITIUM	THYROID	3.82E-02	3.48E-02	7.31E-02	CHILD(1)	1850m WNW
IODINE, PARTICULATES & TRITIUM	THYROID	1.18E-02	6.71E-03	1.85E-02	CHILD(2)	4000m WSW
IODINE, PARTICULATES & TRITIUM	TOTAL BODY	6.81E-04	2.31E-03	2.99E-03	ADULT(2)	4000m WSW

SUMMARY OF POPULATION DOSES FOR 2001			
EFFLUENT	APPLICABLE ORGAN	TOTAL 1+2 ESTIMATED POPULATION DOSE (person-rem)	TOTAL 1+2 AVERAGE DOSE TO POPULATION (rem per person)
LIQUID	TOTAL BODY	4.1E-03	1.9E-07(3)
GASEOUS	TOTAL BODY	2.4E-02	1.7E-06(4)

NOTES:

(1) Doses were calculated for HYPOTHETICAL receptors at the site boundary.

(2) Highest dose for REAL individual or receptor.

(3) Calculation based on a population of 303,500 for shore line exposure and for salt water invertebrate ingestion and 18,500 for salt water sport fish ingestion.

(4) Calculation based on a population of 299,000 within fifty (50) miles of South Texas Project Electric Generating Station.

(5) Receptor 3 is an individual ingesting fresh water sport fish and receiving shoreline exposure from the Little Robbins Slough Area.

RESULTS OF THE PROTECTED AREA DIRECT RADIATION MEASUREMENTS PROGRAM

Table 8-1

2001 STPEGS PROTECTED AREA THERMOLUMINESCENT DOSIMETER MONITORING STATIONS						
Station Number	1st Qtr Average	2nd Qtr Average	3rd Qtr Average	4th Qtr Average	Average Rate	Average[1] Net Rate
	[2](mR)	[2](mR)	[2](mR)	[2](mR)	[2](mR)	(mR/hour)
1	14.9	12.7	13.2	14.0	13.7	-0-
2	12.9	11.9	12.3	12.8	12.5	-0-
3	12.8	12.4	12.7	13.0	12.7	-0-
4	13.1	13.1	12.7	13.1	13.0	-0-
5	14.3	14.3	13.2	14.9	14.2	-0-
6	15.7	16.1	15.2	16.4	15.9	0.00021
7	16.1	16.3	15.7	15.8	16.0	0.00026
8	13.6	13.7	13.9	13.8	13.8	-0-
9	13.1	12.9	13.2	12.9	13.0	-0-
10	12.8	11.7	12.2	12.4	12.3	-0-
11	12.2	11.5	11.9	11.7	11.8	-0-
12	12.4	11.9	12.4	12.5	12.3	-0-
13	12.7	12.5	12.0	12.5	12.4	-0-
14	12.6	12.2	12.4	12.4	12.4	-0-
15	13.2	12.9	13.0	12.8	13.0	-0-
16	12.6	12.2	12.3	12.6	12.4	-0-

Notes:
Individual values normalized to a 91 day quarter.
Only the calcium sulfate elements were used in these averages.

(1) Net Rate:
Difference between the exposure rate in 2001 and the rate measured in 1986 due to natural background
([average rate] - 15.4 mR background) / 91 days / 24 hours per day

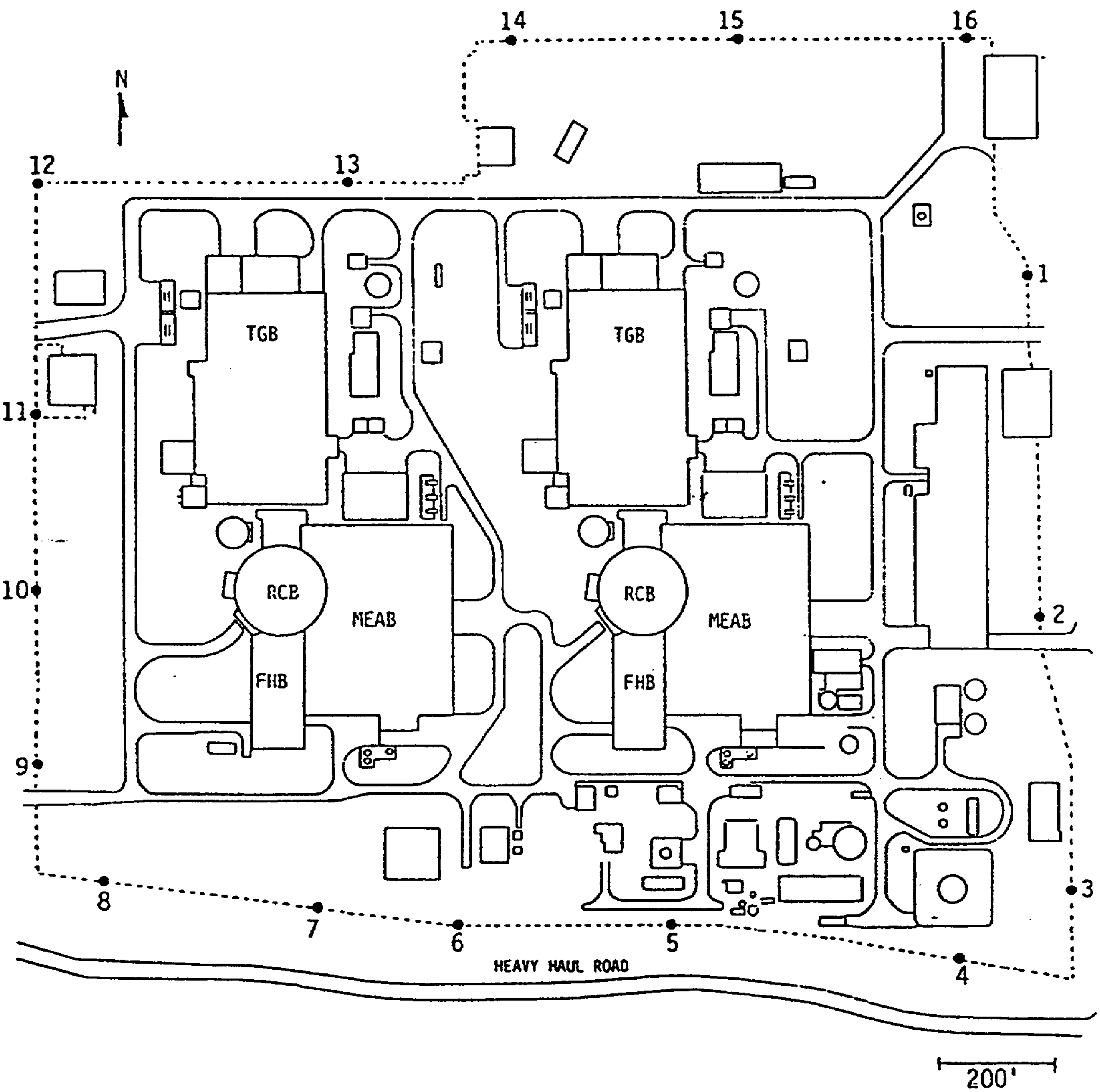
The 1986 background rate of 15.4 milliroentgen per quarter at the site boundary has been used to reflect the pre-operational baseline exposure rate for STP. Historically the exposure rate measured near the protected area fence has been lower than the site boundary's historical background. This year, dosimeter stations 6 and 7 had exposure rates above the site boundary's background rate. These two stations typically have the highest rates due to radioactive waste handling activities on the south sides of the Units.

Zero (0) indicates background levels.

(2) mR = milliroentgen, a unit of exposure for X and gamma rays

FIGURE 8-1

PROTECTED AREA MONITORING STATIONS



JOINT FREQUENCY TABLES

First Quarter 2001

Joint Frequency Tables

JOINT FREQUENCY TABLE

STABILITY CLASS -A-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	3	4	0	0	0	7	4.7	11.7
NNE	0	0	0	6	2	0	0	0	8	5.4	11.1
NE	0	0	0	0	1	0	0	0	1	0.7	13.2
ENE	0	0	0	3	1	0	0	0	4	2.7	11.2
E	0	0	0	3	4	0	0	0	7	4.7	11.8
ESE	0	0	0	8	14	0	0	0	22	14.9	13.6
SE	0	0	0	10	3	0	0	0	13	8.8	11.7
SSE	0	0	2	5	4	1	0	0	12	8.1	12.3
S	0	0	0	16	12	1	0	0	29	19.6	12.9
SSW	0	0	1	2	6	0	0	0	9	6.1	12.9
SW	0	0	0	2	0	0	0	0	2	1.4	11.3
WSW	0	0	1	1	0	0	0	0	2	1.4	9.0
W	0	0	0	3	0	0	0	0	3	2.0	10.8
WNW	0	0	1	2	1	0	0	0	4	2.7	10.0
NW	0	0	5	8	2	0	0	0	15	10.1	10.1
NNW	0	0	0	5	4	1	0	0	10	6.8	13.1
TOTAL	0	0	10	77	58	3	0	0	148	100.0	
%	0.0	0.0	6.8	52.0	39.2	2.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 12.1 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 107
TOTAL NUMBER OF VALID HOURS= 2053
TOTAL NUMBER OF HOURS FOR PERIOD= 2160

JOINT FREQUENCY TABLE

STABILITY CLASS -B-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	6	6	3	0	0	0	15	11.6	8.8
NNE	0	0	5	5	1	0	0	0	11	8.5	8.0
NE	0	0	1	5	1	0	0	0	7	5.4	10.3
ENE	0	0	2	3	2	0	0	0	7	5.4	10.8
E	0	0	1	4	2	0	0	0	7	5.4	10.5
ESE	0	0	0	6	3	0	0	0	9	7.0	12.9
SE	0	0	2	6	1	0	0	0	9	7.0	10.3
SSE	0	0	0	9	1	0	0	0	10	7.8	10.7
S	0	0	1	6	2	0	0	0	9	7.0	11.3
SSW	0	0	0	2	0	0	0	0	2	1.6	7.8
SW	0	0	1	3	0	0	0	0	4	3.1	8.3
WSW	0	0	1	1	0	0	0	0	2	1.6	6.9
W	0	0	0	1	0	0	0	0	1	0.8	11.6
WNW	0	0	2	1	0	0	0	0	3	2.3	6.0
NW	0	0	2	4	3	1	0	0	10	7.8	12.0
NNW	0	0	2	8	10	3	0	0	23	17.8	12.7
TOTAL	0	0	26	70	29	4	0	0	129	100.0	
%	0.0	0.0	20.2	54.3	22.5	3.1	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.6 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 107
TOTAL NUMBER OF VALID HOURS= 2053
TOTAL NUMBER OF HOURS FOR PERIOD= 2160

JOINT FREQUENCY TABLE

STABILITY CLASS -C-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	1	5	12	8	0	0	0	26	16.8	10.7
NNE	0	0	4	8	2	0	0	0	14	9.0	9.3
NE	0	0	4	7	2	0	0	0	13	8.4	9.1
ENE	0	0	1	4	3	0	0	0	8	5.2	11.8
E	0	1	2	2	1	0	0	0	6	3.9	7.4
ESE	0	0	4	2	4	0	0	0	10	6.5	10.4
SE	0	0	4	7	8	1	0	0	20	12.9	11.8
SSE	0	0	2	6	5	1	0	0	14	9.0	11.5
S	0	0	0	4	0	0	0	0	4	2.6	9.7
SSW	0	0	2	0	0	0	0	0	2	1.3	5.9
SW	0	0	3	1	0	0	0	0	4	2.6	6.9
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	3	0	0	0	0	0	3	1.9	6.3
WNW	0	0	3	0	0	0	0	0	3	1.9	4.0
NW	0	0	1	5	5	0	0	0	11	7.1	11.4
NNW	0	0	3	4	6	4	0	0	17	11.0	13.0
TOTAL	0	2	41	62	44	6	0	0	155	100.0	
%	0.0	1.3	26.5	40.0	28.4	3.9	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.5 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 107
TOTAL NUMBER OF VALID HOURS= 2053
TOTAL NUMBER OF HOURS FOR PERIOD= 2160

JOINT FREQUENCY TABLE

STABILITY CLASS -D-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	1	23	76	50	0	0	0	150	17.4	10.9
NNE	0	1	21	52	13	0	0	0	87	10.1	9.5
NE	0	1	15	66	15	1	0	0	98	11.4	10.2
ENE	0	0	13	44	11	0	0	0	68	7.9	10.4
E	0	0	21	45	5	1	0	0	72	8.4	9.1
ESE	0	0	13	30	3	0	0	0	46	5.3	9.1
SE	0	1	7	29	52	1	0	0	90	10.5	12.6
SSE	0	0	1	35	29	5	0	0	70	8.1	13.0
S	0	0	3	16	1	0	0	0	20	2.3	9.9
SSW	0	1	3	0	0	0	0	0	4	0.5	5.5
SW	0	0	1	1	0	0	0	0	2	0.2	7.8
WSW	0	0	0	2	1	0	0	0	3	0.3	10.8
W	0	0	3	1	1	0	0	0	5	0.6	7.3
WNW	0	1	3	2	2	0	0	0	8	0.9	8.1
NW	0	0	8	12	9	1	0	0	30	3.5	10.6
NNW	0	0	20	51	34	3	0	0	108	12.5	11.3
TOTAL	0	6	155	462	226	12	0	0	861	100.0	
%	0.0	0.7	18.0	53.7	26.2	1.4	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.7 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 107
TOTAL NUMBER OF VALID HOURS= 2053
TOTAL NUMBER OF HOURS FOR PERIOD= 2160

JOINT FREQUENCY TABLE

STABILITY CLASS -E-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	3	14	12	10	0	0	0	39	10.1	8.8
NNE	0	2	11	10	2	0	0	0	25	6.5	7.4
NE	0	3	18	8	0	0	0	0	29	7.5	6.3
ENE	0	3	18	8	0	0	0	0	29	7.5	6.3
E	0	3	16	9	2	0	0	0	30	7.8	7.1
ESE	0	2	24	13	2	0	0	0	41	10.6	7.2
SE	0	2	17	18	10	0	0	0	47	12.2	8.9
SSE	0	0	12	22	0	0	0	0	34	8.8	8.0
S	0	0	10	14	0	0	0	0	24	6.2	7.8
SSW	0	0	9	2	1	0	0	0	12	3.1	7.5
SW	0	0	3	7	2	0	0	0	12	3.1	9.7
WSW	0	1	1	5	0	0	0	0	7	1.8	7.9
W	0	1	3	1	0	0	0	0	5	1.3	5.5
WNW	0	0	3	0	0	0	0	0	3	0.8	4.7
NW	0	4	7	1	0	0	0	0	12	3.1	4.6
NNW	0	0	23	12	2	0	0	0	37	9.6	7.4
TOTAL	0	24	189	142	31	0	0	0	386	100.0	
%	0.0	6.2	49.0	36.8	8.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 7.5 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 107
TOTAL NUMBER OF VALID HOURS= 2053
TOTAL NUMBER OF HOURS FOR PERIOD= 2160

JOINT FREQUENCY TABLE

STABILITY CLASS -F-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	3	10	0	0	0	0	0	13	6.6	4.8
NNE	0	4	8	3	0	0	0	0	15	7.6	5.8
NE	0	4	8	4	0	0	0	0	16	8.1	4.9
ENE	0	4	14	0	0	0	0	0	18	9.1	4.5
E	0	4	15	1	0	0	0	0	20	10.2	5.2
ESE	0	2	9	0	0	0	0	0	11	5.6	4.6
SE	0	1	12	0	0	0	0	0	13	6.6	5.3
SSE	0	2	8	3	0	0	0	0	13	6.6	6.1
S	0	1	3	3	0	0	0	0	7	3.6	5.8
SSW	0	0	5	1	0	0	0	0	6	3.0	6.2
SW	0	0	5	1	0	0	0	0	6	3.0	6.5
WSW	0	0	4	5	0	0	0	0	9	4.6	7.4
W	0	1	5	0	0	0	0	0	6	3.0	5.1
WNW	0	1	5	0	0	0	0	0	6	3.0	4.4
NW	0	5	11	2	0	0	0	0	18	9.1	4.6
NNW	0	2	17	1	0	0	0	0	20	10.2	5.7
TOTAL	0	34	139	24	0	0	0	0	197	100.0	
%	0.0	17.3	70.6	12.2	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 5.3 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 107
TOTAL NUMBER OF VALID HOURS= 2053
TOTAL NUMBER OF HOURS FOR PERIOD= 2160

JOINT FREQUENCY TABLE

STABILITY CLASS -G-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	1	4	1	0	0	0	0	6	3.4	5.3
NNE	0	6	7	0	0	0	0	0	13	7.3	3.6
NE	0	10	23	0	0	0	0	0	33	18.6	4.4
ENE	0	5	15	0	0	0	0	0	20	11.3	4.4
E	0	2	12	1	0	0	0	0	15	8.5	4.6
ESE	0	4	10	0	0	0	0	0	14	7.9	3.8
SE	0	5	12	0	0	0	0	0	17	9.6	4.7
SSE	0	8	3	0	0	0	0	0	11	6.2	3.2
S	0	2	1	0	0	0	0	0	3	1.7	2.9
SSW	0	1	0	0	0	0	0	0	1	0.6	2.1
SW	0	1	0	0	0	0	0	0	1	0.6	2.2
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	1	5	0	0	0	0	0	6	3.4	4.1
WNW	0	10	4	0	0	0	0	0	14	7.9	3.3
NW	0	8	7	1	0	0	0	0	16	9.0	4.2
NNW	0	1	5	1	0	0	0	0	7	4.0	4.6
TOTAL	0	65	108	4	0	0	0	0	177	100.0	
%	0.0	36.7	61.0	2.3	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 4.2 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 107
TOTAL NUMBER OF VALID HOURS= 2053
TOTAL NUMBER OF HOURS FOR PERIOD= 2160

JOINT FREQUENCY TABLE

ALL CLASSES COMBINED

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	9	62	110	75	0	0	0	256	12.5	10.0
NNE	0	13	56	84	20	0	0	0	173	8.4	8.4
NE	0	18	69	90	19	1	0	0	197	9.6	8.2
ENE	0	12	63	62	17	0	0	0	154	7.5	8.3
E	0	10	67	65	14	1	0	0	157	7.6	7.9
ESE	0	8	60	59	26	0	0	0	153	7.5	8.7
SE	0	9	54	70	74	2	0	0	209	10.2	10.4
SSE	0	10	28	80	39	7	0	0	164	8.0	10.4
S	0	3	18	59	15	1	0	0	96	4.7	9.9
SSW	0	2	20	7	7	0	0	0	36	1.8	8.2
SW	0	1	13	15	2	0	0	0	31	1.5	8.3
WSW	0	1	7	14	1	0	0	0	23	1.1	8.1
W	0	3	19	6	1	0	0	0	29	1.4	6.3
WNW	0	12	21	5	3	0	0	0	41	2.0	5.4
NW	0	17	41	33	19	2	0	0	112	5.5	8.2
NNW	0	3	70	82	56	11	0	0	222	10.8	10.3
TOTAL	0	131	668	841	388	25	0	0	2053	100.0	
%	0.0	6.4	32.5	41.0	18.9	1.2	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 9.1 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 107
TOTAL NUMBER OF VALID HOURS= 2053
TOTAL NUMBER OF HOURS FOR PERIOD= 2160

Second Quarter 2001

Joint Frequency Tables

JOINT FREQUENCY TABLE

STABILITY CLASS -A-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	3	6	0	0	0	0	0	9	1.5	5.0
NNE	0	3	4	0	3	0	0	0	10	1.7	7.5
NE	0	3	10	5	1	0	0	0	19	3.2	6.7
ENE	0	0	6	6	0	0	0	0	12	2.0	8.1
E	0	0	4	9	2	0	0	0	15	2.6	9.8
ESE	0	1	5	17	39	0	0	0	62	10.6	12.6
SE	0	0	9	72	52	16	0	0	149	25.4	12.7
SSE	0	1	6	44	40	14	0	0	105	17.9	13.0
S	0	0	11	99	57	0	0	0	167	28.4	11.1
SSW	0	0	9	13	0	0	0	0	22	3.7	8.1
SW	0	0	0	1	0	0	0	0	1	0.2	8.0
WSW	0	1	0	0	0	0	0	0	1	0.2	2.8
W	0	1	1	0	0	0	0	0	2	0.3	3.4
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	2	0	0	0	0	0	2	0.3	4.6
NNW	0	2	7	2	0	0	0	0	11	1.9	6.2
TOTAL	0	15	80	268	194	30	0	0	587	100.0	
%	0.0	2.6	13.6	45.7	33.0	5.1	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 11.3 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 116
TOTAL NUMBER OF VALID HOURS= 2068
TOTAL NUMBER OF HOURS FOR PERIOD= 2184

JOINT FREQUENCY TABLE

STABILITY CLASS -B-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	1	3	0	0	0	0	4	3.4	8.9
NNE	0	1	0	5	5	0	0	0	11	9.5	11.3
NE	0	0	2	1	0	0	0	0	3	2.6	7.2
ENE	0	1	3	2	0	0	0	0	6	5.2	6.4
E	0	1	1	0	0	0	0	0	2	1.7	3.8
ESE	0	0	0	7	3	0	0	0	10	8.6	11.7
SE	0	0	3	20	9	3	0	0	35	30.2	12.1
SSE	0	0	2	8	16	1	0	0	27	23.3	13.3
S	0	1	4	7	1	0	0	0	13	11.2	8.4
SSW	0	0	0	2	0	0	0	0	2	1.7	9.9
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	1	0	0	0	0	0	1	0.9	4.3
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	1	0	0	0	0	0	1	0.9	5.3
NNW	0	0	1	0	0	0	0	0	1	0.9	5.2
TOTAL	0	4	19	55	34	4	0	0	116	100.0	
%	0.0	3.4	16.4	47.4	29.3	3.4	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.9 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 116
TOTAL NUMBER OF VALID HOURS= 2068
TOTAL NUMBER OF HOURS FOR PERIOD= 2184

JOINT FREQUENCY TABLE

STABILITY CLASS -C-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	1	1	1	0	0	0	3	2.7	11.5
NNE	0	0	1	3	7	0	0	0	11	9.9	13.2
NE	0	1	0	2	2	0	0	0	5	4.5	10.5
ENE	0	0	2	2	0	0	0	0	4	3.6	8.2
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	2	8	1	0	0	0	11	9.9	10.8
SE	0	0	2	14	17	4	0	0	37	33.3	13.2
SSE	0	0	2	11	10	0	0	0	23	20.7	12.4
S	0	0	4	3	2	0	0	0	9	8.1	9.6
SSW	0	0	2	2	0	0	0	0	4	3.6	8.6
SW	0	0	0	1	0	0	0	0	1	0.9	7.7
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	1	0	0	0	0	0	0	1	0.9	2.9
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	1	0	0	0	0	1	0.9	9.3
NNW	0	0	1	0	0	0	0	0	1	0.9	4.8
TOTAL	0	2	17	48	40	4	0	0	111	100.0	
%	0.0	1.8	15.3	43.2	36.0	3.6	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 11.7 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 116
TOTAL NUMBER OF VALID HOURS= 2068
TOTAL NUMBER OF HOURS FOR PERIOD= 2184

JOINT FREQUENCY TABLE

STABILITY CLASS -D-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	7	23	10	0	0	0	40	6.5	10.4
NNE	0	0	6	15	7	0	0	0	28	4.6	10.3
NE	0	0	6	2	2	0	0	0	10	1.6	7.5
ENE	0	2	2	2	0	0	0	0	6	1.0	6.0
E	0	0	4	5	1	0	0	0	10	1.6	8.1
ESE	0	1	12	41	2	0	1	0	57	9.3	9.0
SE	0	0	23	80	50	3	0	0	156	25.4	11.2
SSE	0	1	34	99	92	0	0	0	226	36.8	11.5
S	0	0	12	40	9	1	0	0	62	10.1	10.1
SSW	0	0	2	5	0	0	0	0	7	1.1	8.8
SW	0	0	1	0	0	0	0	0	1	0.2	5.9
WSW	0	0	1	0	0	0	0	0	1	0.2	5.2
W	0	0	1	0	0	0	0	0	1	0.2	6.2
WNW	0	0	2	0	0	0	0	0	2	0.3	5.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	1	1	3	2	0	0	0	7	1.1	8.7
TOTAL	0	5	114	315	175	4	1	0	614	100.0	
%	0.0	0.8	18.6	51.3	28.5	0.7	0.2	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.7 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 116
TOTAL NUMBER OF VALID HOURS= 2068
TOTAL NUMBER OF HOURS FOR PERIOD= 2184

JOINT FREQUENCY TABLE

STABILITY CLASS -E-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	2	3	0	0	0	0	5	1.7	6.6
NNE	0	1	6	1	1	0	0	0	9	3.0	7.1
NE	0	2	4	0	0	0	0	0	6	2.0	4.9
ENE	0	3	11	0	0	0	0	0	14	4.7	4.2
E	0	4	12	0	1	0	0	0	17	5.6	5.1
ESE	0	7	21	3	0	0	0	0	31	10.3	5.2
SE	0	1	50	20	3	0	0	0	74	24.6	6.9
SSE	0	2	41	41	13	0	0	0	97	32.2	8.7
S	0	1	7	23	0	0	0	0	31	10.3	8.6
SSW	0	0	2	1	0	0	0	0	3	1.0	7.3
SW	0	0	1	0	0	0	0	0	1	0.3	6.8
WSW	0	1	0	2	0	0	0	0	3	1.0	7.8
W	0	1	0	1	0	0	0	0	2	0.7	5.0
WNW	0	0	2	1	0	0	0	0	3	1.0	6.7
NW	0	0	1	1	0	0	0	0	2	0.7	6.3
NNW	0	3	0	0	0	0	0	0	3	1.0	3.2
TOTAL	0	26	160	97	18	0	0	0	301	100.0	
%	0.0	8.6	53.2	32.2	6.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 7.2 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 116
TOTAL NUMBER OF VALID HOURS= 2068
TOTAL NUMBER OF HOURS FOR PERIOD= 2184

JOINT FREQUENCY TABLE

STABILITY CLASS -F-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	1	0	0	0	0	0	1	0.6	6.4
NNE	0	1	6	0	0	0	0	0	7	4.2	4.2
NE	0	8	15	0	0	0	0	0	23	13.8	4.0
ENE	0	14	18	0	0	0	0	0	32	19.2	3.8
E	0	8	7	0	0	0	0	0	15	9.0	3.7
ESE	1	7	8	0	0	0	0	0	16	9.6	3.9
SE	0	7	22	2	0	0	0	0	31	18.6	4.4
SSE	0	3	22	1	0	0	0	0	26	15.6	5.3
S	0	2	4	0	0	0	0	0	6	3.6	4.7
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	1	0	0	0	0	0	0	1	0.6	3.0
WSW	0	2	0	0	0	0	0	0	2	1.2	2.3
W	1	0	0	0	0	0	0	0	1	0.6	0.7
WNW	0	3	1	0	0	0	0	0	4	2.4	2.5
NW	0	0	1	0	0	0	0	0	1	0.6	4.2
NNW	0	1	0	0	0	0	0	0	1	0.6	3.3
TOTAL	2	57	105	3	0	0	0	0	167	100.0	
%	1.2	34.1	62.9	1.8	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 4.2 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 116
TOTAL NUMBER OF VALID HOURS= 2068
TOTAL NUMBER OF HOURS FOR PERIOD= 2184

JOINT FREQUENCY TABLE

STABILITY CLASS -G-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	1	8	3	0	0	0	0	0	12	7.0	3.1
NNE	0	19	13	0	0	0	0	0	32	18.6	3.6
NE	0	24	13	0	0	0	0	0	37	21.5	3.3
ENE	1	13	8	0	0	0	0	0	22	12.8	3.3
E	0	11	9	0	0	0	0	0	20	11.6	3.5
ESE	0	16	6	0	0	0	0	0	22	12.8	3.3
SE	0	4	6	0	0	0	0	0	10	5.8	3.9
SSE	0	0	0	0	0	0	0	0	0	0.0	0.0
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	1	0	0	0	0	0	1	0.6	4.2
WNW	1	3	1	0	0	0	0	0	5	2.9	1.7
NW	0	2	1	0	0	0	0	0	3	1.7	3.1
NNW	0	3	5	0	0	0	0	0	8	4.7	3.8
TOTAL	3	103	66	0	0	0	0	0	172	100.0	
%	1.7	59.9	38.4	0.0	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 3.4 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 116
TOTAL NUMBER OF VALID HOURS= 2068
TOTAL NUMBER OF HOURS FOR PERIOD= 2184

JOINT FREQUENCY TABLE

ALL CLASSES COMBINED

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	1	11	21	30	11	0	0	0	74	3.6	8.2
NNE	0	25	36	24	23	0	0	0	108	5.2	7.8
NE	0	38	50	10	5	0	0	0	103	5.0	5.0
ENE	1	33	50	12	0	0	0	0	96	4.6	4.8
E	0	24	37	14	4	0	0	0	79	3.8	5.7
ESE	1	32	54	76	45	0	1	0	209	10.1	8.7
SE	0	12	115	208	131	26	0	0	492	23.8	10.6
SSE	0	7	107	204	171	15	0	0	504	24.4	11.1
S	0	4	42	172	69	1	0	0	288	13.9	10.3
SSW	0	0	15	23	0	0	0	0	38	1.8	8.3
SW	0	1	2	2	0	0	0	0	5	0.2	6.3
WSW	0	4	2	2	0	0	0	0	8	0.4	5.0
W	1	3	3	1	0	0	0	0	8	0.4	3.9
WNW	1	6	6	1	0	0	0	0	14	0.7	3.5
NW	0	2	6	2	0	0	0	0	10	0.5	5.0
NNW	0	10	15	5	2	0	0	0	32	1.5	5.7
TOTAL	5	212	561	786	461	42	1	0	2068	100.0	
%	0.2	10.3	27.1	38.0	22.3	2.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 9.3 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 116
TOTAL NUMBER OF VALID HOURS= 2068
TOTAL NUMBER OF HOURS FOR PERIOD= 2184

Third Quarter 2001

Joint Frequency Tables

JOINT FREQUENCY TABLE

STABILITY CLASS -A-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	1	3	2	0	0	0	0	6	1.2	6.3
NNE	0	0	5	0	0	0	0	0	5	1.0	4.2
NE	0	1	3	3	0	0	0	0	7	1.4	7.3
ENE	0	0	8	5	2	0	0	0	15	3.1	7.3
E	0	0	5	3	3	0	0	0	11	2.2	8.5
ESE	0	1	4	7	2	0	0	0	14	2.9	8.4
SE	0	0	3	34	4	0	0	0	41	8.4	10.4
SSE	0	0	4	37	4	0	0	0	45	9.2	10.3
S	0	2	22	163	17	0	0	0	204	41.5	9.9
SSW	0	0	23	59	0	0	0	0	82	16.7	8.7
SW	0	1	15	19	1	0	0	0	36	7.3	7.6
WSW	0	1	3	1	0	0	0	0	5	1.0	5.7
W	0	0	6	1	0	0	0	0	7	1.4	5.6
WNW	0	1	3	0	0	0	0	0	4	0.8	4.7
NW	0	1	3	1	0	0	0	0	5	1.0	5.4
NNW	0	1	3	0	0	0	0	0	4	0.8	5.3
TOTAL	0	10	113	335	33	0	0	0	491	100.0	
%	0.0	2.0	23.0	68.2	6.7	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 9.1 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 35
TOTAL NUMBER OF VALID HOURS= 2173
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -B-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	2	0	0	0	0	2	2.4	9.7
NNE	0	1	4	2	0	0	0	0	7	8.2	7.3
NE	0	0	2	13	0	0	0	0	15	17.6	9.1
ENE	0	0	2	2	0	0	0	0	4	4.7	7.6
E	0	0	2	0	0	0	0	0	2	2.4	5.8
ESE	0	0	2	0	0	0	0	0	2	2.4	5.1
SE	0	0	1	4	2	0	0	0	7	8.2	10.3
SSE	0	0	2	12	0	0	0	0	14	16.5	9.7
S	0	0	2	12	5	0	0	0	19	22.4	10.6
SSW	0	0	4	2	0	0	0	0	6	7.1	7.3
SW	0	0	0	4	0	0	0	0	4	4.7	9.6
WSW	0	0	1	0	0	0	0	0	1	1.2	4.4
W	0	0	1	0	0	0	0	0	1	1.2	6.1
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	1	0	0	0	0	0	1	1.2	7.1
TOTAL	0	1	24	53	7	0	0	0	85	100.0	
%	0.0	1.2	28.2	62.4	8.2	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 9.0 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 35
TOTAL NUMBER OF VALID HOURS= 2173
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -C-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	1	0	3	2	0	0	0	6	6.1	9.5
NNE	0	0	2	7	0	0	0	0	9	9.1	8.4
NE	0	0	1	10	1	0	0	0	12	12.1	9.5
ENE	0	0	3	0	0	0	0	0	3	3.0	7.2
E	0	1	1	1	0	0	0	0	3	3.0	6.8
ESE	0	0	2	4	0	0	0	0	6	6.1	7.8
SE	0	0	1	9	0	0	0	0	10	10.1	10.1
SSE	0	0	5	14	0	0	0	0	19	19.2	8.6
S	0	0	3	10	0	0	0	0	13	13.1	8.8
SSW	0	0	5	4	0	0	0	0	9	9.1	7.7
SW	0	0	1	3	0	0	0	0	4	4.0	8.7
WSW	0	0	0	2	0	0	0	0	2	2.0	10.9
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	1	0	0	0	0	0	1	1.0	5.4
NNW	0	0	0	1	1	0	0	0	2	2.0	12.1
TOTAL	0	2	25	68	4	0	0	0	99	100.0	
%	0.0	2.0	25.3	68.7	4.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 8.8 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 35
TOTAL NUMBER OF VALID HOURS= 2173
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -D-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	4	6	5	0	0	0	15	5.1	10.5
NNE	0	2	6	26	0	0	0	0	34	11.6	8.4
NE	0	1	11	10	2	0	0	0	24	8.2	8.5
ENE	0	0	8	2	1	0	0	0	11	3.8	7.4
E	0	0	4	3	3	0	0	0	10	3.4	9.1
ESE	0	0	13	4	0	0	0	0	17	5.8	7.0
SE	0	0	9	28	1	0	0	0	38	13.0	9.3
SSE	0	0	20	29	0	0	0	0	49	16.7	8.1
S	0	1	9	37	4	0	0	0	51	17.4	9.3
SSW	0	1	6	7	0	0	0	0	14	4.8	7.9
SW	0	0	1	8	1	0	0	0	10	3.4	9.7
WSW	0	1	2	3	0	0	0	0	6	2.0	7.7
W	0	1	3	2	0	0	0	0	6	2.0	7.5
WNW	0	1	0	0	0	0	0	0	1	0.3	3.4
NW	0	0	1	0	0	0	0	0	1	0.3	4.7
NNW	0	2	4	0	0	0	0	0	6	2.0	5.1
TOTAL	0	10	101	165	17	0	0	0	293	100.0	
%	0.0	3.4	34.5	56.3	5.8	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 8.5 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 35
TOTAL NUMBER OF VALID HOURS= 2173
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -E-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	2	10	1	0	0	0	0	13	1.9	5.5
NNE	0	0	13	11	0	0	0	0	24	3.4	7.2
NE	0	2	28	7	0	0	0	0	37	5.3	6.2
ENE	0	2	16	0	0	0	0	0	18	2.6	4.7
E	0	2	11	2	0	0	0	0	15	2.1	5.2
ESE	0	1	19	9	0	0	0	0	29	4.2	6.5
SE	0	2	57	15	1	0	0	0	75	10.7	6.3
SSE	0	0	98	63	1	0	0	0	162	23.2	7.3
S	0	0	50	114	2	0	0	0	166	23.8	8.5
SSW	0	0	52	58	0	0	0	0	110	15.8	7.7
SW	0	0	12	16	0	0	0	0	28	4.0	7.6
WSW	0	1	4	2	0	0	0	0	7	1.0	6.6
W	0	0	1	1	0	0	0	0	2	0.3	6.3
WNW	0	0	1	1	0	0	0	0	2	0.3	7.5
NW	0	2	2	0	0	0	0	0	4	0.6	3.9
NNW	0	1	3	2	0	0	0	0	6	0.9	5.7
TOTAL	0	15	377	302	4	0	0	0	698	100.0	
%	0.0	2.1	54.0	43.3	0.6	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 7.3 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 35
TOTAL NUMBER OF VALID HOURS= 2173
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -F-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	5	14	0	0	0	0	0	19	5.9	5.0
NNE	0	7	20	9	0	0	0	0	36	11.1	5.5
NE	0	6	13	1	0	0	0	0	20	6.2	4.4
ENE	0	9	7	1	0	0	0	0	17	5.2	3.8
E	0	9	10	0	0	0	0	0	19	5.9	4.0
ESE	0	16	17	1	0	0	0	0	34	10.5	3.8
SE	0	9	78	2	0	0	0	0	89	27.5	4.8
SSE	0	0	66	3	0	0	0	0	69	21.3	5.8
S	0	0	6	2	0	0	0	0	8	2.5	6.5
SSW	0	0	3	0	0	0	0	0	3	0.9	6.2
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	1	0	0	0	0	0	1	0.3	5.6
W	0	0	1	0	0	0	0	0	1	0.3	3.9
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	2	0	0	0	0	0	2	0.6	4.6
NNW	0	4	2	0	0	0	0	0	6	1.9	3.9
TOTAL	0	65	240	19	0	0	0	0	324	100.0	
%	0.0	20.1	74.1	5.9	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 4.9 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 35
TOTAL NUMBER OF VALID HOURS= 2173
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -G-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	10	5	0	0	0	0	0	15	8.2	3.5
NNE	0	17	33	2	0	0	0	0	52	28.4	4.7
NE	0	12	13	1	0	0	0	0	26	14.2	4.0
ENE	0	10	6	0	0	0	0	0	16	8.7	3.1
E	0	13	6	0	0	0	0	0	19	10.4	3.4
ESE	0	9	4	0	0	0	0	0	13	7.1	3.3
SE	0	6	11	0	0	0	0	0	17	9.3	3.6
SSE	0	5	1	0	0	0	0	0	6	3.3	2.8
S	0	1	0	0	0	0	0	0	1	0.5	3.1
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	1	0	0	0	0	0	0	1	0.5	2.4
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	4	3	0	0	0	0	0	7	3.8	3.3
NNW	0	5	5	0	0	0	0	0	10	5.5	3.3
TOTAL	0	93	87	3	0	0	0	0	183	100.0	
%	0.0	50.8	47.5	1.6	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 3.8 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 35
TOTAL NUMBER OF VALID HOURS= 2173
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

ALL CLASSES COMBINED

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	19	36	14	7	0	0	0	76	3.5	6.5
NNE	0	27	83	57	0	0	0	0	167	7.7	6.3
NE	0	22	71	45	3	0	0	0	141	6.5	6.6
ENE	0	21	50	10	3	0	0	0	84	3.9	5.3
E	0	25	39	9	6	0	0	0	79	3.6	5.5
ESE	0	27	61	25	2	0	0	0	115	5.3	5.7
SE	0	17	160	92	8	0	0	0	277	12.7	6.9
SSE	0	5	196	158	5	0	0	0	364	16.8	7.6
S	0	4	92	338	28	0	0	0	462	21.3	9.2
SSW	0	1	93	130	0	0	0	0	224	10.3	8.1
SW	0	2	29	50	2	0	0	0	83	3.8	8.0
WSW	0	3	11	8	0	0	0	0	22	1.0	6.9
W	0	1	12	4	0	0	0	0	17	0.8	6.3
WNW	0	2	4	1	0	0	0	0	7	0.3	5.3
NW	0	7	12	1	0	0	0	0	20	0.9	4.2
NNW	0	13	18	3	1	0	0	0	35	1.6	5.0
TOTAL	0	196	967	945	65	0	0	0	2173	100.0	
%	0.0	9.0	44.5	43.5	3.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 7.4 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 35
TOTAL NUMBER OF VALID HOURS= 2173
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

Fourth Quarter 2001

Joint Frequency Tables

JOINT FREQUENCY TABLE

STABILITY CLASS -A-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	1	1	0	0	0	2	4.9	11.8
NNE	0	0	0	0	1	0	0	0	1	2.4	13.8
NE	0	0	0	1	0	0	0	0	1	2.4	10.4
ENE	0	0	0	1	0	0	0	0	1	2.4	8.6
E	0	0	0	1	1	0	0	0	2	4.9	12.4
ESE	0	0	0	0	1	0	0	0	1	2.4	14.8
SE	0	0	0	0	2	0	0	0	2	4.9	12.9
SSE	0	0	1	0	0	0	0	0	1	2.4	7.3
S	0	0	0	5	4	0	0	0	9	22.0	12.5
SSW	0	0	0	3	1	0	0	0	4	9.8	10.7
SW	0	0	0	0	1	0	0	0	1	2.4	14.9
WSW	0	0	0	0	1	0	0	0	1	2.4	14.7
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	2	0	0	0	0	2	4.9	10.4
NW	0	0	0	3	1	0	0	0	4	9.8	12.3
NNW	0	0	0	5	4	0	0	0	9	22.0	11.6
TOTAL	0	0	1	22	18	0	0	0	41	100.0	
%	0.0	0.0	2.4	53.7	43.9	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 11.9 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 117
TOTAL NUMBER OF VALID HOURS= 2091
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -B-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	5	4	0	0	0	9	7.5	11.9
NNE	0	0	3	5	5	0	0	0	13	10.8	11.4
NE	0	0	0	3	0	0	0	0	3	2.5	9.6
ENE	0	0	0	2	1	0	0	0	3	2.5	11.5
E	0	0	0	4	3	0	0	0	7	5.8	13.0
ESE	0	0	0	6	8	1	0	0	15	12.5	14.0
SE	0	0	0	14	3	1	0	0	18	15.0	11.9
SSE	0	0	0	6	2	0	0	0	8	6.7	10.4
S	0	0	3	10	5	0	0	0	18	15.0	10.4
SSW	0	0	0	3	1	0	0	0	4	3.3	11.9
SW	0	0	1	1	1	0	0	0	3	2.5	9.0
WSW	0	0	0	1	0	0	0	0	1	0.8	9.8
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	1	1	0	0	0	0	2	1.7	7.3
NW	0	0	0	1	2	0	0	0	3	2.5	11.8
NNW	0	0	2	3	8	0	0	0	13	10.8	12.5
TOTAL	0	0	10	65	43	2	0	0	120	100.0	
%	0.0	0.0	8.3	54.2	35.8	1.7	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 11.7 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 117
TOTAL NUMBER OF VALID HOURS= 2091
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -C-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	2	2	5	0	0	0	9	4.8	11.7
NNE	0	0	4	4	4	0	0	0	12	6.4	10.5
NE	0	0	4	10	5	0	0	0	19	10.2	9.7
ENE	0	0	1	11	5	0	0	0	17	9.1	10.9
E	0	0	4	5	1	0	0	0	10	5.3	9.0
ESE	0	0	5	15	6	2	0	0	28	15.0	11.0
SE	0	1	5	14	5	0	0	0	25	13.4	9.5
SSE	0	1	5	16	4	0	0	0	26	13.9	9.5
S	0	0	1	7	5	0	0	0	13	7.0	11.6
SSW	0	0	0	3	0	0	0	0	3	1.6	10.0
SW	0	0	2	0	2	0	0	0	4	2.1	9.9
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	1	2	1	0	0	0	0	4	2.1	5.0
NW	0	0	0	2	0	0	0	0	2	1.1	11.3
NNW	0	0	1	8	5	1	0	0	15	8.0	12.6
TOTAL	0	3	36	98	47	3	0	0	187	100.0	
%	0.0	1.6	19.3	52.4	25.1	1.6	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.4 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 117
TOTAL NUMBER OF VALID HOURS= 2091
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -D-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	7	25	45	5	0	0	82	16.0	13.0
NNE	0	2	7	18	13	2	0	0	42	8.2	11.0
NE	0	2	14	40	7	0	0	0	63	12.3	9.0
ENE	0	1	9	13	1	0	0	0	24	4.7	8.4
E	0	0	9	20	3	0	0	0	32	6.2	9.2
ESE	0	1	10	23	16	0	0	0	50	9.7	10.4
SE	0	0	18	40	6	0	0	0	64	12.5	9.3
SSE	0	1	11	31	3	0	0	0	46	8.9	9.6
S	0	0	5	15	3	0	0	0	23	4.5	8.6
SSW	0	0	3	3	1	0	0	0	7	1.4	8.0
SW	0	0	0	1	2	0	0	0	3	0.6	13.5
WSW	0	0	0	2	0	0	0	0	2	0.4	8.6
W	0	0	2	1	0	0	0	0	3	0.6	6.8
WNW	0	1	2	0	0	0	0	0	3	0.6	5.5
NW	0	1	2	3	12	1	0	0	19	3.7	12.7
NNW	0	0	5	19	22	5	0	0	51	9.9	12.8
TOTAL	0	9	104	254	134	13	0	0	514	100.0	
%	0.0	1.8	20.2	49.4	26.1	2.5	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.5 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 117
TOTAL NUMBER OF VALID HOURS= 2091
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -E-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	1	2	16	26	4	0	0	0	49	8.7	8.2
NNE	0	2	15	30	0	0	0	0	47	8.3	7.8
NE	0	2	13	10	2	0	0	0	27	4.8	7.6
ENE	0	6	30	12	3	0	0	0	51	9.1	6.6
E	0	3	33	19	1	0	0	0	56	9.9	7.3
ESE	0	2	24	21	7	1	0	0	55	9.8	8.8
SE	0	0	52	19	0	0	0	0	71	12.6	7.1
SSE	0	0	30	26	3	0	0	0	59	10.5	7.9
S	0	1	19	29	3	3	0	0	55	9.8	9.2
SSW	0	0	10	12	1	0	0	0	23	4.1	7.7
SW	0	0	2	4	0	0	0	0	6	1.1	8.6
WSW	0	0	2	2	0	0	0	0	4	0.7	7.6
W	0	1	5	1	0	0	0	0	7	1.2	5.1
WNW	0	0	2	1	0	0	0	0	3	0.5	6.2
NW	0	4	10	1	0	0	0	0	15	2.7	4.9
NNW	0	2	19	13	1	0	0	0	35	6.2	7.5
TOTAL	1	25	282	226	25	4	0	0	563	100.0	
%	0.2	4.4	50.1	40.1	4.4	0.7	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 7.7 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 117
TOTAL NUMBER OF VALID HOURS= 2091
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -F-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	2	17	0	0	0	0	0	19	7.8	5.7
NNE	0	4	11	14	0	0	0	0	29	11.9	6.8
NE	0	7	19	7	0	0	0	0	33	13.6	5.2
ENE	0	6	15	0	0	0	0	0	21	8.6	4.7
E	0	10	35	0	0	0	0	0	45	18.5	4.5
ESE	0	7	24	1	0	0	0	0	32	13.2	4.6
SE	0	4	21	1	0	0	0	0	26	10.7	5.0
SSE	0	3	8	0	0	0	0	0	11	4.5	4.9
S	0	0	2	0	0	0	0	0	2	0.8	4.8
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	1	0	0	0	0	0	1	0.4	5.9
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	1	0	0	0	0	0	1	0.4	5.4
WNW	0	3	5	0	0	0	0	0	8	3.3	4.4
NW	0	3	1	0	0	0	0	0	4	1.6	3.9
NNW	0	1	9	1	0	0	0	0	11	4.5	5.4
TOTAL	0	50	169	24	0	0	0	0	243	100.0	
%	0.0	20.6	69.5	9.9	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 5.1 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 117
TOTAL NUMBER OF VALID HOURS= 2091
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

STABILITY CLASS -G-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	7	6	0	0	0	0	0	13	3.1	3.9
NNE	0	18	40	7	0	0	0	0	65	15.4	4.7
NE	0	38	73	10	0	0	0	0	121	28.6	4.4
ENE	1	34	50	0	0	0	0	0	85	20.1	3.8
E	1	18	29	1	0	0	0	0	49	11.6	3.8
ESE	0	7	12	0	0	0	0	0	19	4.5	3.6
SE	0	3	15	0	0	0	0	0	18	4.3	4.1
SSE	1	1	1	0	0	0	0	0	3	0.7	3.0
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	1	0	0	0	0	0	0	1	0.2	2.4
WSW	0	1	0	0	0	0	0	0	1	0.2	3.0
W	0	2	2	2	0	0	0	0	6	1.4	4.9
WNW	0	7	8	0	0	0	0	0	15	3.5	3.6
NW	1	6	5	1	0	0	0	0	13	3.1	3.7
NNW	0	6	8	0	0	0	0	0	14	3.3	4.2
TOTAL	4	149	249	21	0	0	0	0	423	100.0	
%	0.9	35.2	58.9	5.0	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 4.1 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 117
TOTAL NUMBER OF VALID HOURS= 2091
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

JOINT FREQUENCY TABLE

ALL CLASSES COMBINED

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	1	11	48	59	59	5	0	0	183	8.8	10.2
NNE	0	26	80	78	23	2	0	0	209	10.0	7.8
NE	0	49	123	81	14	0	0	0	267	12.8	6.4
ENE	1	47	105	39	10	0	0	0	202	9.7	5.9
E	1	31	110	50	9	0	0	0	201	9.6	6.5
ESE	0	17	75	66	38	4	0	0	200	9.6	8.8
SE	0	8	111	88	16	1	0	0	224	10.7	8.0
SSE	1	6	56	79	12	0	0	0	154	7.4	8.5
S	0	1	30	66	20	3	0	0	120	5.7	9.7
SSW	0	0	13	24	4	0	0	0	41	2.0	8.6
SW	0	1	6	6	6	0	0	0	19	0.9	9.6
WSW	0	1	2	5	1	0	0	0	9	0.4	8.4
W	0	3	10	4	0	0	0	0	17	0.8	5.3
WNW	0	12	20	5	0	0	0	0	37	1.8	4.9
NW	1	14	18	11	15	1	0	0	60	2.9	8.1
NNW	0	9	44	49	40	6	0	0	148	7.1	10.1
TOTAL	5	236	851	710	267	22	0	0	2091	100.0	
%	0.2	11.3	40.7	34.0	12.8	1.1	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 7.9 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 5
TOTAL NUMBER OF INVALID HOURS= 117
TOTAL NUMBER OF VALID HOURS= 2091
TOTAL NUMBER OF HOURS FOR PERIOD= 2208

First Quarter 2001

Batch Release

Joint Frequency Table

The following periods represent times during which the reactor containment purge valves were open for periods greater than one hour. Consequently, these meteorological data are submitted as batch release periods.

FROM	2/ 5/01	4:00	TO	2/ 5/01	5:00
FROM	3/ 6/01	12:00	TO	3/ 7/01	11:00
FROM	3/ 7/01	15:00	TO	3/13/01	18:00
FROM	3/13/01	20:00	TO	3/16/01	17:00
FROM	3/17/01	11:00	TO	3/18/01	20:00
FROM	3/20/01	0:00	TO	3/20/01	01:00
FROM	3/21/01	20:00	TO	3/21/01	21:00
FROM	3/22/01	2:00	TO	3/22/01	10:00
FROM	3/22/01	20:00	TO	3/23/01	10:00
FROM	3/24/01	6:00	TO	3/25/01	10:00
FROM	3/25/01	18:00	TO	3/27/01	01:00
FROM	3/27/01	3:00	TO	3/27/01	7:00
FROM	3/27/01	10:00	TO	3/28/01	20:00

JOINT FREQUENCY TABLE

STABILITY CLASS -A-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	1	2	0	0	0	3	9.7	11.9
NNE	0	0	0	1	2	0	0	0	3	9.7	12.9
NE	0	0	0	0	1	0	0	0	1	3.2	13.2
ENE	0	0	0	1	1	0	0	0	2	6.5	12.0
E	0	0	0	0	1	0	0	0	1	3.2	13.5
ESE	0	0	0	4	7	0	0	0	11	35.5	13.6
SE	0	0	0	2	2	0	0	0	4	12.9	13.3
SSE	0	0	0	1	0	0	0	0	1	3.2	11.9
S	0	0	0	2	0	0	0	0	2	6.5	11.3
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	1	0	0	0	1	3.2	15.0
NW	0	0	0	2	0	0	0	0	2	6.5	10.6
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	0	0	14	17	0	0	0	31	100.0	
%	0.0	0.0	0.0	45.2	54.8	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 12.8 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 407
TOTAL NUMBER OF HOURS FOR PERIOD= 407

JOINT FREQUENCY TABLE

STABILITY CLASS -B-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	2	2	1	0	0	0	5	16.7	8.9
NNE	0	0	0	1	0	0	0	0	1	3.3	10.5
NE	0	0	0	2	1	0	0	0	3	10.0	12.7
ENE	0	0	0	2	1	0	0	0	3	10.0	12.9
E	0	0	0	1	1	0	0	0	2	6.7	12.5
ESE	0	0	0	0	1	0	0	0	1	3.3	16.2
SE	0	0	1	1	0	0	0	0	2	6.7	9.0
SSE	0	0	0	1	0	0	0	0	1	3.3	10.5
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	1	0	0	0	0	1	3.3	11.6
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	1	3	0	0	0	4	13.3	14.9
NNW	0	0	1	2	4	0	0	0	7	23.3	12.5
TOTAL	0	0	4	14	12	0	0	0	30	100.0	
%	0.0	0.0	13.3	46.7	40.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 12.0 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 407
TOTAL NUMBER OF HOURS FOR PERIOD= 407

JOINT FREQUENCY TABLE

STABILITY CLASS -C-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	1	3	2	0	0	0	6	18.2	11.3
NNE	0	0	0	1	0	0	0	0	1	3.0	9.8
NE	0	0	1	4	1	0	0	0	6	18.2	10.0
ENE	0	0	0	2	2	0	0	0	4	12.1	13.6
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	3	0	1	0	0	0	4	12.1	7.5
SE	0	0	2	2	0	0	0	0	4	12.1	8.3
SSE	0	0	1	2	0	0	0	0	3	9.1	8.6
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	1	0	0	0	1	3.0	13.6
NNW	0	0	0	0	4	0	0	0	4	12.1	14.0
TOTAL	0	0	8	14	11	0	0	0	33	100.0	
%	0.0	0.0	24.2	42.4	33.3	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.6 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 407
TOTAL NUMBER OF HOURS FOR PERIOD= 407

JOINT FREQUENCY TABLE

STABILITY CLASS -D-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	3	6	7	0	0	0	16	10.5	11.4
NNE	0	0	2	6	5	0	0	0	13	8.5	11.0
NE	0	0	0	22	10	1	0	0	33	21.6	12.4
ENE	0	0	1	8	2	0	0	0	11	7.2	10.8
E	0	0	2	13	1	1	0	0	17	11.1	10.5
ESE	0	0	2	10	3	0	0	0	15	9.8	10.3
SE	0	1	2	8	4	0	0	0	15	9.8	10.6
SSE	0	0	1	4	1	0	0	0	6	3.9	9.9
S	0	0	0	2	0	0	0	0	2	1.3	9.8
SSW	0	1	0	0	0	0	0	0	1	0.7	2.2
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	1	1	0	0	0	2	1.3	12.0
W	0	0	0	0	1	0	0	0	1	0.7	13.8
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	1	2	1	0	0	0	4	2.6	9.7
NNW	0	0	1	8	8	0	0	0	17	11.1	12.2
TOTAL	0	2	15	90	44	2	0	0	153	100.0	
%	0.0	1.3	9.8	58.8	28.8	1.3	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 11.2 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 407
TOTAL NUMBER OF HOURS FOR PERIOD= 407

JOINT FREQUENCY TABLE

STABILITY CLASS -E-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	1	0	3	4	0	0	0	8	11.4	10.9
NNE	0	0	1	1	0	0	0	0	2	2.9	7.7
NE	0	0	2	2	0	0	0	0	4	5.7	7.5
ENE	0	1	7	3	0	0	0	0	11	15.7	6.2
E	0	1	3	3	2	0	0	0	9	12.9	8.5
ESE	0	1	6	2	0	0	0	0	9	12.9	6.3
SE	0	0	1	4	0	0	0	0	5	7.1	8.5
SSE	0	0	0	1	0	0	0	0	1	1.4	7.7
S	0	0	3	5	0	0	0	0	8	11.4	8.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	1	0	0	0	0	0	1	1.4	7.3
WSW	0	1	1	1	0	0	0	0	3	4.3	5.7
W	0	0	1	1	0	0	0	0	2	2.9	7.2
WNW	0	0	1	0	0	0	0	0	1	1.4	3.6
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	5	1	0	0	0	0	6	8.6	6.5
TOTAL	0	5	32	27	6	0	0	0	70	100.0	
%	0.0	7.1	45.7	38.6	8.6	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 7.6 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 407
TOTAL NUMBER OF HOURS FOR PERIOD= 407

JOINT FREQUENCY TABLE

STABILITY CLASS -F-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	1	1	0	0	0	0	0	2	4.9	4.6
NNE	0	0	2	0	0	0	0	0	2	4.9	6.9
NE	0	0	1	0	0	0	0	0	1	2.4	4.4
ENE	0	0	10	0	0	0	0	0	10	24.4	5.1
E	0	1	6	0	0	0	0	0	7	17.1	5.7
ESE	0	0	5	0	0	0	0	0	5	12.2	4.3
SE	0	0	5	0	0	0	0	0	5	12.2	5.8
SSE	0	0	3	0	0	0	0	0	3	7.3	6.3
S	0	0	1	0	0	0	0	0	1	2.4	4.2
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	1	0	0	0	0	0	0	1	2.4	3.5
WNW	0	0	1	0	0	0	0	0	1	2.4	5.2
NW	0	1	2	0	0	0	0	0	3	7.3	4.2
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	4	37	0	0	0	0	0	41	100.0	
%	0.0	9.8	90.2	0.0	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 5.2 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 407
TOTAL NUMBER OF HOURS FOR PERIOD= 407

JOINT FREQUENCY TABLE

STABILITY CLASS -G-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	1	0	0	0	0	1	2.0	8.5
NNE	0	2	1	0	0	0	0	0	3	6.1	2.6
NE	0	0	7	0	0	0	0	0	7	14.3	4.6
ENE	0	1	5	0	0	0	0	0	6	12.2	4.5
E	0	1	4	0	0	0	0	0	5	10.2	4.7
ESE	0	0	4	0	0	0	0	0	4	8.2	4.3
SE	0	1	3	0	0	0	0	0	4	8.2	4.1
SSE	0	3	2	0	0	0	0	0	5	10.2	3.4
S	0	2	1	0	0	0	0	0	3	6.1	2.9
SSW	0	1	0	0	0	0	0	0	1	2.0	2.1
SW	0	1	0	0	0	0	0	0	1	2.0	2.2
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	1	1	0	0	0	0	0	2	4.1	3.0
WNW	0	1	0	0	0	0	0	0	1	2.0	3.3
NW	0	3	1	1	0	0	0	0	5	10.2	4.4
NNW	0	0	1	0	0	0	0	0	1	2.0	4.5
TOTAL	0	17	30	2	0	0	0	0	49	100.0	
%	0.0	34.7	61.2	4.1	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 4.1 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 407
TOTAL NUMBER OF HOURS FOR PERIOD= 407

JOINT FREQUENCY TABLE

ALL CLASSES COMBINED

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	2	7	16	16	0	0	0	41	10.1	10.6
NNE	0	2	6	10	7	0	0	0	25	6.1	9.5
NE	0	0	11	30	13	1	0	0	55	13.5	10.7
ENE	0	2	23	16	6	0	0	0	47	11.5	8.1
E	0	3	15	17	5	1	0	0	41	10.1	8.7
ESE	0	1	20	16	12	0	0	0	49	12.0	9.1
SE	0	2	14	17	6	0	0	0	39	9.6	9.0
SSE	0	3	7	9	1	0	0	0	20	4.9	7.6
S	0	2	5	9	0	0	0	0	16	3.9	7.4
SSW	0	2	0	0	0	0	0	0	2	0.5	2.2
SW	0	1	1	0	0	0	0	0	2	0.5	4.8
WSW	0	1	1	2	1	0	0	0	5	1.2	8.2
W	0	2	2	2	1	0	0	0	7	1.7	7.0
WNW	0	1	2	0	1	0	0	0	4	1.0	6.8
NW	0	4	4	6	5	0	0	0	19	4.7	8.8
NNW	0	0	8	11	16	0	0	0	35	8.6	11.3
TOTAL	0	28	126	161	90	2	0	0	407	100.0	
%	0.0	6.9	31.0	39.6	22.1	0.5	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 9.2 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 407
TOTAL NUMBER OF HOURS FOR PERIOD= 407

Second Quarter 2001

Batch Release

Joint Frequency Table

The following periods represent times during which the reactor containment purge valves were open for periods greater than one hour. Consequently, these meteorological data are submitted as batch release periods.

FROM 4/ 1/ 1 10:00 TO 4/ 1/ 1 16:00

JOINT FREQUENCY TABLE

STABILITY CLASS -A-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	0	0	0	0	0	0	0.0	0.0
NNE	0	0	0	0	0	0	0	0	0	0.0	0.0
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	1	0	0	0	0	1	25.0	12.4
SSE	0	0	0	2	1	0	0	0	3	75.0	12.3
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	0	0	3	1	0	0	0	4	100.0	
%	0.0	0.0	0.0	75.0	25.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 12.3 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 7
TOTAL NUMBER OF HOURS FOR PERIOD= 7

JOINT FREQUENCY TABLE

STABILITY CLASS -B-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	0	0	0	0	0	0	0.0	0.0
NNE	0	0	0	0	0	0	0	0	0	0.0	0.0
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	1	0	0	0	0	1	33.3	12.3
SSE	0	0	1	0	0	0	0	0	1	33.3	7.1
S	0	0	0	1	0	0	0	0	1	33.3	9.2
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	0	1	2	0	0	0	0	3	100.0	
%	0.0	0.0	33.3	66.7	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 9.5 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 7
TOTAL NUMBER OF HOURS FOR PERIOD= 7

JOINT FREQUENCY TABLE

STABILITY CLASS -C-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	0	0	0	0	0	0	0.0	0.0
NNE	0	0	0	0	0	0	0	0	0	0.0	0.0
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	0	0	0	0	0	0	0.0	0.0
SSE	0	0	0	0	0	0	0	0	0	0.0	0.0
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	0	0	0	0	0	0	0	0	0.0	
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

AVE SPEED FOR THIS TABLE= 0.0 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 7
TOTAL NUMBER OF HOURS FOR PERIOD= 7

JOINT FREQUENCY TABLE

STABILITY CLASS -D-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	0	0	0	0	0	0	0.0	0.0
NNE	0	0	0	0	0	0	0	0	0	0.0	0.0
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	0	0	0	0	0	0	0.0	0.0
SSE	0	0	0	0	0	0	0	0	0	0.0	0.0
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	0	0	0	0	0	0	0	0	0.0	
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

AVE SPEED FOR THIS TABLE= 0.0 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 7
TOTAL NUMBER OF HOURS FOR PERIOD= 7

JOINT FREQUENCY TABLE

STABILITY CLASS -E-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	0	0	0	0	0	0	0.0	0.0
NNE	0	0	0	0	0	0	0	0	0	0.0	0.0
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	0	0	0	0	0	0	0.0	0.0
SSE	0	0	0	0	0	0	0	0	0	0.0	0.0
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	0	0	0	0	0	0	0	0	0.0	
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

AVE SPEED FOR THIS TABLE= 0.0 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 7
TOTAL NUMBER OF HOURS FOR PERIOD= 7

JOINT FREQUENCY TABLE

STABILITY CLASS -F-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	0	0	0	0	0	0	0.0	0.0
NNE	0	0	0	0	0	0	0	0	0	0.0	0.0
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	0	0	0	0	0	0	0.0	0.0
SSE	0	0	0	0	0	0	0	0	0	0.0	0.0
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	0	0	0	0	0	0	0	0	0.0	
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

AVE SPEED FOR THIS TABLE= 0.0 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 7
TOTAL NUMBER OF HOURS FOR PERIOD= 7

JOINT FREQUENCY TABLE

STABILITY CLASS -G-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	0	0	0	0	0	0	0.0	0.0
NNE	0	0	0	0	0	0	0	0	0	0.0	0.0
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	0	0	0	0	0	0	0.0	0.0
SSE	0	0	0	0	0	0	0	0	0	0.0	0.0
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	0	0	0	0	0	0	0	0	0.0	
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

AVE SPEED FOR THIS TABLE= 0.0 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 7
TOTAL NUMBER OF HOURS FOR PERIOD= 7

JOINT FREQUENCY TABLE

ALL CLASSES COMBINED

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	0	0	0	0	0	0	0.0	0.0
NNE	0	0	0	0	0	0	0	0	0	0.0	0.0
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	2	0	0	0	0	2	28.6	12.4
SSE	0	0	1	2	1	0	0	0	4	57.1	11.0
S	0	0	0	1	0	0	0	0	1	14.3	9.2
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	0	1	5	1	0	0	0	7	100.0	
%	0.0	0.0	14.3	71.4	14.3	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 11.1 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 0
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 7
TOTAL NUMBER OF HOURS FOR PERIOD= 7

Third Quarter 2001

Batch Release

Joint Frequency Table

No batch releases were made in this time period.

Fourth Quarter 2001

Batch Release

Joint Frequency Table

The following periods represent times during which the reactor containment purge valves were open for periods greater than one hour. Consequently, these meteorological data are submitted as batch release periods.

```
FROM 10/ 2/01  5:00  TO 10/ 3/01 10:00
FROM 10/ 3/01 12:00  TO 10/ 8/01 21:00
FROM 10/11/01  8:00  TO 10/11/01 10:00
FROM 10/11/01 11:00  TO 10/14/01 13:00
FROM 10/14/01 15:00  TO 10/16/01 11:00
FROM 10/16/01 13:00  TO 10/22/01 23:00
```

JOINT FREQUENCY TABLE

STABILITY CLASS -A-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	0	0	0	0	0	0	0.0	0.0
NNE	0	0	0	0	1	0	0	0	1	20.0	13.8
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	0	0	0	0	0	0	0.0	0.0
SSE	0	0	0	0	0	0	0	0	0	0.0	0.0
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	2	0	0	0	0	2	40.0	9.3
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	2	0	0	0	0	2	40.0	10.4
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	0	0	4	1	0	0	0	5	100.0	
%	0.0	0.0	0.0	80.0	20.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.6 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 2
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 438
TOTAL NUMBER OF HOURS FOR PERIOD= 438

JOINT FREQUENCY TABLE

STABILITY CLASS -B-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	1	2	0	0	0	3	13.0	12.9
NNE	0	0	0	0	3	0	0	0	3	13.0	16.1
NE	0	0	0	2	0	0	0	0	2	8.7	9.5
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	3	0	0	0	0	3	13.0	10.0
SE	0	0	0	6	0	0	0	0	6	26.1	10.1
SSE	0	0	0	3	0	0	0	0	3	13.0	10.1
S	0	0	0	1	0	0	0	0	1	4.3	9.3
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	1	0	0	0	0	1	4.3	10.4
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	1	0	0	0	0	0	1	4.3	5.1
TOTAL	0	0	1	17	5	0	0	0	23	100.0	
%	0.0	0.0	4.3	73.9	21.7	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.9 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 2
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 438
TOTAL NUMBER OF HOURS FOR PERIOD= 438

JOINT FREQUENCY TABLE

STABILITY CLASS -C-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	1	2	0	0	0	3	7.1	13.5
NNE	0	0	1	0	0	0	0	0	1	2.4	7.2
NE	0	0	2	1	0	0	0	0	3	7.1	7.5
ENE	0	0	0	1	0	0	0	0	1	2.4	10.0
E	0	0	0	1	0	0	0	0	1	2.4	10.4
ESE	0	0	2	9	0	0	0	0	11	26.2	9.4
SE	0	0	2	5	0	0	0	0	7	16.7	8.1
SSE	0	0	0	7	1	0	0	0	8	19.0	9.9
S	0	0	0	1	1	0	0	0	2	4.8	11.3
SSW	0	0	0	1	0	0	0	0	1	2.4	11.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	1	0	0	0	0	1	2.4	10.1
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	1	1	1	0	0	0	3	7.1	9.9
TOTAL	0	0	8	29	5	0	0	0	42	100.0	
%	0.0	0.0	19.0	69.0	11.9	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 9.6 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 2
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 438
TOTAL NUMBER OF HOURS FOR PERIOD= 438

JOINT FREQUENCY TABLE

STABILITY CLASS -D-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	2	8	10	0	0	0	20	15.9	12.5
NNE	0	1	3	3	0	2	0	0	9	7.1	10.3
NE	0	0	4	10	0	0	0	0	14	11.1	8.3
ENE	0	0	6	3	0	0	0	0	9	7.1	7.3
E	0	0	1	4	0	0	0	0	5	4.0	8.4
ESE	0	1	1	8	0	0	0	0	10	7.9	8.8
SE	0	0	6	18	1	0	0	0	25	19.8	9.1
SSE	0	1	3	11	1	0	0	0	16	12.7	9.0
S	0	0	2	5	2	0	0	0	9	7.1	8.9
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	1	0	0	0	0	1	0.8	9.1
WNW	0	0	1	0	0	0	0	0	1	0.8	7.4
NW	0	0	1	1	0	0	0	0	2	1.6	7.5
NNW	0	0	1	1	3	0	0	0	5	4.0	11.0
TOTAL	0	3	31	73	17	2	0	0	126	100.0	
%	0.0	2.4	24.6	57.9	13.5	1.6	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 9.5 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 2
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 438
TOTAL NUMBER OF HOURS FOR PERIOD= 438

JOINT FREQUENCY TABLE

STABILITY CLASS -E-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	1	1	1	0	2	0	0	0	5	7.0	7.3
NNE	0	0	1	1	0	0	0	0	2	2.8	6.8
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	4	2	0	0	0	0	0	6	8.5	3.1
E	0	0	7	0	0	0	0	0	7	9.9	6.3
ESE	0	0	8	5	0	0	0	0	13	18.3	6.7
SE	0	0	14	1	0	0	0	0	15	21.1	6.3
SSE	0	0	5	4	2	0	0	0	11	15.5	9.4
S	0	0	0	3	1	0	0	0	4	5.6	11.9
SSW	0	0	1	1	0	0	0	0	2	2.8	7.2
SW	0	0	1	0	0	0	0	0	1	1.4	6.9
WSW	0	0	0	1	0	0	0	0	1	1.4	7.7
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	1	1	0	0	0	0	0	2	2.8	4.0
NNW	0	2	0	0	0	0	0	0	2	2.8	2.9
TOTAL	1	8	41	16	5	0	0	0	71	100.0	
%	1.4	11.3	57.7	22.5	7.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 6.9 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 2
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 438
TOTAL NUMBER OF HOURS FOR PERIOD= 438

JOINT FREQUENCY TABLE

STABILITY CLASS -F-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	3	0	0	0	0	0	3	5.7	6.1
NNE	0	3	0	1	0	0	0	0	4	7.5	4.3
NE	0	1	4	0	0	0	0	0	5	9.4	4.2
ENE	0	2	6	0	0	0	0	0	8	15.1	4.1
E	0	2	7	0	0	0	0	0	9	17.0	4.7
ESE	0	2	10	0	0	0	0	0	12	22.6	4.5
SE	0	1	7	0	0	0	0	0	8	15.1	4.8
SSE	0	1	2	0	0	0	0	0	3	5.7	4.5
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	1	0	0	0	0	0	0	1	1.9	2.4
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	0	0	0	0	0	0	0	0.0	0.0
TOTAL	0	13	39	1	0	0	0	0	53	100.0	
%	0.0	24.5	73.6	1.9	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 4.5 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 2
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 438
TOTAL NUMBER OF HOURS FOR PERIOD= 438

JOINT FREQUENCY TABLE

STABILITY CLASS -G-

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	1	2	0	0	0	0	0	3	2.5	4.5
NNE	0	4	13	1	0	0	0	0	18	15.3	4.9
NE	0	16	20	0	0	0	0	0	36	30.5	3.6
ENE	1	9	13	0	0	0	0	0	23	19.5	3.8
E	0	4	3	0	0	0	0	0	7	5.9	3.5
ESE	0	3	6	0	0	0	0	0	9	7.6	3.9
SE	0	1	11	0	0	0	0	0	12	10.2	4.5
SSE	0	0	1	0	0	0	0	0	1	0.8	6.4
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	0	0	0	0	0	0	0	0	0.0	0.0
W	0	0	1	0	0	0	0	0	1	0.8	5.1
WNW	0	3	1	0	0	0	0	0	4	3.4	3.1
NW	0	1	2	0	0	0	0	0	3	2.5	3.8
NNW	0	0	1	0	0	0	0	0	1	0.8	4.4
TOTAL	1	42	74	1	0	0	0	0	118	100.0	
%	0.8	35.6	62.7	0.8	0.0	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 4.0 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 2
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 438
TOTAL NUMBER OF HOURS FOR PERIOD= 438

JOINT FREQUENCY TABLE

ALL CLASSES COMBINED

PRIMARY TOWER

WIND SPEED (MPH)

DIR (FROM)	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	1	2	8	10	16	0	0	0	37	8.4	10.7
NNE	0	8	18	6	4	2	0	0	38	8.7	7.4
NE	0	17	30	13	0	0	0	0	60	13.7	5.2
ENE	1	15	27	4	0	0	0	0	47	10.7	4.6
E	0	6	18	5	0	0	0	0	29	6.6	5.6
ESE	0	6	27	25	0	0	0	0	58	13.2	6.8
SE	0	2	40	30	1	0	0	0	73	16.7	7.3
SSE	0	2	11	25	4	0	0	0	42	9.6	9.0
S	0	0	2	10	4	0	0	0	16	3.7	10.0
SSW	0	0	1	4	0	0	0	0	5	1.1	8.8
SW	0	0	1	0	0	0	0	0	1	0.2	6.9
WSW	0	0	0	1	0	0	0	0	1	0.2	7.7
W	0	0	1	1	0	0	0	0	2	0.5	7.1
WNW	0	4	2	4	0	0	0	0	10	2.3	6.4
NW	0	2	4	1	0	0	0	0	7	1.6	4.9
NNW	0	2	4	2	4	0	0	0	12	2.7	8.3
TOTAL	2	66	194	141	33	2	0	0	438	100.0	
%	0.5	15.1	44.3	32.2	7.5	0.5	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 7.1 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 0
TOTAL NUMBER OF CALMS= 2
TOTAL NUMBER OF INVALID HOURS= 0
TOTAL NUMBER OF VALID HOURS= 438
TOTAL NUMBER OF HOURS FOR PERIOD= 438

31379592
U0601

OFFSITE DOSE CALCULATION MANUAL
(ODCM)

Revision 11

SOUTH TEXAS PROJECT

Plant Manager Approval ____________________ Date 12/2/01

PORC Meeting Number 01-034 for Part A Revision 11: Effective 01/01/2002
PORC Meeting Number 01-034 for Part B Revision 11: Effective 01/01/2002

January 1, 2002

PREFACE

The South Texas Project (STP) Offsite Dose Calculation Manual (ODCM) is divided into two parts: Part A, Radiological Effluent Monitoring Programs, which provides the in-plant radiological effluent monitoring program requirements for liquid and gas sampling and analysis, along with the Radiological Environmental Monitoring Program requirements; and Part B, Radiological Calculational Methods and Parameters, which provides approved methods to determine effluent monitor setpoint values and estimates of doses and radionuclide concentrations occurring beyond the boundaries of the station resulting from normal station operation.

The sampling and analysis programs in Part A provide the inputs for the models of Part B in order to calculate offsite doses and radionuclide concentrations necessary to determine compliance with the dose and concentration requirements of Control 3/4.11 in Part A of the ODCM. The Radiological Environmental Monitoring Program required by Control 3/4.12 in Part A, and outlined within this manual provides the means to determine that measurable concentrations of radioactive materials released as a result of the operation of STPEGS are not significantly higher than expected.

Changes to the ODCM shall be performed in accordance with Technical Specification 6.14 [ITS 5.5.1] .

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PART B

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PART A

RADIOLOGICAL EFFLUENT MONITORING PROGRAMS

INTRODUCTION

Part A of the Offsite Dose Calculation Manual (ODCM) describes the sampling and analysis programs conducted by STPEGS which provide input to the models in Part B of the ODCM for calculating liquid and gaseous effluent concentrations, monitor setpoints, and offsite doses. The results of Part B calculations are used to determine compliance with the concentration and dose requirements of Part A.

The minimum required Radiological Environmental Monitoring Program (REMP) is described in Part A. The current sampling station locations, as well as the details of the current sampling program implementation and philosophy, appear in Part B. The information obtained from the REMP provides data which may allow evaluation of the relationship between quantities of radioactive materials released in effluents and resultant radiation doses to individuals from principal pathways of exposure. The data developed in the surveillance and monitoring programs described in Part A of the ODCM provide a means to confirm that measurable concentrations of radioactive materials released as a result of STPEGS operations are not significantly higher than expected based on the models in Part B.

SECTION 1.0

DEFINITIONS

1.0 DEFINITIONS

The defined terms of this section appear in capitalized type and are applicable throughout these Controls.

ACTION

1.1 ACTION shall be that part of a Control that prescribes remedial measures required under designated conditions.

ANALOG CHANNEL OPERATIONAL TEST

1.2 An ANALOG CHANNEL OPERATIONAL TEST shall be the injection of a simulated signal into the channel as close to the sensor as practicable to verify OPERABILITY of alarm, interlock, and/or trip functions. The ANALOG CHANNEL OPERATIONAL TEST shall include adjustments, as necessary, of the alarm, interlock, and/or Trip Setpoints so that the Setpoints are within the required range and accuracy.

CHANNEL CALIBRATION

1.3 A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel so that it responds within the required range and accuracy to known values of input. The CHANNEL CALIBRATION shall encompass the entire channel including the sensors and alarm, interlock, and/or trip functions, and may be performed by any series of sequential, overlapping, or total channel steps so that the entire channel is calibrated.

CHANNEL CHECK

1.4 A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

DIGITAL CHANNEL OPERATIONAL TEST

1.5 A DIGITAL CHANNEL OPERATIONAL TEST shall consist of injecting simulated process data, where available, or exercising the digital computer hardware using data base manipulation to verify OPERABILITY of alarm, interlock, and/or trip functions.

DOSE EQUIVALENT I-131

1.6 DOSE EQUIVALENT I-131 shall be that concentration of I-131 (μCi/gram) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table E-7 of NRC Regulatory Guide 1.109, Revision 1, October 1977.

FREQUENCY NOTATION

1.7 The FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the intervals defined in Table 1.1.

GASEOUS WASTE PROCESSING SYSTEM

1.8 A GASEOUS WASTE PROCESSING SYSTEM shall be any system designed and installed to reduce radioactive gaseous effluents by collecting Reactor Coolant System offgases from the Reactor Coolant System and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

MEMBER(S) OF THE PUBLIC

1.9 MEMBER(S) OF THE PUBLIC means an individual in a controlled area or UNRESTRICTED AREA. However, an individual is not a member of the public during any period in which the individual receives an occupational dose. [ITS - Deleted - the standard definition of 10CFR20.1003 will become effective]

OFFSITE DOSE CALCULATION MANUAL

1.10 The OFFSITE DOSE CALCULATION MANUAL (ODCM) contains the methodology and parameters used in the calculation of offsite doses due to radioactive gaseous and liquid effluents, the calculation of gaseous and liquid effluent monitoring Alarm/Trip Setpoints, and the conduct of the Radiological Environmental Monitoring Program. The ODCM shall also contain the Radioactive Effluent Controls required by Technical Specification 6.8.3g and Radiological Environmental Monitoring Programs along with descriptions of the information that should be included in the Annual Radiological Environmental Operating Report and Radioactive Effluent Release Report.

OPERABLE - OPERABILITY

1.11 A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified function(s), and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its function(s) are also capable of performing their related support function(s).

1.0 DEFINITIONS (Continued)

OPERATIONAL MODE - MODE

1.12 An OPERATIONAL MODE (i.e., MODE) shall correspond to any one inclusive combination of core reactivity condition, power level, and average reactor coolant temperature specified in Table 1.2.

PURGE - PURGING

1.13 PURGE or PURGING shall be any controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.

RATED THERMAL POWER

1.14 RATED THERMAL POWER shall be a total reactor core heat transfer rate to the reactor coolant of 3800 MW_t.

REPORTABLE EVENT

1.15 A REPORTABLE EVENT shall be any of those conditions specified in Section 50.73 of 10 CFR Part 50.

SITE BOUNDARY

1.16 The SITE BOUNDARY means that line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

SOLIDIFICATION

1.17 SOLIDIFICATION shall be the conversion of wet wastes into a form that meets shipping and burial ground requirements.

SOURCE CHECK

1.18 A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a source of increased radioactivity.

THERMAL POWER

1.19 THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

1.0 DEFINITIONS (Continued)

UNRESTRICTED AREA

1.20 An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY access to whi is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and /or recreational purposes.

VENTING

1.21 VENTING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent, used in system names, does not imply a VENTING process.

TABLE 1.1

FREQUENCY NOTATION

NOTATION	FREQUENCY
S	At least once per 12 hours
D	At least once per 24 hours
W	At least once per 7 days
M	At least once per 31 days
Q	At least once per 92 days
SA	At least once per 184 days
R	At least once per 18 months
S/U	Prior to each reactor startup
N.A.	Not applicable
P	Completed prior to each release

TABLE 1.2

OPERATIONAL MODES

	MODE	REACTIVITY CONDITION, K_{eff}	% RATED THERMAL POWER*	AVG COOLANT TEMPERATURE
1.	POWER OPERATION	≥ 0.99	$> 5\%$	$\geq 350°F$
2.	STARTUP	≥ 0.99	$\leq 5\%$	$\geq 350°F$
3.	HOT STANDBY	< 0.99	0	$\geq 350°F$
4.	HOT SHUTDOWN	< 0.99	0	$350°F > T_{avg} > 200°F$
5.	COLD SHUTDOWN	< 0.99	0	$\leq 200°F$
6.	REFUELING**	≤ 0.95	0	$\leq 140°F$

* Excluding decay heat.

** Fuel in the reactor vessel with the vessel head closure bolts less than fully tensioned or with the head removed.

SECTION 2.0

RESPONSIBILITIES FOR PART A OF THE ODCM

2.0 RESPONSIBILITIES FOR PART A OF THE ODCM

All changes to Part A of the ODCM shall conform to the requirements of Technical Specification 6.14 [ITS 5.5.1] .

SECTIONS 3.0 and 4.0

CONTROLS AND SURVEILLANCE REQUIREMENTS

3/4 CONTROLS AND SURVEILLANCE REQUIREMENTS

3/4.0 APPLICABILITY

CONTROLS

3.0.1 Compliance with the Controls contained in the succeeding controls is required during the OPERATIONAL MODES or other conditions specified therein; except that upon failure to meet the Control, the associated ACTION requirements shall be met.

3.0.2 Noncompliance with a control shall exist when the requirements of the Control and associated ACTION requirements are not met within the specified time intervals. If the Control is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

3.0.3 When a Control is not met, except as provided in the associated ACTION requirements, within 1 hour action shall be initiated to place the unit in a MODE in which the control does not apply by placing it, as applicable, in:

a. At least HOT STANDBY within the next 6 hours,

b. At least HOT SHUTDOWN within the following 6 hours, and

c. At least COLD SHUTDOWN within the subsequent 24 hours.

Where corrective measures are completed that permit operation under the ACTION requirements, the action may be taken in accordance with the specified time limits as measured from the time of failure to meet the Control. Exceptions to these requirements are stated in the individual controls.

This control is not applicable in MODE 5 or 6.

3.0.4 Entry into an OPERATIONAL MODE or other specified condition shall not be made when the conditions for the Control are <u>not</u> met and the associated ACTION requires a shutdown if they are not met within a specified time interval. Entry into an OPERATIONAL MODE or specified condition may be made in accordance with ACTION requirements when conformance to them permits continued operation of the facility for an unlimited period of time. This provision shall not prevent passage through or to OPERATIONAL MODES as required to comply with ACTION requirements. Exceptions to these requirements are stated in the individual controls.

SURVEILLANCE REQUIREMENTS

4.0.1 Surveillance Requirements shall be met during the OPERATIONAL MODES or other conditions specified for individual Controls unless otherwise stated in an individual Surveillance Requirement.

4.0.2 Each Surveillance Requirement shall be performed within the specified surveillance interval with a maximum allowable extension not to exceed 25 percent of the specified surveillance interval.

4.0.3 Failure to perform a Surveillance Requirement within the allowed surveillance interval, defined by Control 4.0.2, shall constitute a failure to meet the OPERABILITY requirements for a Control. The time limits of the ACTION requirements are applicable at the time it is identified that a Surveillance Requirement has not been performed. The ACTION requirements may be delayed for up to 24 hours to permit the completion of the surveillance when the allowed outage time limits of the ACTION requirements are less than 24 hours. Surveillance Requirements do not have to be performed on inoperable equipment.

4.0.4 Entry into an OPERATIONAL MODE or other specified condition shall not be made unless the Surveillance Requirement(s) associated with the Control has been performed within the stated surveillance interval or as otherwise specified. This provision shall not prevent passage through or to OPERATIONAL MODES as required to comply with ACTION requirements.

3/4.3 INSTRUMENTATION

3/4.3.3 MONITORING INSTRUMENTATION

3/4.3.3.10 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

CONTROLS

3.3.3.10 The radioactive liquid effluent monitoring instrumentation channels shown in Table 3.3-12 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Control 3.11.1.1 are not exceeded. The Alarm/Trip Setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters in this manual.

APPLICABILITY: At all times.

ACTION:

a. With a radioactive liquid effluent monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above control, immediately suspend the release of radioactive liquid effluents monitored by the affected channel, or declare the channel inoperable.

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.3-12. Restore the inoperable instrumentation to OPERABLE status within 30 days, or explain in the next Radioactive Effluent Release Report pursuant to Control 6.9.1.4 why this inoperability was not corrected within the time specified.

c. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.10 Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and DIGITAL CHANNEL OPERATIONAL TEST at the frequencies shown in Table 4.3-8.

TABLE 3.3-12

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION
1. Radioactivity Monitors Providing Alarm and Automatic Termination of Release		
Liquid Waste Processing Discharge Monitor (N1RA-RT-8038 or N2RA-RT-8038)	1	43
2. Flow Rate Measurement Devices		
Liquid Waste Processing Discharge Line (N1WL-FT-4078 or N2WL-FT-4078)	1	46

TABLE 3.3-12 (Continued)

ACTION STATEMENTS

ACTION 43 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 14 days provided that prior to initiating a release:

a. At least two independent samples are analyzed in accordance with Control 4.11.1.1.1, and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge line valving.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 44 - (Not used)

ACTION 45 - (Not used)

ACTION 46 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves generated in place may be used to estimate flow.

TABLE 4.3-8

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	DIGITAL CHANNEL OPERATIONAL TEST
1. Radioactivity Monitors Providing Alarm and Automatic Termination of Release				
Liquid Waste Processing Discharge Monitor (N1RA-RT-8038 or N2RA-RT-8038)	D(2)	P	R(3)	Q(1)
2. Flow Rate Measurement Devices				
Liquid Waste Processing Discharge Line (N1WL-FT-4078 or N2WL-FT-4078)	D(4)	N.A.	R	N.A.

TABLE 4.3-8 (Continued)

TABLE NOTATIONS

(1) The DIGITAL CHANNEL OPERATIONAL TEST shall also demonstrate that automatic isolation this pathway and control room alarm annunciation occur if any of the following conditions exists:

a. Instrument indicates measured levels above the Alarm/Trip Setpoint, or

b. Monitor failure.

(2) CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

(3) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(4) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

3/4.3.3 MONITORING INSTRUMENTATION

3/4.3.3.11 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

CONTROLS

3.3.3.11 The radioactive gaseous effluent monitoring instrumentation channels shown in Table 3.3-13 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Control 3.11.2.1 and Technical Specification 3.11.2.5 [ITS 5.5.12a] are not exceeded. The Alarm/Trip Setpoints of these channels meeting Control 3.11.2.1 shall be determined and adjusted in accordance with the methodology and parameters in this manual.

APPLICABILITY: As shown in Table 3.3-13

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above control, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel inoperable.

b. With the number of OPERABLE radioactive gaseous effluent monitoring instrumentation channels less than the Minimum Channels OPERABLE, take the ACTION shown in Table 3.3-13. Restore the inoperable instrumentation to OPERABLE status within 30 days, or explain in the next Radioactive Effluent Release Report pursuant to Control 6.9.1.4 why this inoperability was not corrected within the time specified.

c. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.11 Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and ANALOG CHANNEL OPERATIONAL TEST or DIGITAL CHANNEL OPERATIONAL TEST, as applicable, at the frequencies shown in Table 4.3-9.

TABLE 3.3-13

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1. (Not used)			
2. (Not used)			
a. (Not used)			
b. (Not used)			
c. (Not used)			
3. Unit Vent			
a. Noble Gas Activity Monitor (N1(2)RA-RT-8010B)	1	*	49
b. Iodine Monitor (N1(2)RA-RT-8010A) or Iodine Sampler (N1(2)RA-RT-8010B)	1	*	53
c. Particulate Monitor (N1(2)RA-RT-8010A) or Particulate Sampler (N1(2)RA-RT-8010B)	1	*	53
d. Flow Rate Monitor (normal N1(2)RA-RT-8010F) or (accident N1(2)RA-RT-8010G)	1	*	48
e. Sample Flow Rate Monitor (normal N1(2)RA-FT-8010H) or (accident N1(2)RA-FT-8010L) or N1(2)RA-FT-8010A for RT-8010A)	1	*	48

TABLE 3.3-13 (Continued)

TABLE NOTATIONS

* At all times

ACTION STATEMENTS

ACTION 47 - (Not used)

ACTION 48 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours.

ACTION 49 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per 12 hours and these samples are analyzed for radioactivity within 24 hours.

ACTION 50 - (Not used)

ACTION 51 - (Not used)

ACTION 52 - (Not used)

ACTION 53 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via the affected pathway may continue for up to 30 days provided samples are continuously collected with auxiliary sampling equipment as required in this manual.

TABLE 4.3-9

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	DIGITAL CHANNEL OPERATIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1. (Not used)					
2. (Not used)					
3. Unit Vent					
a. Noble Gas Activity Monitor (N1(2)RA-RT-8010B)	D	M	$R^{(3)}$	$Q^{(2)}$	*
b. Iodine Monitor (N1(2)RA-RT-8010A)	D	M	$R^{(3)}$	$Q^{(2)}$	*
or Iodine Sampler (N1(2)RA-RT-8010B)	W	N.A.	N.A.	N.A.	
c. Particulate Monitor (N1(2)RA-RT-8010A)	D	M	$R^{(3)}$	$Q^{(2)}$	*
or Particulate Sampler (N1(2)RA-RT-8010B)	W	N.A.	N.A.	N.A.	
d. Flow Rate Monitor (normal N1(2)RA-RT-8010F) or (accident N1(2)RA-RT-8010G)	D	N.A.	R	N.A.	*
e. Sampler Flow Rate Monitor (normal N1(2)RA-FT-8010H) or (accident N1(2) RA-FT-8010L) or (N1(2)RA-FT-8010A for RT-8010A)	D	N.A.	R	Q	*

TABLE 4.3-9 (Continued)

TABLE NOTATIONS

* At all times

(1) (Not used)

(2) The DIGITAL CHANNEL OPERATIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

a. Instrument indicates measured levels above the Alarm Setpoint, or

b. Monitor failure.

(3) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

3/4.11 RADIOACTIVE EFFLUENTS

3/4.11.1 LIQUID EFFLUENTS

LIQUID EFFLUENT SAMPLING AND ANALYSIS PROGRAM

Radioactive liquid wastes shall be sampled and analyzed in accordance with the program specified in Table A3-1 for STPEGS. The results of the radioactive analysis shall be used as appropriate with the methodology of Part B of the ODCM to assure that the concentrations of liquid effluents from the cooling reservoir are maintained within the limits of Control 3.11.1.1.

Radioactive effluent information for liquids obtained from sampling and analysis programs shall also be used in conjunction with the methodologies in Part B to demonstrate compliance with the dose objectives and surveillance requirements of Controls 3/4.11.1.2 and 3/4.11.1.3, and Technical Specification 3/4.11.1.4 [ITS 5.5.12c].

3/4.11 RADIOACTIVE EFFLUENTS

3/4.11.1 LIQUID EFFLUENTS

3/4.11.1.1 CONCENTRATION

CONTROLS

3.11.1.1 The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS (See Figure 5.1-4) shall be limited to 10 times the concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} μCi/ml total activity.

APPLICABILITY: At all times.

ACTION:

With the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeding the above limits, immediately restore the concentration to within the above limits.

SURVEILLANCE REQUIREMENTS

4.11.1.1.1 Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Table A3-1.

4.11.1.1.2 The results of the radioactivity analyses shall be used in accordance with the methodology and parameters in this manual to assure that the concentrations at the point of release are maintained within the limits of Control 3.11.1.1.

TABLE A3-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)[(1)] (µCi/ml)
1. Batch Waste Release Tanks[(2)]				
a. Waste Monitor Tanks	P Each Batch	P Each Batch	Principal Gamma Emitters[(3)]	$5x10^{-7}$
			I-131	$1x10^{-6}$
b. Laundry and Hot Shower Tank	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)	$1x10^{-5}$
c. Waste Evaporator Condensate Tanks	P Each Batch	M Composite[(4)]	H-3	$1x10^{-5}$
			Gross Alpha	$1x10^{-7}$
d. Any other tanks which discharge liquid wastes past RT-8038	P Each Batch	Q Composite[(4)]	Sr-89, Sr-90	$5x10^{-8}$
			Fe-55	$1x10^{-6}$

<u>TABLE A3-1</u> (Continued)

<u>TABLE NOTATIONS</u>

(1) The LLD is defined, for purposes of these controls, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.65 s_b + K / T}{E * V * 2.22 \times 10^6 * Y * e^{(-\lambda \Delta t)}}$$

Where:

LLD =the "a priori" lower limit of detection (microCurie per unit mass or volume),

s_b = the standard deviation of the background counting rate or of the counting rate of a blank sample, as appropriate (counts per minute),

K = the value should be set to 2.71; the value may be set to 0.0 if the background contains 25 or more counts,

T = background count time (minutes),

E = the counting efficiency (counts per disintegration),

V = the sample size (units of mass or volume),

2.22×10^6 = the number of disintegrations per minute per microCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (s^{-1}), and

Δt = the elapsed time between the midpoint of sample collection and the time of counting(s).

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an <u>a priori</u> (before the fact) limit representing the capability of a measurement system and not as an <u>a posteriori</u> (after the fact) limit for a particular measurement.

(2) A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed by methods described in plant operating procedures to assure representative sampling.

TABLE A3-1 (Continued)

TABLE NOTATIONS (Continued)

(3) The principal gamma emitters for which the LLD specification applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Radioactive Effluent Release Report pursuant to Control 6.9.1.4 as outlined in Regulatory Guide 1.21, Appendix B, Revision 1, June 1974.

(4) A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen that is representative of the liquids released.

3/4.11 RADIOACTIVE EFFLUENTS

3/4.11.1 LIQUID EFFLUENTS

3/4.11.1.2 DOSE

CONTROLS

3.11.1.2 The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to UNRESTRICTED AREAS (see Figure 5.1-4) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrems to the whole body and to less than or equal to 5 mrems to any organ, and

b. During any calendar year to less than or equal to 3 mrems to the whole body and to less than or equal to 10 mrems to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2 [ITS - deleted - pursuant to 10CFR50.4], a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits. This Special Report shall also include: (1) the results of radiological analyses of the drinking water source, and (2) the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR Part 141, Safe Drinking Water Act.*

b. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.1.2 Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in this manual at least once per 31 days.

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* The requirements of ACTION a.(1) and (2) are applicable only if drinking water supply is taken from the receiving water body within 3 miles of the plant discharge. In the case of river-sited plants, this is 3 miles downstream only.

3/4.11 RADIOACTIVE EFFLUENT

3/4.11.1 LIQUID EFFLUENTS

3/4.11.1.3 LIQUID WASTE PROCESSING SYSTEM

CONTROLS

3.11.1.3 The Liquid Waste Processing System shall be OPERABLE and appropriate portions of the system shall be used to reduce releases of radioactivity when the projected doses due to the liquid effluent, from each unit, to UNRESTRICTED AREAS (see Figure 5.1-4) would exceed 0.06 mrem to the whole body or 0.2 mrem to any organ in a 31-day period.

APPLICABILITY: At all times.

ACTION:

a. With radioactive liquid waste being discharged without treatment and in excess of the above limits and any portion of the Liquid Waste Processing System not in operation, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2 [ITS - deleted - pursuant to 10CFR50.4], a Special Report that includes the following information:

    1. Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability,

    2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

    3. Summary description of action(s) taken to prevent a recurrence.

b. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.1.3.1 Doses due to liquid releases from each unit to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the methodology and parameters in this manual when Liquid Waste Processing Systems are not being fully utilized.

4.11.1.3.2 The installed Liquid Waste Processing System shall be considered OPERABLE by meeting Controls 3.11.1.1 and 3.11.1.2.

3/4.11 RADIOACTIVE EFFLUENTS

3/4.11.2 GASEOUS EFFLUENTS

GASEOUS EFFLUENT SAMPLING AND ANALYSIS PROGRAM

Radioactive gaseous wastes shall be sampled and analyzed in accordance with the program specified in Table A4-1 for STPEGS. The results of the radioactive analyses shall be used as appropriate with the methodologies of Part B of the ODCM to assure that the dose rates due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary are within the limits of Control 3.11.2.1.

Radioactive effluent information for gaseous wastes obtained from sampling and analysis programs shall also be used in conjunction with the methodologies in Part B to demonstrate compliance with the dose objectives and surveillance requirements of Controls 3/4.11.2.1, 3/4.11.2.2, 3/4.11.2.3, 3/4.11.2.4, and 3/4.11.4.

3/4.11 RADIOACTIVE EFFLUENT

3/4.11.2 GASEOUS EFFLUENTS

3/4.11.2.1 DOSE RATE

CONTROLS

3.11.2.1 The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY (see Figure 5.1-3) shall be limited to the following :

a. For noble gases: Less than or equal to 500 mrems/yr to the whole body and less than or equal to 3000 mrems/yr to the skin, and

b. For Iodine-131, for Iodine-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrems/yr to any organ.

APPLICABILITY: At all times.

ACTION:

With the dose rate(s) exceeding the above limits, immediately restore the release rate to within the above limit(s).

SURVEILLANCE REQUIREMENTS

4.11.2.1.1 The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in this manual.

4.11.2.1.2 The dose rate due to Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in this manual by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table A4-1.

TABLE A4-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

GASEOUS RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD)(1) (μCi/ml)
1. Unit Vent	M(3)(4) Grab Sample	M	Principal Gamma Emitters(2)	$1x10^{-4}$
			H-3 (oxide)	$1x10^{-6}$
2. All Release Types as listed above.	Continuous(6)	W(7) Charcoal Sample	I-131	$1x10^{-12}$
			I-133	$1x10^{-10}$
	Continuous(6)	W(7) Particulate Sample	Principal Gamma Emitters(2)	$1x10^{-11}$
	Continuous(6)	M Composite Particulate Sample	Gross Alpha	$1x10^{-11}$
	Continuous(6)	Q Composite Particulate Sample	Sr-89, Sr-90	$1x10^{-11}$

TABLE A4-1 (Continued)

TABLE NOTATIONS

(1) The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.65 s_b + K / T}{E * V * 2.22 \times 10^6 * Y * e^{(-\lambda \Delta t)}}$$

Where:

LLD=the "a priori" lower limit of detection (microCurie per unit mass or volume),

s_b = the standard deviation of the background counting rate or of the counting rate of a blank sample, as appropriate (counts per minute),

K = the value should be set to 2.71; the value may be set to 0.0 if the background contains 25 or more counts,

T = background count time (minutes),

E = the counting efficiency (counts per disintegration),

V = the sample size (units of mass or volume),

2.22×10^6 = the number of disintegrations per minute per microCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (s^{-1}), and

Δt = the elapsed time between the midpoint of sample collection and the time of counting(s).

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

TABLE A4-1 (Continued)

TABLE NOTATIONS (Continued)

(2) The principal gamma emitters for which the LLD specification applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 in noble gas releases; and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, Cs-134, Cs-137, Ce-141, and Ce-144 in Iodine and particulate releases. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Radioactive Effluent Release Report pursuant to Control 6.9.1.4 as outlined in Regulatory Guide 1.21, Appendix B, Revision l, June 1974.

(3) Sampling and analysis shall also be performed following shutdown, startup, or a THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1-hour period.

(4) Tritium grab samples shall be taken at least once per week when the primary coolant or the Refueling Water Storage Tank contains water with tritium concentrations in excess of 5 uCi/gm as determined by routine sampling or process knowledge.

(5) (Not used)

(6) The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Controls 3.11.2.1, 3.11.2.2, and 3.11.2.3.

(7) Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing, or after removal from sampler. Sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown, startup, or THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1-hour period and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if: (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the reactor coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

Amendment 1

3/4.11.2.2 DOSE - NOBLE GASES

CONTROLS

3.11.2.2 The air dose due to noble gases released in gaseous effluents, from each unit, to areas at and beyond the SITE BOUNDARY (see Figure 5.1-3) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation, and

b. During any calendar year: Less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

APPLICABILITY: At all times.

ACTION

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2 [ITS - deleted - pursuant to 10CFR50.4], a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.2.2 Cumulative dose contributions for the current calendar quarter and current calendar year for noble gases shall be determined in accordance with the methodology and parameters in this manual at least once per 31 days.

3/4.11 RADIOACTIVE EFFLUENTS

3/4.11.2 GASEOUS EFFLUENTS

3/4.11.2.3 DOSE - IODINE-131, IODINE-133, TRITIUM, AND RADIOACTIVE MATERIAL IN PARTICULATE FORM

CONTROLS

3.11.2.3 The dose to a MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released, from each unit, to areas at and beyond the SITE BOUNDARY (see Figure 5.1-3) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ, and

b. During any calendar year: Less than or equal to 15 mrems to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from release of Iodine-131, Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2 [ITS - deleted - pursuant to 10CFR50.4], a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.2.3 Cumulative dose contributions for the current calendar quarter and current calendar year for Iodine-131, Iodine-133, tritium and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with the methodology and parameters in this manual at least once per 31 days.

3/4.11 RADIOACTIVE EFFLUENTS

3/4.11.2 GASEOUS EFFLUENTS

3/4.11.2.4 GASEOUS WASTE PROCESSING SYSTEM

CONTROLS

3.11.2.4 The GASEOUS WASTE PROCESSING SYSTEM shall be OPERABLE and appropriate portions of this system shall be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases, from each unit, to areas at and beyond the SITE BOUNDARY (see Figure 5.1-3) would exceed:

a. 0.2 mrad to air from gamma radiation, or

b. 0.4 mrad to air from beta radiation, or

c. 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

APPLICABILITY: At all times.

ACTION:

a. With radioactive gaseous waste being discharged without treatment and in excess of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specificati 6.9.2 [ITS - deleted - pursuant to 10CFR50.4], a Special Report that includes the following information:

   1. Identification of any inoperable equipment or subsystems, and the reason for the inoperability,

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of action(s) taken to prevent a recurrence.

b. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.2.4.1 Doses due to gaseous releases from each unit to areas at and beyond the SITE BOUNDARY shall be projected at least once per 31 days in accordance with the methodology and parameters in this manual when the GASEOUS WASTE PROCESS SYSTEM is not being fully utilized.

4.11.2.4.2 The installed GASEOUS WASTE PROCESSING SYSTEM shall be considered OPERABLE by meeting Controls 3.11.2.1, and either 3.11.2.2 or 3.11.2.3.

3/4.11 RADIOACTIVE EFFLUENTS

3/4.11.4 TOTAL DOSE

CONTROLS

3.11.4 The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrems to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

APPLICABILITY: At all times.

ACTION:

a. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Controls 3.11.1.2a, 3.11.1.2b, 3.11.2.2a, 3.11.2.2b, 3.11.2.3a, or 3.11.2.3b, calculations shall be made including direct radiation contributions from the units and from outside storage tanks to determine whether the above limits of Control 3.11.4 have been exceeded. If such is the case, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2 [ITS - deleted - pursuant to 10CFR50.4], a Special Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. This Special Report, as defined in 10 CFR Part 20.2203(b), shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

b. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.4.1 Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with Controls 4.11.1.2, 4.11.2.2, and 4.11.2.3, and in accordance with the methodology and parameters in this manual.

4.11.4.2 Cumulative dose contributions from direct radiation from the units and from radwaste storage tanks shall be determined in accordance with the methodology and parameters in this manual. This requirement is applicable only under conditions set forth in ACTION a. of Control 3.11.4.

3/4.12 RADIOLOGICAL ENVIRONMENTAL MONITORING

SAMPLING AND ANALYSIS PROGRAM

The Radiological Environmental Monitoring Program (REMP) provides representative measurements of radiation and radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposure of MEMBERS OF THE PUBLIC resulting from station operation. This monitoring program is required by Control 3.12.1. The monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50, and thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of effluent measurements and the modeling of the environmental exposure pathways which have been incorporated into Part B of the ODCM.

The monitoring program as specified at fuel load shall remain in effect for at least the first three years of commercial operation. Following this period, program changes may be initiated based on operational experience.

In accordance with Control Surveillance Requirement 4.12.1, a sampling and analysis program shall be conducted. The implemented Radiological Environmental Monitoring Program, as described in Section 5.0 of Part B of the ODCM, shall as a minimum satisfy the requirements of Table B5-1. Detection capability requirements and reporting levels for radioactivity concentrations in environmental samples are shown in Tables A5-1 and A5-2, respectively.

3/4.12 RADIOLOGICAL ENVIRONMENTAL MONITORING

3/4.12.1 MONITORING PROGRAM

CONTROLS

3.12.1 The Radiological Environmental Monitoring Program (REMP) shall be conducted as specified in Table B5-1 and Table A5-2.

APPLICABILITY: At all times.

ACTION:

a. With the Radiological Environmental Monitoring Program not being conducted as specified, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report required by Control 6.9.1.3, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

b. With the level of radioactivity as the result of plant effluents in an environmental sampling medium at a specified location exceeding the reporting levels of the REMP when averaged over any calendar quarter, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.9.2 [ITS - deleted - pursuant to 10CFR50.4], a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose* to a MEMBER OF THE PUBLIC is less than the calendar year limits of Controls 3.11.1.2, 3.11.2.2, or 3.11.2.3. When more than one of the radionuclides in the REMP are detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1.0$$

When radionuclides other than those listed in the REMP are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose* to a MEMBER OF THE PUBLIC from all radionuclides is equal to or greater than the calendar year limits of Controls 3.11.1.2, 3.11.2.2 or 3.11.2.3. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report required by Control 6.9.1.3.

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* The methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC shall be indicated in this report.

3/4.12.1 MONITORING PROGRAM (Continued)

ACTION: (Continued)

c. With milk or fresh leafy vegetable samples unavailable from one or more of the sample locations required by the REMP, identify specific locations for obtaining replacement samples and add them within 30 days to the Radiological Environmental Monitoring Program given in this manual. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Pursuant to Technical Specification 6.14 [ITS 5.5.1], submit with the next Radioactive Effluent Release Report documentation for a change to this manual including a revised figure(s) and table to Part B of this manual reflecting the new location(s) with supporting information identifying the cause of the unavailability of samples and justifying the selection of the new location(s) for obtaining samples.

d. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.12.1 The radiological environmental monitoring samples shall be collected pursuant to the REMP from the specific locations given in the Table B5-1 and figure(s) in this manual, and shall be analyzed pursuant to the requirements of and the detection capabilities required by the REMP.

TABLE A5-1

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS[(1),(2)]
LOWER LIMIT OF DETECTION[(3)]

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)	SEDIMENT (pCi/kg, dry)
Gross Beta	4	0.01				
H-3	3000					
Mn-54	15		130			
Fe-59	30		260			
Co-58,60	15		130			
Zn-65	30		260			
Zr-Nb-95	15					
I-131	1[(4)]	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	60	180
Ba-La-140	15			15		

TABLE A5-1 (Continued)

TABLE NOTATIONS

(1) This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3.

(2) Required detection capabilities for thermoluminescent dosimeters used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13.

(3) The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.65 s_b + K / T}{E * V * 2.22 * Y * e^{(-\lambda \Delta t)}}$$

Where:

LLD = the "a priori" lower limit of detection (picoCuries per unit mass or volume),

s_b = the standard deviation of the background counting rate or of the counting rate of a blank sample, as appropriate (counts per minute),

K = the value should be set to 2.71; the value may be set to 0.0 if the background contains 25 or more counts,

T = background count time (minutes),

E = the counting efficiency (counts per disintegration),

V = the sample size (units of mass or volume),

2.22 = the number of disintegrations per minute per picoCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (s^{-1}), and

Δt = the elapsed time between environmental collection, or end of the sample collecting period, and time of counting(s).

Typical values of E, V, Y, and Δt should be used in the calculation.

TABLE A5-1 (Continued)

TABLE NOTATIONS (Continued)

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally, background fluctuations, unavoidable small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3.

(4) LLD for drinking water samples. If no drinking water pathway exists, the LLD of gamma isotopic analysis may be used. Since the most restrictive LLD is for other gamma emitters is 15 pCi/liter, this value may be used for iodine in water.

TABLE A5-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES
REPORTING LEVELS

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)
H-3	30,000				
Mn-54	1,000		30,000	1000(1)	30,000(1)
Fe-59	400		10,000	400(1)	10,000(1)
Co-58	1,000		30,000	1000(1)	30,000(1)
Co-60	300		10,000	300(1)	10,000(1)
Zn-65	300		20,000	300(1)	20,000(1)
Zr-Nb-95	400		10,000(1)	400(1)	10,000(1)
I-131	2	0.9	50(1)	3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200		5,000(1)	300	5,000(1)

(1) SUGGESTED reporting levels added to the required values in proportion to comparable media. These added values are not required reporting levels but serve as guidance for when it is appropriate to give the Nuclear Regulatory Commission Regional IV Office a courtesy call. Fish = 25 * Water values; Milk = Water values; Food Products = Fish values.

3/4.12 RADIOLOGICAL ENVIRONMENTAL MONITORING

3/4.12.2 LAND USE CENSUS

As part of the Radiological Environmental Monitoring Program, Control 3/4.12.2 requires that a land use census be conducted annually during the growing season to identify within a distance of 8 km (5 miles) the location in each of the 16 meteorological sectors of the nearest milk animal, the nearest residence, and the nearest garden of greater than 50 m^2 (500 ft^2) producing broadleaf vegetation.

The land use census ensures that changes in the use of area beyond the SITE BOUNDARY are identified, and appropriate modifications to the monitoring program and dose assessment models are made, if necessary. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50.

For the purpose of conducting the land use census as required by Control Surveillance Requirement 4.12.2, station personnel should determine what survey methods will provide the necessary results considering the type of information to be collected and its use. For example, land use census results shall be obtained by using a survey method, or combination of methods, which may include, but are not limited to, door-to-door surveys (i.e., roadside identification of locations), aerial surveys, or by consulting local agricultural authorities.

Control 3.12.2.b requires that new locations identified from the census that yield a calculated dose or dose commitment 20% greater than at a location from which samples are currently being obtained be added within 30 days to the REMP. These new locations shall be added to the sampling program only if reliable sampling of the affected pathway(s) can be devised.

3/4.12 RADIOLOGICAL ENVIRONMENTAL MONITORING

3/4.12.2 LAND USE CENSUS

CONTROLS

3.12.2 A Land Use Census shall be conducted and shall identify within a distance of 8 km (5 miles) the location in each of the 16 meteorological sectors of the nearest milk animal, the nearest residence, and the nearest garden* of greater than 50 m^2 (500 ft^2) producing broad leaf vegetation.

APPLICABILITY: At all times.

ACTION:

a. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment greater than the values currently being calculated in Control 4.11.2.3, pursuant to Control 6.9.1.4, identify the new location(s) in the next Radioactive Effluent Release Report.

b. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment (via the same exposure pathway) 20% greater than at a location from which samples are currently being obtained in accordance with Control 3.12.1, add the new location(s) within 30 days to the Radiological Environmental Monitoring Program given in Part B of this manual. The sampling location(s) excluding the control station location, having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from this monitoring program after October 31 of the year in which this Land Use Census was conducted. Pursuant to Technical Specification 6.14 [ITS 5.5.1], submit in the next Radioactive Effluent Release Report documentation for a change to this manual including a revised figure(s) and table(s) for Part B of this manual reflecting the new location(s) with information supporting the change in sampling locations.

c. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.12.2 The Land Use Census shall be conducted at least once per 12 months using that information that will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities, as described in this manual. The results of the Land Use Census shall be included in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3.

* Broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the SITE BOUNDARY in each of two different direction sectors with the highest predicted D/Qs in lieu of the garden census. Controls for broad leaf vegetation sampling in the REMP shall be followed, including analysis of control samples.

3/4.12 RADIOLOGICAL ENVIRONMENTAL MONITORING

3/4.12.3 INTERLABORATORY COMPARISON PROGRAM

CONTROLS

3.12.3 The Interlaboratory Comparison Program shall be maintained to ensure that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring. The program shall demonstrate the ability to measure low levels of relevant radionuclides in sample matrices corresponding to samples required by the REMP. The intercomparison program shall maintain traceability to National Institute of Standards and Technology (NIST), or an equivalent type of traceability.

APPLICABILITY: At all times.

ACTION:

a. With the Interlaboratory Comparison Program not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3.

b. The provisions of Control 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.12.3 The Interlaboratory Comparison Program is described in this manual. A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report pursuant to Control 6.9.1.3.

BASES FOR SECTIONS 3.0 and 4.0

CONTROLS AND SURVEILLANCE REQUIREMENTS

NOTE

The BASES contained in the succeeding pages summarizes the reasons for the Controls in Section 3.0 and 4.0, but are not part of these Controls.

3/4.3.3 MONITORING INSTRUMENTATION

3/4.3.3.10 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in this manual to ensure that the alarm/trip will occur prior to exceeding the limits of Technical Specification 6.8.3g.2 [ITS 5.5.4b] or 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

3/4.3.3.11 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluent during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in this manual to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50. The sensitivity of any noble gas activity monitors used to show compliance with the gaseous effluent release requirements of Control 3.11.2.2 shall be such that concentrations as low as 1×10^{-6} μCi/cc are measurable.

BASES

3/4.11.1 LIQUID EFFLUENTS

3/4.11.1.1 CONCENTRATION

This control is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than ten times the concentration levels specified in 10 CFR Part 20, Appendix B, Table 2, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope.

This control applies to the release of radioactive materials in liquid effluents from all units at the site.

The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually); Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968); and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

3/4.11.1.2 DOSE

This control is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Control implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A. of Appendix I to assure that the releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The dose calculation methodology and parameters in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified in this manual for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977; and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

3/4.11.1.2 DOSE (Continued)

This control applies to the release of radioactive materials in liquid effluents from each unit at the site.

3/4.11.1.3 LIQUID WASTE PROCESSING SYSTEM

The OPERABILITY of the Liquid Waste Processing System ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This control implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the Liquid Waste Processing System were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

This control applies to the release of radioactive materials in liquid effluents from each unit at the site.

3/4.11.2 GASEOUS EFFLUENTS

3/4.11.2.1 DOSE RATE

This control is provided to ensure that the dose at any time at and beyond the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 to UNRESTRICTED AREAS. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC to annual average concentrations exceeding ten times the limits specified in Appendix B, Table 2 of 10 CFR Part 20. For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of that MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. Examples of calculations for such MEMBERS OF THE PUBLIC, with the appropriate occupancy factors, shall be given in this manual. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrems/year to the whole body or to less than or equal to 3000 mrems/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrems/year.

3/4.11.2.1 DOSE RATE (Continued)

This control applies to the release of radioactive materials in gaseous effluents from all units at the site.

The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually); Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968); and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

3/4.11.2.2 DOSE - NOBLE GASES

This control is provided to implement the requirements of Sections II.B, III.A and IV.A of Appendix I, 10 CFR Part 50. The Control implements the guides set forth in Section II.B of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The dose calculation methodology and parameters established in this manual for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977; and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977. The ODCM equations provided for determining the air doses at and beyond the SITE BOUNDARY are based upon the historical average atmospheric conditions.

This control applies to the release of radioactive materials in gaseous effluents from each unit at the site.

3/4.11.2.3 DOSE - IODINE-131, IODINE-133, TRITIUM, AND RADIOACTIVE MATERIAL IN PARTICULATE FORM

This control is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. The Controls are the guides set forth in Section II.C of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The calculational methods specified in the Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977; and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate controls for Iodine-131, Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days, are dependent upon the existing radionuclide pathways to man, in the areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of these calculations were: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure to man.

This control applies to the release of radioactive materials in gaseous effluents from each unit at the site.

3/4.11.2.4 GASEOUS WASTE PROCESSING SYSTEM

The OPERABILITY of the GASEOUS WASTE PROCESSING SYSTEM ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of the systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This control implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the system were specified as a suitable fraction of the dose design objectives set forth in Section II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

3/4.11 RADIOACTIVE EFFLUENTS

BASES

3/4.11.2.4 GASEOUS WASTE PROCESSING SYSTEM

This Control applies to the release of radioactive material in gaseous effluents from each unit at the site.

3/4.11.4 TOTAL DOSE

This control is provided to meet the dose limitation of 40 CFR Part 190 that has been incorporated into 10 CFR Part 20.2203. The control requires the preparation and submittal of a Special Report whenever the calculated doses due to releases of radioactivity and to radiation from uranium fuel cycle sources exceed 25 mrems to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation doses from the reactor units and outside storage tanks are kept small. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR Part 190.11 and 10 CFR Part 20.2203, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190 and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in Controls 3.11.1.1 and 3.11.2.1. An individual is not considered a MEMBER OF THE PUBLIC during any period in which the individual receives an occupational dose..

BASES

3/4.12.1 MONITORING PROGRAM

The Radiological Environmental Monitoring Program required by this control provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposure of MEMBERS OF THE PUBLIC resulting from the plant operation. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and thereby supplements the Radiological Effluent Monitoring Program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring. The initially specified monitoring program will be effective for at least the first 3 years of commercial operation. Following this period, program changes may be initiated based on operational experience.

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLDs). The LLDs required by this manual are considered optimum for routine environmental measurements industrial laboratories. It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Detailed discussion of the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually); Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal.Chem. 40, 586-93 (1968); and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

3/4.12.2 LAND USE CENSUS

This control is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the Radiological Environmental Monitoring Program given in the ODCM are made if required by the results of this census. The best information from the door-to-door survey, from aerial survey or from consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 50 m^2 provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were made: (1) 20% of the garden was used for growing broad leaf vegetation (i.e, similar to lettuce and cabbage), and (2) a vegetation yield of 2 kg/m^2.

BASES

3/4.12.3 INTERLABORATORY COMPARISON PROGRAM

The requirement for participation in an Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurement of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50.

SECTION 5.0

DESIGN FEATURES

5.1 SITE

5.1.3 MAP DEFINING UNRESTRICTED AREAS AND SITE BOUNDARY FOR RADIOACTIVE GASEOUS AND LIQUID EFFLUENTS

5.1.3 Information regarding radioactive gaseous and liquid effluents, which will allow identification of structures and release points as well as definition of UNRESTRICTED AREAS within the SITE BOUNDARY that are accessible to MEMBERS OF THE PUBLIC, shall be as shown in Figures 5.1-3 and 5.1-4.

The UNRESTRICTED AREA boundary may coincide with the Exclusion (fenced) Area boundary, as defined in 10 CFR Part 100.3(a), but the UNRESTRICTED AREA does not include areas over water bodies. The concept of UNRESTRICTED AREAS, established at or beyond the SITE BOUNDARY, is utilized in the Controls to keep levels of radioactive materials in liquid and gaseous effluents as low as is reasonably achievable, pursuant to 10 CFR Part 50.36a.

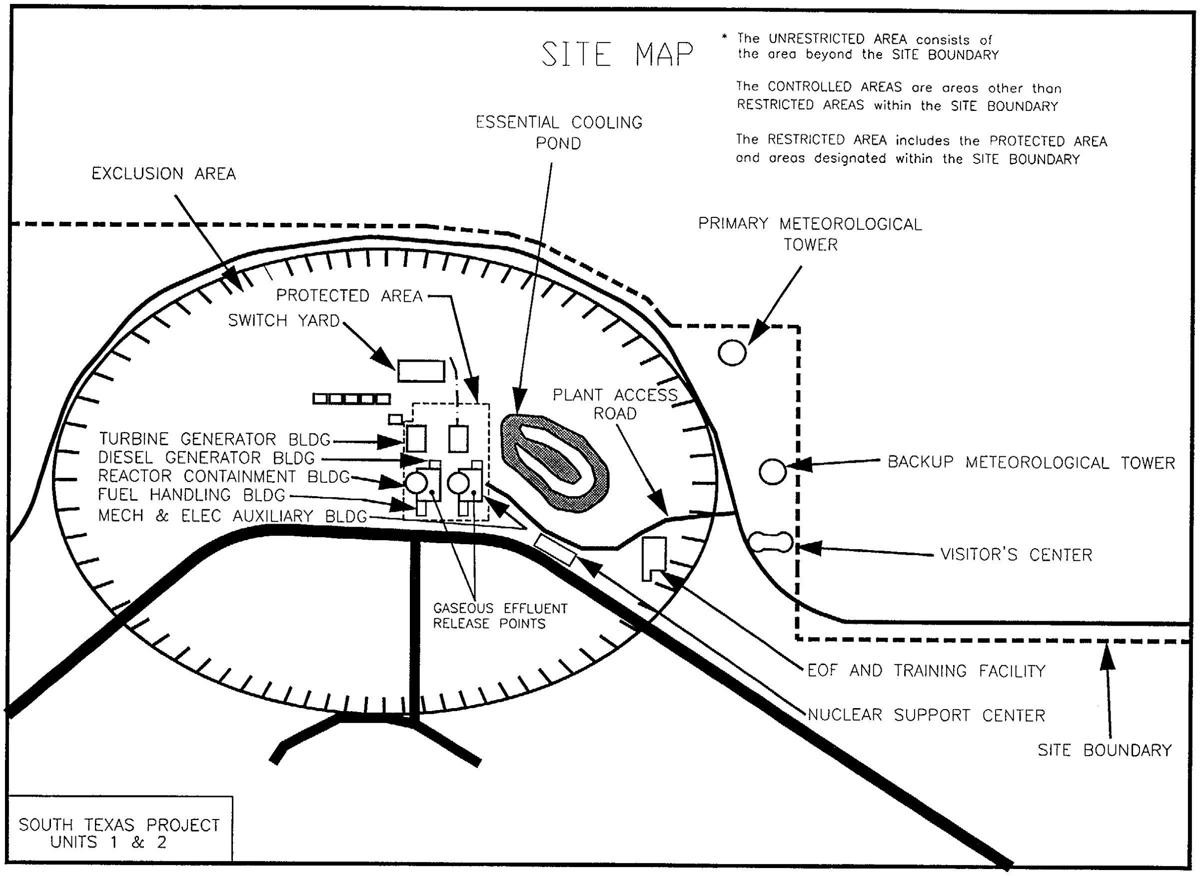

FIGURE 5.1-3
UNRESTRICTED AREA* AND SITE BOUNDARY FOR RADIOACTIVE GASEOUS EFFLUENTS
(SEE ALSO FIGURE 5.1-4)

E-0009.DWG
REV 2

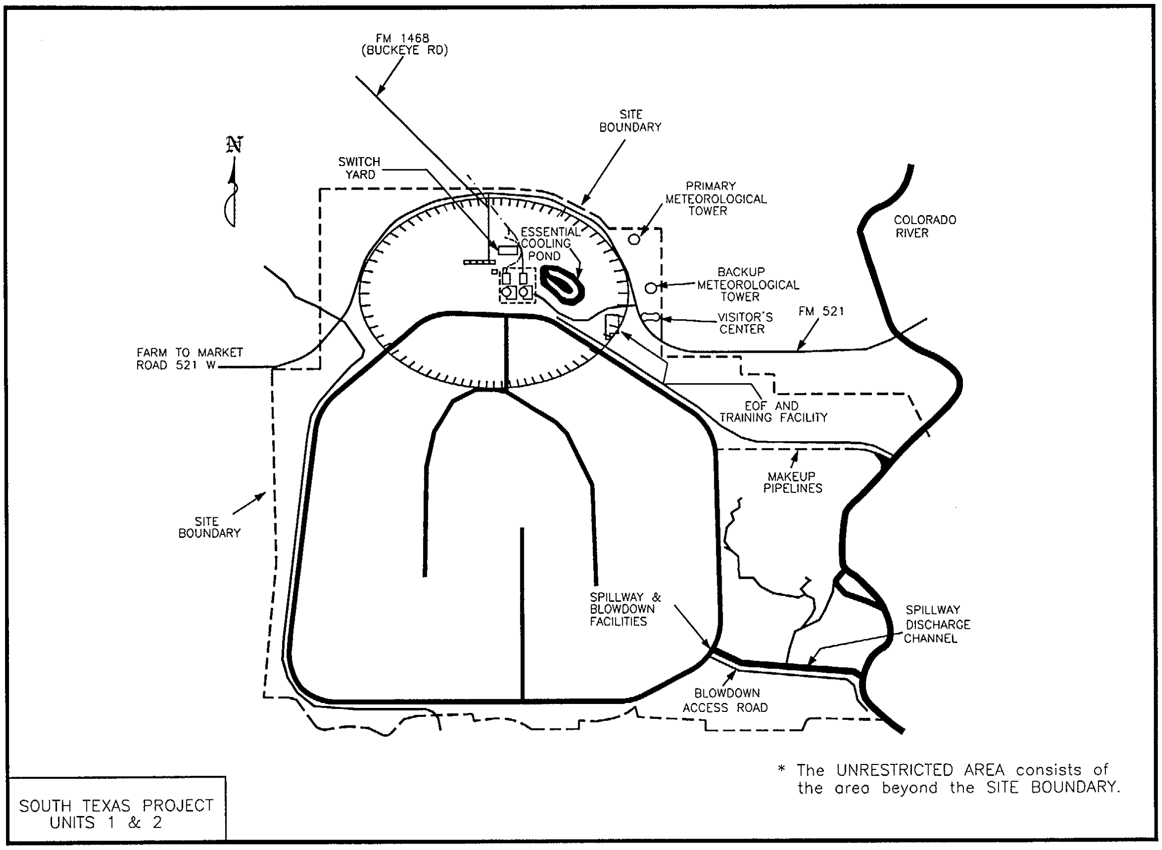

FIGURE 5.1-4
UNRESTRICTED AREA* AND SITE BOUNDARY FOR RADIOACTIVE LIQUID EFFLUENTS

STP E-0006
REV 1

SECTION 6.0

ADMINISTRATIVE CONTROLS

6.8.3 Radiological Environmental Monitoring Program

The Radiological Environmental Monitoring Program shall be established, implemented, and maintained as follows:

A program shall be provided to monitor the radiation and radionuclides in the environs of the plant. The program shall provide (1) representative measurements of radioactivity in the highest potential exposure pathways, and (2) verification of the accuracy of the effluent monitoring program and modeling of environmental exposure pathways. The program shall (1) be contained in the ODCM, (2) conform to the guidance of Appendix I to 10 CFR Part 50, and (3) including the following:

1) Monitoring, sampling, analysis, and reporting of radiation and radionuclides in the environment in accordance with the methodology and parameters in the ODCM,

2) A Land Use Census to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the monitoring program are made if required by the results of this census, and

3) Participation in a Interlaboratory Comparison Program to ensure that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring.

6.9.1.3 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT*

6.9.1.3 Routine Annual Radiological Environmental Operating Reports covering the operation of the unit during the previous calendar year shall be submitted prior to May 1 of each year. The initial report shall be submitted prior to May 1 of the year following initial criticality.

The Annual Radiological Environmental Operating Reports shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies, with operational controls, as appropriate, and with previous environmental surveillance reports, and an assessment of the observed impacts of the plant operation on the environment. The reports shall also include the results of the Land Use Census required by Control 3.12.2.

The Annual Radiological Environmental Operating Reports shall include summarized and tabulated results of radiological environmental samples and environmental radiation measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979 for samples taken during the period at the locations specified in the Table B5-1 and Figures B4-1 and B4-2 in this manual. In the event that some individual results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as possible in a supplementary report.

The reports shall also include the following: a summary description of the Radiological Environmental Monitoring Program; at least two legible maps** covering all sampling locations keyed to a table giving distances and directions from the centerline of one reactor; the results of licensee participation in the Interlaboratory Comparison Program and the corrective action taken if the specified program is not being performed as required by Control 3.12.3; reason for not conducting the Radiological Environmental Monitoring Program as required by Control 3.12.1, and discussion of all deviations from the sampling schedule; discussion of environmental sample measurements that exceed the reporting levels but are not the result of plant effluents, pursuant to ACTION b. of Control 3.12.1; and discussion of all analyses in which the LLD required was not achievable.

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* A single submittal may be made for a multiple unit station. The submittal should combine those sections that are common to all units at the station.

** One map shall cover stations near the SITE BOUNDARY; a second shall include the more distant stations.

6.9.1.4 RADIOACTIVE EFFLUENT RELEASE REPORT*

6.9.1.4 Routine Radioactive Effluent Release Reports covering the operation of the unit during the previous calendar year of operation shall be submitted within 60 days after January 1 of each year. The period of the first report shall begin with the date of initial criticality.

The Radioactive Effluent Release Report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof. For solid wastes, the format for Table 3 in Appendix B shall be supplemented with three additional categories: class of solid wastes (as defined by 10 CFR Part 61), type of container (e.g., LSA, Type A, Type B, Large Quantity) and SOLIDIFICATION agent or absorbent (e.g., cement, urea formaldehyde).

The Radioactive Effluent Release Report to be submitted within 60 days after January 1 of each year shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing in electronic form (computer media) of wind speed, wind direction, atmospheric stability, and precipitation (if measured), or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.** This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year. This same report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY (Figures 5.1-3 and 5.1-4) during the report period. All assumptions used in making these assessments, i.e., specific activity, exposure time, and location, shall be included in these reports. The meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents, as determined by sampling frequency and measurement, shall be used for determining the gaseous pathway doses. The assessment of radiation doses shall be performed in accordance with the methodology and parameters in this manual.

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* A single submittal may be made for a multiple unit station. The submittal should combine those sections that are common to all units at the station; however, for units with separate radwaste systems, the submittal shall specify the releases of radioactive material from each unit.

** In lieu of submission with the Radioactive Effluent Release Report, the licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

6.9.1.4 RADIOACTIVE EFFLUENT RELEASE REPORT (Continued)

The Radioactive Effluent Release Report to be submitted within 60 days after January 1 of each year shall also include an assessment of radiation doses to the likely most exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources, including doses from primary effluent pathways and direct radiation, for the previous calendar year to show conformance with 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operation." Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Rev. 1, October 1977.

The Radioactive Effluent Release Report shall include a list and description of unplanned releases from the site to UNRESTRICTED AREAS of radioactive materials in gaseous and liquid effluents made during the reporting period.

The Radioactive Effluent Release Report shall include any changes made during the reporting period to the PROCESS CONTROL PROGRAM and to the ODCM, pursuant to Technical Specifications 6.13 and 6.14 [ITS 5.5.1] , respectively, as well as any major change to Liquid and Gaseous Radwaste Treatment Systems pursuant to Control 6.15. It shall also include a listing of new locations for dose calculations and/or environmental monitoring identified by the Land Use Census pursuant to Control 3.12.2.

The Radioactive Effluent Release Report shall also include the following: an explanation as to why the inoperability of liquid or gaseous effluent monitoring instrumentation was not corrected within the time specified in Control 3.3.3.10 or 3.3.3.11, respectively; and description of the events leading to liquid holdup tanks or gas storage tanks exceeding the limits of Technical Specification 3.11.2.6 [ITS 5.5.12b] , respectively.

6.15 MAJOR CHANGES TO LIQUID AND GASEOUS RADWASTE TREATMENT SYSTEMS*

6.15.1 Licensee-initiated major changes to the Radwaste Treatment Systems (liquid and gaseous):

a. Shall be reported to the Commission in the Radioactive Effluent Release Report for the period in which the evaluation was reviewed by the PORC. The discussion of each change shall contain:

1. A summary of the evaluation that led to the determination that the change could be made in accordance with 10 CFR Part 50.59;

2. Sufficient detailed information to totally support the reason for the change without benefit of additional or supplemental information;

3. A detailed description of the equipment, components, and processes involved and the interfaces with other plant systems;

4. An evaluation of the change, which shows the predicted releases of radioactive materials in liquid and gaseous effluents that differ from those previously predicted in the License application and amendments thereto;

5. An evaluation of the change, which shows the expected maximum exposures to a MEMBER OF THE PUBLIC in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the License application and amendments thereto;

6. A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents, to the actual releases for the period prior to when the change is to be made;

7. An estimate of the exposure to plant operating personnel as a result of the change; and

8. Documentation of the fact that the change was reviewed and found acceptable by the PORC.

b. Shall become effective upon review and acceptance by the PORC.

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* Licensees may choose to submit the information called for in this Control as part of an FSAR update.

STP ODCM

PART B

RADIOLOGICAL CALCULATIONAL METHODS AND PARAMETERS

Notation Conventions Common throughout Part B to the ODCM

Symbols	Notation Description
AF	Allocation Factor
DF	Dilution Factor
Dfi	Dose factor for nuclide "i"
Dr	Dose rate
D/Q	Ground deposition factor for airborne particles
EC	Effluent Concentration from 10CFR20, Appendix B, Table 2, column 2
FHB	Fuel-Handling Building
GWPS	Gaseous Waste Processing System
LC	Limiting Concentration for a liquid or gaseous effluent stream
MAB	Mechanical Auxiliary Building
MCR	Main Cooling Reservoir
ODCM	Offsite Dose Calculation Manual
Qi	Release rate for nuclide "i"
RCB	Reactor Containment Building
S_f	Shielding factor
SF	Safety Factor
SGBS	Steam Generator Blowdown System
STP	South Texas Project
TGB	Turbine-Generator Building
UFSAR	Updated Final Safety Analysis Report
X(a,i,j)	Matrix values with dimensions of age " a", nuclide "i", and organ "j"
X/Q	Atmospheric dispersion factor for noble gas, tritium, and ^{14}C
X/Q_{depl}	Atmospheric dispersion factors with depletion for particles and iodine
$\sum_i$	Summation over all applicable nuclides
$\sum_{path}$	Summation over all applicable environmental pathways to man

1.0 Introduction

1.1 Purpose

Part B of the Off-site Dose Calculation Manual (ODCM) provides the methods and parameters used to calculate off-site doses due to routine radioactive liquid and gaseous effluent releases. This ODCM is a supporting document to the Technical Specifications for the South Texas Project (STP) and meets the following identified needs:

a. Section 3.1 of this ODCM describes the methods approved for setting alarm points on liquid monitors to ensure that the concentrations of radioactive liquid effluents released to the UNRESTRICTED AREA are limited to ten times the effluent concentration limits of 10CFR20, Appendix B, Table 2;

b. Section 3.2 describes the methods approved for setting alarm points on gaseous monitors to ensure that the dose rate from radioactive noble gas effluents released to the UNRESTRICTED AREA do not exceed the values specified in Part A, Control 3/4.11.2.1 of this ODCM;

c. Sections 4.1 to 4.4 describe the methods approved for calculating doses and dose rates to the maximum exposed MEMBER OF THE PUBLIC in the UNRESTRICTED AREA for comparison with the Control limits of Part A of the ODCM;

d. Sections 4.5 and 4.6 describe the conditions under which the liquid and gaseous waste processing systems are to be operated.

e. Section 4.7 describes the methods approved for calculating the total dose from the uranium fuel cycle to the maximum exposed MEMBER OF THE PUBLIC for comparison with the limits of 40CFR190;

f. Section 4.8 describes the method approved for calculating doses to MEMBERS OF THE PUBLIC who may visit STP or travel within the site boundary for comparison with the limits of 10CFR20.1301;

g. Section 4.9 outlines how population doses are to be calculated for the Regulatory Guide 1.121 report.

h. Section 5.0 describes the Radiological Environmental Monitoring Program (REMP) including the minimum sampling program and sample locations.

The models used in this ODCM are consistent with "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance With 10CFR50, Appendix I" (Regulatory Guide 1.109).

Changes to the methods contained in this document are reviewed and approved by the Plant Operations Review Committee (PORC) as required by Technical Specification 6.14 [ITS 5.5.1] and revisions are forwarded to the NRC with the Radioactive Effluent Release Report. However, the general methods presented should accommodate operational flexibility.

1.2 General Site Description

The South Texas Project (STP) consists of two pressurized water reactor units situated on a 19-square mile site. The units are similar in design and operate independently with a minimum of shared systems. Each unit has its own liquid radioactive waste treatment system and its own ventilation system. Each unit consists of a reactor containment building, an attached fuel-handling and storage building, an attached mechanical electrical auxiliary building, and a detached turbine generator building.

The most notable common system is the cooling reservoir into which liquid radioactive effluents are discharged from both units. Also, the systems which monitor radioactive releases for each unit report their results to a common computer for the purposes of report generation and off-site dose calculation.

The site is relatively remote with the nearest resident over two miles from either unit and with the nearest community about four miles distant. The closest site boundary is nearly a mile from either unit.

The terrain is coastal plain with farm land and range predominating. The land rises slowly from sea level 10 miles south of the plant to an elevation of 45 feet 10 miles to the north. The only topographical relief consists of plant associated structures and shallow gullies. The methods discussed in this document for calculating off-site doses due to atmospheric releases were evaluated against this relatively simple terrain.

Dose calculations for liquid effluent releases include considerations for dilution and radioactive decay in the large cooling reservoir into which releases from both units are made. These dose estimates are based on off-site discharges from the reservoir to the Colorado River and the Little Robbins Slough area as a consequence of initial radioactive effluent releases into the reservoir.

2.0 Summary of Release Points and Detector System

2.1 Gaseous Release Points (UFSAR Section 11.3)

The sources of routine releases for each unit at STP are:

1) Turbine-Generator Building (TGB);
2) Reactor Containment Building (RCB);
3) Mechanical Auxiliary Building (MAB);
4) Fuel-Handling Building (FHB);
5) Gaseous Waste Processing System (GWPS);

The gaseous effluents from the RCB, MAB, and FHB ventilation systems, the GWPS, and the TGB process vents (for deaerator and condenser vacuum pump vents) are routed to a common exhaust pipe located on the roof of each unit's Mechanical and Electrical Auxiliary Buildings. The effluent is monitored for noble gas, sampled for particulates and iodines by the detectors of RT-8010B at each unit, and then exhausted 22 meters above local grade (local grade is 7 meters above mean sea level) at an average flow rate of 5660 cubic meters per minute. Figure B2-1 summarizes the system installed at each unit.

Occasionally other atmospheric release points may be important, such as the main steam line atmospheric dumps, off-normal releases, auxiliary feed pump turbine exhaust, gland steam condenser vents, and other secondary system steam leaks. An estimate will be made of any such unmonitored effluent releases prior to off-site dose calculation. These release estimates will be based on the mass of secondary coolant lost and the nuclide concentrations in the secondary coolant.

Releases to the atmosphere may be classified into two categories: continuous, and batch releases. Most releases from STP are continuous with minor variations which are intermittent in nature and usually of relatively short duration (minutes to hours). These releases are considered "continuous" in the sense that they occur frequently, may be overlapping, and do not usually involve a significant fraction of the total activity released in a calendar quarter during any given hour. An example of such a release is the venting of containment to equalize pressure. However, those plant evolutions leading to a one-hour release exceeding approximately ten times the average one-hour release are considered a batch. An example of a batch release is the operation of the purge fans for a few hours to remove noble gases from containment for personnel protection reasons. Meteorological data associated with these infrequent periods of high release shall be reported separately as provided by Regulatory Guide 1.21, Rev. 1, section C.1.

2.2 Liquid Discharge Points (UFSAR Section 11.2)

The sources of liquid radioactive discharges are the Liquid Waste Processing System, the TGB drains, and the Condensate Polishing System regenerates. All liquid effluents are eventually discharged to the main cooling reservoir (MCR). Some are routed to the liquid radwaste processing system of each unit for treatment, and some contain such a low concentration of radioactive material that they require no treatment before discharge. Instrumentation is located as indicated in Figure B2-2

Radioactive liquids exceeding the discharge limits are routed to the Liquid Waste Processing System (LWPS) for treatment and batch discharge to the MCR. Prior to discharge, the liquid in the tank to be discharged is sampled, analyzed, and approved for discharge if the constraints of the ODCM are met. Batches are monitored during the discharge using a scintillation detector (RT-8038) mounted off-line from the discharge pipe. The liquid effluent enters the Open Loop Auxiliary Cooling Water System, then the Circulating Water System, and finally the MCR. Upon initiation of a high radiation or monitor failure alarm, the monitor automatically terminates the discharge to the Open Loop Auxiliary Cooling Water System by diverting the flow back to the waste tanks.

Regenerative liquid waste from the Condensate Polishing system in each TGB can also be a source of radioactive waste. Condensate Polishing system detector (RT-8042) is located on the discharge of the system to the MCR via the neutralization basin. Upon detection of high radiation or an instrument failure, a signal automatically secures the discharge to the neutralization basin. After sampling and analyzing the tank contents, flow may be diverted to the LWPS of the appropriate unit, processed through the neutralization basin, or discharged directly to the main cooling reservoir.

Liquid effluents from TGB floor drains consisting of leakage from the condensate pump, the low pressure heater drip pump, the moisture separator drip pump seal leakoff, and other secondary system leaks are monitored continuously by the TGB drain detector (RT-8041). Upon detection of high radiation level or detector failure, the detector automatically stops the sump pumps and initiates alarms. Following sampling and analysis, the contaminated liquid effluent may be routed to the neutralization basin or radioactive waste processing system as appropriate prior to discharge into the main cooling reservoir.

The Steam Generator Blowdown System (SGBS) is monitored for control of plant processes. Under normal conditions there are no discharges from the SGBS, but a process control instrument (RT-8043) is installed to help identify primary to secondary system leakage. In the event radioactivity above the high alarm set point is detected or the instrument fails, the detector initiates the automatic termination of the SGBS discharge to the neutralization basin. Provided sampling and analysis confirms that the activity is below discharge limits, the SGBS effluent may be discharged to the main cooling reservoir via the neutralization basin.

Most liquid effluent discharges are by batch and are sampled and analyzed prior to discharge. However, discharges not monitored by RT-8038 are not sampled prior to discharge unless a process detector alarms. Trace levels of activity that may be discharged by such routes are estimated based on routine sampling of the secondary system water and the estimated mass of secondary coolant lost. These discharges are considered continuous for tracking purposes.

Liquid radioactive releases from STP originate in the MCR and leave the site to the uncontrolled environments of the Colorado River, the West Branch of the Colorado, and the Little Robbins Slough drainage area. Under normal circumstances all radioactive liquid effluents are diluted into the 150,000 acre-foot (average fill height) reservoir prior to release from the site. From time-to-time controlled releases may be made to the Colorado River through blowdown facilities. However, some releases are uncontrollable such as flow from the hydraulic relief wells surrounding the reservoir or seepage from the spillway gates.

Because of the large capacity of the reservoir, the radionuclide concentrations in these releases (controlled and uncontrolled) are expected to be a small fraction of the concentration limits listed in Table 2, Appendix B of the 10CFR20. The nuclide concentrations in waters released from the reservoir are estimated based on discharges to the MCR, deposition in the MCR, and radioactive decay. A monitoring program for the MCR and relief well discharges is used as the basis for confirming that radionuclide concentrations released to the off-site environment are not larger than predicted by the liquid effluent model described in Part B of the ODCM, Section 4.1.

Release of contaminated secondary coolant directly to the storm drainage system at STP is possible. Should such a release occur, an estimate of the off-site dose consequences shall be made and the release shall be documented.

2.3 Detector System and Instrument Responses

Three types of detectors are used in association with effluent monitors. All are sensitive to gamma rays; however, some are primarily sensitive to beta radiation. Those sensitive primarily to beta include the air particulate and noble gas detectors. Those sensitive primarily to gamma rays include the iodine in air detectors and the liquid discharge detectors.

The noble gas (normal range) detectors consist of plastic scintillators which respond primarily to beta particles. The response of these detectors is a function of beta energy as can be seen from Figure B2-3. These detectors are calibrated in uCi/cc for gases with beta emission spectra similar to that of Xe-133.

The air particulate detectors also consist of plastic scintillators which respond primarily to beta decay from particulates deposited on a filter paper. These detectors are calibrated in uCi/ml relative to Cs-137 betas with an overall response similar to that shown in Figure B2-4.

The iodine air channel detectors are NaI(Tl) scintillators in conjunction with a single channel analyzer adjusted to monitor the 364 keV gamma of I-131. The iodine window of this detector is set $\pm$5% about the 364 keV peak to minimize response to interfering radiation. The detectors are calibrated in uCi/cc of I-131 based on a Ba-133 calibration source.

The liquid effluent detectors are NaI(Tl) scintillators which are sized (1.5 by 1 inch) to be sensitive to a broad range of gamma emitters. These detectors are calibrated in uCi/ml relative to Cs-137 but have general gamma detection ability similar to that shown in Figure B2-5. The lower level discriminators for these detectors are set at about 100 keV to eliminate detection of x-rays, low energy gammas as from Xe-133, and electronics noise in order to minimize the detector background count rates.

The following systems are duplicated for Units 1 and 2 independently.

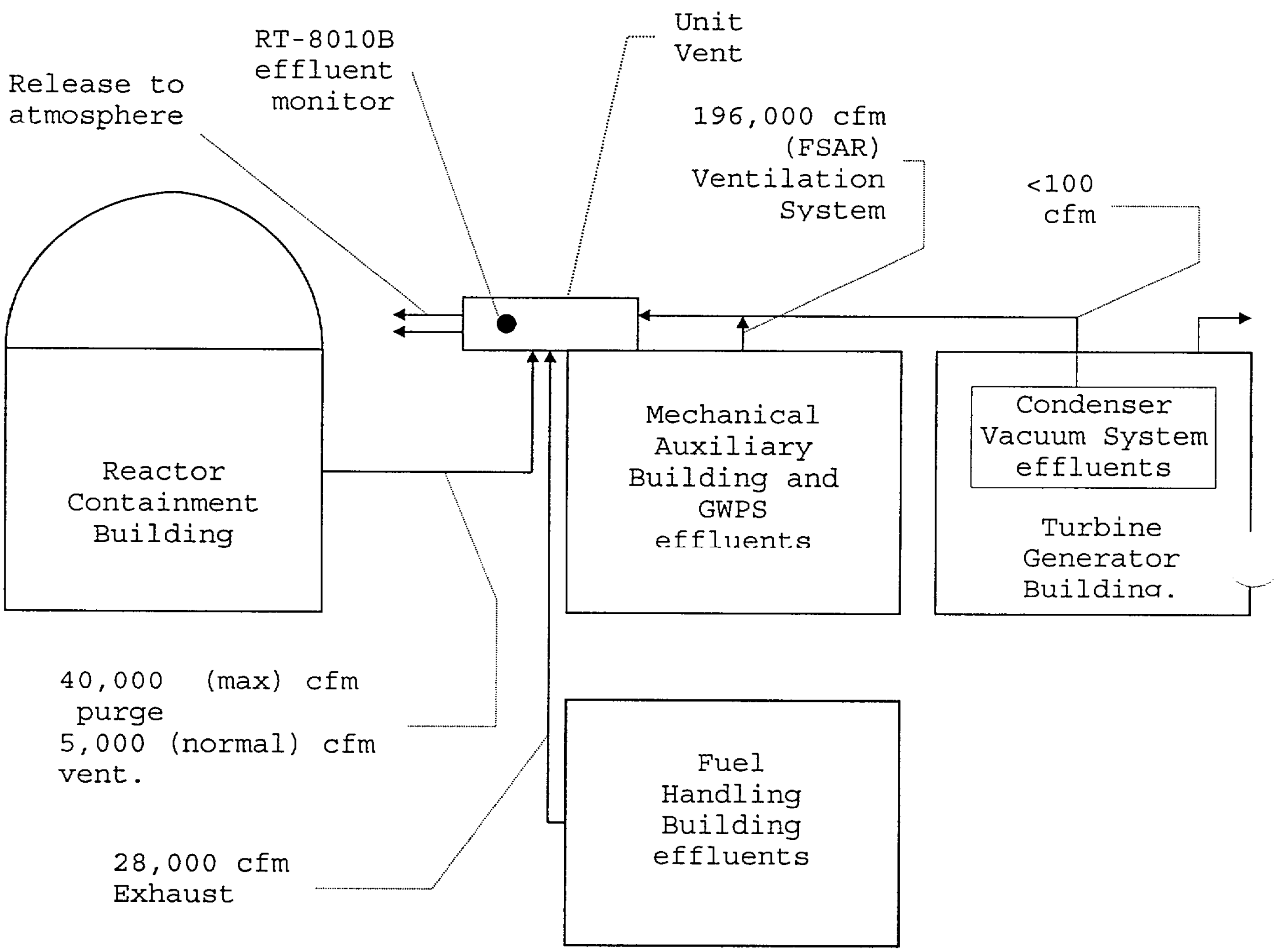


Figure B2-1: Gaseous Effluents

The following systems are duplicated for both units except for the components in the shaded area.

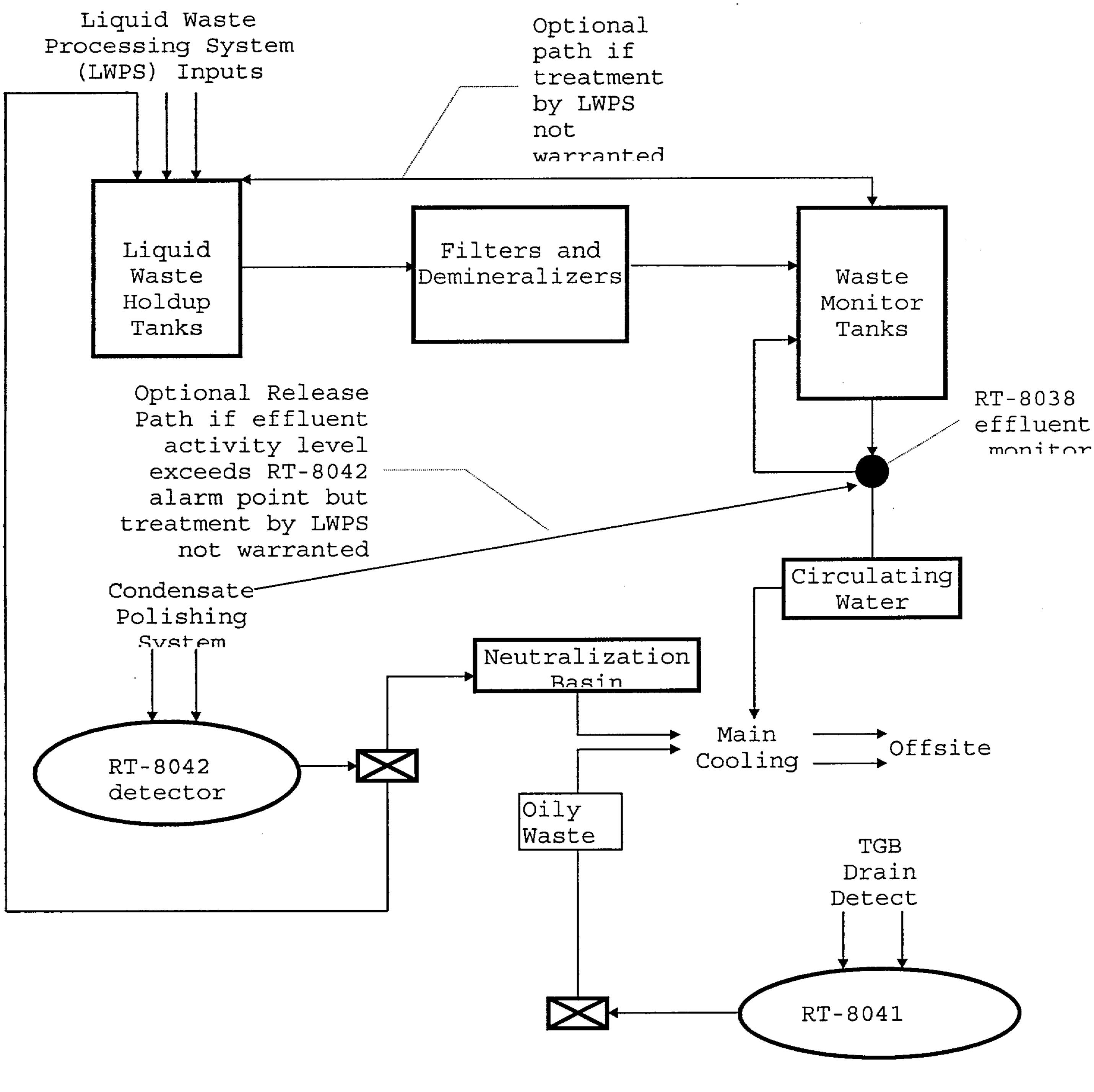


Figure B2-2: Liquid
Effluents

Figure B2-3: Energy Response Curve for the RD-52 Off-line Beta Detector Operating at 760 mm Hg and 25° C (assuming one beta per disintegration. Curve shape from ODCM Rev. 3 but shifted by 1.18 to correspond to STP primary calibration measurements of 1989.)

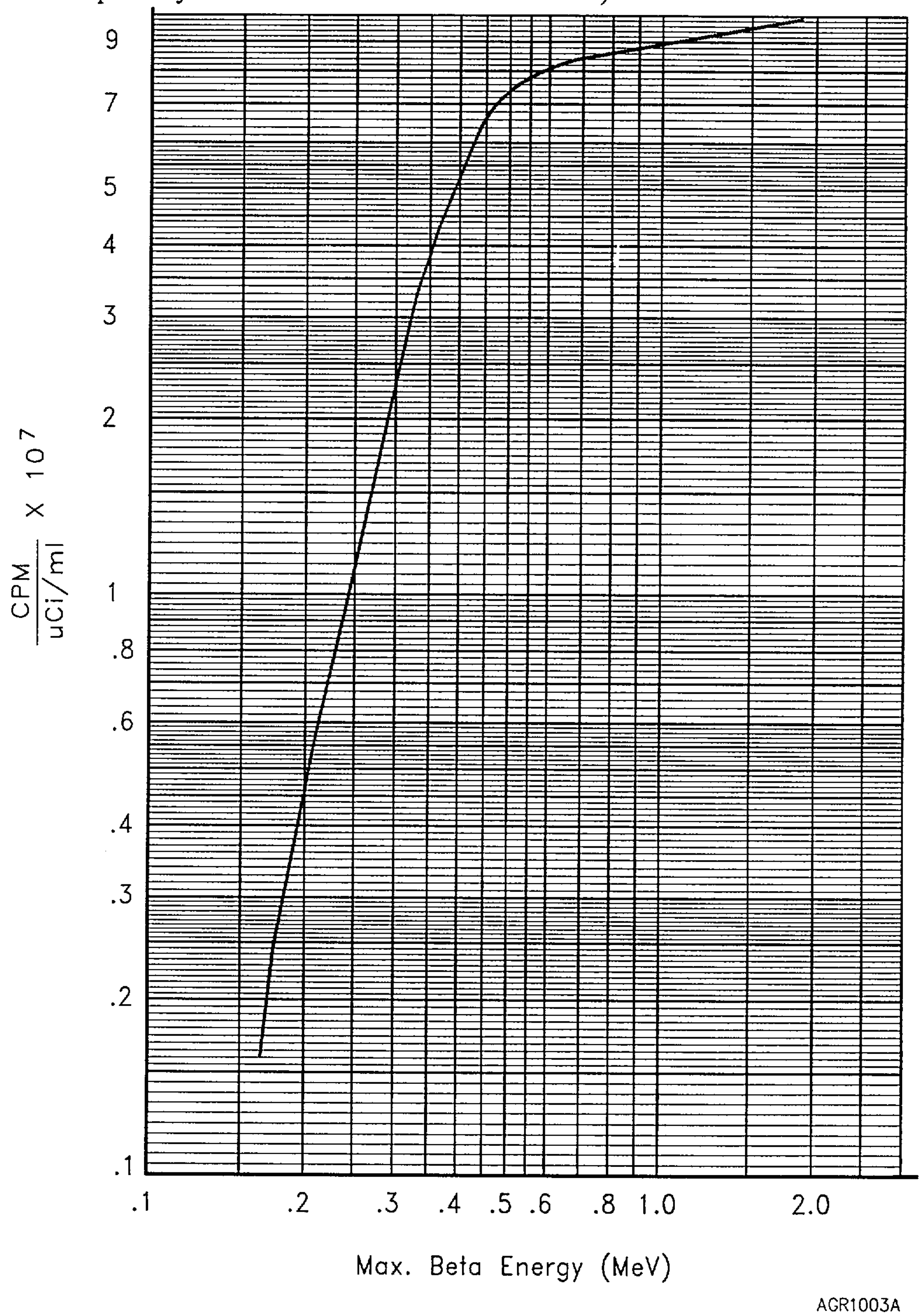


Figure B2-4: RD-56 Particulate Detector Energy Response to Betas (assuming one beta per disintegration. Copied from G. A. Technologies report EL-3296.)

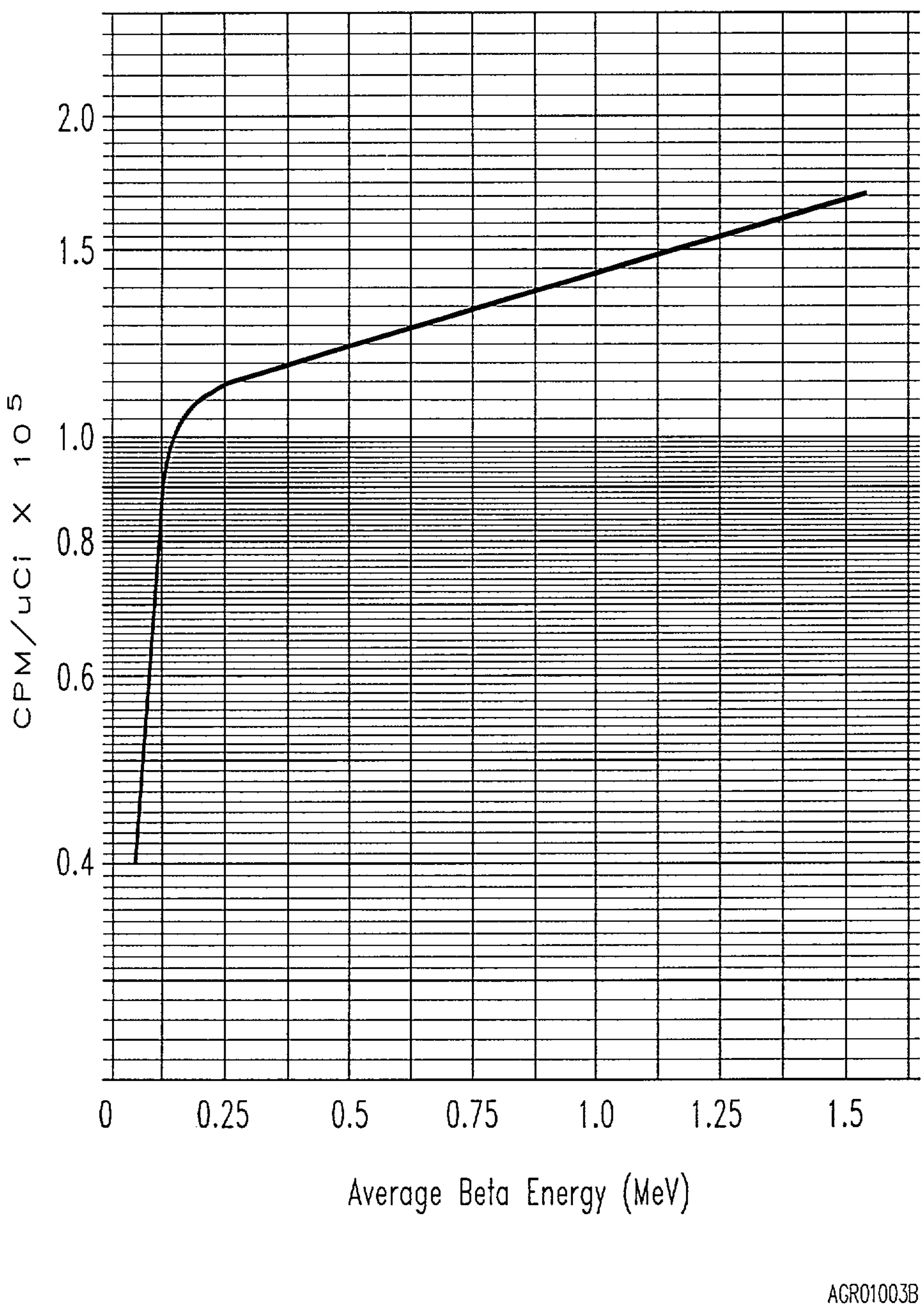
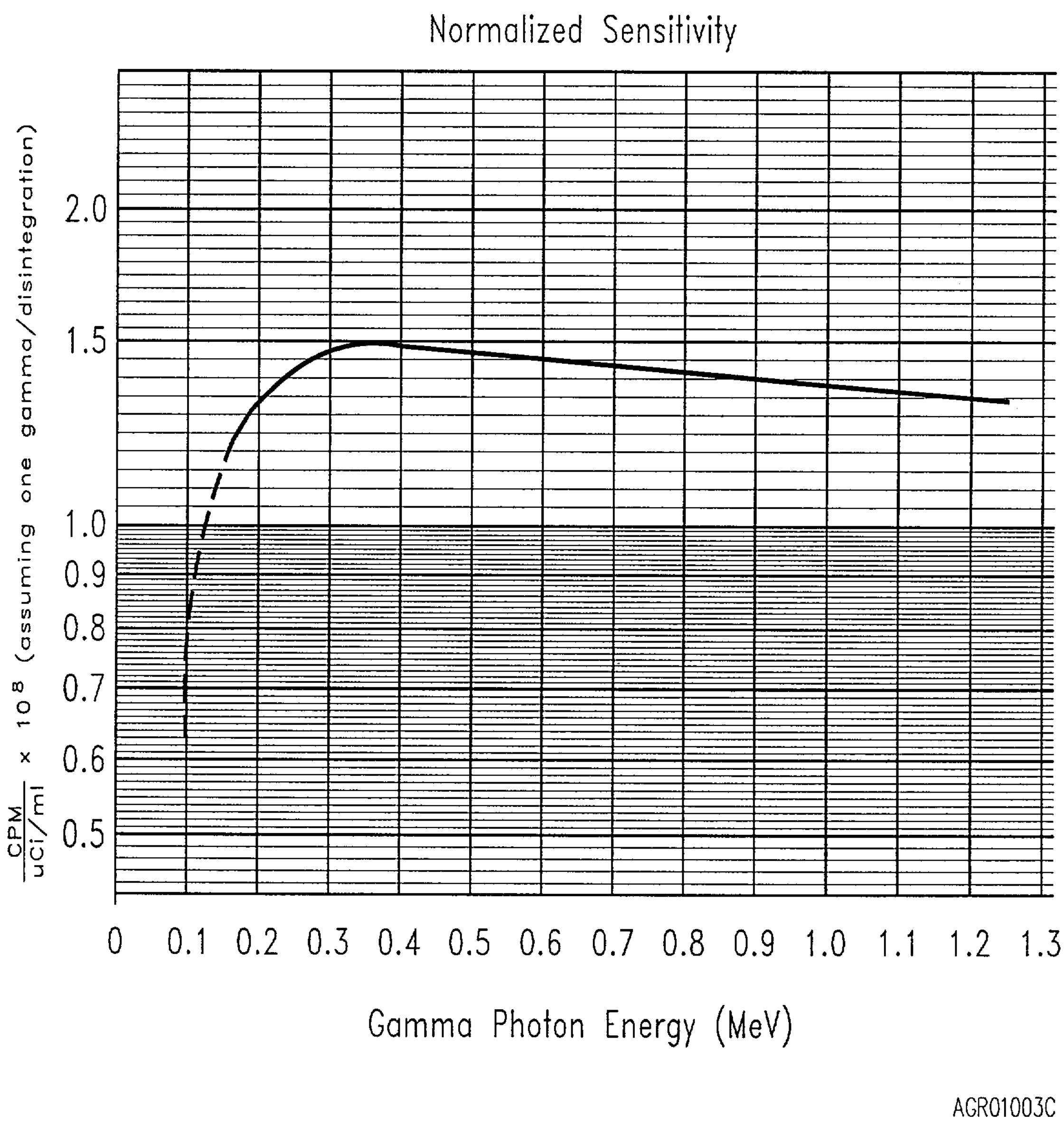


Figure B2-5: Detector Energy Response to Gamma Radiation for the RD-53 Off-line Gamma Detecto
(Revised to reflect 1989 primary calibration.)



3.0 Alarm Set point Adjustments

3.1 Liquid Effluents

3.1.1 Control Requirements

Control 3/4.11.1.1 of Part A of the ODCM requires that the concentration of radioactive material released at any time from the South Texas Project (STP) to unrestricted areas be limited to ten times the Effluent Concentration (ECs) in water. The ECs are as indicated in 10CFR20, Appendix B, Table 2, Column 2 for nuclides other than dissolved or entrained noble gases. Noble gas concentrations must be limited to 2.0E-04 uCi/ml.

3.1.2 Interpretation

Liquid effluent discharges from STP are diluted by a 7000-acre reservoir. Plant discharges are all routed into the cooling reservoir where substantial dilution and radioactive decay may occur before ultimate release from the site. The reservoir lies totally within the confines of the site and the use of its water is restricted to plant operation. Recreational use of the reservoir is limited to occasional catch and release fishing tournaments for employees and their families. This recreational use is closely controlled to prevent ingestion of radioactive effluents. Liquid effluents diluted into the cooling reservoir may be released during:

a) scheduled blowdown operations to the Colorado River,
b) passive hydraulic relief well flow,
c) dilution into the shallow ground water aquifer, or
d) spillway releases.

The blowdown releases will be planned; however, the other releases are not controlled by the operations staff. To assure that the provisions of Part A, Control 3/4.11.1.1 are satisfied, the concentrations of radionuclides in the reservoir shall be maintained at levels less than ten times the limits of 10CFR20, Appendix B, Table 2, Column 2. Hence, STP shall apply controls on the concentration of liquid effluents as they are discharged into the reservoir to assure that any releases to uncontrolled areas from the reservoir meet the requirements of Control 3/4.11.1.1.

3.1.3 Implementation

Concentrations of radionuclides in the cooling reservoir will be controlled such that the sum of their ratios to the ECs, **A**, remains less than ten as indicated in Equation 3.1a below:

$$A = \frac{C_1}{EC_1} + \frac{C_2}{EC_2} + \ldots + \frac{C_i}{EC_i} < 10 \qquad \text{Eq. 3.1a}$$

where $C_1, C_2, \ldots, C_i$ are the measured nuclide concentrations of a representative sample of reservoir water (uCi/ml);

$EC_1, EC_2, \ldots, EC_i$ are the associated effluent concentrations of those nuclides which collectively contribute at least 90% to the total dose.

As long as "A" from equation 3.1a above is less than ten, releases from the reservoir to the off-site environment will meet the requirements of Control 3/4.11.1.1. In order to assure that **A** never exceeds ten, the dilution afforded by the circulating coolant and auxiliary cooling water flows must be estimated. The dilution of liquid radioactive waste discharges into the circulating coolant from each unit is calculated as indicated below:

$$A = [DF_r * A_r] + [DF_c * A_c] \qquad \text{Eq. 3.1b}$$

$$DF_r = \frac{F_r}{F_c + F_r} \qquad \text{Eq. 3.1c}$$

$$DF_c = \frac{F_c}{F_c + F_r} \qquad \text{Eq. 3.1d}$$

where:

A = the sum of the effluent concentrations in the circulating coolant as it reenters the reservoir divided by their ECs; $A < 10$.

DF_r = dilution factor for a radioactive waste

A_r = number of ECs permitted in the radioactive waste flow from the waste monitor tank, unitless factor;

DF_c = dilution factor for circulating coolant

A_c = number of ECs in the circulating coolant before addition of the radioactive waste stream as measured periodically for the reservoir, unitless factor;

F_r = average flow rate of radioactive waste as determined by the rated pump capacity of the radioactive waste discharge, gal/min;

F_c = flow rate of circulating coolant and the open loop auxiliary cooling water, normally 4.5E5 gal/min (4.5E5 is 1/2 the normal circulating coolant flow of each unit since liquid radioactive waste is discharged into only one of two 138" lines). F_c may be determined by multiplying the number of circulating coolant pumps operating by the rated pump capacity;

Since liquid effluents are released as batches, the very large dilution factor afforded by the reservoir would not be fully used even if high concentrations of liquid radioactive waste were infrequently discharged from the plant. As an operational rule, liquid effluents should not be discharged to the reservoir if the value of **A**, as described by Eq. 3.1a and as calculated by

Eq. 3.1b, exceeds "ten". From practical experience, limiting liquid effluent discharges such that $A \leq 10$ maintains the measured reservoir concentrations within the limits of 10CFR20, Table 2, column 2.

If the value of "A" in equation 3.1b is set to its limiting value of 10, the terms in Eq. 3.1b above can be rearranged as shown below:

$$A_r = \frac{[F_c * (10 - A_c)]}{F_r} + 10 \qquad \text{Eq. 3.1e}$$

An estimate of A_r appropriate for limiting routine batch discharges to the reservoir can be made assuming that the radioactive waste stream flow is at its nominal value, the flow of dilution water is at its minimum, and that the reservoir is virtually unpolluted. In this case the values for each variable above become:

F_c = 113,000 gpm (one circulating coolant water pump)
F_r = 250 gpm (nominal flow rate limit for radioactive waste discharge pump);
A_c = 0 (reflecting good radioactive discharge management)

Hence, Eq. 3.1e can be solved for A_r as:

$$A_r = [113{,}000/250 * (10\text{-}0)] + 10 = 4530$$

This suggests that for normal operation with a "clean" reservoir, the administrative limit for discharges should limit discharge concentrations to no more than about 4530 times the effective EC of the radioactive waste stream.

The radioactive waste stream itself is characterized by a mixture of radionuclides at concentrations $C_1, C_2, ..., C_j$. The effective EC of this waste stream can be estimated from the radiochemical analysis of the waste monitor tank prior to a batch discharge using the following formula for effective EC:

$$EC_{eff} = \frac{\sum C_j}{\sum (C_j / EC_j)} \qquad \text{Eq. 3.1f}$$

where

C_j = concentrations of individual radionuclides, "j", in the mixture, uCi/ml
$\sum C_j$ = sum of the concentrations in the waste monitor tank, uCi/ml
EC_j = effluent concentrations listed in 10CFR20, Appendix B, Table 2, column 2, for each radionuclide, "j", uCi/ml
EC_{eff} = effective EC for a mixture of radionuclides, uCi/ml

The limiting concentration, LC, may be estimated by multiplying the value of EC_{eff} from Eq. 3.1f by the factor A_r from Eq. 3.1e.

$$LC = A_r * EC_{eff} \qquad \text{Eq. 3.1g}$$

This limiting concentration could be used as the basis for setting the liquid effluent monitor, RT-8038, if the instrument could detect these nuclides. However, the model RD-53 detector used in the RT-8038 monitor is sensitive to only gamma emitting nuclides, and its sensitivity to individual gamma emitters is not the same. The alarm set point must be based on the response of the RD-53 detector in counts per minute, cpm, to a nuclide mix in a particular discharge corresponding to an LC.

The count rate corresponding to the effective effluent concentration, CR, can be calculated in a manner similar to the methods of equation 3.1f.

$$CR = \frac{\sum(C_j * Er_j)}{\sum(C_j/EC_j)} \qquad \text{Eq. 3.1h}$$

where

CR = count rate, cpm, associated with one EC_{eff}

Er_j = RD-53 response to nuclide "j", (cpm)/(uCi/ml)

The limiting count rate, LCR, may be estimated as was the limiting concentration in equation 3.1g.

$$LCR = A_r * CR \qquad \text{Eq. 3.1i}$$

The following example uses the average mixture of radionuclides measured in the liquid effluent released during August 1988 to calculate the limiting concentration and corresponding limiting count rate for the RT-8038 monitor:

Nuclide	Concentration C (uCi/ml)	EC (uCi/ml)	Concentration/ EC (C/EC)	Er (cpm)/(uCi/ml)	C * Er (cpm)
H-3	1.74E-02	1E-03	1.7E+01	0	0
Cr-51	4.22E-08	5E-04	8.4E-05	1.45E+07	6.12E-01
Mn-54	2.80E-08	3E-05	9.3E-04	1.40E+08	5.91E+00
Co-58	1.01E-06	2E-05	5.1E-02	1.83E+08	1.85E+02
Zr-95	3.41E-08	2E-05	1.7E-03	1.40E+08	4.77E+00
Nb-95	3.41E-08	3E-05	1.1E-03	1.40E+08	4.77E+00
Co-60	2.20E-08	3E-06	7.3E-03	2.65E+08	5.83E+00
Xe-133	3.96E-05	2E-04	2.0E-01	0	0
Xe-135	2.48E-07	2E-04	1.2E-03	1.31E+08	3.25E+01
	1.74E-02		1.7E+01		2.39E+02

$EC_{eff} = (\sum C_j) / (\sum(C_j/EC_j))$ = (1.74E-02 uCi/ml)/ 1.7E+01
= 1.0E-03 uCi/ml

$CR = (\sum(C_j * Er_j)) / (\sum(C_j/EC_j))$ = (2.39E+02 cpm)/ 1.7E+01
= 1.4E+01 cpm

The limiting discharge concentration in this example can be estimated using Eq. 3.1g as shown below:

LC = 4530 * 1.0E-03 uCi/ml = 4.5 uCi/ml

Note that radionuclides were included in the calculation which could not be detected by the model RD-53 detector. Examples of such nuclides include H-3, C-14, Fe-55, Tc-99, and Sr-90.

The alarm set point must be calculated based on the count rate RT-8038 would indicate if this limiting concentration were present. This count rate can be estimated using Eq. 3.1i as shown below:

LCR = 4530 * 14 cpm = 63,000 cpm

Note that no provision was made for the detector background, uncertainty in instrument response, or any safety factor in this calculation. Plant implementing procedures shall provide instructions for inclusion of background in the set point estimation and shall have provisions for cleaning the detector if the background becomes large enough to interfere with measurements.

As a result of improved radioactive waste treatment the gamma emitter concentrations of radioactive liquid effluents may be a very small fraction of the non-gamma emitter concentrations. The limiting count rate may yield an alarm set point lower than the expected count rate or expected monitor response. In these cases, plant implementing procedures may provide instructions for determining the alarm set point.

The limiting count rate calculated in Eq. 3.1i above should include these final adjustments as shown below to yield the alarm set point:

alarm set point = (LCR) * SF + bkg   Eq. 3.1j

where

SF = safety factor which includes the error margin calculated for this monitor. The effluent monitors are assumed to be accurate to 25%. An appropriate safety factor therefore should be set at 0.75 to reasonably assure an alarm and automatic discharge termination at or before exceeding the limiting concentration. The reader should note that the limiting concentration is calculated at the monitor, before the vast dilution provided by the reservoir.

Hence, even if the LC were substantially exceeded for discharges into the reservoir, little chance exists to exceed an EC in unrestricted areas.

bkg = detector background in cpm

For the example chosen above and assuming bkg = 0, this calculation would look like:

alarm set point= 63,000 cpm * 0.75 + 0 cpm
= 47,000 cpm

The detector response function is not as precisely known as this example would suggest; hence, 20-30% differences between estimated alarm set points are not significant. It may be convenient for this alarm set point to be expressed in units of uCi/ml or uCi/sec based on the appropriate uCi/cpm conversion factor. The RT-8038 alarm may be set to a default value if the default does not exceed the value calculated in Eq. 3.1j above.

The alarm set point and calibration factors for liquid effluent monitor RT-8038 are applied to batch discharges and are adjusted for each discharge if the nuclide mix is sufficiently different to change either the discharge limit or calibration factor from the previous setting by more than 25%. If the alarm set point is exceeded during a batch discharge, the discharge is automatically terminated until the batch discharge activity is confirmed. Discharges from two or more waste monitor tanks from a single unit simultaneously are prohibited. Hence, this ODCM does not provide instructions for simultaneous discharges from the radioactive waste monitoring system.

RT-8038 is the only liquid effluent monitor for each unit. Gamma detection instrumentation is installed for other systems (RT-8041 and RT-8042) as shown in Figure B2-2. These process control instruments have alarm set points at 1.0E-06 uCi/ml or less (one EC for Cs-137) above background and act to identify rather than to quantify activity in systems during a discharge. If activity is identified, it is sampled and discharged (if treatment is not required to meet the limiting concentration of equation 3.1g) or is routed to the liquid waste processing system for treatment and discharge as a routine liquid effluent.

3.2 Gaseous Effluents

3.2.1 Control Requirements

Control 3/4.11.2.1 of Part A of the ODCM requires that the dose rates at the site boundary and beyond from noble gases be no greater than 500 mrem/year total body and 3000 mrem/year to the skin. Furthermore, dose rates due to I-131, I-133, H-3, and all radionuclides in particulate form with half-lives greater than eight days shall be less than or equal to 1500 mrem/year to any organ.

3.2.2 Interpretation

In order to help ensure that these limits are not exceeded, the alarm set points for the MAB/RCB common exhaust noble gas monitors are to be calculated such that the nearest offsite receptor would not be exposed to noble gas concentrations likely to produce a dose rate greater than Control 3/4.11.2.1 from the combined releases from Units 1 and 2. Iodines, tritium, and all other radionuclides contributing to organ doses are not considered for purposes of setting alarm points since they are sampled and not monitored.

3.2.3 Implementation

The nearest site boundary is about a mile from either unit; hence, a factor to relate the release to the concentration at the site boundary is necessary. UFSAR Tables 2.3-25 and 2.3-27 contain 2-hour and annual average X/Q values at the site boundary in each of 16 sectors. Logarithmic interpolation provides an estimate of 5.3E-06(sec/m^3) for the 500 hour X/Q in the NNW sector. This value of X/Q shall be used to provide estimates of dilution for the purpose of setting alarm points for routine releases.

The most prevalent radioactive gas present in the effluent may be used to control emissions when the noble gas effluent is dominated by a single nuclide. If no single nuclide dominates, then release alarm set points should be based on the average mixture found.

The dose rate to individuals at the site boundary may be estimated using the equations of section B4.4.2 (Eq. 4.4d for whole body dose rate and Eq. 4.4e for skin dose rate). Therefore, the limits of Control 3/4.11.2.1 may be expressed in terms of the following equations for each noble gas:

$$\text{whole body dose rate} = Dr_{gamma} * 8760 < 0.5 \text{ rem/yr} \qquad \text{Eq. 3.2a}$$

$$\text{skin dose rate} = Dr_{skin} * 8760 < 3 \text{ rem/yr} \qquad \text{Eq. 3.2b}$$

where 8760 = units conversion factor (hr/yr)

Dr_{gamma} = whole body dose rate, rem/hr

Dr_{skin} = skin dose rate, rem/hr

$$Dr_{gamma} = 0.114 * X/Q * \sum_i (Qi * Dfi_{gamma}) * S_f \qquad \text{(rem/hr)}$$

$$Dr_{skin} = 1.11 * S_f * Dr_{gamma(air)} + Dr_{beta(skin)} \qquad \text{(rem/h)}$$

and where

$$Dr_{gamma(air)} = 0.114 * X/Q * \sum_i Qi*Dfi_{gamma(air)} \quad \text{(rad/h)}$$

$$Dr_{beta(skin)} = 0.114 * X/Q * \sum_i Qi*Dfi_{beta(skin)} \quad \text{(rem/h)}$$

Dfi_{gamma} = gamma dose to tissue conversion factor by nuclide from Table B-1, Regulatory Guide 1.109 (mrem-m^3/pCi-yr),
$Dfi_{gamma(air)}$ = gamma dose to air conversion factor by nuclide from Table B-1, Regulatory Guide 1.109 (mrad-m^3/pCi-yr),
$Dfi_{beta(skin)}$ = beta dose to tissue conversion factor by nuclide from Table B-1, Regulatory Guide 1.109 (mrem-m^3/pCi-yr),
1.11 = ratio of the mass stopping powers for electrons in air to tissue.
0.114 = conversion factor from (mrem-m^3)/(pCi-yr) to (rem-m^3)/(uCi-hr)
Qi = isotope "i" release rate (uCi/sec) from monitors RT-8010B
X/Q = 5.3E-06 (sec/m^3);
S_f = 1.0 (a shielding factor set to one since it is not applicable for instantaneous dose rate calculations);

Hence, there exist release rates, Q_j, for each noble gas which would correspond to the whole body (500 mrem/yr) and skin (3000 mrem/yr) limits of Eqs. 3.2a and 3.2b. Furthermore, if the release rate is divided by the unit vent flow rate, the limiting stack concentration may be estimated for each noble gas as indicated below and as listed in Table B3-3:

$$\text{(limiting stack concentrations)}_{wb} = LC_{wb} = Q_j / F$$

$$= \frac{0.5}{Dr_{gamma} * 8760 * F} \text{ (uCi/cc)} \qquad \text{Eq. 3.2c}$$

$$\text{(limiting stack concentrations)}_{skin} = LC_{skin} = Q_j / F$$

$$= \frac{3.0}{Dr_{skin} * 8760 * F} \text{ (uCi/cc)} \qquad \text{Eq. 3.2d}$$

where F = unit vent flow rate (200,000 scfm = 9.4E+07 cc/sec)
0.5 = whole body dose rate limit, rem/yr
3.0 = skin dose rate limit, rem/yr

As for the liquid monitor, a safety factor should be included to afford operators an opportunity to take corrective action should a release threaten to exceed the Control limit. However, an allocation factor is also necessary to assure that the off-site dose rate due to effluents from other potential release points do not combine to exceed the Control limit. Errors associated with the effluent monitoring must also be considered in estimating the set point. Lastly, the detector background should be included in the alarm set point calculation. The set point calculation should therefore resemble Eq. 3.2e as shown below:

alarm set point = [(LC) * SF * AF] + bkg   Eq. 3.2e

where LC = either the whole body or skin limiting stack concentration, whichever is less, uCi/cc

SF = safety factor which includes a margin for monitor error for this monitor (Bechtel calculation 9ZC6008 documents the RD-52 detector statistical accuracy to be about 40%. Hence, the safety factor is estimated as: 1 - 0.4 = 0.6). Measurements of grab samples taken during noble gas releases has demonstrated that the RD-52 detector is more accurate than the engineering calculation suggests. Thus the safety factor of 0.6 is conservative.

AF = allocation factor (ex: 0.5 or half for each unit)

bkg = detector background, uCi/cc

EXAMPLE CALCULATION

The routine release point alarm setting should be limited to the value listed for Xe-133 in Table B3-3. However, a calculation for a release with several noble gases could be made as shown below if a very precise estimate of the limit were necessary.

Given:

Nuclide	Measured Concentration, C (uCi/cc)	Limiting Concentration, LC (uCi/cc)		C / LC	
		Whole Body	Skin	Whole Body	Skin
Ar-41	1.0E-06	1.14E-04	4.63E-04	8.77E-03	2.16E-03
Kr-85	1.0E-06	6.24E-02	4.44E-03	1.6E-05	2.25E-04
Xe-133	4.0E-05	3.42E-03	8.64E-03	1.17E-02	4.63E-03
				2.05E-02	7.02E-03

The fraction of the limiting concentration for both whole body and skin exposures is estimated as the sum of the ratios of the measured release concentrations divided by the corresponding limiting concentrations from Table B3-3. These values are listed in the table above under the column "C/LC." In this example, the sum for the whole body exposure is more limiting than for the skin (normal result). This sum represents the fraction of the limiting concentration for the current release. The limiting concentration for each nuclide in the mixture could be increased by the factor listed in the column "C/∑(C/LC)" below:

C/ ∑ (C/LC)	Re_i	(C/ ∑ (C/LC))*Re_i
4.88E-05	2.6	1.26E-04
4.88E-05	2.4	1.17E-04
1.95E-03	1.0	1.95E-03
2.04E-03		LC_{eff} = 2.19E-03

Since the monitor does not respond to all radionuclides the same, the product of value "C/∑(C/LC)" and "Re_i" (the relative response from Table B3-2) yields the monitor response to each nuclide in the mixture at their respective maximum concentrations, column "C/∑(C/LC) * Re_i". The sum of these concentrations, LC_{eff}, is the effective limiting concentration indicated at the monitor when the whole body or skin dose rate at the site boundary equals 500 mrem/yr or 3000 mrem/yr, respectively.

$$LC_{eff} = \sum_i ((C_i / '(C_i / LC_i)) * Re_i) \qquad \text{Eq. 3.2f}$$

The alarm set point would be estimated in accordance with Equation 3.2e as shown below where LC_{eff} is used in place of LC:

alarm set point= [2.19E-03 uCi/cc * 0.5 * 0.6] + 0 uCi/cc
= 6.6E-05 uCi/cc or 67,000 uCi/sec (at a vent flow rate of 200,000 cfm)

The alert set point may be chosen at any value, but typically might be set at about 80% of the alarm limit.

Note that the limiting release concentration (2.04E-03 uCi/cc) is about 93% of the indicated limiting concentration (2.18E-03 uCi/cc) in this example because ^{41}Ar and ^{85}Kr do not have the same monitor response as ^{133}Xe to which the detector is calibrated.

If the alarm set point calculated using this method is too conservative to permit a short term release, the set point may be recalculated using the anticipated X/Q during the release period using the best available forecast data and Equation 4.4d of Section B4.4. If no concurrent release from Unit 2 is projected, the allocation factor in Equation 3.2e could be increased to unity if the release were closely monitored. Equation 4.4d used to calculate the sector average X/Q would not provide conservative X/Q estimates and, hence, the release would require close monitoring to assure compliance with the Control limit.

Some process control monitors exist within the plant which are used to limit the effluent from particular parts of the plant should they threaten to cause the unit vent monitor to exceed its alarm set point. Although these process monitor set points are not required to be set in accordance with the ODCM, these alarm set points could be related to the unit vent alarm set point based on their contribution to the unit vent exhaust rate. For example, the containment supplemental purge line could have its set point calculated as:

$$(\text{alarm})_{purge} = \frac{\text{unit vent flow}}{\text{supp. purge flow}} * (\text{Unit Vent alarm setting}) * AF' \quad \text{Eq. 3.2g}$$

where unit vent flow rate = 200,000 scfm = 94 m^3/sec
supp. purge flow = 5,000 scfm = 2.4 m^3/sec
Unit Vent alarm setting = current unit vent alarm set point
AF' = additional allocation factor (note: the sum of all allocation factors shall be 1.0)

For example: 0.2 for supplemental purge
0.2 for purge line
0.2 for fuel handling building
0.2 for waste gas process system
0.2 for remainder of plant

Although Control 3/4.11.2.1 requires periodic confirmation that the off-site dose rates calculated for particulates, tritium, and iodine do not exceed 1500 mrem/year to any organ, alarm/trip set points are not practicable to apply when considering instantaneous iodine and particulate dose rates. NUREG-0133 acknowledges that for practical reasons such alarm set points could not be set unambiguously.

Although the above method is suitable for the common MAB/RCB exhaust system, two other monitored atmospheric exhausts are not addressed. The condenser vacuum pumps may exhaust to the roof of TGB or to the unit vent. This alarm set point is dictated by plant safety considerations and is more conservative than off-site dose criteria. The flow (dry gas) through this exhaust is only about 2 (cubic meters/minute) and hence would not contribute significantly to the off-site dose unless the concentration of noble gas was exceedingly high, higher in fact than levels STP would permit to be exhausted onto the top level of the turbine building. The set point for this detector is adjusted to assure the safety of plant personnel if exhaust is to the TGB roof. Any releases from this exhaust whether routed to the unit vent or not will be included in monthly off-site dose calculations and will be reported in conformance with Regulatory Guide 1.21.

The other potential release is through the main atmospheric steam dumps which may release activity contained in the secondary coolant following turbine trips at greater than 50% power. These events are not frequent and the radiation monitoring system is not capable of accurately measuring this type of release. The Annual Effluent Release Report will contain estimates for such releases based on the measured nuclide concentrations in the secondary coolant and the estimated mass of coolant vented. For example:

release of nuclide "i" = Flowrate * Time * Concentration_i

where Flowrate = estimated steam vent rate, lbs/sec
Time = duration of release, sec
Concentration_i = concentration of nuclide "i", uCi/lbs.

Plant operation with the RT-8010B alarm set using the methods of this section and with the 500 hour X/Q shall demonstrate that the off-site dose rate does not exceed the Control 3/4.11.2.1 limits. If an unusual operating situation arises such that the release rate approaches or exceeds the RT-8010B alarm set point, the actual dose rate shall be calculated using actual meteorological and release data with the methods of ODCM Part B, Section 4.3. The real time dose rate may be used to demonstrate compliance with Control 3.11.2.1.

Table B3-1: Liquid Release Detector, RD-53, Response to 1 uCi/ml of Each Nuclide

Nuclide (uCi/ml)	Count Rate Response (Er) (cpm)/(uCi/ml)
Be-7	1.50E+07
Sc-46	2.74E+08
Cr-51	1.45E+07
Mn-54	1.40E+08
Co-57	9.78E+07
Co-58	1.83E+08
Fe-59	1.38E+08
Co-60	2.65E+08
Zn-65	7.26E+07
Kr-85	6.24E+07
Kr-85m	1.07E+08
Rb-86	1.18E+07
Kr-87	8.86E+07
Kr-88	8.49E+07
Sr-91	1.90E+08
Zr-95	1.40E+08
Nb-95	1.40E+08
Zr-97	1.64E+08
Nb-97	1.42E+08
Mo-99	2.74E+08
Tc-99m	9.82E+07
Ag-110m	4.38E+08
Sn-113	9.86E+07
Sb-122	1.09E+08
Sb-124	2.49E+08
Sb-125	1.21E+08
Te-129m	4.12E+06
I-130	4.72E+08
Xe-131m	2.35E+06
I-131	1.43E+08
Te-131m	2.48E+08
Te-132	1.19E+08
Xe-133	0
Xe-133m	1.41E+07
I-133	1.45E+08
Cs-134	3.17E+08
Xe-135	1.31E+08
Xe-135m	1.16E+08
I-135	1.79E+08
Cs-136	3.90E+08
Cs-137	1.21E+08
Xe-138	1.24E+08
Ba-140	4.65E+07
La-140	2.74E+08
Ce-144	1.13E+07
Hf-181	2.00E+08
W-187	1.11E+08

Table B3-1: Liquid Release Detector, RD-53, Response to
1 uCi/ml of Each Nuclide
(Continued)

The response of the RD-53 detectors to different radionuclides can be estimated using the gamma emissions from each radionuclide and the monitor's most recent calibration data (detection efficiencies used in this example are from Figure B2-5). The estimated response values listed above were estimated as shown below:

$$Er = \frac{\text{detected cpm}}{\text{uCi/ml of nuclide}} = Eff_1 * n_1 + Eff_2 * n_2 + ... + Eff_i * n_i$$

where Eff_i = gamma detection efficiency for each gamma of energy class "i" from Figure B2-5 (cpm)/(uCi/ml)),

n_i = frequency of gamma energy class "i" emission per decay.

Pure beta emitters and alpha emitters produce zero response on this instrument. Gamma emitters with energies less than 100 keV should produce little or no response on this monitor.

Example Calculations for Entrained Noble Gases

Nuclide	Detection		Gamma Fraction	Er (cpm)/(uCi/ml)
	Gamma Energy (keV)	Efficiency (cpm)/(uCi/ml)		
Kr-85m	151	1.15×10^8	0.755	8.68E+07
	304	1.46×10^8	0.140	2.04E+07
				Total =1.07E+06
Xe-131m	164	1.20×10^8	0.0196	2.35E+06
Xe-133	81	0	0.371	0
Xe-133m	233	1.37×10^8	0.103	1.41E+07
Xe-135	250	1.40×10^8	0.903	1.264E+08
	608	1.44×10^8	0.0291	4.2E+06
				Total =1.31E+08
Xe-135m	527	1.45×10^8	0.800	1.16E+08

Table B3-2: Noble Gas Detector, RD-52, Response to 1 uCi/cc of Each Nuclide

Nuclide	Count Rate Response (E) cpm / uCi/cc	Indicated Response (Re_i) uCi/cc (Xe-133 Equivalent) / uCi/cc
Ar-41	9.4E+07	2.6
Kr-85m	6.9E+07	1.9
Kr-85	8.55E+07	2.4
Kr-87	9.9E+07	2.8
Kr-88	8.3E+07	2.3
Kr-89	1.0E+08	2.8
Kr-90	1.0E+08	2.8
Xe-131m	5.5E+05	0.015
Xe-133m	4.8E+05	0.14
Xe-133	3.55E+07	1.0
Xe-135m	1.5E+07	0.042
Xe-135	8.9E+07	2.5
Xe-137	1.0E+08	2.8
Xe-138	1.0E+08	2.8

The RD-52 beta radiation detectors are used in the RT-8010B gaseous radioactive effluent discharge monitor. The response of the detector to different radionuclides can be estimated using the beta emissions from each radionuclide and the monitor's most recent calibration (beta detection efficiencies used in this example are from Figure B2-3). The response values in the column labeled "Count Rate Response (E)" were calculated as shown below:

$$E = \text{detector cpm/(uCi/cc)} = Eff_1 * n_1 + Eff_2 + n_2 + ... + Eff_i * n_i$$

where Eff_i = beta detection efficiency each beta of energy class "i" from Figure B2-3 (cpm per uCi/cc),

n_i = frequency of beta energy class "i" emission per decay.

The efficiency of detection factor relative to Xe-133, Re_i, may be calculated from the above efficiency as follows:

$$Re_i = E \,/\, \frac{cpm}{uCi/cc} \text{ of reference nuclide}$$

The reference nuclide is the radionuclide with which the detector was calibrated and the one for which 1 uCi/cc indicated by the monitor actually corresponds to 1 uCi/cc in the sample line. Most other radionuclides will only approximately reflect a 1 uCi/cc monitor response when 1 uCi/cc is in the sample line. Thus, the "Indicated Detector Response (Re_i)" column shows how well the RT-8010B monitor estimates the concentrations of each radionuclide potentially in the gaseous effluent stream.

Example Calculations for Noble Gas Releases

Nuclide	Beta Energy max (keV)	Detection Efficiency (cpm)/(uCi/ml)	Beta Fraction	E (cpm)/(uCi/cc)
Ar-41	1200	9.4E+07	1.00	9.4E+07
Kr-85m	820	8.8E+07	0.78	6.9E+07
Kr-85	670	8.55E+07	1.00	8.55E+07
Kr-87	3800 1300	1.0E+08 9.6E+07	0.73 0.27	7.3E+07 2.6E+07 9.9E+07
Kr-88	2800 900 520	1.0E+08 9.0E+07 7.6E+07	0.20 0.12 0.68	2.0E+07 1.1E+07 5.2E+07 8.3E+07
Kr-89	4000	1.0E+08	1.00	1.0E+08
Kr-90	2800	1.0E+08	1.00	1.0E+08
Xe-131m	130 160	0.0E+00 1.3E+06	0.58 0.42	0.0E+08 5.5E+05 5.5E+05
Xe-133m	200 230	4.2E+06 7.8E+06	0.62 0.28	2.6E+06 2.2E+06 4.8E+06
Xe-133	350	3.55E+07	1.00	3.55E+07
Xe-135m	500	7.3E+07	0.20	1.5E+07
Xe-135	910 550	9.0E+07 7.8E+07	0.97 0.03	8.73E+07 2.3E+06 8.9E+06
Xe-137	4000 3600	1.0E+08 1.0E+08	0.67 0.33	6.7E+07 3.3E+07 1.0E+08
Xe-138	2400	1.0E+08	1.00	1.0E+08

Example Calculations for Noble Gas Releases

Nuclide	Detection Efficiency (cpm)/(uCi/cc)	Reference Nuclide (cpm)/uCi/cc)	Re_i uCi/cc Xe-133/cpm uCi/cc/cpm
Ar-41	9.4E+07	3.55E+07	2.6
Kr-85m	6.9E+07	3.55E+07	1.9
Kr-85	8.55E+07	3.55E+07	2.4
Kr-87	9.9E+07	3.55E+07	2.8
Kr-88	8.3E+07	3.55E+07	2.3
Kr-89	1.0E+08	3.55E+07	2.8
Kr-90	1.0E+08	3.55E+07	2.8
Xe-131m	5.5E+05	3.55E+07	0.015
Xe-133m	4.8E+06	3.55E+07	0.14
Xe-133	3.55E+07	3.55E+07	1.0
Xe-135m	1.5E+07	3.55E+07	0.42
Xe-135	8.9E+07	3.55E+07	2.5
Xe-137	1.0E+08	3.55E+07	2.8
Xe-138	1.0E+08	3.55E+07	2.8

Table B3-3: Noble Gas Detector, RD-52, Response to Single Nuclide

Nuclide	Limiting Stack Whole Body (uCi/cc)	Concentration Skin (uCi/cc)	Limiting Count Rate (cpm)	Indicated Response (uCi/cc Xe-133)
Ar-41	1.14E-04	4.63E-04	1.1E+04	3.0E-04
Kr-85m	8.59E-04	2.13E-03	5.9E+04	1.7E-03
Kr-85	6.24E-02	4.44E-03	3.8E+05	1.1E-02
Kr-87	1.70E-04	3.64E-04	1.7E+04	4.7E-04
Kr-88	6.84E-05	3.13E-04	5.7E+03	1.6E-04
Kr-89	6.05E-05	2.06E-04	6.1E+03	1.7E-04
Kr-90	6.44E-05	2.38E-04	6.4E+03	1.8E-04
Xe-131m	1.10E-02	9.29E-03	5.1E+03	1.4E-04
Xe-133m	4.00E-03	4.44E-03	1.9E+04	5.6E-04
Xe-133	3.42E-03	8.64E-03	1.2E+05	3.4E-03
Xe-135m	3.22E-04	1.36E-03	4.8E+03	1.4E-04
Xe-135	5.55E-04	1.51E-03	4.9E+04	1.4E-03
Xe-137	7.08E-04	4.35E-04	4.4E+04	1.2E-03
Xe-138	1.14E-04	4.20E-04	1.1E+04	3.2E-04

NOTE: The limiting stack concentrations for whole body and skin listed above were calculated using Equations 3.2c and 3.2d. The limiting count rate and indicated response are calculated using the more restrictive limiting stack concentration as shown below:

Limiting Count Rate= Stack Concentration * E
Indicated Response = Stack Concentration * Re_i

4.0 Off-site Dose Calculations

4.1 Liquid Releases

4.1.1 Control Requirements

Control 3.11.1.2 of Part A of the ODCM requires that cumulative dose contribution estimates be calculated once every 31 days. The cumulative dose contributions should consider the dose or dose commitment to a MEMBER OF THE PUBLIC at or beyond the site boundary from radionuclides in liquid effluent releases. Such releases are limited to ensure that projected doses from each unit are:

a. less than or equal to 1.5 mrems to the total body and less than or equal to 5 mrems to any organ during any calendar quarter, and;

b. less than or equal to 3 mrems to the total body and less than or equal to 10 mrems to any organ during any calendar year.

If the above dose guides are not met, a report must be filed with the NRC Region IV office as required by 10CFR50, Appendix I.

4.1.2 Implementation of Control 3.11.1.2

In order to satisfy the requirements of Control 3.11.1.2, the individuals who suffer the maximum total body and organ doses due to liquid effluent releases are identified. The appropriate total body and organ doses, Dose(a,j), are calculated once a month for fish ingestion and shoreline exposure for each potentially exposed individual (Little Robbins area, Colorado River, and Matagorda Bay/Gulf). These doses are summed for both pathways at each location and compared with the limits of Control 3.11.1.2.

$$\text{Dose}(a,j) = \sum_{path} \sum_{i} Q(i) * R(a,i,j)_{pathway} \quad \text{(mrem)} \qquad \text{Eq. 4.1a}$$

where Q(i) and R(a,i,j) are described in Table B4-2 and where the values for R(a,i,j) are taken from Table B4-7a. The applicable pathways for doses due to liquid effluents are listed in Table B4-4.

4.2 Liquid Exposure Dose Model

4.2.1 Pathways for Radionuclide Ingestion by Man

Radionuclides which have been released from either unit, mix with the water of the reservoir. These nuclides are expected to be further diluted into the Colorado River with blowdown operations or releases via the spillway overflow (following unusually heavy rains). Water containing trace amounts of radionuclides may diffuse through the bottom of the reservoir and become mixed with shallow ground water. Hydraulic relief wells about the reservoir perimeter may include in their discharge some of this diluted radionuclide-bearing water. These discharges enter the Colorado River, the West Branch Colorado River, and Little Robbins Slough (composed of both branches of Little Robbins Slough; sometimes called West Little Robbins Slough and East Fork Little Robbins Slough). These streams discharge into Matagorda Bay.

4.2.1.1 Colorado River Environment The Colorado River is used primarily for sport fishing and occasionally for barge traffic. No municipal water supplies lie downstream from the plant discharge structure and none are likely to be developed because of the high salt content of the river in this area. A few water use permits allow irrigation of crop land with water taken downstream from the plant, but these permits are seldom (if ever) exercised.

STP possesses Environmental Protection Agency and Texas Department of Water Resources permits which allow the plant to discharge cooling reservoir water only if the river flow exceeds 800 cfs. The average flow rate of the Colorado is about 600 cfs which means blowdown can only occur in rainy periods when river flow is higher than 800 cfs (about 40% of the time). Because such planned discharges and any unplanned spillway releases are likely to occur only during rainy periods, no irrigation is likely with water bearing plant-released radionuclides even if the other water use permits were active. Therefore, no individual or population dose estimates are made on the basis of irrigation with surface water containing radionuclides originating from STP reservoir releases.

The only credible pathway available for internal exposure is the consumption of sea trout, red drum, flounder, catfish, crabs, and shrimp taken from the river by sports fishermen.

Since two small communities are built on the river, one near the discharge facility (Selkirk Island) and the other about seven miles downstream (Matagorda), external exposure is also possible due to shoreline deposits. A number of recreational cabins and trailers also line the east shore of the river south of Matagorda to the Gulf of Mexico (see Figures B4-1 and B4-2).

4.2.1.2 Little Robbins Slough Environment Little Robbins Slough drains through a marsh accessible to local land owners only. Freshwater fish are taken from ponds in this area for sport. However, the annual take is normally small and limited to a few families. Also, some cattle graze in areas where water from Little Robbins Slough might be ingested; however, water for cattle in the area is typically supplied by wells rather than surface water. Hence, no meat ingestion pathways are considered for liquid effluents.

4.2.1.3 Matagorda Bay and the Gulf of Mexico The Colorado River, West Branch Colorado, Little Robbins Slough, and the East Fork Little Robbins Slough all discharge into Matagorda Bay which connects to the Gulf of Mexico as shown in Figure B4-1. Because these bodies of water are connected by natural and man-made channels and the resulting circulation patterns are unknown, no mixing models are available to predict concentrations. However, the average flows of these discharges into Matagorda Bay are small compared with the volume of Matagorda Bay moved to the Gulf of Mexico by tide action. The Matagorda Bay concentration determines the doses due to saltwater pathways and may be assumed to be determined by the ratio of the activity reaching the bay each day and the volume of water moved by tide action (193,820 acre-ft/day).

Internal dose from nuclides reaching Matagorda Bay or the Gulf of Mexico is due to the consumption of sea trout, red drum, and flounder by sports fishermen, and crabs, shrimp, and oysters taken both commercially and by sportsmen.

Since the town of Palacios is built on the shores of Matagorda Bay, external exposure due to shoreline deposits is possible.

4.2.2 Model for Reservoir Related Radionuclide Decay and Release Off-site

A generally conservative calculation of the off-site dose is accomplished using off-site liquid effluent releases estimated according to the method described in this section.

Table B4-1 lists fractions as calculated by this method for each radionuclide anticipated to be discharged from the plant to the reservoir. These fractions represent the portion of a particular liquid effluent discharge from the plant which will eventually leave the site. These fractions are different for each release route from the reservoir and consist of the product of the variable "Floss" and one or more of the variables "fc, fwc, flrs, and felrs" as described below.

4.2.2.1 Model of the Annual Average Liquid Off-site Release Estimates Based on Plant Discharges to the Reservoir

Radioactive materials released from STP into the main cooling reservoir do not expose members of the public because the reservoir use is restricted. The water is not used for irrigation or drinking and fishing is controlled to prevent ingestion by members of the public. However, a fraction of radioactive material released into the reservoir may eventually leave the reservoir from blowdown activities, overflow, or seepage. The variable "Floss" developed in this section represents the fraction of the activity for a given nuclide which may eventually escape the reservoir through these three mechanisms. The mathematical derivation of the Floss variable follows.

Assumptions:

1. Activity released to the reservoir is not available for release off-site for two weeks, during which time it becomes mixed with previous releases. The mass flow of the reservoir water is such that it should take about two weeks for water to work its way around to the spillway. After one complete circuit of the reservoir (about three weeks), a given release should have mixed into a much larger volume of water than was the original batch release.

2. Batch releases of liquid effluents to the reservoir are made every day or two and are about the same magnitude. Consequently, they approximate a constant discharge rate (Ci/yr). This assumption along with the travel time of assumption #1 above helps assure that the radionuclides in the reservoir are fairly uniformly mixed.

3. The releases due to seepage and blowdown are constant and continuous (any release over the spillway is small and considered to be part of the routine blowdown activity). This assumption is accurate for the seepage, but is only accurate for blowdown if large averaging times are considered. The model is based on annual averages which helps to smooth the discrete blowdown operations each year to approximate a continuous activity.

4. The rate that radioactivity is lost from the reservoir is proportional to the amount of activity in the reservoir at any time. This assumption allows all losses from the reservoir to be treated mathematically the same way as radioactive decay. This assumption is accurate insofar as long averaging times allow discrete discharges to the reservoir and discrete releases from the reservoir off-site to approximate continuous processes.

5. Evaporation from the reservoir offers a release method for tritium and noble gases, but does not affect any other radionuclides. Hence, the release rate constant for tritium will be different than for non-volatile radionuclides.

6. The volume of the reservoir remains constant. A steady state assumption to simplify the model.

7. Five (5) percent of the radioactive material (100% of tritium) discharged from the plant to the reservoir remains in solution and available for release from the reservoir to the off-site environment per EPRI STPEGS MCR Bottom Sediment Characterization Study, 1991, by Richard E. Lockwood (STP) and David R. Blankinship (Texas A&M University).

Estimation of Remaining Batch Discharge as a Function of Time

The remaining radioactivity, A(t), for a given radionuclide as a function of time after a single discharge of plant effluent mixes into the reservoir is related to the fully mixed discharge activity, A_o, as described below:

$$A(t) = A_o * e^{[-(Y+Yr)*t]} \qquad \text{Eq.4.2a}$$

where:

Y = release rate constant for water from the reservoir, per day;
Yr = the radioactive decay rate for the given nuclide, per day;
(Y+Yr)= total loss rate (release rate and radioactive decay rate) from the reservoir, per day;

t	=	time since mixing in reservoir is complete (14 days after discharge) in days;
A_o	=	activity available for release from the reservoir following a discharge of activity, A_i, from the plant to the reservoir including a mixing delay of 14 days, Ci;
A(t)	=	current activity following mixing of a radionuclide from a plant discharge to the reservoir, Ci.

<u>Release Rate From the Reservoir</u>

The rate of release for a given nuclide from the reservoir is a function of time since discharge from the plant to the reservoir as shown below:

release rate = (activity in the reservoir) * (release rate constant)

since Y = release rate constant (per day)
and A(t) = amount of activity in the reservoir at time "t"

then release rate = A(t) * Y

and substituting for A(t) from Equation Eq. 4.2a

$$\text{release rate} = Y * A_o * e^{[-(Y+Yr)*t]} \qquad \text{Eq. 4.2b}$$

<u>Integrated Release From the Reservoir</u>

The total release during any period of time can be estimated by integrating the release rate of Equation Eq. 4.2b above and evaluating it for that time period.

$$\text{Total release} = \int_{t=T_i}^{T_f} (\text{release rate})\, dt$$

$$= \int_{t=T_i}^{T_f} A_o * Y * e^{[-(Y+Yr)*t]}\, dt$$

$$= \frac{A_o * Y *}{-(Y+Yr)} \int_{t=T_i}^{T_f} e^{[-(Y+Yr)*t]}\, dt$$

$$= \frac{A_o * Y}{-(Y+Yr)} * \left(e^{[-(Y+Yr)*Tf]} - e^{[-(Y+Yr)*Ti]} \right)$$

$$= \frac{A_o * Y}{(Y+Yr)} * \left(e^{[-(Y+Yr)*Ti]} - e^{[-(Y+Yr)*Tf]} \right) \qquad \text{Eq. 4.2c}$$

Example Release Calculation

Examples of how one would expect activity to leave STP following a discharge to the reservoir from the plant follow. Three radionuclides are illustrated: a long-lived nuclide such as Cs-137; a nuclide of moderate half-life such as Co-60; and a short-lived nuclide such as Fe-59.

Value of integral from year "T_i" to year "T_f" using Equation 4.2c with three values of Yr.

T_i	T_f	Yr=6.3E-5 per day	Yr=3.4E-4 per day	Yr=2.3E-2 per day
0	1	0.0024 A_o	0.0023 A_o	2.92E-04 A_o
1	2	0.0023 A_o	0.0020 A_o	0.000 A_o
2	3	0.0023 A_o	0.0018 A_o	0.00
3	4	0.0022 A_o	0.0016 A_o	0.00
...	...	...	...	...
...	...	...	...	...
...	...	...	...	...
19	20	0.0015 A_o	0.0000 A_o	0.00
...	...	...	...	...
...	...	...	...	...
...	...	...	...	...
		0.0000 A_o	0.0000 A_o	0.000 A_o
	Total =	0.0950 A_o	0.0190 A_o	2.92E-04 A_o

Discussion

Note from the table above that the release (and hence the off-site dose) following a plant discharge to the reservoir is spread out in time, particularly for the longer-lived nuclides. If we assume that all of a given nuclide which is destined to leave STP does so in the first year, we would assign the dose associated with the release indicated in the last line of the table in the first year and omit the releases listed for subsequent years.

This method is generally conservative since for nuclides with half-lives greater than a couple of years, the dose estimate corresponding to the integrated release is several times larger than the true dose corresponding to the actual release in the first year. The only instance where the method might not be conservative is if in a given year a long-lived nuclide accounted for a large fraction of the 3-mrem limit. If in the following year a short-lived nuclide accounted for the dose, the dose estimate in that second year might be only about 90% of the dose actually delivered that year. This is because the long-lived nuclide from the previous year would still be delivering off-site dose the second year even though the model assigned all that dose the first year. In turn, the short-lived nuclide would deliver virtually all its off-site dose in the year it was actually released to the reservoir.

Conclusion

Considering the uncertainties in estimating off-site flow rates, the possibility of making a 10% error in the off-site doses in consecutive years seems unimportant. Therefore, the ODCM will assign all dose related to the integrated release from the reservoir for a given discharge into the reservoir in the year of the discharge to the reservoir. This integrated release is simply

$$\text{total release} = \frac{A_o * Y}{(Y+Yr)} * \left(e^{[-(Y+Yr)*Ti]} - e^{[-(Y+Yr)*Tf]} \right)$$

evaluated with T_f = infinity (years) and
T_i = 0 (years).

$$\text{total release} = A_o * \frac{Y}{Y + Yr} \qquad \text{Eq. 4.2d}$$

This total release from the reservoir assumes that "Ti" above is measured from the time a radionuclide becomes available for release from the reservoir. Since 14 days must elapse before liquid effluents mix throughout the reservoir, a radioactive decay term, EXP[-Yr*14], should be applied to be strictly correct mathematically. An additional correction factor may be added to account for permanent radionuclide deposition in the reservoir bottom sediments. Five (5) percent of the radioactive material (100% of tritium) released to the reservoir remains in solution. Hence the fraction, Floss, from a given initial plant discharge into the reservoir, A_i, which eventually leaves the reservoir to the uncontrolled off-site environment is

$$\text{Floss} = \frac{\text{total release from site}}{\text{initial release to reservoir}} = \frac{A_o * Y / (Y+Yr)}{A_i} \qquad \text{Eq. 4.2e}$$

where $A_o = A_i * \text{EXP}[-Yr*14] * 0.05$ following 14 days of decay and 95% sedimentation.

The fractional loss, Floss, value can be calculated by substituting for the variable A_o in Equation 4.2e.

$$\text{Floss} = \frac{Y / (Y+Yr) * A_i * \text{EXP}[-Yr*14]}{A_i} = \frac{Y}{Y+Yr} * \text{EXP}[-Yr*14] * 0.05 \qquad \text{Eq. 4.2f}$$

Equation 4.2f is used in section B4.2.2.2 to estimate the fraction of an initial plant discharge into the reservoir which eventually leaves the reservoir to the off-site environment.

4.2.2.2 Liquid Off-site Effluent Release Estimates for Nonvolatile Radionuclides (Evaporation of Tritium and Water Omitted)

The fractions of nuclide "i" from a plant discharge to the reservoir which may eventually reach the off-site environment, $N_c(i)$, $N_m(i)$, $N_{lr}(i)$, are calculated for the three bodies of water into which nuclides might concentrate as below:

Colorado River:	$N_c(i)$	= fc * Floss
Matagorda Bay:	$N_m(i)$	= (fc + fwc + flrs + felrs) * Floss
Little Robbins Slough:	$N_{lr}(i)$	= (flrs + felrs) * Floss

where

Floss = fraction of activity which eventually leaves STP following release to the reservoir from Equation 4.2f

$$= \frac{Y}{Y+Yr_i} * EXP[-Yr_i*14] *0.05$$

Y = loss rate due to blowdown and seepage from the nominal reservoir volume
= (annual blowdown flow rate + seepage)/reservoir volume)
= (3400 AF/y + 5700 AF/y) per 150,000 AF = 6.067E-2 per year =1.662E-4 per day

Yr_i = loss rate due to radioactive decay
= 0.693/(nuclide half-life in days)

fc = fraction of water loss reaching the Colorado River (blowdown plus relief well flow)
= (1027 AF/y + 3400 AF/y) per 9100 AF/y = 0.486

fwc = fraction of water loss reaching the W. Branch Colorado (relief well flow)
= 174 AF/y per 9100 AF/y = 0.019

flrs = fraction of water loss reaching the Little Robbins Slough (relief well flow)
= 2210 AF/y per 9100 AF/y = 0.243

felrs = fraction of water loss reaching the E. Fork of Little Robbins Slough (relief well flow)
= 494 AF/y per 9100 AF/y = 0.054

Reservoir Volume and Flow Data

1. The reservoir volume is fixed at 150,000 AF (nominal volume).
2. The seepage rate is 5700 AF/y to the shallow aquifer (approximately 1800 AF/y remain in the shallow aquifer).

3. The evaporation rate is 38,592 AF/y.
4. The blowdown rate is 3400 AF/y to the Colorado River (anticipated maximum value).
5. Relief well flow to the Colorado River is 1027 AF/y (best estimate).
6. Relief well flow to the W. Branch Colorado River is 174 AF/y (best estimate).
7. Relief well flow to the Little Robbins Slough is 2210 AF/y (best estimate).
8. Relief well flow to E. Fork Little Robbins Slough is 494 AF/y (best estimate).

For example, the fraction of Co-60 reaching the Colorado River, N_c(Co-60), that appears in Table B4-1 is calculated as follows:

$$
\begin{aligned}
\text{Floss} &= Y / (Y + Yr_i) * \text{EXP}[-Yr*14] *0.05 \\
&= 1.662E\text{-}4 / (1.662E\text{-}4 + 0.693/1.93E3) * \text{EXP}[-0.693/1.93E3*14] * 0.05 \\
&= 0.016 \\
N_c(\text{Co-60}) &= fc * \text{Floss} = 0.486 * 0.016 = 7.64E\text{-}3
\end{aligned}
$$

This values of N(i) are used in the equations of sections B4.2.3 to calculate dose to Members of the Public off-site.

4.2.2.3 Tritium Off-site Releases in Liquid Effluents (Evaporative Losses Included)

The fractions of ^3H from a plant discharge to the reservoir which may eventually reach the off-site environment must be calculated differently than for the non-volatile nuclides described in section B4.2.2.2. The values of Floss, fc, fwc, flrs, and felrs all have different values because evaporative loses contribute to the reduction of ^3H in the reservoir before it can migrate off-site.

$N_c(^3H)$, $N_m(^3H)$, $N_{lr}(^3H)$ = calculated as previously described in section B4.2.2.2

Floss = 8.712E-04/(8.712E-04 + 1.54E-04) = 0.8498

$$
\begin{aligned}
Y &= 47{,}690 \text{ AF/y per } 150{,}000 \text{ AF} = 0.3180 \text{ per year} \\
&= 8.712E\text{-}04 \text{ per day} \\
Yr_{H3} &= 0.693/(4506 \text{ days}) = 1.54E\text{-}04 \text{ per day}
\end{aligned}
$$

fc = (1027 AF/y + 3400 AF/y) per 47,690 AF/y = 9.283E-2

fwc = 174 AF/y per 47,690 AF/y = 3.649E-3

flrs = 2210 AF/y per 47,690 AF/y = 4.634E-2

felrs = 494 AF/y per 47,690 AF/y = 1.036E-2

4.2.3 Off-site Doses from Liquid Effluents

Liquid pathway doses are calculated using the total integrated nuclide releases from the reservoir to the off-site environment. These releases are diluted into the annual average flow of the receiving body of water. Resulting doses will generally overestimate the true off-site values since the activity would normally leave STP over several years and hence would be diluted by substantially more than one year's flow volume once off-site. For example, 50% of the activity contained in the reservoir water is released approximately every 11 years (evaporation excluded); hence, no more than 5.9% of a very long-lived nuclide would leave the site via liquid pathways in any one year. Nevertheless, the projected dose for each release is estimated based upon the assumption that all the activity destined to leave the reservoir does so in the current year. These doses are summed to calculate the month's contribution to the committed dose to the MEMBER OF THE PUBLIC at or beyond the site boundary receiving the greatest dose due to liquid releases. This individual's dose is determined by the consumption of fish and marine invertebrates plus shoreline exposure along the Colorado River, Matagorda Bay or the Little Robbins Slough as calculated below.

4.2.3.1 Fish Ingestion Pathway The pathway dose factors for an individual who ingests saltwater fish, crabs, and shrimp from the Colorado River, Matagorda Bay, or freshwater fish from the Little Robbins Slough area are calculated using Equation 4.2g where the parameter descriptions are in Table B4-2 and the parameter values are as listed in Table B4-3. The resulting pathway dose factors are tabulated in Table B4-7a by organ and age. The dose commitment age as described in Regulatory Guide 1.109 was used in the tabulation of dose factors in Table B4-7a.

$$R(a,i,j)_{pathway} = 1000 * \frac{U}{M*F} * \sum_i N(i)*B(i) * D(a,i,j) * EXP[-Y(i)*T] \quad \text{(mrem/Ci)} \qquad \text{Eq. 4.2g}$$

Equation 4.2g is equivalent to Regulatory Guide 1.109 Equation A-3 methods. It is restated as used in the computer program used to calculate the pathway dose factors at STP and includes a factor, N(i), to account for radioactive decay and sedimentation before leaving the reservoir.

4.2.3.2 Shoreline Deposition Pathway Individuals who live in the area could be exposed to accumulations of contaminated silt deposited along the Colorado River bank, along Little Robbins Slough, or on the shores of Matagorda Bay. The pathway dose factors from these potential shoreline deposits are calculated using Equation 4.2h with the parameters described in Table B4-2 and with values as listed in Table B4-3. The resulting pathway dose factors are compiled in Table B4-7a by organ and age. The dose commitment age as described in Regulatory Guide 1.109 was used in the tabulation of dose factors in Table B4-7a.

$$R(a,i,j)_{shore\ exposure} = 110{,}000 * \frac{Ub*W}{M*F} * \sum_i N(i) * T(i) * D(a,i,j) * EXP[-Y(i)*T]$$

$$* (1 - EXP[-Y(i)*Tb]) \quad \text{(mrem/Ci)} \qquad \text{Eq. 4.2h}$$

Equation 4.2h is equivalent to Regulatory Guide 1.109 Equation A-7 methods. It is restated as used in the computer program used to calculate the pathway dose factors at STP and includes a factor, N(i), to account for radioactive decay and sedimentation before leaving the reservoir.

4.3 Gaseous Releases

4.3.1 Control Requirements

Control 3.11.2.1 of Part A of the ODCM requires that the dose rate at or beyond the site boundary due to radioactive materials released in gaseous effluents from the site be limited to the following values:

a. The dose rate limit for noble gases must be less than 500 mrem/yr to the total body and less than 3000 mrem/yr to the skin, and

b. The dose rate limit for all radionuclides other than noble gases with half-lives greater than 8 days be less than 1500 mrem/yr to any organ.

These requirements stem from the NRC desire for nuclear power plants to operate at a small fraction of the radiological protection limits of 10CFR20.

Control 3.11.2.2 of Part A of the ODCM also requires that the air dose in areas at or beyond the site boundary due to noble gases released in gaseous effluents shall be limited to the following:

a. During any calendar quarter to less than or equal to 5 mrads for gamma radiation and 10 mrads for beta radiation, and

b. During any calendar year to less than or equal to 10 mrads for gamma radiation and 20 mrads for beta radiation.

Control 3.11.2.3 further limits the dose to a MEMBER OF THE PUBLIC from I-131, I-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at or beyond the site boundary as follows:

a. During any calendar quarter to less than or equal to 7.5 mrems to any organ, and

b. During any calendar year to less than or equal to 15 mrems to any organ.

These last two requirements stem from STP's commitment to operate STP within the guidelines described in 10CFR50, Appendix I, for maintaining doses to the public as low as reasonably achievable.

4.3.2 Implementation of Control 3.11.2.1

4.3.2.1 Noble Gases All gaseous effluent releases from STP are assumed to be ground level due to the proximity of each unit's vent to the roof. For the purpose of demonstrating that off-site dose rates have not exceeded the dose rate limits of this Control, the atmospheric dispersion factor, X/Q, may be assumed to be 5.3E-06 sec/cubic meter. This represents the 500 hour average X/Q at the site boundary and occurs in the NNW sector. When possible, actual hourly X/Q values coupled with hourly release data are used in place of composite release data and historical average X/Qs.

The hourly average dose rates to the whole body and to the skin due to noble gas releases may be estimated using Equations 4.4d and 4.4e of this section provided the shielding factor, Sf, equals 1.0 for the purpose of determining compliance with Control 3.11.2.1.

4.3.2.2 Iodine and Particulates The maximum dose rate to an organ, j, in a given age group, a, due to particulate releases may be estimated as follows:

$$\text{Dose rate}(a,j) = X/Q * \sum_{i} R(a,i,j)_{inhalation} * Q(i) + D/Q * \sum_{path} \sum_{i} (R(a,i,j)_{pathway}) * Q(i) \quad \text{(mrem/hr)} \quad \text{Eq. 4.3a}$$

where

Q(i)	= release rate of nuclide "i" (Ci/hr),
X/Q	= 5.3E-06 (sec/m^3) (or actual estimate of X/Q for H3 and C14 or depleted X/Q for particulates and iodines at the time of release),
D/Q	= 8.4E-09 (1 /m^2) (or actual estimate of D/Q at the exposure location),
$R(a,i,j)_{pathway}$	= pathway dose factors from Table B4-7b (units as described in notes to Table B4-7).

The highest organ dose so calculated may be used for demonstrating compliance with Control 3.11.2.1. However, only pathways confirmed by the land use census need be considered (e.g. cow-milk-infant pathway need not be considered in the absence of the cow).

4.3.3 Implementation of Control 3.11.2.2

NUREG-0133 allows STP to use the highest calculated annual average X/Q in calculating doses for comparison with the quarterly and annual dose limits. However, NUREG-0133 recommends the use of the highest 500-hour average X/Q for doses due to short-term releases. STP normally has available hourly average X/Q values for each sector plus time-dated release information. When possible, these hourly X/Q values coupled with hourly release data are used in place of composite release data and historical average X/Qs.

The historical dispersion values which may be used for calculations in place of historical averages are:

annual average releases = 1.1E-06 (seconds per cubic meter)
500 hour or shorter releases = 5.3E-06 (seconds per cubic meter)

4.3.3.1 Noble Gases The noble gas releases averaged over a calendar quarter or a calendar year result in a dose to air at the site boundary as calculated using Equations 4.4f for gamma radiation and Equation 4.4h for beta radiation.

4.3.4 Implementation of Control 3.11.2.3

4.3.4.1 Iodines, Tritium, and Particulates The dose to a MEMBER OF THE PUBLIC stationed at or beyond the site boundary (Table B4-6) due to radioiodine and particulate releases is estimated using Equation 4.4k and the appropriate pathway dose factor from Table B4-7b. The historical dispersion values (X/Q and depleted X/Q) may be used in place of actual data if necessary as described in part 4.3.3 above.

4.4 Gaseous Dose Models and Dose Formulas

4.4.1 Dispersion Calculation Methods

If current meteorological data are used to estimate dispersion, X/Q, in place of the historical values, calculations for routine releases use the sector-average version of the equations for atmospheric relative concentration. These calculations are made in accordance with the methodology in NRC Regulatory Guide 1.111 and are all based on ground level releases.

4.4.1.1 X/Q Calculation The sector average X/Q for a given hour is calculated using:

$$X/Q = \frac{2.03}{Umn * Dxqc * Smn} \quad (sec/m^3) \qquad \text{Eq. 4.4a}$$

where

$$Smn = [sz^2 + (Hcon^2/2 * \pi)]^{1/2}$$

or

$$Smn = sz * (3)^{1/2}; \text{ whichever is less;}$$

and

Hcon = building height (meters),
sz = vertical dispersion coefficient (meters),
Smn = dispersion coefficient with building wake factor included (meters)
Dxqc = downwind distance to the receptor (meters),
Umn = hourly average wind speed (meters/second),
2.03 = $(2/\pi)^{1/2}$ divided by the sector width in radians, $(2*\pi/16)$.
π = 3.14

4.4.1.2 Depleted X/Q Calculation X/Q values are used in conjunction with tritium and noble gases released. However, the downwind concentrations for particulates and radioiodines will be affected by ground deposition. X/Q values used for calculating inhalation doses from particulates and radioiodines must be modified by the ground depletion factors of Table B4-4 (from Figure 2 of NRC Regulatory Guide 1.111).

$$(X/Q)_{depl} = (X/Q) * (\text{ground depletion factor}) \quad (sec/m^3) \qquad \text{Eq. 4.4b}$$

4.4.1.3 Ground Deposition Ground deposition is calculated using the deposition factors of Table B4-5 (also from Regulatory Guide 1.111, Figures 6-9).

$$(D/Q) = \frac{(\text{deposition factor})}{Dxqc * 0.3927} \quad (1/m^2) \qquad \text{Eq. 4.4c}$$

where 0.3927 = radians in one sector or $(2\pi)/16$,
Dxqc = down wind distance (meters).

Deposition calculated by multiplying this term, D/Q, by the release rate, Q, will yield values independent of atmospheric stability as indicated in NRC Regulatory Guide 1.111.

4.4.2 Submersion Dose From Noble Gases

The methods used to estimate doses due to noble gases are those of Regulatory Guide 1.109. The whole body and skin doses from submersion in a cloud of noble gas may be calculated by multiplying the appropriate dose factor for the plume pathway from Table B4-7b by the dispersion, X/Q, and by the release rate, Q. An equivalent calculation can be accomplished using the formulas described in the following three subsections:

4.4.2.1 Whole Body Dose Rate

$$Dr_{gamma} = 0.114 * X/Q * \sum_i (Q(i) * Dfi_{gamma}) * S_f \quad (rem/hr) \qquad \text{Eq. 4.4d}$$

where

0.114	=	conversion factor from $(mrem\text{-}m^3)/(pCi\text{-}yr)$ to $(rem\text{-}m^3)/(uCi\text{-}hr)$
X/Q	=	from Equation 4.4a (sec/m^3)
Q(i)	=	isotope "i" release rate (uCi/sec) from monitor RT-8010B
Dfi_{gamma}	=	gamma dose to tissue conversion factor for nuclide gamma "i" from Table B-1 of Regulatory Guide 1.109 $(mrem\text{-}m^3/pCi\text{-}yr)$
S_f	=	0.7, shielding factor from Regulatory Guide 1.109
	=	1.0 when determining compliance with Control 3.11.2.1

Dr_{gamma} of Equation 4.4d is equivalent to $D^T_\infty(r,\theta)$ of Equation B-8 in Regulatory Guide 1.109. Equation 4.4d is expressed as rem/hr whereas Equation B-8 is expressed in units of rem/yr.

Equation 4.4d contains factors which exist in the Regulatory Guide as the combination of Equations B-8 and C-3.

4.4.2.2 Skin Dose Rate from Noble Gases Skin dose rate is calculated based on both the beta emissions and gammas coming from the noble gas cloud surrounding the receptor.

$$Dr_{skin} = 1.11 * S_f * Dr_{gamma(air)} + Dr_{beta(skin)} \quad \text{(rem/h)} \qquad \text{Eq. 4.4e}$$

where

$$Dr_{gamma(air)} = 0.114 * X/Q * \sum_i Q(i) * Dfi_{gamma(air)} \quad \text{(rad/h)} \qquad \text{Eq. 4.4f}$$

and

$$Dr_{beta(skin)} = 0.114 * X/Q * \sum_i Q(i) * Dfi_{beta(skin)} \quad \text{(rem/h)} \qquad \text{Eq. 4.4g}$$

S_f = 0.7, default shielding factor from Regulatory Guide 1.109, Table E-15
= 1.0 when determining compliance with Control 3.11.2.1
$Dfi_{beta(skin)}$ = beta dose to tissue conversion factor from Table B-1, Regulatory Guide 1.109 (mrem-m^3/pCi-yr),
$Dfi_{gamma(air)}$ = gamma dose to air conversion factor from Table B-1, Regulatory Guide 1.109 (mrad-m^3/pCi-yr),
1.11 = ratio of the mass stopping powers for electrons in air to tissue from Regulatory Guide 1.109 Equation B-9.
Q(i) = isotope "i" release rate (uCi/sec) from monitor RT-8010B

Equation 4.4e is equivalent to Equation B-9 in combination with Equation C-3 of Regulatory Guide 1.109. Equations 4.4f and 4.4g were extracted from Equation 4.4e to simplify its expression. The conversion constant was adjusted to provide rem per hour rather than rem per year as found in the Regulatory Guide. Equation 4.4f is also equivalent to Equation B-5 combined with Equation B-4 of Regulatory Guide 1.109.

The gamma dose rate to air is calculated here as an intermediate step in calculating the total dose rate to skin from noble gases. However, this gamma dose rate to air value, Dr gamma(air) from Equation 4.4f is used to demonstrate compliance with the first part of Control 3.11.2.2 if multiplied by the release duration in hours as described in Section B4.4.2.3.

4.4.2.3 Dose to Air from Noble Gases The dose to air at the site boundary is a required dose calculation in Control 3.11.2.2. The first step is to calculate the beta dose rate to air for noble gases as indicated below:

$$Dr_{beta(air)} = 0.114 * X/Q * \sum_i Q(i) * Dfi_{beta(air)} \quad \text{(rad/h)} \qquad \text{Eq. 4.4h}$$

where $Dfi_{beta(air)}$ = beta dose to air conversion factor from Table B-1, Regulatory Guide 1.109 ($mrad\text{-}m^3/pCi\text{-}yr$),

0.114 = conversion factor from ($mrad\text{-}m^3/pCi\text{-}yr$) to ($rad\text{-}m^3/uCi\text{-}hr$),

X/Q = from Equation 4.4a (sec/m^3),

Q(i) = isotope "i" release rate (uCi/sec) from monitors RT-8010B.

Equation 4.4h contains the elements of Equations B-4 and B-5 of Regulatory Guide 1.109. The dose rates of Equations 4.4f and 4.4h may be multiplied by the release duration to give the dose to air from gamma and beta radiation as shown below:

$$Dose_{gamma(air)} = Dr_{gamma(air)} * T \qquad \text{Eq. 4.4i}$$

$$Dose_{beta(air)} = Dr_{beta(air)} * T \qquad \text{Eq. 4.4j}$$

where $Dr_{gamma(air)}$ is from Equation 4.4f

$Dr_{beta(air)}$ is from Equation 4.4h

T is the release duration

4.4.3 Dose Due to Airborne Radionuclides

The dose delivered to the individual with the highest exposure due to airborne radioactive particles and gases is calculated as the sum of pathway doses for all nuclides present.

$$Dose_{air}(a,j) = (dispersion) * \sum_{path} \sum_{i} Q(i) * R(a,i,j) \quad \text{(mrem)} \qquad \text{Eq. 4.4k}$$

where

dispersion= ground deposition, D/Q ($1/m^2$), for ingestion and deposition pathways, or $(X/Q)_{depl}$ (sec/m^3), for particle inhalation pathways, or (X/Q) (sec/m^3), for noble gas, H-3, and C-14 all pathways

Q(i) = integrated release of nuclide "i" stored by plant computer from monitors RT-8010B (Ci),

R(a,i,j) = age, nuclide, and organ specific dose factor for a given pathway as listed in Table B4-7b (units as described in notes to Table B4-7).

For ingestion pathways involving particles, the ground deposition as calculated from Equation 4.4c is used for the dispersion in Equation 4.4k.

For inhalation of particles, the depleted X/Q from Equation 4.4b is used for the dispersion in Equation 4.4k.

For both ingestion and inhalation of H-3 and C-14, the X/Q from Equation 4.4a is substituted for dispersion in Equation 4.4k.

For plume immersion dose to noble gases, the X/Q from Equation 4.4a is substituted for dispersion in Equation 4.4k.

Although in practice these calculations are performed at the distances and directions listed in Table B4-6, only the distance and direction giving the largest organ dose is used in Equation 4.4k above.

The exposure pathway dependent dose factors, R(a,i,j), of Table B4-7b were generated using a code similar to NRC's GASPAR routine as described in NUREG-0597. The pathways for radionuclides released to the atmosphere which may expose the local population do not include the milk pathway. No milk cows or goats have been identified within five miles of the plant, and no commercial dairies exist within fifty miles of the plant. Since a milk cow or goat could be introduced in the future, Table B4-7b contains dose factors for those pathways even though they are not used at this time. These dose factors of Table B4-7b were calculated for the pathways, organs, and age groups as described below:

Pathways	*Pathway Description*
Plume Immersion	Whole body and skin exposure to noble gas
Ground	Whole body and skin exposure to particulates deposited on ground
Vegetation Ingestion	Organ doses to particles, ^{3}H, and ^{14}C deposited on vegetation
Meat Ingestion	Organ doses to particles, ^{3}H, and ^{14}C in meat products
Cow Milk	Not currently an active pathway
Goat Milk	Not currently an active pathway
Inhalation	Organ doses to inhaled particles, ^{3}H, and ^{14}C

Age Group	*Years of age (yr)*	*Dose Commitment Age (yr)*	*Fraction of population in each age group*
Infant	0 - 1	0	0.0
Child	1 - 11	4	0.18
Teen	11 - 17	14	0.11
Adult	17 →	17	0.71

Organs
Total Body
G.I. Tract
Bone
Liver
Kidney
Thyroid
Lung
Skin