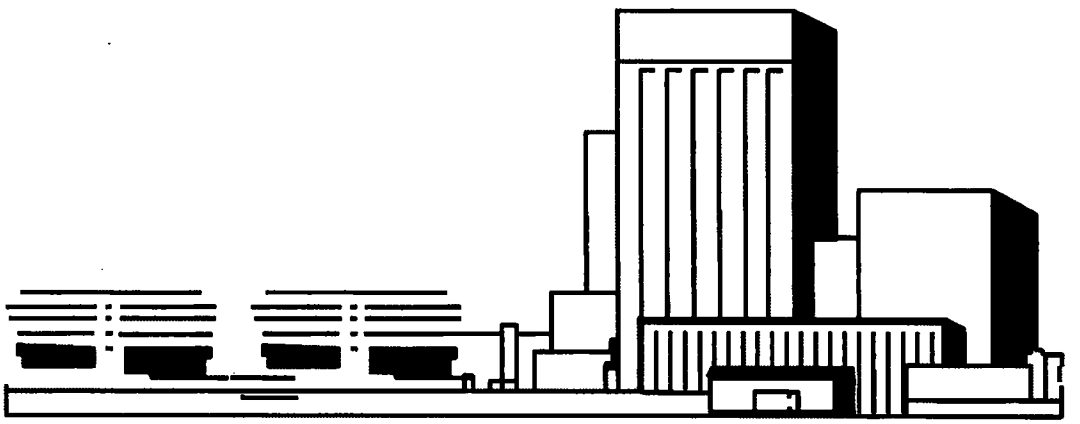
ENERGY NORTHWEST

Columbia Generating Station Annual Radioactive Effluent Release Report

January through December 2013



REFERENCES:
10 CFR 50.36a(a)(2)
CGS Technical Specification 5.6.2

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Energy Northwest

Submitted
April, 2014

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1.0 Introduction

This report has been prepared in compliance with Parts 50 of Title 10 of the Code of Federal Regulations (CFR), specifically 10 CFR 50.36a(a)(2) and Columbia Generating Station (CGS) Technical Specification 5.6.2. It includes a summary of the quantities of radioactive liquid and gaseous effluents and solid radwaste released from Columbia Generating Station during calendar year 2013. Effluent data is summarized on a quarterly basis.

Throughout this report, units of activity and dose are as defined in 10 CFR 20.1004, 20.1005, and Nuclear Regulatory Commission (NRC) Regulatory Guide 1.109-1977.

The United States National Council on Radiation Protection published Report #160 in 2009 which can serve to put radiation dose into perspective for the reader of this report. It was determined that the average yearly dose to a person living in the United States is 620 mrem from all sources. Of this, ~50% is attributed to natural sources (radiation from gaseous radon, cosmic or space radiation, natural radioactive material in the ground, and natural radioactive materials in our bodies). About 48% is attributed to diagnostic and therapeutic medical exposure. Radiation dose from nuclear power was grouped into a category comprising <0.1% of the total.

2.0 Liquid Effluents

No planned releases of contaminated liquids from the liquid radwaste processing system were discharged to the Columbia River from Columbia Generating Station during calendar year 2013. The last discharge to the river from liquid processing took place in 1998.

In 2013, there were no known leaks to the environment of radioactive liquids.

3.0 Gaseous Effluents

Routine Releases

Gaseous effluents from Columbia Generating Station are released from three (3) principal release points:

Main Plant Vent -- mixed mode release
Turbine Building – mixed mode release
Radwaste Building -- ground level release

The gaseous source terms from each release point are listed in Tables 3-1, 3-2, and 3-3. The activation gas argon-41 is included in these tables under fission gases to allow a match with the fission and activation gas totals of Table 3-4. Table 3-4 provides a summation of the total activity released, the average release rate, gross alpha radioactivity, and the estimated total error associated with the measurements of radioactivity in the gaseous effluents.

Radioactivity measurements for gaseous effluent releases are performed for fission and activation gases by collecting the samples in a Marinelli beaker and analyzing them using gamma spectroscopy. Air is analyzed for tritium by collection of water vapor on a desiccant with subsequent distillation and liquid scintillation counting. Particulates and iodines are sampled continuously and the sample media (particulate filters and charcoal cartridges) are analyzed weekly using gamma spectroscopy. Each quarter a chemical separation process is used to isolate strontium from the composite particulate filters and quantification is accomplished with liquid scintillation detection. The average energy per disintegration of fission and activation gases is not included in this report as it is not required by Technical Specifications and is not used for gaseous effluent release rate limit calculations.

When a radioisotope is not positively identified at levels greater than the Minimum Detectable Activity (MDA) or Minimum Detectable Concentration (MDC), a value of zero is used for release concentrations and offsite dose assessments. Table 3-6 contains the Lower Limit of Detection (LLD) values corresponding to the sampling methods and analytical instruments used for each principal radioisotope except carbon-14 (C-14 or ^{14}C) as C-14 releases are estimated only.

Dose calculations were performed for releases using the NRC XOQDOQ and NRC Regulatory Guide 1.109 methodology (manually or with the GASPAR II computer program) and parameter values as described in the Offsite Dose Calculation Manual (ODCM). This methodology was based on Publication 2 of the International Commission on Radiation Protection released in 1959. As dose calculation methodology for soil resuspension is not described in the previously described documents nor as yet in the ODCM, it is described in detail in this report.

Quarterly and annual doses to the potentially highest-exposed Member of the Public (MOP) at and beyond the site boundary were calculated. In addition, quarterly and annual doses were calculated at actual resident locations identified in the annual land use census. ODCM limits are based on 10 CFR 20 and Appendix I to 10 CFR 50. The threshold for air dose applies to fission and activation gases and is ten (10) mrad for beta and five (5) mrad for gamma quarterly and twenty (20) mrad for beta and ten (10) mrad for gamma annually. The threshold for organ dose applies to iodine, tritium, and particulates with half-lives greater than eight days and is seven and a half (7.5) mrem quarterly and fifteen (15) mrem annually. For fission and activation gases the dose rate limits are less than or equal to 500 mrem per year to the whole body and less than or equal to 3000 mrem per year to the skin. For iodines, particulates, and tritium the dose rate limit is less than or equal to 1500 mrem/year to any organ.

Dose calculations were also conducted for Members of the Public within the site boundary. The results are discussed and tabulated in Section 6.0.

Heating Steam Vents and Reliefs

Building heat during the winter months is provided by either Seal Steam Evaporator B or by the Auxiliary Boiler. Vents and reliefs of this system to the atmosphere are unmonitored for licensed materials but the water used for steam is sampled

routinely while in use. The Auxiliary Boiler was not used during the 2013 heating season. At the start of the heating season, analysis of water in Seal Steam Evaporator B indicated 5.81E-10 Curies/ml of tritium and this activity decreased during the season due to dilution with non-tritiated makeup water. Assuming the entire initial inventory (1.14E+07 ml) was released, the total release would be 6.63E-03 Curies of tritium through unmonitored vents of the heating steam system within and outside the main power block (Turbine, Radwaste, Reactor, and General Services buildings). These vents are unmonitored as this is an insignificant release point as defined in Revision 2 of NRC Regulatory Guide 1.21 as this activity comprises 0.013% of the total tritium released during 2013.

Cooling System Sediment Disposal Cell – Diffuse Source

Cooling Tower and Spray Pond sediment are periodically sampled and disposed of on the surface of the ground in a fenced area within the site boundary authorized by the Washington State Energy Facility Site Evaluation Council. No materials are permitted to be placed in the Cooling System Sediment Disposal Cell (Disposal Cell) with licensed activity greater than the following limitations in Table 3a:

Table 3a – Source Term of Disposal Cell

Isotope	Limit (pCi/gm)
Co-60	5
Mn-54	30
Zn-65	50
Cs-134	10
Cs-137	20

Dose to Members of the Public based on the limits shown above are provided in Section 6.0 of this report.

Storm Drain Pond (SDP) – Diffuse Source

Columbia Generating Station was designed with an evaporation basin (Storm Drain Pond) within the Owner Controlled Area and described in the CGS National Pollutant Discharge Elimination System (NPDES) permit as "Outfall 2". The SDP receives storm water runoff, wastewater from potable and demineralized water production, intake air wash unit blowdown, and water from non-radioactive equipment dewatering, leakage, cleaning, and flushing activities. Since discovery of residual licensed radioactive material in the soil of the SDP in 1993, the pond has been fenced and posted in accordance with 10 CFR 20 requirements.

In August and September of 2011, environmental sampling of soil downstream of the outfall to the Storm Drain Pond found low levels of Mn-54, Co-58, Co-60, Zn-65, Cs-134, and Cs -137. The measured activity values were reported in the 2011 Annual Radiological Environmental Operating Report. Fe-55, Ni-63, and Sr-90 results were less than the MDC values. Except for tritium, no activity greater than the Minimum Detectable Activity (MDA) was found in the flow-proportional outfall discharge samples in 2013. Soil sampling was performed in June, 2013.

The source of the low level activity was determined to be monitored and controlled gaseous effluent releases. The recapture of activity released is from a) the precipitation washout/rainout of released activity, b) cooling tower and spray pond plume drifting north to northwest over the gaseous release ducts and scavenging activity, and c) the re-condensation of water vapor in gaseous effluents. Figure 1 shows a wind rose overlaid onto a site map showing a bimodal wind pattern with wind commonly from the S to SE taking spray pond and cooling tower water vapor plumes over gaseous effluent release points.

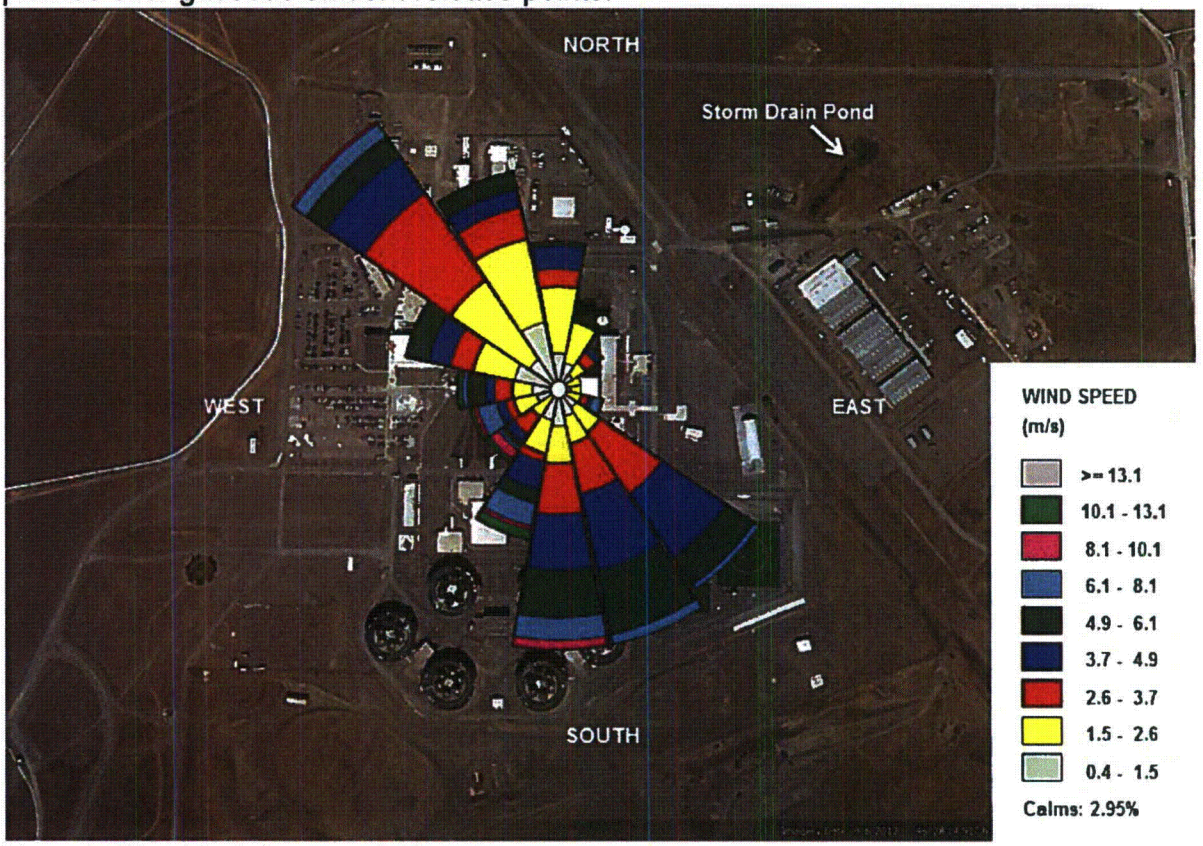

Figure 1 - Bimodal wind rose overlaid on site map.

For the purpose of evaluating the potential dose impact to Members of the Public, dose estimates were based on the maximum activity (shown in Table 3b) detected in 2013.

Table 3b – Source Term for Storm Drain Pond

	Max Activity In Soil (pCi/kg)
Mn-54	45.6
Co-58	<MDA
Co-60	1860
Zn-65	119
Cs-134	<MDA
Cs-137	172
	Max Activity In Outfall Water
H-3	4.95E+03

Abnormal Release – Open door at base of vertical release duct

During 2013, a door at the base of the reactor building release duct was found open (Action Request-Condition Reports (AR-CR) 282284 & 282355). A review of the exhaust flow rate shows that the door was open from 0556 hr on 3/16/13 and continued to 4/3/13. The flow rate recorded in the upper portion of the duct showed a decrease from 73324 cfm to 64960 cfm when the door opened.

The reactor building Heating, Ventilation, and Air Conditioning (HVAC) System and the Offgas Post Treatment System both discharge into the middle of this vertically-oriented release duct. Normally, the path of least resistance is out the top of the duct. When this maintenance access door was open, approximately 11.4% of what would have gone out the designed (upper) exit of the stack was exiting horizontally out of the base of this vertical release duct.

This was a monitored release as a representative sample of the air in the exhaust duct during this time was being taken by a 32-nozzle sample array.
This duct is considered a mixed mode release point as defined by NRC Regulatory Guide 1.111, Revision 1, 1977. The NRC Computer code XOQDOQ is used by Columbia Generating Station to determine dispersion and deposition values. Plume buoyancy is calculated with inputs of the heat emission rate (the same for both the door exit and the upper release point), the vertical exit velocity (different for the two exit points), and the horizontal wind speed (same for the two exit points). XOQDOQ then determines the effective stack height at locations of interest. To demonstrate compliance with routine ODCM Requirements for Operability (release limitations), the exhaust flow rate measured by the flow elements in the upper portion of the vertical release duct was adjusted to reflect the actual release flow rate (corrected for loss at the door). As such, the activity released through the open door was accounted for.

Abnormal Release – Seal Steam Relief Valve

On 9/22/13, an unmonitored, abnormal gaseous release (AR-CR 294265) occurred. It was noted that a seal steam relief valve (SS-RV-9A) was lifting and not reseating due to leakby of pressure control valve BS-PCV-18A. The relief valve is on the shell side of Seal Steam Evaporator A (SS-EVAP-1A) and exhausts at the roof of the building. Evaporator A is supplied by Feedwater from the Main Condensate system downstream of the 5th Stage Feedwater heaters (the water has passed through the condensate filter demineralizers and is preheated). The relief valve was open for approximately 12.76 hours and water loss was estimated at 71.62 gallons per minute resulting in 54,832 gallons released. Samples of this system at the time of the release showed Co-60, Cs-137, and H-3. The activity present and the total curies released is shown in Table 3c.

Table 3c – Source Term for Seal Steam Vent

Nuclide	Concentration (µCi/ml)	Curies Released (Curies)
Co-60	3.53E-08	7.33E-06
Cs-137	5.21E-08	1.08E-05
H-3	2.26E-03	4.63E-01

A Joint Frequency Distribution table was developed from 9/22/13 at 1500 hours to 9/23/13 at 0400 hrs and the results shown in Table 5-12 of this report. From this, the dispersion and deposition values were derived. As winds were from the S to SSW, only Members of the Public in the N to ENE sectors were affected.

Carbon-14

Carbon-14, with a half-life of 5,730 years, is a naturally occurring isotope of carbon produced by cosmic ray interactions in the atmosphere. When C-14 decays it emits a beta particle of varying energies up to 0.156 MeV with an average energy of 0.049 MeV. As a result of this low energy, the air and inhalation doses are insignificant. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. C-14 is also produced in commercial nuclear reactors, but the amounts produced are much less than those produced naturally or from weapons testing.

Although 10 CFR 50.36a has always required reporting the principal nuclides released, carbon-14 had been exempted because of the large quantity that existed naturally in the environment. However, following release of Revision 2 of Regulatory Guide 1.21 (Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste), the NRC recommended that U.S. nuclear power plants evaluate whether C-14 is a "principal radionuclide", and if so, report the amount of C-14 released.

A radionuclide is considered a principal radionuclide if it contributes either (1) greater than 1 percent of the 10 CFR Part 50, Appendix I, design objective dose, or (2) greater than 1 percent of the activity of all radionuclides in the type of effluent

being considered. This implementation of "primary radionuclides" ensures both (1) radionuclides that are present in relatively large amounts but that contribute very little to dose, and (2) radionuclides that are present in very small amounts but that have a relatively high contribution to dose are appropriately included in the annual effluent report.

At Columbia Generating Station, improvements over the years in effluent management practices and fuel performance have resulted in a significant decrease in radioactive gaseous emissions. As a result, C-14 has become a "principal radionuclide" for the gaseous effluent pathway at Columbia Generating Station. Columbia Generating Station's 2013 Annual Radioactive Effluent Release Report (ARERR) contains estimates of C-14 radioactivity released in 2013, and estimates of public dose resulting from the C-14 effluent.

Since there were no liquid tank releases to the river, there was no dose to a Member of the Public from liquid releases. The quantity of gaseous C-14 released to the environment is estimated by use of a C-14 source term scaling factor based on power generation. Electric Power Research Institute (EPRI) Technical Report 1021106 estimates the production of C-14 at approximately 5 Ci/GW_{th} - yr or 17.8 Ci/yr at rated power. Based on Columbia Generating Station power production for 2013 and assuming that all C-14 generated is released in gaseous effluent, then the total C-14 emission is calculated to be 15.4 Ci.

C-14 releases in BWRs occur primarily as a mix of organic carbon and carbon dioxide released from the offgas system. Since Columbia operates with a reducing chemistry, most, if not all, of the C-14 species initially produced are organic (e.g., methane). As a general rule, C-14 in the primary coolant is essentially all organic with a large fraction as a gaseous species. When the reactor coolant or offgas is exposed to an oxidizing environment (e.g. in the offgas treatment system or during shutdowns or refueling), a transformation from the organic to an inorganic chemical form can occur.

Public dose estimates from airborne C-14 are performed using dose models from NRC Regulatory Guide 1.109, Revision 1, 1977. The estimated C-14 dose impact from Columbia Generating Station in 2013 was well below the 10 CFR 50, Appendix I, ALARA design objective (i.e., 15 mrem/yr per unit) as shown in Section 6 of this report.

An estimate of Carbon-14 releases in units of Curies (Ci) was made based on thermal power generation in units of gigawatts-thermal (GW_{th}) and shown below in Table 3d.

Table 3d - Carbon-14 Production

^{14}C Production Rate	5.1 ±0.6	Ci/GW_{th} - yr
Rated Thermal Power	3.486	GWth
CGS Production Rate	17.8 ±2.1	Ci/yr at rated power

	GW_{th}-hrs	Ci of ^{14}C	Ci of $^{14}CO_2$
1st Quarter	7,488	4.42E+00	4.20E+00
2nd Quarter	3,610	2.11E+00	2.00E+00
3rd Quarter	7,607	4.39E+00	4.17E+00
4th Quarter	7,674	4.43E+00	4.21E+00
Total Year 2013	26,379	1.54E+01	1.46E+01
Growing Season	11,302	6.58E+00	6.25E+00

The ^{14}C production rate was estimated from Electric Power Research Institute (EPRI) Technical Report 1021106 which also estimated that 95% of ^{14}C production is released as $^{14}CO_2$ and the remainder assumed to be $^{14}CH_4$.

Out-of-Service Effluent Monitors

The ODCM requires submittal in this report of the reasons why any effluent monitors were not returned to a functional status within 30-days of failure. During 2013, there were no ODCM-related effluent monitors out of service longer than 30 days.

Gaseous Effluent Tables

Table 3-0 10 CFR Part 50 Appendix I Dose Compliance

Report Period: January -- December 2013

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year*
Noble Gas					
Gamma Air Dose (mrad)	3.69E-03	5.12E-04	3.17E-03	4.81E-03	1.27E-02
ODCM Limit	5	5	5	5	10
% of Limit	7.38E-02	1.02E-02	6.34E-02	9.62E-02	1.27E-01
Beta Air Dose (mrad)	1.30E-03	1.81E-04	1.12E-03	1.70E-03	4.47E-03
ODCM Limit	10	10	10	10	20
% of Limit	1.30E-02	1.81E-03	1.12E-02	1.70E-02	2.24E-02
Iodine-131, Iodine-133, Tritium, and Particulates with half-lives greater than eight days.					
Organ Dose (mrem)	4.36E-03	1.11E-03	3.41E-03	5.20E-03	1.46E-02
ODCM Limit	7.5	7.5	7.5	7.5	15
% of Limit	5.81E-02	1.48E-02	4.55E-02	6.93E-02	9.71E-02

* Calculated quarterly doses cannot be directly compared to the annual doses. Each above listed quarterly dose is the highest calculated dose based on a number of variables. Variables that make comparison difficult include location, meteorological data (quarterly joint frequency distribution (JFD) tables vs. annual JFD tables), receptor age, target organ, and characteristics of the emitted radionuclides.

This table shows the highest air dose or organ dose for either a hypothetical resident at the site boundary or an actual resident within a 5-mile radius.

The pathways of exposure considered at the site boundary are the plume exposure, ground exposure, and inhalation pathways only and does not include dose from non-depositing C-14. The highest organ dose received from all gaseous effluent releases (including C-14), for the full year of 2013, for residents identified in the Land Use Census, and for all pathways of exposure identified, was for a resident (child) at 4.26 miles ESE. The highest organ dose for the plume exposure, ground exposure, garden produce ingestion, and inhalation pathways was 2.13E-2 mrem which is 0.14% of the 15 mrem 10 CFR 50 Appendix I guideline.

Table 3-1 Main Plant Vent Releases – Mixed Mode
Fission Gases and Iodines

Report Period: January -- December 2013

Nuclides Released	1st Quarter (Ci)	2nd Quarter (Ci)	3rd Quarter (Ci)	4th Quarter (Ci)	Year (Ci)
A. Fission gases					
krypton-85	<MDA	<MDA	<MDA	<MDA	<MDA
krypton-85m	<MDA	<MDA	<MDA	<MDA	<MDA
krypton-87	<MDA	<MDA	<MDA	<MDA	<MDA
krypton-88	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-133	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-133m	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-135	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-135m	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-138	<MDA	<MDA	<MDA	<MDA	<MDA
Others					
argon-41	1.25E+01	2.40E+00	9.76E+00	1.92E+01	4.39E+01
Total for period *	1.25E+01	2.40E+00	9.76E+00	1.92E+01	4.39E+01
B. Iodines					
iodine-131	<MDA	7.96E-06	<MDA	<MDA	7.96E-06
iodine-132	<MDA	<MDA	<MDA	<MDA	<MDA
iodine-133	<MDA	1.04E-05	<MDA	<MDA	1.04E-05
iodine-134	<MDA	<MDA	<MDA	<MDA	<MDA
iodine-135	<MDA	<MDA	<MDA	<MDA	<MDA
Total for period *	0.00E+00	1.84E-05	0.00E+00	0.00E+00	1.84E-05

* MDA values are not included in the totals. MDA = Less than the "a posteriori" minimal detectable activity (microcuries per unit mass or volume).

Table 3-1 Main Plant Vent Releases – Mixed Mode (Continued)
Particulates and Tritium

Report Period: January -- December 2013

Nuclides Released	1st Quarter (Ci)	2nd Quarter (Ci)	3rd Quarter (Ci)	4th Quarter (Ci)	Year (Ci)
C. Particulates					
strontium-89	1.49E-06	1.04E-06	4.67E-07	4.81E-07	3.48E-06
strontium-90	<MDA	6.98E-07	<MDA	<MDA	6.98E-07
cesium-134	<MDA	<MDA	<MDA	<MDA	<MDA
cesium-137	<MDA	<MDA	<MDA	<MDA	<MDA
barium-lanthanum-140	<MDA	<MDA	<MDA	<MDA	<MDA
silver-110m	<MDA	<MDA	<MDA	<MDA	<MDA
cerium-141	<MDA	<MDA	<MDA	<MDA	<MDA
cerium-144	<MDA	<MDA	<MDA	<MDA	<MDA
cobalt-58	3.56E-05	2.21E-05	<MDA	<MDA	5.78E-05
cobalt-60	5.73E-05	8.02E-05	<MDA	2.51E-06	1.40E-04
iron-59	<MDA	<MDA	<MDA	<MDA	<MDA
manganese-54	2.27E-05	1.72E-05	<MDA	<MDA	3.99E-05
zinc-65	9.56E-06	2.62E-05	<MDA	<MDA	3.57E-05
chromium-51	<MDA	2.68E-05	<MDA	<MDA	2.68E-05
antimony-125	<MDA	<MDA	<MDA	<MDA	<MDA
Total for period*	1.27E-04	1.74E-04	4.67E-07	3.00E-06	3.04E-04
Others with T 1/2 < 8 days					
arsenic-76	<MDA	<MDA	<MDA	<MDA	<MDA
bromine-82	3.36E-06	6.85E-06	1.30E-05	2.00E-05	4.32E-05
copper-64	<MDA	<MDA	<MDA	<MDA	<MDA
molybdenum-99	<MDA	<MDA	<MDA	<MDA	<MDA
rhenium-188	<MDA	<MDA	<MDA	<MDA	<MDA
sodium-24	<MDA	<MDA	<MDA	<MDA	<MDA
technetium-99m	2.64E-04	<MDA	<MDA	<MDA	2.64E-04
zinc-69m	2.80E-05	<MDA	<MDA	<MDA	2.80E-05
Total with T 1/2 < 8 days*	2.95E-04	6.85E-06	1.30E-05	2.00E-05	3.35E-04
D. Tritium					
tritium	4.53E-01	6.71E-01	4.54E-01	6.37E-01	2.22E+00

* MDA values are not included in the totals. MDA = Less than the "a posteriori" minimal detectable activity (microcuries per unit mass or volume).

Table 3-2 Turbine Building Releases – Mixed Mode
Fission Gases and Iodines

Report Period: January -- December 2013

Nuclides Released	1st Quarter (Ci)	2nd Quarter (Ci)	3rd Quarter (Ci)	4th Quarter (Ci)	Year (Ci)
A. Fission gases					
krypton-85	<MDA	<MDA	<MDA	<MDA	<MDA
krypton-85m	<MDA	<MDA	<MDA	<MDA	<MDA
krypton-87	<MDA	<MDA	<MDA	<MDA	<MDA
krypton-88	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-133	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-133m	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-135	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-135m	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-138	<MDA	<MDA	<MDA	<MDA	<MDA
Others					
argon-41	<MDA	<MDA	<MDA	<MDA	<MDA
Total for period *	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
B. Iodines					
iodine-131	<MDA	<MDA	<MDA	2.08E-05	2.08E-05
iodine-132	<MDA	<MDA	<MDA	<MDA	<MDA
iodine-133	<MDA	<MDA	<MDA	1.02E-04	1.02E-04
iodine-134	<MDA	<MDA	<MDA	<MDA	<MDA
iodine-135	<MDA	<MDA	<MDA	<MDA	<MDA
Total for period *	0.00E+00	0.00E+00	0.00E+00	1.23E-04	1.23E-04

* MDA values are not included in the totals. MDA = Less than the "a posteriori" minimal detectable activity (microcuries per unit mass or volume).

Table 3-2 Turbine Building Releases – Mixed Mode (Continued)
Particulates and Tritium

Report Period: January -- December 2013

Nuclides Released	1st Quarter (Ci)	2nd Quarter (Ci)	3rd Quarter (Ci)	4th Quarter (Ci)	Year (Ci)
C. Particulates					
strontium-89	7.87E-06	<MDA	1.76E-06	<MDA	9.63E-06
strontium-90	<MDA	2.32E-06	<MDA	1.79E-06	4.11E-06
cesium-134	<MDA	<MDA	<MDA	<MDA	<MDA
cesium-137	<MDA	<MDA	<MDA	<MDA	<MDA
barium-lanthanum-140	<MDA	<MDA	<MDA	<MDA	<MDA
cerium-141	<MDA	<MDA	<MDA	<MDA	<MDA
cerium-144	<MDA	<MDA	<MDA	<MDA	<MDA
cobalt-58	<MDA	<MDA	<MDA	<MDA	<MDA
cobalt-60	<MDA	3.41E-06	<MDA	7.90E-06	1.13E-05
iron-59	<MDA	<MDA	<MDA	<MDA	<MDA
manganese-54	<MDA	<MDA	<MDA	<MDA	<MDA
zinc-65	<MDA	<MDA	<MDA	<MDA	<MDA
chromium-51	<MDA	<MDA	<MDA	<MDA	<MDA
Total for period*	7.87E-06	5.73E-06	1.76E-06	9.69E-06	2.51E-05
Others with T 1/2 < 8 days					
molybdenum-99	<MDA	<MDA	<MDA	<MDA	<MDA
Total with T 1/2 < 8 days*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
D. Tritium					
tritium	5.94E+00	3.01E-01	2.69E+00	3.10E+00	1.20E+01

* MDA values are not included in the totals. MDA = Less than the "a posteriori" minimal detectable activity (microcuries per unit mass or volume).

Table 3-3 Radwaste Building Releases – Ground Mode Fission Gases and Iodines

Report Period: January -- December 2013

Nuclides Released	1st Quarter (Ci)	2nd Quarter (Ci)	3rd Quarter (Ci)	4th Quarter (Ci)	Year (Ci)
A. Fission gases					
krypton-85	<MDA	<MDA	<MDA	<MDA	<MDA
krypton-85m	<MDA	<MDA	<MDA	<MDA	<MDA
krypton-87	<MDA	<MDA	<MDA	<MDA	<MDA
krypton-88	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-133	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-133m	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-135	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-135m	<MDA	<MDA	<MDA	<MDA	<MDA
xenon-138	<MDA	<MDA	<MDA	<MDA	<MDA
Others					
argon-41	<MDA	<MDA	<MDA	<MDA	<MDA
Total for period *	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
B. Iodines					
iodine-131	<MDA	<MDA	<MDA	<MDA	<MDA
iodine-132	<MDA	<MDA	<MDA	<MDA	<MDA
iodine-133	<MDA	<MDA	<MDA	<MDA	<MDA
iodine-134	<MDA	<MDA	<MDA	<MDA	<MDA
iodine-135	<MDA	<MDA	<MDA	<MDA	<MDA
Total for period *	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* MDA values are not included in the totals. MDA = Less than the "a posteriori" minimal detectable activity (microcuries per unit mass or volume).

Table 3-3 Radwaste Building Releases – Ground Mode (Continued)
Particulates and Tritium

Report Period: January -- December 2013

Nuclides Released	1st Quarter (Ci)	2nd Quarter (Ci)	3rd Quarter (Ci)	4th Quarter (Ci)	Year (Ci)
C. Particulates					
strontium-89	3.84E-07	3.73E-07	3.05E-08	<MDA	7.87E-07
strontium-90	<MDA	1.08E-07	2.75E-07	3.49E-07	7.32E-07
cesium-134	<MDA	<MDA	<MDA	<MDA	<MDA
cesium-137	<MDA	<MDA	<MDA	<MDA	<MDA
barium-lanthanum-140	<MDA	<MDA	<MDA	<MDA	<MDA
cerium-141	<MDA	<MDA	<MDA	<MDA	<MDA
cerium-144	<MDA	<MDA	<MDA	<MDA	<MDA
cobalt-58	<MDA	<MDA	<MDA	<MDA	<MDA
cobalt-60	<MDA	<MDA	<MDA	2.49E-07	2.49E-07
iron-59	<MDA	<MDA	<MDA	<MDA	<MDA
manganese-54	<MDA	<MDA	<MDA	<MDA	<MDA
zinc-65	<MDA	<MDA	<MDA	<MDA	<MDA
Total for period*	3.84E-07	4.81E-07	3.06E-07	5.98E-07	1.77E-06
Others with T 1/2 < 8 days molybdenum-99	<MDA	<MDA	<MDA	<MDA	<MDA
Total with T 1/2 < 8 days*	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
D. Tritium					
tritium	1.80E-01	1.00E-01	7.29E-02	1.02E-01	4.55E-01

* MDA values are not included in the totals. MDA = Less than the "a posteriori" minimal detectable activity (microcuries per unit mass or volume).

Table 3-3A Seal Steam Release – Ground Mode
Fission Gases and Iodines

Report Period: January -- December 2013

Nuclides Released	1st Quarter (Ci)	2nd Quarter (Ci)	3rd Quarter (Ci)	4th Quarter (Ci)	Year (Ci)
A. Fission gases					
krypton-85					
krypton-85m					
krypton-87					
krypton-88					
xenon-133					
xenon-133m					
xenon-135					
xenon-135m					
xenon-138					
Others					
argon-41					
Total for period *	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
B. Iodines					
iodine-131			<MDA		<MDA
iodine-132			<MDA		<MDA
iodine-133			<MDA		<MDA
iodine-134			<MDA		<MDA
iodine-135			<MDA		<MDA
Total for period *	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* MDA values are not included in the totals. MDA = Less than the "a posteriori" minimal detectable activity (microcuries per unit mass or volume).

Table 3-3A Seal Steam Release – Ground Mode (Continued)
Particulates and Tritium

Report Period: January -- December 2013

Nuclides Released	1st Quarter (Ci)	2nd Quarter (Ci)	3rd Quarter (Ci)	4th Quarter (Ci)	Year (Ci)
C. Particulates					
strontium-89					
strontium-90					
cesium-134			<MDA		<MDA
cesium-137			1.08E-05		1.08E-05
barium-lanthanum-140			<MDA		<MDA
cerium-141			<MDA		<MDA
cerium-144			<MDA		<MDA
cobalt-58			<MDA		<MDA
cobalt-60			7.33E-06		7.33E-06
iron-59			<MDA		<MDA
manganese-54			<MDA		<MDA
zinc-65			<MDA		<MDA
Total for period*			1.81E-05		1.81E-05
Others with T 1/2 < 8 days					
Total with T 1/2 < 8 days*					
D. Tritium					
tritium			4.63E-01		4.63E-01

* MDA values are not included in the totals. MDA = Less than the "a posteriori" minimal detectable activity (microcuries per unit mass or volume).

Table 3-4 Summation of Releases
Gaseous Effluents

Report Period: January -- December 2013

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year	Est* Total %Error
A. Fission and activation gases						
Total release (Ci)	1.25E+01	2.40E+00	9.76E+00	1.92E+01	4.39E+01	4.30E+01
Average release rate (µCi/s)	1.59E+00	3.05E-01	1.24E+00	2.45E+00	1.40E+00	
Percent of ODCM limit (%)	2.82E-03	5.28E-04	2.41E-03	3.68E-03	2.42E-03	
B. Iodines						
Total I-131 (Ci)	<MDA	7.96E-06	<MDA	2.08E-05	2.87E-05	4.60E+01
Average release rate (µCi/s)	<MDA	1.01E-06	<MDA	2.64E-06	9.14E-07	
Percent of ODCM limit (%)	0.00E+00	1.06E-06	0.00E+00	5.92E-07	4.6E-07	
C. Particulates						
Particulates with half-lives >8 days (Ci)	1.35E-04	1.80E-04	2.53E-06	1.33E-05	3.31E-04	4.50E+01
Average release rate (µCi/s)	1.72E-05	2.29E-05	3.22E-07	1.69E-06	1.05E-05	
Percent of ODCM limit (%)	4.23E-06	6.05E-06	5.15E-07	9.72E-07	2.96E-06	
Gross alpha radioactivity (Ci)	1.80E-06	5.52E-07	3.13E-06	4.02E-06	9.50E-06	7.30E+01
D. Tritium						
Total release (Ci)	6.58E+00	1.07E+00	3.21E+00	3.84E+00	1.47E+01	2.60E+01
Average release rate (µCi/s)	8.37E-01	1.37E-01	4.09E-01	4.88E-01	4.67E-01	
Percent of ODCM limit (%)	5.97E-05	6.80E-06	9.47E-06	9.08E-06	1.08E-05	

* Measurement errors are sample-specific. The values reported represent an approximate overall error. Some of the contributors of this error are measurements associated with estimating the sample volume, the exhaust duct flow rates, plateout factors, charcoal cartridge efficiencies, temperatures of sample lines, buildings, and ambient air, barometric pressure, sample line vacuum, run time estimates, anisokinetic correction factors where needed, and gravimetric, gamma spectroscopy, and liquid scintillation analysis errors.

MDA = Less than the "a posteriori" minimal detectable activity (microcuries per unit mass or volume).

ODCM release rate limits are based on dose rate. For fission and activation gases the dose rate limits are less than or equal to 500 mrem/year to the whole body and less than or equal to 3000 mrem/year to the skin. For I-131, particulates, and tritium the dose rate limit is less than or equal to 1500 mrem/year to any organ. The ODCM dose factors and the highest site boundary dispersion value for each period were used in the calculation.

Table 3-5 Gaseous Purges and Vents

Report Period: January -- December 2013

Type	Number	Total Time (hr.)	Maximum Time (hr.)	Minimum Time (hr.)	Mean Time (hr.)
Purge	2.00E+00	4.02E+01	3.54E+01	4.78E+00	2.01E+01
Vent	5.30E+01	6.19E+01	6.52E+00	3.67E-01	1.17E+00

Columbia Generating Station is a continuous release plant. All purges and vents are discharged through the High-Efficiency Particulate Air (HEPA) filters and charcoal beds of the Standby Gas Treatment System and released through the reactor building release duct which is, by procedure and design, sampled and continuously monitored for radioactive gaseous waste.

Table 3-6 Lower Limits of Detection
Gaseous Effluents

Report Period: January -- December 2013

Fission Gases

Nuclide	Required LLD† (µCi/cc)	Achieved Analysis LLD (µCi/cc)
krypton-87	1.00E-04	1.05E-08
krypton-88	1.00E-04	1.29E-08
xenon-133	1.00E-04	1.00E-08
xenon-133m	1.00E-04	3.25E-08
xenon-135	1.00E-04	3.77E-09
xenon-138	1.00E-04	4.48E-08

Iodines

iodine-131	1.00E-12	5.79E-14
iodine-133	1.00E-10	1.10E-12

Particulates

strontium-89	1.00E-11	1.16E-14
strontium-90	1.00E-11	5.12E-15
cesium-134	1.00E-11	4.63E-14
cesium-137	1.00E-11	3.91E-14
molybdenum-99	1.00E-11	7.97E-13
cerium-141	1.00E-11	4.70E-14
cerium-144	1.00E-11	1.78E-13
cobalt-58	1.00E-11	4.27E-14
cobalt-60	1.00E-11	7.75E-14
iron-59	1.00E-11	1.01E-13
manganese-54	1.00E-11	3.68E-14
zinc-65	1.00E-11	1.10E-13
Gross Alpha	1.00E-11	9.01E-16

Tritium

hydrogen-3	1.00E-06	5.85E-11

† From ODCM Table 6.2.2.1-1

4.0 Solid Radwaste

This section of the annual effluent report provides information required by the Columbia Generating Station Offsite Dose Calculation Manual and recommended by Nuclear Regulatory Commission Regulatory Guide 1.21-1974.

Solid Radwaste Information required by the Offsite Dose Calculation Manual

January -- December 2013

Class A

1. Container Volumes

5 GAL PAIL	1.0 ft^3
30 GAL DRUM	4.0 ft^3
55 GAL DRUM	7.5 ft^3
Liquid Tote	42.8 ft^3
B-25 Steel Box	96 ft^3
PL8-120 Polyethylene HIC	120.3 ft^3
EL-142 Polyethylene HIC	132.4 ft^3
B-88 Steel Box	138 ft^3
ES-190 Steel Liner	170.2 ft^3
14-170 Steel Liner	180.1 ft^3

2. Total Curies

   4.15E+02 Ci

3. Principal Radionuclides

Nuclide	Curies	Percent
Co-60	1.89E+02	4.55E+01
Fe-55	8.83E+01	2.13E+01
Zn-65	7.76E+01	1.87E+01
Mn-54	2.61E+01	6.29E+00
Ni-63	1.42E+01	3.43E+00
Co-58	1.31E+01	3.17E+00
Cr-51	2.86E+00	6.91E-01
C-14	1.29E+00	3.11E-01

Fe-59	7.08E-01	1.71E-01
Cs-137	6.71E-01	1.62E-01
H-3	2.34E-01	5.64E-02
Nb-95	2.29E-01	5.53E-02
Ag-110m	1.35E-01	3.25E-02
Zr-95	1.08E-01	2.61E-02
Sb-124	1.00E-01	2.41E-02
Sr-89	8.08E-02	1.95E-02
Co-57	6.35E-02	1.53E-02
Ce-144	5.00E-02	1.21E-02
Ni-59	4.31E-02	1.04E-02
La-140	2.68E-02	6.46E-03
Ba-140	2.39E-02	5.76E-03
Sb-125	2.20E-02	5.30E-03
Sr-90	1.24E-02	2.99E-03
I-131	2.26E-02	5.45E-03
Pu-241	1.95E-02	4.70E-03
Ce-141	6.67E-04	1.61E-04
Cm-242	4.58E-04	1.10E-04
Pu-238	3.28E-04	7.91E-05
Pu-239	2.35E-04	5.66E-05
Am-241	1.95E-04	4.70E-05
Tc-99	1.56E-04	3.76E-05
Cm-243	9.22E-05	2.22E-05
Pu-242	6.86E-06	1.65E-06
I-129	4.26E-06	1.03E-06
K-40	2.58E-07	6.22E-08

4. Source

Resins	4.12E+02 Ci
DAW	2.34E+00 Ci
Irradiated Components	0.00E+00 Ci
Other (Sealed Source, Mixed Waste, & Liquid Waste)	4.36E-05 Ci

5. Type of Container

   All containers shipped as Exempt, Limited Quantity, LSA, SCO or Radioactive material in IP-1, IP-2, Type A, or Type B (including casks) as appropriate.

6. Solidification Agent

   None

Class B

There were no Class B shipments made during calendar year 2013

Class C

There were no Class C shipments made during calendar year 2013

Solid Radwaste Information Recommended by NRC Regulatory Guide 1.21
January -- December 2013

Solid waste shipped offsite for burial or disposal (not irradiated fuel).

1. Type of Waste

Waste Stream	Unit	Annual Cumulative	Est. Total Error %
a. Spent resins, filter sludge, evaporator bottoms, etc.	m^3	1.45E+02	
	Ci	4.12E+02	2.5E+01%
b. Dry Active Waste	m^3	1.35E+02	
	Ci	2.34E+00	2.5E+01%
c. Irradiated Components	m^3	0.00E+00	
	Ci	0.00E+00	None
d. Other Waste (Sealed Source, mixed waste, & Liquid Waste)	m^3	9.38E+00	
	Ci	4.36E-05	2.5E+01%

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

   a. Dewatered Spent Resins -- All Classes

Nuclide	Curies	Percent
Co-60	1.88E+02	4.56E+01
Fe-55	8.82E+01	2.14E+01
Zn-65	7.71E+01	1.87E+01
Mn-54	2.60E+01	6.30E+00
Ni-63	1.42E+01	3.44E+00
Co-58	1.28E+01	3.10E+00
Cr-51	2.35E+00	5.70E-01
C-14	1.29E+00	3.13E-01
Fe-59	7.08E-01	1.72E-01
Cs-137	6.46E-01	1.57E-01
H-3	2.33E-01	5.65E-02
Nb-95	2.12E-01	5.14E-02
Ag-110m	1.25E-01	3.03E-02
Sb-124	9.39E-02	2.28E-02
Zr-95	8.89E-02	2.16E-02
Sr-89	7.66E-02	1.86E-02
Co-57	6.35E-02	1.54E-02

Ce-144	5.00E-02	1.21E-02
Ni-59	4.31E-02	1.05E-02
La-140	2.68E-02	6.50E-03
Ba-140	2.39E-02	5.80E-03
I-131	2.26E-02	5.48E-03
Pu-241	1.95E-02	4.73E-03
Sr-90	1.23E-02	2.98E-03
Sb-125	7.89E-03	1.91E-03
Ce-141	6.67E-04	1.62E-04
Cm-242	4.35E-04	1.05E-04
Pu-238	3.12E-04	7.57E-05
Pu-239	2.23E-04	5.41E-05
Am-241	1.95E-04	4.73E-05
Tc-99	1.55E-04	3.76E-05
Cm-243	9.22E-05	2.24E-05
Pu-242	6.86E-06	1.66E-06
I-129	4.24E-06	1.03E-06

b. Dry Active Waste (DAW) -- All Classes

Nuclide	Curies	Percent
Co-60	7.85E-01	3.35E+01
Cr-51	5.14E-01	2.19E+01
Zn-65	4.66E-01	1.99E+01
Co-58	3.29E-01	1.40E+01
Mn-54	7.34E-02	3.13E+00
Fe-55	6.39E-02	2.73E+00
Cs-137	2.52E-02	1.07E+00
Zr-95	1.92E-02	8.19E-01
Nb-95	1.72E-02	7.34E-01
Ni-63	1.58E-02	6.74E-01
Sb-125	1.41E-02	6.01E-01
Ag-110m	9.78E-03	4.17E-01

Sb-124	6.05E-03	2.58E-01
Sr-89	4.21E-03	1.80E-01
H-3	9.63E-04	4.11E-02
C-14	3.72E-04	1.59E-02
Sr-90	8.97E-05	3.83E-03
Cm-242	2.28E-05	9.73E-04
Pu-238	1.61E-05	6.87E-04
Pu-239	1.16E-05	4.95E-04
Tc-99	8.81E-07	3.76E-05
I-129	2.42E-08	1.03E-06

c. Irradiated Components
None

d. Other Waste (Sealed Source & Mixed Waste)

Nuclide	Curies	Percent
Co-60	3.18E-05	7.29E+01
H-3	8.75E-06	2.01E+01
Zn-65	1.90E-06	4.36E+00
Mn-54	6.54E-07	1.50E+00
K-40	2.58E-07	5.92E-01
Co-58	2.50E-07	5.73E-01

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
24	Tractor - Trailer via Public Highway	US Ecology, Inc. P.O. Box 638 Hanford Reservation Richland, WA. 99352
1*	Tractor - Trailer via Public Highway	Perma-Fix Northwest 2025 Battelle Blvd Richland, WA 99352

(* After processing, portions of these shipments will be forwarded for disposal.)

Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
None	N/A	N/A

5.0 Meteorological Data

The meteorological data contained in Tables 5-1 through 5-11 was obtained from a meteorological tower located 762 meters (2500 feet) west of Columbia Generating Station. Data was recovered from two sets of redundant instruments on the tower at the 10 meter (33-foot) and 75 meter (245- foot) levels. The meteorological data is a composite file generated from the automated data recovery systems for the calendar year 2013. Data is archived on the Energy Northwest Local Area Network.

Meteorological data recovery for 2013 was 99.2% from the 33-foot level and 99.1% from the 245-foot level. Redundant wind and temperature sensors are installed at both levels of the meteorological tower. Data from the two systems can be combined to permit maximum data recovery for defined date ranges.

The data in Tables 5-1 through 5-8 provide joint frequency distributions (JFD) at the 10-meter and 75-meter levels by quarter for 2013. These tables show the total hours at various wind speeds for each sector and stability class. The NRC stability classes A through G, eleven wind speed categories, and the 16 wind direction sectors were used to prepare each joint frequency table. Tables 5-9 and 5-10 provide the annual joint frequency distributions at the specified heights for 2013. Table 5-11 provides a joint frequency distribution from the 10 meter wind instruments during daylight hours of the growing season. The threshold value for daylight was chosen at solar irradiance of greater than 5 watts/m^2. This JFD table was used for C-14 dose estimates from ingestion pathways.

Wind speed is measured in miles per hour in the tables and speeds below 1.0 MPH were recorded as calms.

There are a number of atmospheric factors which affect dispersivity, but are not modeled in the CGS estimates of dispersion and deposition. Those conditions which were measured or documented at the Hanford Meteorological Station during 2013 were: snow (2.0 inches total in January and December), total precipitation (5.38 inches), freezing rain (8 days), dust or blowing dust (4 days), fog (41 days), and thunderstorms (13 days).

Rainfall as recorded at the Columbia Generating Station meteorological tower was 3.6 inches.

Table 5-1 1st Quarter Average, 33 Ft Above Ground Level (AGL)

Elevation: 33 Start Date: 1/1/2013 Total number of Periods: 2159
Period: 1st Quarter Stop Date: 4/1/2013 Periods of No Data Recovery: 11
System Percent Data Recovery: 99.5%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
4.5	6.7	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6
6.7	8.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
13.4	17.9	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
17.9	22.4	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	3
22.4	29.1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		5	1	0	0	0	0	0	0	1	3	0	0	0	1	2	3	16

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1	9
2.2	4.5	7	1	0	0	0	0	0	0	0	0	0	0	0	2	2	11	23
4.5	6.7	5	3	0	0	0	0	0	0	1	0	1	0	0	1	0	9	20
6.7	8.9	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7
8.9	11.2	2	0	0	0	0	0	0	3	1	0	0	0	2	3	2	0	13
11.2	13.4	0	0	0	0	0	0	0	3	7	0	1	2	0	0	2	1	16
13.4	17.9	0	0	0	0	0	0	0	0	4	2	1	2	2	2	0	1	14
17.9	22.4	0	0	0	0	0	0	0	0	0	1	1	1	1	3	1	0	8
22.4	29.1	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	4
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		20	4	0	0	0	0	0	6	13	4	7	5	5	11	14	25	114

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	8	5	6	5	3	2	3	2	7	1	6	6	7	11	11	8	91
2.2	4.5	24	16	9	1	0	1	5	14	26	17	6	7	9	21	32	34	222
4.5	6.7	9	9	6	1	0	0	11	19	17	6	2	5	2	16	27	10	140
6.7	8.9	9	1	3	0	0	0	9	21	18	2	1	1	1	9	16	12	103
8.9	11.2	0	0	0	0	0	0	3	15	17	3	0	0	0	7	8	4	57
11.2	13.4	0	0	0	0	0	0	1	5	7	5	2	0	2	5	3	2	32
13.4	17.9	0	0	0	0	0	0	0	3	13	15	4	4	2	4	2	1	48
17.9	22.4	0	0	0	0	0	0	0	0	2	9	5	3	0	3	0	0	22
22.4	29.1	0	0	0	0	0	0	0	0	0	2	3	1	0	3	0	0	9
29.1	40.3	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	3
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		50	31	24	7	3	3	32	79	107	62	29	28	23	79	99	71	727

Table 5-1 1st Quarter Average, 33 Ft AGL (Continued)

Stability Class: E

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	3	1	5	3	1	4	4	4	4	1	6	3	6	12	14	2	73
2.2	4.5	6	7	3	1	0	2	7	11	9	7	4	9	3	17	13	13	112
4.5	6.7	5	5	6	0	0	0	5	16	17	4	1	3	11	10	5	9	97
6.7	8.9	0	1	2	0	0	1	10	10	5	4	3	5	2	4	5	0	52
8.9	11.2	0	0	2	0	0	0	11	6	15	5	5	2	3	8	3	0	60
11.2	13.4	0	0	0	0	0	0	0	4	5	9	5	1	3	5	2	0	34
13.4	17.9	0	0	0	0	0	0	0	0	8	15	8	1	2	7	0	0	41
17.9	22.4	0	0	0	0	0	0	0	0	1	3	4	1	0	4	0	0	13
22.4	29.1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
29.1	40.3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		14	14	18	4	1	7	37	51	64	50	36	25	30	67	42	24	484

Stability Class: F

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	3	8	1	1	2	4	8	3	10	8	6	7	4	10	7	4	86
2.2	4.5	8	11	6	0	0	3	9	13	5	8	10	5	4	18	24	15	139
4.5	6.7	3	3	3	0	0	0	4	12	13	6	4	3	2	5	14	12	84
6.7	8.9	0	0	1	0	0	0	8	22	12	2	1	0	3	7	4	0	60
8.9	11.2	0	0	0	0	0	0	5	7	7	0	1	2	2	3	1	0	28
11.2	13.4	0	0	0	0	0	0	0	3	4	2	0	2	0	4	1	0	16
13.4	17.9	0	0	0	0	0	0	0	0	2	2	0	1	1	0	0	0	6
17.9	22.4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		14	22	11	1	2	7	34	60	54	28	22	20	16	47	51	31	420

Stability Class: G

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	4	7	1	0	0	1	5	8	7	8	2	2	4	7	8	7	71
2.2	4.5	11	10	4	0	0	0	3	9	4	9	3	5	8	7	20	17	110
4.5	6.7	1	2	0	0	0	0	1	8	12	0	2	1	0	4	13	4	48
6.7	8.9	0	0	0	0	0	0	0	16	4	1	1	0	0	0	1	0	23
8.9	11.2	0	0	0	0	0	0	0	6	4	2	0	0	0	0	0	0	12
11.2	13.4	0	0	0	0	0	0	1	3	0	1	0	0	0	0	0	0	5
13.4	17.9	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		16	19	5	0	0	1	10	51	31	21	8	8	12	18	42	28	270

Stability Class: All

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	19	21	13	9	6	11	20	17	28	18	20	18	21	40	47	22	330
2.2	4.5	56	45	22	2	0	6	24	47	44	41	23	26	24	65	91	93	609
4.5	6.7	28	22	15	1	0	0	21	55	60	16	10	12	15	36	59	45	395
6.7	8.9	14	3	6	0	0	1	27	69	39	9	6	6	6	20	26	14	246
8.9	11.2	2	0	2	0	0	0	19	37	44	10	6	4	7	21	14	4	170
11.2	13.4	0	0	0	0	0	0	2	18	23	17	8	5	5	14	9	3	104
13.4	17.9	0	0	0	0	0	0	0	4	28	34	13	8	7	13	2	2	111
17.9	22.4	0	0	0	0	0	0	0	0	4	14	10	5	1	11	2	0	47
22.4	29.1	0	0	0	0	0	0	0	0	0	6	6	1	0	3	0	0	16
29.1	40.3	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	4
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		119	91	58	12	6	18	113	247	270	168	102	86	86	223	250	183	2032

Periods of Calm while in Stability Class:							
A	B	C	D	E	F	G	Total
0	0	1	36	25	20	34	116

Table 5-2 1st Quarter Average, 245 Ft AGL

Elevation: 245 Start Date: 1/1/2013 Total number of Periods: 2160
Period: 1st Quarter Stop Date: 4/1/2013 Periods of No Data Recovery: 12
System Percent Data Recovery: 99.4%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
2.2	4.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4.5	6.7	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
6.7	8.9	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
13.4	17.9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	2	1	0	0	1	1	0	5
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		6	1	0	0	0	0	0	0	0	3	1	0	0	1	1	3	16

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3
2.2	4.5	7	3	1	0	0	0	0	0	0	0	0	0	0	3	0	8	22
4.5	6.7	4	4	1	0	0	0	0	0	1	0	1	0	0	1	0	8	20
6.7	8.9	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	5	10
8.9	11.2	2	0	0	0	0	0	0	2	1	0	0	0	0	2	1	0	8
11.2	13.4	1	0	0	0	0	0	0	0	2	4	0	0	2	0	2	1	12
13.4	17.9	0	0	0	0	0	0	0	0	5	4	2	2	1	0	0	3	17
17.9	22.4	0	0	0	0	0	0	0	0	0	0	2	0	3	2	1	0	8
22.4	29.1	0	0	0	0	0	0	0	0	0	1	1	2	2	1	2	0	9
29.1	40.3	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		16	11	3	0	0	0	0	2	9	9	7	5	8	9	7	25	111

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	3	9	5	2	2	2	3	7	7	5	4	2	2	7	8	12	80
2.2	4.5	17	16	18	2	1	0	2	8	19	12	13	8	9	16	33	23	197
4.5	6.7	11	7	6	1	1	0	4	9	22	7	2	6	2	8	15	15	116
6.7	8.9	13	2	3	2	0	0	4	8	24	11	4	1	1	2	17	11	103
8.9	11.2	3	1	1	0	0	0	1	10	13	9	1	1	0	5	9	10	64
11.2	13.4	1	0	0	0	0	0	0	1	15	7	0	0	0	6	9	6	45
13.4	17.9	0	0	0	0	0	0	0	3	9	13	5	4	0	8	6	4	52
17.9	22.4	0	0	0	0	0	0	0	1	5	14	8	2	2	4	1	0	37
22.4	29.1	0	0	0	0	0	0	0	0	1	6	7	3	0	4	0	0	21
29.1	40.3	0	0	0	0	0	0	0	0	0	1	5	3	0	1	1	0	11
40.3	90.0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
TOTALS		48	35	33	7	4	2	14	47	115	87	49	30	16	61	99	81	728

Table 5-2 1st Quarter Average, 245 Ft AGL (Continued)

Stability Class: E

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	4	4	1	4	0	3	2	4	2	1	0	1	3	5	9	44
2.2	4.5	5	2	8	1	0	5	11	4	9	3	5	3	2	1	6	6	71
4.5	6.7	4	4	8	2	0	0	2	9	14	4	4	3	2	7	7	9	79
6.7	8.9	4	4	7	1	1	0	3	7	12	4	0	1	2	6	10	4	66
8.9	11.2	2	0	3	1	0	0	3	4	4	3	2	2	5	7	3	4	43
11.2	13.4	0	0	0	0	0	0	2	10	5	5	4	2	2	12	2	0	44
13.4	17.9	0	0	2	0	0	0	1	3	10	13	8	2	3	9	4	3	58
17.9	22.4	0	0	0	0	0	0	0	0	3	13	12	5	2	7	6	0	48
22.4	29.1	0	0	0	0	0	0	0	0	1	10	8	4	0	10	1	0	34
29.1	40.3	0	0	0	0	0	0	0	0	0	4	2	2	0	2	0	0	10
40.3	90.0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTALS		16	14	32	6	5	5	25	39	62	61	47	24	19	64	44	35	498

Stability Class: F

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	3	3	1	3	2	4	5	4	1	2	2	4	2	1	3	41
2.2	4.5	4	5	6	5	5	5	3	8	6	5	4	2	1	1	4	8	72
4.5	6.7	12	11	11	1	0	2	2	18	10	8	0	5	0	5	5	5	95
6.7	8.9	4	4	5	1	0	0	6	9	7	7	1	1	4	5	3	8	65
8.9	11.2	1	1	4	0	0	0	2	8	5	3	1	3	1	3	5	4	41
11.2	13.4	0	0	0	0	0	0	1	7	5	7	3	0	4	1	9	0	37
13.4	17.9	1	0	0	0	0	0	2	7	7	10	2	0	1	9	3	1	43
17.9	22.4	0	0	0	0	0	0	1	1	1	7	0	0	3	8	3	0	24
22.4	29.1	0	0	0	0	0	0	0	0	0	2	1	0	4	3	0	0	10
29.1	40.3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		23	24	29	8	8	9	21	63	45	51	14	13	22	37	33	29	429

Stability Class: G

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	1	1	2	0	1	2	6	2	0	2	1	0	1	1	1	22
2.2	4.5	3	5	3	6	1	1	8	8	11	9	4	5	1	3	6	0	74
4.5	6.7	7	7	3	1	0	0	7	10	13	12	4	3	2	1	3	6	79
6.7	8.9	4	7	4	0	0	0	1	6	8	9	5	1	1	5	5	2	58
8.9	11.2	1	0	1	1	0	0	0	4	4	1	2	4	3	1	4	3	29
11.2	13.4	0	0	0	0	0	0	0	0	2	4	1	0	0	1	1	4	13
13.4	17.9	1	0	0	0	0	0	1	2	4	3	1	0	0	1	2	0	15
17.9	22.4	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	4
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		17	20	12	10	1	2	19	36	44	40	19	14	7	15	22	16	294

Stability Class: All

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	7	18	13	6	9	5	12	20	17	8	9	5	7	13	16	26	191
2.2	4.5	38	31	36	14	7	11	24	28	45	29	26	18	13	24	49	45	438
4.5	6.7	42	33	29	5	1	2	15	46	60	31	11	17	6	22	30	44	394
6.7	8.9	27	21	20	4	1	0	14	30	51	31	10	4	8	18	35	30	304
8.9	11.2	9	2	9	2	0	0	6	28	27	16	6	10	9	18	22	21	185
11.2	13.4	2	0	0	0	0	0	3	18	29	27	8	2	8	20	23	12	152
13.4	17.9	2	0	2	0	0	0	4	15	35	44	18	8	5	27	15	11	186
17.9	22.4	0	0	0	0	0	0	1	2	9	36	22	7	10	23	11	0	121
22.4	29.1	0	0	0	0	0	0	0	0	2	21	18	9	6	19	4	0	79
29.1	40.3	0	0	0	0	0	0	0	0	0	6	8	6	0	3	1	0	24
40.3	90.0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	3
TOTALS		127	105	109	31	18	18	79	187	275	251	137	86	72	187	206	189	2077

Periods of Calm while in Stability Class:

A	B	C	D	E	F	G	Total
0	0	4	34	12	11	10	71

Table 5-3 2nd Quarter Average, 33 Ft AGL

Elevation: 33 Start Date: 4/1/2013 Total number of Periods: 2184
Period: 2nd Quarter Stop Date: 7/1/2013 Periods of No Data Recovery: 38
System Percent Data Recovery: 98.3%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
6.7	8.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
8.9	11.2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
11.2	13.4	3	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	6
13.4	17.9	5	0	0	0	0	0	0	0	2	3	0	0	0	0	0	1	11
17.9	22.4	0	3	4	0	0	0	0	0	0	3	0	0	0	0	1	0	11
22.4	29.1	0	0	0	0	0	0	0	0	0	2	1	0	2	0	2	0	7
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		13	4	4	0	0	0	0	0	4	8	1	0	2	0	3	4	43

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	4	3	0	0	0	0	0	0	0	1	0	0	0	0	0	1	9
6.7	8.9	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	10
8.9	11.2	2	3	0	0	0	0	0	0	1	0	0	0	0	0	2	2	10
11.2	13.4	1	0	2	0	0	0	0	1	1	1	0	0	0	0	0	1	7
13.4	17.9	3	1	3	0	0	0	0	0	3	4	0	0	0	2	0	0	16
17.9	22.4	0	1	1	0	0	0	0	0	0	1	0	1	1	1	0	0	6
22.4	29.1	0	0	0	0	0	0	0	0	0	0	3	2	1	0	0	0	6
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		15	11	6	0	0	0	0	1	5	7	3	4	2	3	2	6	65

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	3	0	0	0	1	0	0	0	0	0	1	1	0	0	1	1	8
2.2	4.5	3	3	5	0	0	0	1	1	2	2	2	0	0	0	1	1	21
4.5	6.7	5	6	2	1	0	1	3	1	4	2	2	0	0	1	0	6	34
6.7	8.9	2	2	2	0	0	1	1	2	10	4	1	0	2	1	1	2	31
8.9	11.2	3	3	0	0	0	1	0	4	10	1	3	0	0	2	2	1	30
11.2	13.4	2	2	0	0	0	0	0	1	4	4	1	4	2	1	1	0	22
13.4	17.9	2	1	1	0	0	0	0	1	3	4	1	3	6	1	1	1	25
17.9	22.4	0	0	1	0	0	0	0	0	1	2	1	2	2	0	0	0	9
22.4	29.1	0	0	0	0	0	0	0	0	0	2	3	3	4	0	2	0	14
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		20	17	11	1	1	3	5	10	34	21	15	13	16	7	9	12	195

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	3	1	4	3	3	2	3	4	1	5	1	0	2	1	0	2	35
2.2	4.5	8	13	6	11	16	11	24	19	20	13	7	10	6	7	3	7	181
4.5	6.7	6	15	6	3	8	15	28	39	36	8	4	4	5	4	6	6	193
6.7	8.9	4	3	4	5	9	4	9	19	24	8	5	4	5	4	3	6	116
8.9	11.2	5	3	6	0	0	1	5	17	17	7	4	4	4	5	7	5	90
11.2	13.4	4	0	3	0	0	0	6	9	10	3	2	3	2	4	0	1	47
13.4	17.9	1	3	1	0	0	0	2	3	6	15	11	3	7	12	11	1	76
17.9	22.4	2	0	0	0	0	0	0	1	0	5	5	3	6	10	4	1	37
22.4	29.1	0	0	0	0	0	0	0	0	0	2	4	1	5	3	2	0	17
29.1	40.3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		33	38	30	22	36	33	77	111	114	66	45	32	42	50	36	29	794

Table 5-3 2nd Quarter Average, 33 Ft AGL (Continued)

Stability Class: E

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	0	0	3	0	5	3	1	3	3	2	2	4	4	4	2	37
2.2	4.5	2	2	2	3	4	4	6	16	8	6	7	6	9	2	5	2	84
4.5	6.7	3	2	5	0	0	4	10	8	9	2	3	5	5	6	6	9	77
6.7	8.9	5	2	2	1	1	0	11	17	9	8	3	10	8	6	7	1	91
8.9	11.2	0	1	1	0	0	1	6	10	7	3	3	5	7	13	8	1	66
11.2	13.4	0	2	0	0	0	0	2	6	7	8	3	2	3	20	10	3	66
13.4	17.9	1	1	0	0	0	0	0	1	8	5	4	3	3	17	9	0	52
17.9	22.4	0	0	0	0	0	0	0	0	2	0	0	0	1	1	0	0	4
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		12	10	10	7	5	14	38	59	53	35	25	33	40	69	50	18	478

Stability Class: F

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	4	6	2	3	1	2	3	1	1	2	4	1	3	2	2	38
2.2	4.5	9	13	4	3	2	1	15	11	11	9	6	1	0	4	8	3	100
4.5	6.7	3	6	3	1	0	2	13	25	12	2	2	3	0	4	7	15	98
6.7	8.9	1	1	0	1	0	1	3	8	10	8	1	1	1	3	7	1	47
8.9	11.2	0	1	2	0	0	0	2	3	3	2	0	0	2	3	1	0	19
11.2	13.4	0	0	0	0	0	0	0	3	1	3	0	0	0	1	0	0	8
13.4	17.9	0	0	0	0	0	0	0	0	2	5	0	0	0	0	1	0	8
17.9	22.4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		14	25	15	7	5	5	35	53	41	30	11	9	4	18	26	21	319

Stability Class: G

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	10	4	5	1	2	1	2	2	3	3	0	0	2	2	0	5	42
2.2	4.5	10	6	4	0	0	2	9	12	7	3	2	3	1	2	8	7	76
4.5	6.7	8	5	4	0	0	0	4	16	5	1	0	1	0	0	4	9	57
6.7	8.9	0	0	3	0	0	0	2	10	3	1	0	0	0	0	0	1	20
8.9	11.2	0	0	3	0	0	0	0	2	4	2	0	0	0	0	0	0	11
11.2	13.4	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		28	15	19	2	2	3	17	42	22	11	2	4	3	4	12	22	208

Stability Class: All

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	18	9	15	9	9	9	10	10	8	12	6	7	9	10	7	12	160
2.2	4.5	32	37	21	17	22	18	55	59	48	33	24	20	16	15	25	20	462
4.5	6.7	31	37	20	5	8	22	58	89	66	16	11	13	10	15	23	46	470
6.7	8.9	17	12	11	7	10	6	26	56	56	29	10	15	16	14	18	15	318
8.9	11.2	13	11	12	0	0	3	13	36	42	15	10	9	13	23	20	9	229
11.2	13.4	10	4	5	1	0	0	8	20	25	20	6	9	7	26	11	6	158
13.4	17.9	12	6	5	0	0	0	2	5	24	36	16	9	16	32	22	3	188
17.9	22.4	2	4	6	0	0	0	0	1	4	11	6	6	10	12	5	1	68
22.4	29.1	0	0	0	0	0	0	0	0	0	6	11	6	12	3	7	0	45
29.1	40.3	0	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	4
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		135	120	95	39	49	58	172	276	273	178	102	95	109	151	138	112	2102

Periods of Calm while in Stability Class:							
A	B	C	D	E	F	G	Total
0	0	0	10	7	15	12	44

Table 5-4 2nd Quarter Average, 245 Ft AGL

Elevation: 245 Start Date: 4/1/2013 Total number of Periods: 2184
Period: 2nd Quarter Stop Date: 7/1/2013 Periods of No Data Recovery: 37
System Percent Data Recovery: 98.3%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
6.7	8.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
8.9	11.2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
11.2	13.4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
13.4	17.9	4	2	0	0	0	0	0	0	2	1	0	0	0	0	0	0	9
17.9	22.4	0	2	5	0	0	0	0	0	1	4	0	0	0	0	0	0	12
22.4	29.1	0	0	0	0	0	0	0	0	0	4	0	0	1	0	3	0	8
29.1	40.3	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		12	5	5	0	0	0	0	0	3	9	1	0	2	0	3	3	43

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4.5	6.7	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11
6.7	8.9	3	3	1	0	0	0	0	0	0	1	0	0	0	0	0	1	9
8.9	11.2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	2	2	7
11.2	13.4	1	0	2	0	0	0	0	0	2	0	0	0	0	0	0	1	6
13.4	17.9	1	3	3	0	0	0	0	0	2	2	0	0	0	0	0	0	11
17.9	22.4	0	1	1	0	0	0	0	0	0	5	0	0	0	3	0	0	10
22.4	29.1	0	0	0	0	0	0	0	0	0	1	2	3	2	0	0	0	8
29.1	40.3	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		12	13	7	0	0	0	0	0	4	9	3	4	2	3	2	6	65

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
2.2	4.5	7	4	5	0	0	1	1	0	1	3	1	1	0	0	3	4	31
4.5	6.7	6	7	2	0	0	0	1	3	5	1	2	0	0	1	0	2	30
6.7	8.9	0	2	0	1	0	1	1	2	6	6	2	0	2	0	1	1	25
8.9	11.2	4	3	2	0	0	0	0	1	8	6	0	2	0	1	2	1	30
11.2	13.4	1	0	0	0	0	1	0	0	4	2	1	1	0	1	2	0	13
13.4	17.9	1	3	1	0	0	1	0	1	4	9	1	8	6	0	1	1	37
17.9	22.4	0	0	1	0	0	0	0	0	0	1	0	2	3	1	0	0	8
22.4	29.1	0	0	0	0	0	0	0	0	0	2	1	4	4	0	2	0	13
29.1	40.3	0	0	0	0	0	0	0	0	0	1	3	1	1	1	0	0	7
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		19	19	11	1	0	4	3	7	28	31	11	19	16	5	11	10	195

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	3	3	1	2	3	6	6	5	4	1	1	0	1	1	0	1	38
2.2	4.5	7	11	7	7	12	11	18	22	22	13	8	7	6	7	4	4	166
4.5	6.7	4	10	6	6	2	13	19	23	33	19	7	4	4	4	5	1	160
6.7	8.9	7	4	6	3	8	6	8	16	18	10	8	3	5	3	3	7	115
8.9	11.2	4	1	4	1	6	4	7	9	16	9	6	5	5	4	6	3	90
11.2	13.4	2	0	2	0	1	1	2	6	10	10	3	1	2	3	1	1	45
13.4	17.9	4	3	0	0	0	2	1	3	13	10	10	4	3	11	4	1	69
17.9	22.4	1	0	1	0	0	0	1	1	1	9	2	5	3	9	5	2	40
22.4	29.1	1	0	0	0	0	0	0	0	0	5	7	3	6	11	6	0	39
29.1	40.3	0	0	0	0	0	0	0	0	0	3	4	0	5	2	2	0	16
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		33	32	27	19	32	43	62	85	117	89	56	32	40	55	36	20	778

Table 5-4 2nd Quarter Average, 245 Ft AGL (Continued)

Stability Class: E

Wind Speed Min	Wind Speed Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	2	3	2	3	2	0	2	0	1	3	3	0	21
2.2	4.5	2	0	0	1	3	4	6	5	6	2	3	6	6	5	5	0	54
4.5	6.7	1	1	1	2	0	1	6	3	4	4	0	3	3	9	4	2	44
6.7	8.9	4	5	4	2	1	1	2	7	8	4	4	4	5	4	3	4	62
8.9	11.2	2	4	1	0	1	2	7	7	9	4	4	4	3	6	2	2	58
11.2	13.4	3	0	1	0	0	0	1	7	7	3	1	3	5	4	5	1	41
13.4	17.9	0	0	1	0	0	2	1	5	14	9	6	7	10	23	11	4	93
17.9	22.4	1	2	1	0	0	0	2	2	4	8	6	5	2	35	6	1	75
22.4	29.1	0	0	0	0	0	0	0	0	1	2	2	0	4	16	5	0	30
29.1	40.3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		13	12	9	5	7	13	27	39	55	37	28	32	39	105	45	14	480

Stability Class: F

Wind Speed Min	Wind Speed Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	1	2	1	1	2	4	1	1	1	0	4	1	1	20
2.2	4.5	3	3	2	5	2	3	6	5	6	5	5	11	9	4	4	1	74
4.5	6.7	5	1	5	0	2	0	6	3	4	4	5	3	1	3	5	6	53
6.7	8.9	1	3	3	0	1	1	4	8	8	2	2	1	2	5	5	2	48
8.9	11.2	4	2	3	2	0	1	2	5	4	2	2	0	1	2	8	3	41
11.2	13.4	0	1	0	0	1	0	0	3	3	5	1	0	2	3	1	1	21
13.4	17.9	0	0	1	0	0	0	2	7	3	4	3	0	2	8	4	2	36
17.9	22.4	0	1	1	1	0	0	0	2	2	5	1	0	1	6	3	0	23
22.4	29.1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	5
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		13	11	15	9	8	6	21	35	34	33	20	16	18	35	31	16	321

Stability Class: G

Wind Speed Min	Wind Speed Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	2	2	1	2	0	1	1	3	1	4	4	0	0	0	0	3	24
2.2	4.5	4	6	7	3	0	1	2	6	8	2	2	2	2	2	8	3	58
4.5	6.7	3	2	2	0	0	1	5	11	4	2	0	0	1	0	1	9	41
6.7	8.9	5	2	3	0	0	1	1	7	4	2	1	2	0	1	4	4	37
8.9	11.2	0	0	0	0	0	0	1	3	7	1	0	0	0	1	7	4	24
11.2	13.4	0	0	1	0	0	0	0	3	4	2	1	0	0	0	1	2	14
13.4	17.9	0	0	0	0	0	0	1	1	2	2	3	0	0	1	0	0	10
17.9	22.4	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
22.4	29.1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		14	12	16	7	0	4	11	34	30	15	11	4	3	5	21	25	212

Stability Class: All

Wind Speed Min	Wind Speed Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	5	5	2	5	7	11	10	13	11	6	8	1	2	8	4	6	104
2.2	4.5	24	24	21	16	17	20	33	38	43	25	19	27	23	18	24	12	384
4.5	6.7	26	25	16	8	4	15	37	43	50	30	14	10	9	17	15	23	342
6.7	8.9	20	20	17	6	10	10	16	40	44	25	17	10	14	13	16	20	298
8.9	11.2	17	12	10	3	7	7	17	25	44	22	12	11	9	14	27	15	252
11.2	13.4	11	1	6	0	2	2	3	19	30	22	7	5	9	11	10	7	145
13.4	17.9	10	11	6	0	0	5	5	17	40	37	23	19	21	43	20	8	265
17.9	22.4	2	6	11	2	0	0	3	5	8	32	9	12	9	54	14	3	170
22.4	29.1	1	0	1	1	0	0	0	0	1	19	12	10	17	27	16	0	105
29.1	40.3	0	0	0	0	0	0	0	0	0	5	9	2	7	3	3	0	29
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		116	104	90	41	47	70	124	200	271	223	130	107	120	208	149	94	2094

Periods of Calm while in Stability Class:							
A	B	C	D	E	F	G	Total
0	0	0	26	6	13	8	53

Table 5-5 3rd Quarter Average, 33 Ft AGL

Elevation: 33 Start Date: 7/1/2013 Total number of Periods: 2208
Period: 3rd Quarter Stop Date: 10/1/2013 Periods of No Data Recovery: 13
System Percent Data Recovery: 99.4%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
13.4	17.9	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
17.9	22.4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
22.4	29.1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		7	0	0	0	0	0	0	0	0	2	0	0	0	1	0	2	12

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	3
6.7	8.9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3
8.9	11.2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
11.2	13.4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
13.4	17.9	6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	7
17.9	22.4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
22.4	29.1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		16	0	1	0	0	0	0	0	0	1	2	0	0	0	1	2	23

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2
2.2	4.5	5	7	1	0	2	0	1	0	0	0	0	1	1	1	1	2	22
4.5	6.7	5	10	11	2	0	0	1	1	2	1	2	1	1	2	0	6	45
6.7	8.9	6	10	1	3	1	0	0	2	2	1	1	1	0	0	1	7	36
8.9	11.2	4	0	0	1	0	0	0	3	5	2	2	0	0	0	0	3	20
11.2	13.4	4	2	0	0	0	0	1	1	5	1	1	1	0	0	0	5	21
13.4	17.9	2	1	0	0	0	0	0	1	4	2	0	0	1	1	1	2	15
17.9	22.4	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		26	30	14	6	3	0	3	8	19	8	6	4	3	4	4	25	163

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	3	0	2	5	4	2	5	4	4	3	3	4	4	0	5	7	55
2.2	4.5	4	7	27	5	9	12	19	24	11	10	5	2	1	8	8	7	159
4.5	6.7	7	15	25	13	9	20	39	37	25	13	5	5	3	6	3	8	233
6.7	8.9	4	8	20	4	10	10	22	24	18	5	5	8	4	4	7	1	154
8.9	11.2	4	6	6	6	2	9	16	13	11	4	5	0	3	2	3	7	97
11.2	13.4	1	1	0	0	0	1	5	3	15	3	1	1	1	3	2	2	39
13.4	17.9	3	0	0	0	0	0	3	2	7	13	4	0	2	1	5	3	43
17.9	22.4	0	0	0	0	0	0	0	0	1	8	0	0	0	1	2	3	15
22.4	29.1	0	0	0	0	0	0	0	0	0	2	3	0	0	0	4	0	9
29.1	40.3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		26	37	80	33	34	54	109	107	92	61	32	20	18	25	39	38	805

Table 5-5 3rd Quarter Average, 33 Ft AGL (Continued)

Stability Class: E

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	5	2	1	1	1	3	2	3	5	4	3	2	1	3	1	37
2.2	4.5	6	1	6	2	1	5	7	10	3	8	3	5	3	4	6	7	77
4.5	6.7	2	0	8	2	3	1	7	12	9	10	2	5	5	3	8	7	84
6.7	8.9	3	2	1	0	0	2	12	10	10	5	0	2	4	4	15	13	83
8.9	11.2	2	0	0	0	0	3	7	6	12	3	2	2	2	10	17	9	75
11.2	13.4	0	0	0	0	0	0	2	14	5	4	4	0	2	7	8	5	51
13.4	17.9	0	0	0	0	0	0	0	7	11	9	0	1	4	7	18	0	57
17.9	22.4	0	0	0	0	0	0	0	2	1	3	1	0	1	2	4	0	14
22.4	29.1	0	0	0	0	0	0	0	0	0	4	1	0	1	0	0	0	6
29.1	40.3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		13	8	17	5	5	12	38	63	54	51	18	18	24	38	79	42	485

Stability Class: F

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	2	5	3	2	1	0	1	3	2	2	2	1	4	1	2	2	33
2.2	4.5	18	13	10	1	0	1	8	12	7	11	4	1	2	2	6	16	112
4.5	6.7	6	8	3	1	0	2	7	16	15	5	1	1	2	2	14	8	91
6.7	8.9	4	0	4	0	0	0	4	21	12	1	0	1	4	3	9	5	68
8.9	11.2	1	0	0	0	0	0	3	6	5	2	0	0	2	4	5	0	28
11.2	13.4	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		31	26	20	4	1	3	23	59	42	21	7	4	14	12	36	31	334

Stability Class: G

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	5	5	3	3	1	3	5	4	5	1	0	1	4	3	2	6	51
2.2	4.5	15	28	9	2	1	2	3	11	14	3	3	1	0	3	4	13	112
4.5	6.7	19	9	7	1	0	0	6	15	15	3	1	0	1	2	9	12	100
6.7	8.9	2	0	0	0	0	0	0	15	15	1	0	0	1	0	5	4	43
8.9	11.2	0	0	0	0	0	0	0	2	3	0	0	0	0	0	1	0	6
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		41	42	19	6	2	5	14	47	52	8	4	2	6	8	21	35	312

Stability Class: All

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	10	15	11	11	7	6	14	13	14	11	9	9	14	5	13	16	178
2.2	4.5	48	56	53	10	13	20	38	57	35	32	15	10	7	19	25	45	483
4.5	6.7	40	42	55	19	12	23	60	81	66	32	11	12	12	15	34	42	556
6.7	8.9	21	20	26	7	11	12	38	72	57	13	6	12	13	11	38	31	388
8.9	11.2	14	6	6	7	2	12	26	30	36	11	9	2	7	16	26	20	230
11.2	13.4	11	3	0	0	0	1	8	19	26	8	6	2	3	10	10	12	119
13.4	17.9	15	1	0	0	0	0	3	10	22	25	4	1	7	9	24	6	127
17.9	22.4	1	0	0	0	0	0	0	2	3	12	2	0	1	3	6	3	33
22.4	29.1	0	0	0	0	0	0	0	0	0	8	5	0	1	0	4	0	18
29.1	40.3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		160	143	151	54	45	74	187	284	259	152	69	48	65	88	180	175	2134

Periods of Calm while in Stability Class:

A	B	C	D	E	F	G	Total
0	0	0	17	10	17	17	61

Table 5-6 3rd Quarter Average, 245 Ft AGL

Elevation: 245 Start Date: 7/1/2013 Total number of Periods: 2208
Period: 3rd Quarter Stop Date: 10/1/2013 Periods of No Data Recovery: 13
System Percent Data Recovery: 99.4%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.9	11.2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
11.2	13.4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
13.4	17.9	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
17.9	22.4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		8	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	11

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2
4.5	6.7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
6.7	8.9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
8.9	11.2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5
11.2	13.4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
13.4	17.9	6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	7
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
29.1	40.3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		13	1	0	1	0	0	0	0	0	1	2	0	0	0	1	4	23

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	1	4
2.2	4.5	6	2	6	2	1	1	0	0	1	0	0	1	0	2	1	5	28
4.5	6.7	3	9	7	3	0	1	0	1	1	1	3	1	1	1	1	6	39
6.7	8.9	4	7	1	2	3	0	0	3	4	0	1	0	0	0	2	6	33
8.9	11.2	5	1	0	0	1	0	0	0	3	3	2	1	0	0	0	3	19
11.2	13.4	4	1	0	0	0	0	1	1	3	2	1	1	0	0	0	5	19
13.4	17.9	2	1	0	0	0	0	0	1	2	5	0	0	0	1	1	2	15
17.9	22.4	0	0	0	0	0	0	0	0	1	2	0	1	0	0	0	1	5
22.4	29.1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		24	21	16	8	5	2	1	6	15	14	7	5	1	4	5	29	163

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	2	8	7	3	2	3	10	9	10	4	3	1	3	3	3	6	77
2.2	4.5	3	8	20	12	6	7	23	30	7	8	3	4	2	7	8	7	155
4.5	6.7	2	14	22	7	14	15	19	26	24	10	6	7	2	6	0	4	178
6.7	8.9	3	2	14	11	7	17	18	15	15	7	4	5	2	3	3	2	128
8.9	11.2	5	4	3	8	6	19	12	7	8	6	4	2	3	2	4	6	99
11.2	13.4	1	1	2	0	6	6	6	6	11	3	2	1	0	1	4	5	55
13.4	17.9	3	0	0	0	1	6	4	2	13	11	3	0	4	3	2	2	54
17.9	22.4	0	0	0	0	0	0	1	0	0	9	3	0	1	1	3	2	20
22.4	29.1	0	0	0	0	0	0	0	0	2	6	3	0	0	1	5	0	17
29.1	40.3	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4
40.3	90.0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTALS		19	37	68	41	42	73	93	95	90	64	36	20	17	27	32	34	788

Table 5-6 3rd Quarter Average, 245 Ft AGL (Continued)

Stability Class: E

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	1	1	1	1	2	2	5	1	1	2	0	1	1	0	0	19
2.2	4.5	1	2	6	3	3	2	2	5	6	1	4	5	3	4	2	1	50
4.5	6.7	3	0	2	2	1	2	5	12	3	4	3	3	4	3	7	5	59
6.7	8.9	3	2	2	1	1	2	3	6	5	5	0	2	8	5	8	3	56
8.9	11.2	0	0	0	1	0	2	5	7	3	3	2	2	6	3	10	1	45
11.2	13.4	2	0	0	1	0	1	4	2	6	7	1	3	1	4	7	3	42
13.4	17.9	0	0	0	0	0	2	3	7	19	7	2	0	4	17	28	5	94
17.9	22.4	0	0	0	0	0	0	0	3	13	9	5	1	4	18	18	1	72
22.4	29.1	0	0	0	0	0	0	0	2	1	10	2	1	2	15	1	0	34
29.1	40.3	0	0	0	0	0	0	0	1	0	4	3	1	1	1	0	0	11
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		9	5	11	9	6	13	24	50	57	51	24	18	34	71	81	19	482

Stability Class: F

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	4	3	2	2	2	0	1	3	3	1	2	3	2	4	6	3	41
2.2	4.5	2	5	5	4	1	0	6	4	6	1	6	1	1	2	5	8	57
4.5	6.7	2	4	5	1	1	1	2	4	7	1	4	1	4	2	6	3	48
6.7	8.9	1	1	1	3	0	1	2	12	7	2	0	2	0	0	10	9	51
8.9	11.2	2	0	3	0	0	1	1	8	9	0	3	0	0	4	8	3	42
11.2	13.4	0	0	0	1	0	0	2	3	6	6	0	0	1	4	9	3	35
13.4	17.9	0	0	0	0	0	0	2	6	9	7	0	0	2	16	11	5	58
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	2	6	1	0	9
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		11	13	16	11	4	3	16	40	47	18	15	7	12	38	56	34	341

Stability Class: G

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	2	2	3	2	0	1	4	6	8	1	4	1	2	1	3	1	41
2.2	4.5	8	3	8	2	2	1	3	11	13	8	3	3	2	3	4	6	80
4.5	6.7	9	2	4	1	0	1	2	10	5	4	2	0	1	1	5	6	53
6.7	8.9	1	0	3	2	0	0	2	8	5	7	1	1	0	0	8	17	55
8.9	11.2	1	0	0	0	0	0	1	7	7	4	0	0	0	0	8	6	34
11.2	13.4	1	0	0	0	0	0	0	2	1	4	0	1	1	0	8	4	22
13.4	17.9	0	0	0	0	0	0	2	2	2	0	0	0	1	9	5	1	22
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		22	7	18	7	2	3	14	46	41	28	10	6	7	17	41	41	310

Stability Class: All

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	8	14	15	9	5	6	17	23	22	7	11	5	8	9	12	11	162
2.2	4.5	20	20	45	24	13	11	34	50	33	18	16	14	8	18	20	28	372
4.5	6.7	21	29	40	14	16	20	28	53	40	20	18	12	12	13	19	24	379
6.7	8.9	13	12	21	19	11	20	25	44	36	21	6	10	10	8	32	37	325
8.9	11.2	16	6	6	9	7	22	19	29	30	16	11	5	9	9	30	22	246
11.2	13.4	11	2	2	2	6	7	13	14	27	22	4	6	3	9	28	21	177
13.4	17.9	16	1	0	0	1	8	11	18	45	31	5	0	11	46	47	15	255
17.9	22.4	1	0	0	0	0	0	1	3	14	20	8	2	7	28	22	4	110
22.4	29.1	0	0	0	0	0	0	0	2	3	17	6	1	2	16	6	0	53
29.1	40.3	0	0	0	0	0	0	0	1	0	5	9	1	1	1	0	0	18
40.3	90.0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTALS		106	84	129	77	59	94	148	237	250	177	95	56	71	157	216	162	2118

Periods of Calm while in Stability Class:							
A	B	C	D	E	F	G	Total
1	0	0	34	13	10	19	77

Table 5-7 4th Quarter Average, 33 Ft AGL

Elevation: 33 Start Date: 10/1/2013 Total number of Periods: 2208
Period: 4th Quarter Stop Date: 1/1/2014 Periods of No Data Recovery: 11
System Percent Data Recovery: 99.5%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2.2	4.5	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	4

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4
4.5	6.7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6.7	8.9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
17.9	22.4	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2
22.4	29.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		4	4	2	0	0	0	0	0	0	1	1	1	0	0	1	0	14

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	5	3	0	1	0	0	0	0	0	0	0	0	0	1	3	7	20
2.2	4.5	9	5	3	2	0	0	0	0	0	0	0	0	0	0	3	8	30
4.5	6.7	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	9
6.7	8.9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
8.9	11.2	1	0	0	0	0	0	0	0	2	0	1	0	0	0	1	3	8
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
13.4	17.9	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	3
17.9	22.4	0	1	0	0	0	0	0	0	0	0	2	2	1	0	0	1	7
22.4	29.1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		22	12	3	3	0	0	0	0	2	1	3	2	1	1	7	27	84

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	13	14	21	5	6	6	6	9	5	4	4	8	3	7	12	9	132
2.2	4.5	15	15	4	0	2	4	5	14	15	11	6	6	1	9	17	24	148
4.5	6.7	5	3	4	0	1	1	9	12	1	0	1	3	2	7	12	10	71
6.7	8.9	4	2	0	1	0	0	4	14	3	2	0	2	0	3	11	12	58
8.9	11.2	3	0	1	0	0	0	4	5	6	0	1	1	2	7	2	4	36
11.2	13.4	1	1	0	0	0	0	0	2	5	2	2	2	1	2	5	6	29
13.4	17.9	4	1	1	0	0	0	0	0	6	9	1	1	2	3	2	4	34
17.9	22.4	12	1	0	0	0	0	0	0	1	4	1	3	4	1	0	0	27
22.4	29.1	3	10	0	0	0	0	0	0	1	7	3	0	1	0	0	0	25
29.1	40.3	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		60	49	31	6	9	11	28	56	43	40	19	26	16	39	61	69	563

Table 5-7 4th Quarter Average, 33 Ft AGL (Continued)

Stability Class: E

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	6	3	2	4	1	2	1	2	6	5	2	5	7	8	11	5	70
2.2	4.5	9	5	5	1	1	2	3	9	6	13	10	10	10	16	16	12	128
4.5	6.7	2	2	9	0	0	1	3	4	11	10	4	1	5	10	9	9	80
6.7	8.9	0	0	2	0	0	0	6	12	13	3	2	1	1	7	8	2	57
8.9	11.2	2	0	0	0	0	0	11	11	3	8	2	3	1	4	12	4	61
11.2	13.4	1	0	0	0	0	0	1	3	7	3	0	3	0	3	6	1	28
13.4	17.9	1	2	0	0	0	0	0	1	10	11	5	2	0	1	7	3	43
17.9	22.4	3	5	0	0	0	0	0	0	3	15	4	2	0	0	0	0	32
22.4	29.1	0	0	0	0	0	0	0	0	1	6	0	0	0	0	0	0	7
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		24	17	18	5	2	5	25	42	60	74	29	27	24	49	69	36	506

Stability Class: F

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	10	3	3	1	3	0	4	3	5	8	7	5	9	12	16	12	101
2.2	4.5	10	8	9	3	0	0	3	6	8	10	5	5	15	16	25	21	144
4.5	6.7	0	3	4	0	0	0	1	13	9	3	4	0	2	8	10	12	69
6.7	8.9	0	0	0	1	0	0	5	18	17	7	2	0	4	6	11	3	74
8.9	11.2	0	0	0	0	0	0	1	15	6	2	1	0	0	0	3	1	29
11.2	13.4	0	0	0	0	0	0	1	5	1	1	0	0	0	0	0	0	8
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		20	14	16	5	3	0	15	60	46	31	19	10	30	42	65	49	425

Stability Class: G

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	15	12	4	1	0	2	2	5	4	9	5	10	15	14	17	19	134
2.2	4.5	26	24	12	0	0	0	1	7	12	6	12	9	10	15	30	24	188
4.5	6.7	0	2	3	1	0	0	0	3	5	5	5	0	0	0	13	14	51
6.7	8.9	0	0	0	0	0	0	0	10	9	3	0	0	0	4	4	1	31
8.9	11.2	0	0	0	0	0	0	1	6	0	0	0	0	0	0	0	0	7
11.2	13.4	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	3
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		41	38	20	2	0	2	4	33	30	23	22	19	25	33	64	58	414

Stability Class: All

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	50	35	30	12	10	10	13	19	20	26	18	28	34	42	59	52	458
2.2	4.5	70	59	36	6	3	6	12	36	41	40	33	30	36	56	91	89	644
4.5	6.7	12	10	20	1	1	2	13	32	26	18	14	4	9	25	44	50	281
6.7	8.9	9	2	2	2	0	0	15	54	42	15	4	3	5	20	35	20	228
8.9	11.2	6	0	1	0	0	0	17	37	17	10	5	4	3	11	18	12	141
11.2	13.4	2	1	1	0	0	0	2	12	13	6	2	5	1	5	11	8	69
13.4	17.9	6	3	1	0	0	0	0	1	16	21	7	3	2	4	9	8	81
17.9	22.4	15	7	0	0	0	0	0	0	4	20	7	8	5	1	0	1	68
22.4	29.1	3	15	0	0	0	0	0	0	2	13	3	0	1	0	0	0	37
29.1	40.3	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		173	134	91	21	14	18	72	191	181	170	93	85	96	164	267	240	2010

Periods of Calm while in Stability Class:							
A	B	C	D	E	F	G	Total
0	0	0	47	35	55	50	187

Table 5-8 4th Quarter Average, 245 Ft AGL

Elevation: 245 Start Date: 10/1/2013 Total number of Periods: 2208
Period: 4th Quarter Stop Date: 1/1/2014 Periods of No Data Recovery: 9
System Percent Data Recovery: 99.6%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2.2	4.5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	3

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2.2	4.5	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4.5	6.7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
6.7	8.9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2
29.1	40.3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		5	4	1	0	0	0	0	0	0	1	1	1	0	0	1	0	14

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	5	3	1	1	0	0	0	0	0	0	0	0	0	0	3	3	16
2.2	4.5	6	3	1	2	0	0	0	0	0	0	0	0	0	1	3	8	24
4.5	6.7	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	9
6.7	8.9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5
8.9	11.2	0	0	0	0	0	0	0	0	2	0	1	0	0	0	1	1	5
11.2	13.4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
13.4	17.9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
17.9	22.4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
22.4	29.1	0	1	1	0	0	0	0	0	0	0	2	2	1	0	0	0	7
29.1	40.3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		19	9	3	3	0	0	0	0	2	1	3	2	1	1	8	23	75

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	15	12	8	4	6	10	8	7	5	8	6	4	4	8	15	7	127
2.2	4.5	11	10	2	1	1	2	5	12	15	6	4	1	5	2	14	18	109
4.5	6.7	5	5	3	1	0	0	11	11	4	1	1	2	3	3	7	17	74
6.7	8.9	4	3	0	0	1	0	1	8	2	2	0	2	1	2	9	12	47
8.9	11.2	3	0	0	0	0	0	2	8	7	0	0	0	1	2	5	5	33
11.2	13.4	1	1	0	0	0	0	1	2	3	2	0	1	1	2	3	3	20
13.4	17.9	0	1	2	0	0	0	0	2	3	5	4	2	3	7	4	6	39
17.9	22.4	1	3	1	0	0	0	0	0	2	7	0	1	2	1	3	2	23
22.4	29.1	9	6	0	0	0	0	0	0	1	3	2	4	5	2	1	0	33
29.1	40.3	1	12	0	0	0	0	0	0	0	11	3	0	0	0	0	0	27
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		50	53	16	6	8	12	28	50	42	45	20	17	25	29	61	70	532

Table 5-8 4th Quarter Average, 245 Ft AGL (Continued)

Stability Class: E

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	6	4	0	3	5	2	6	6	5	2	1	2	3	3	6	4	58
2.2	4.5	8	10	6	6	2	4	4	7	9	7	5	6	7	5	10	6	102
4.5	6.7	2	4	4	2	1	0	2	3	2	5	3	1	2	4	4	5	44
6.7	8.9	2	1	4	1	0	1	3	7	4	2	1	3	4	6	15	5	59
8.9	11.2	2	0	3	0	0	0	8	6	10	3	1	0	0	4	4	1	42
11.2	13.4	2	0	0	0	0	0	2	3	6	6	1	1	3	2	4	1	31
13.4	17.9	2	1	0	0	0	0	0	5	12	6	6	1	1	8	9	8	59
17.9	22.4	2	0	0	0	0	0	0	0	2	15	3	6	0	6	7	3	44
22.4	29.1	1	8	0	0	0	0	0	0	3	14	6	1	1	0	0	5	39
29.1	40.3	0	1	0	0	0	0	0	0	0	13	4	2	0	0	0	0	20
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		27	29	17	12	8	7	25	37	53	73	31	23	21	38	59	38	498

Stability Class: F

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	6	8	2	8	10	5	8	5	3	3	2	2	2	2	4	71
2.2	4.5	11	9	15	9	5	5	9	11	4	3	4	10	1	5	8	5	114
4.5	6.7	6	6	7	5	1	0	1	11	4	3	2	0	3	3	5	10	67
6.7	8.9	4	1	4	1	0	0	2	3	3	4	3	0	2	5	2	1	35
8.9	11.2	3	1	4	1	0	0	12	11	13	3	2	0	0	7	0	3	60
11.2	13.4	2	0	0	0	0	0	3	11	4	1	1	0	1	5	3	4	35
13.4	17.9	2	2	0	0	0	0	1	12	7	6	0	0	1	6	8	6	51
17.9	22.4	0	0	0	0	0	0	0	2	2	4	0	0	1	1	0	0	10
22.4	29.1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		29	25	38	18	14	15	33	69	42	27	16	12	11	34	28	33	444

Stability Class: G

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	5	4	8	6	3	5	7	7	6	4	2	4	1	1	5	3	71
2.2	4.5	7	11	19	10	4	2	7	11	13	7	7	4	7	3	9	11	132
4.5	6.7	9	4	16	5	0	0	6	18	13	4	1	0	1	3	6	18	104
6.7	8.9	7	1	8	3	0	0	2	12	10	5	1	0	0	0	2	16	67
8.9	11.2	2	0	3	0	0	0	1	2	5	6	0	0	0	0	3	8	30
11.2	13.4	1	0	0	0	0	0	2	5	1	3	0	0	0	2	6	1	21
13.4	17.9	0	0	0	0	0	0	0	1	6	2	0	0	0	1	2	1	13
17.9	22.4	0	0	0	0	0	0	0	1	2	0	0	0	0	2	0	0	5
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		31	20	54	24	7	7	25	57	56	31	11	8	9	12	33	58	443

Stability Class: All

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	32	31	25	16	22	27	26	28	21	17	12	12	10	14	31	21	345
2.2	4.5	43	44	45	28	12	13	25	41	41	23	20	21	20	16	44	48	484
4.5	6.7	28	19	30	13	2	0	20	43	23	13	7	3	9	13	22	55	300
6.7	8.9	22	6	16	5	1	1	8	30	19	13	5	5	7	13	29	37	217
8.9	11.2	10	1	10	1	0	0	23	27	37	12	4	0	1	13	14	18	171
11.2	13.4	7	1	0	0	0	0	8	21	14	12	2	2	5	11	16	10	109
13.4	17.9	5	4	2	0	0	0	1	20	28	19	11	3	5	22	23	23	166
17.9	22.4	3	3	1	0	0	0	0	3	8	27	3	7	3	10	10	6	84
22.4	29.1	10	15	1	0	0	0	0	0	4	18	11	8	7	2	1	5	82
29.1	40.3	1	17	0	0	0	0	0	0	0	24	7	2	0	0	0	0	51
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		161	141	130	63	37	41	111	213	195	178	82	63	67	114	190	223	2009

Periods of Calm while in Stability Class:

A	B	C	D	E	F	G	Total
1	0	9	78	43	36	23	190

Table 5-9 Year 2013, 33 Ft AGL

Elevation: 33 Start Date: 1/1/2013 Total number of Periods: 8760
Period: Annual 2013 Stop Date: 1/1/2014 Periods of No Data Recovery: 71
System Percent Data Recovery: 99.2%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2.2	4.5	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	4
4.5	6.7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
6.7	8.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5
8.9	11.2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
11.2	13.4	5	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	8
13.4	17.9	9	0	0	0	0	0	0	0	2	3	0	0	0	0	0	2	16
17.9	22.4	1	3	4	0	0	0	0	0	0	3	0	0	0	0	1	0	12
22.4	29.1	0	0	0	0	0	0	0	0	0	4	1	0	2	0	2	0	9
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		22	4	5	0	0	0	0	0	4	10	1	0	2	1	3	8	60

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2	6
4.5	6.7	11	3	1	0	0	0	0	0	0	1	0	0	0	0	0	3	19
6.7	8.9	10	4	0	0	0	0	0	0	0	0	0	0	0	0	2	2	18
8.9	11.2	5	3	0	0	0	0	0	0	1	0	0	0	0	0	2	3	14
11.2	13.4	5	0	2	0	0	0	0	1	1	1	0	0	0	0	1	1	12
13.4	17.9	9	1	3	0	0	0	0	0	4	5	1	0	0	2	0	0	25
17.9	22.4	0	1	1	0	0	0	0	0	0	3	1	2	1	2	1	0	12
22.4	29.1	0	2	0	0	0	0	0	0	0	2	4	2	1	0	0	0	11
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		40	16	9	0	0	0	0	1	6	12	6	5	2	4	6	11	118

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	9	3	1	1	1	0	0	0	0	0	1	1	0	2	12	9	40
2.2	4.5	24	16	9	2	2	0	2	1	2	2	2	1	1	3	7	22	96
4.5	6.7	19	19	13	3	0	1	4	2	7	3	5	1	1	4	0	26	108
6.7	8.9	15	12	3	3	1	1	1	4	12	5	2	1	2	1	2	12	77
8.9	11.2	10	3	0	1	0	1	0	10	18	3	6	0	2	5	5	7	71
11.2	13.4	6	4	0	0	0	0	1	5	16	5	3	7	2	1	3	7	60
13.4	17.9	5	2	1	0	0	0	0	2	11	9	2	5	9	4	2	5	57
17.9	22.4	0	1	1	0	0	0	0	0	2	4	4	5	4	3	1	1	26
22.4	29.1	0	3	0	0	0	0	0	0	0	3	6	3	4	0	2	0	21
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		88	63	28	10	4	3	8	24	68	34	31	24	25	24	34	89	557

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	27	20	33	18	16	12	17	19	17	13	14	18	16	19	28	26	313
2.2	4.5	51	51	46	17	27	28	53	71	72	51	24	25	17	45	60	72	710
4.5	6.7	27	42	41	17	18	36	87	107	79	27	12	17	12	33	48	34	637
6.7	8.9	21	14	27	10	19	14	44	78	63	17	11	15	10	20	37	31	431
8.9	11.2	12	9	13	6	2	10	28	50	51	14	10	5	9	21	20	20	280
11.2	13.4	6	2	3	0	0	1	12	19	37	13	7	6	6	14	10	11	147
13.4	17.9	8	4	2	0	0	0	5	8	32	52	20	8	13	20	20	9	201
17.9	22.4	14	1	0	0	0	0	0	1	4	26	11	9	10	15	6	4	101
22.4	29.1	3	10	0	0	0	0	0	0	1	13	13	2	6	6	6	0	60
29.1	40.3	0	2	0	0	0	0	0	0	0	3	3	1	0	0	0	0	9
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		169	155	165	68	82	101	246	353	356	229	125	106	99	193	235	207	2889

Table 5-9 Year 2013, 33 Ft AGL (Continued)

Stability Class: E

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	10	9	9	11	3	12	11	9	16	14	14	13	19	25	32	10	217
2.2	4.5	23	15	16	7	6	13	23	46	26	34	24	30	25	39	40	34	401
4.5	6.7	12	9	28	2	3	6	25	40	46	26	10	14	26	29	28	34	338
6.7	8.9	8	5	7	1	1	3	39	49	37	20	8	18	15	21	35	16	283
8.9	11.2	4	1	3	0	0	4	35	33	37	19	12	12	13	35	40	14	262
11.2	13.4	1	2	0	0	0	0	5	27	24	24	12	6	8	35	26	9	179
13.4	17.9	2	3	0	0	0	0	0	9	37	40	17	7	9	32	34	3	193
17.9	22.4	3	5	0	0	0	0	0	2	7	21	9	3	2	7	4	0	63
22.4	29.1	0	0	0	0	0	0	0	0	1	11	1	0	1	0	1	0	15
29.1	40.3	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	2
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		63	49	63	21	13	38	138	215	231	210	108	103	118	223	240	120	1953

Stability Class: F

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	16	20	13	6	9	5	15	12	18	19	17	17	18	26	27	20	258
2.2	4.5	45	45	29	7	2	5	35	42	31	38	25	12	21	40	63	55	495
4.5	6.7	12	20	13	2	0	4	25	66	49	16	11	7	6	19	45	47	342
6.7	8.9	5	1	5	2	0	1	20	69	51	18	4	2	12	19	31	9	249
8.9	11.2	1	1	2	0	0	0	11	31	21	6	2	2	6	10	10	1	104
11.2	13.4	0	0	0	0	0	0	1	12	7	6	0	2	0	5	1	0	34
13.4	17.9	0	0	0	0	0	0	0	0	4	7	0	1	1	0	1	0	14
17.9	22.4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		79	87	62	17	11	15	107	232	183	110	59	43	64	119	178	132	1498

Stability Class: G

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	34	28	13	5	3	7	14	19	19	21	8	13	25	26	27	37	299
2.2	4.5	62	68	29	2	1	4	16	39	37	21	20	18	19	27	62	61	486
4.5	6.7	28	18	14	2	0	0	11	42	37	9	8	2	1	6	39	39	256
6.7	8.9	2	0	3	0	0	0	2	51	31	6	1	0	1	4	10	6	117
8.9	11.2	0	0	3	0	0	0	1	17	11	4	0	0	0	0	1	0	37
11.2	13.4	0	0	1	1	0	0	1	5	0	2	0	0	0	0	0	0	10
13.4	17.9	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		126	114	63	10	4	11	45	174	135	63	37	33	46	63	139	143	1206

Stability Class: All

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	97	80	69	41	32	36	57	59	70	67	54	62	78	98	126	102	1128
2.2	4.5	206	197	132	35	38	50	129	199	168	146	95	86	83	155	232	247	2198
4.5	6.7	111	111	110	26	21	47	152	257	218	82	46	41	46	91	160	183	1702
6.7	8.9	61	37	45	16	21	19	106	251	194	66	26	36	40	65	117	80	1180
8.9	11.2	35	17	21	7	2	15	75	141	139	46	30	19	30	71	78	45	771
11.2	13.4	23	8	6	1	0	1	20	69	87	51	22	21	16	55	41	29	450
13.4	17.9	33	10	6	0	0	0	5	20	90	116	40	21	32	58	57	19	507
17.9	22.4	18	11	6	0	0	0	0	3	15	57	25	19	17	27	13	5	216
22.4	29.1	3	15	0	0	0	0	0	0	2	33	25	7	14	6	11	0	116
29.1	40.3	0	2	0	0	0	0	0	0	0	4	4	2	0	1	0	0	13
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		587	488	395	126	114	168	544	999	983	668	367	314	356	627	835	710	8281

Periods of Calm while in Stability Class:

A	B	C	D	E	F	G	Total
0	0	1	110	77	107	113	408

Table 5-10 Year 2013, 245 Ft AGL

Elevation: 245 Start Date: 1/1/2013 Total number of Periods: 8760
Period: Annual 2013 Stop Date: 1/1/2014 Periods of No Data Recovery: 75
System Percent Data Recovery: 99.1%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2.2	4.5	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4.5	6.7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
6.7	8.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
8.9	11.2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
11.2	13.4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6
13.4	17.9	9	2	0	0	0	0	0	0	2	1	0	0	0	0	0	0	14
17.9	22.4	1	2	5	0	0	0	0	0	1	4	0	0	0	0	0	0	13
22.4	29.1	0	0	0	0	0	0	0	0	0	4	0	0	1	0	3	0	8
29.1	40.3	0	0	0	0	0	0	0	0	0	1	2	0	1	0	0	0	4
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		21	6	6	0	0	0	0	0	3	10	2	0	2	0	3	4	57

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
2.2	4.5	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	6
4.5	6.7	13	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	20
6.7	8.9	8	4	1	0	0	0	0	0	0	1	0	0	0	0	1	1	16
8.9	11.2	3	3	0	0	0	0	0	0	0	0	0	0	0	0	3	4	13
11.2	13.4	3	0	2	0	0	0	0	0	2	0	0	0	0	0	0	3	10
13.4	17.9	7	3	3	0	0	0	0	0	2	4	1	0	0	0	0	0	20
17.9	22.4	0	1	1	0	0	0	0	0	0	5	0	0	0	3	0	0	10
22.4	29.1	0	0	0	0	0	0	0	0	0	4	4	4	2	1	1	0	16
29.1	40.3	0	2	0	0	0	0	0	0	0	0	2	1	0	0	0	0	5
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		36	19	8	1	0	0	0	0	4	14	7	5	2	4	5	13	118

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	6	4	3	2	0	0	0	0	0	0	0	0	0	0	4	5	24
2.2	4.5	26	12	13	4	1	2	1	0	2	3	1	2	0	6	7	25	105
4.5	6.7	17	20	10	3	0	1	1	4	7	2	6	1	1	3	1	21	98
6.7	8.9	7	12	2	3	3	1	1	5	10	6	3	0	2	0	4	14	73
8.9	11.2	11	4	2	0	1	0	0	3	14	9	3	3	0	3	4	5	62
11.2	13.4	7	1	0	0	0	1	1	1	9	8	2	2	2	1	4	7	46
13.4	17.9	4	4	1	0	0	1	0	2	11	18	3	10	7	1	2	8	72
17.9	22.4	0	0	1	0	0	0	0	0	1	4	2	3	6	3	1	2	23
22.4	29.1	0	1	1	0	0	0	0	0	0	4	4	8	7	1	4	0	30
29.1	40.3	0	2	0	0	0	0	0	0	0	1	4	2	1	1	0	0	11
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		78	60	33	12	5	6	4	15	54	55	28	31	26	19	31	87	544

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	23	32	21	11	13	21	27	28	26	18	14	7	10	19	26	26	322
2.2	4.5	38	45	47	22	20	20	48	72	63	39	28	20	22	32	59	52	627
4.5	6.7	22	36	37	15	17	28	53	69	83	37	16	19	11	21	27	37	528
6.7	8.9	27	11	23	16	16	23	31	47	59	30	16	11	9	10	32	32	393
8.9	11.2	15	6	8	9	12	23	22	34	44	24	11	8	9	13	24	24	286
11.2	13.4	5	2	4	0	7	7	9	15	39	22	5	3	3	12	17	15	165
13.4	17.9	7	4	2	0	1	8	5	10	38	39	22	10	10	29	16	13	214
17.9	22.4	2	3	2	0	0	0	2	2	8	39	13	8	8	15	12	6	120
22.4	29.1	10	6	0	0	0	0	0	0	4	20	19	10	11	18	12	0	110
29.1	40.3	1	12	0	0	0	0	0	0	0	15	16	3	5	3	3	0	58
40.3	90.0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	3
TOTALS		150	157	144	73	86	130	197	277	364	285	161	99	98	172	228	205	2826

Table 5-10 Year 2013, 245 Ft AGL (Continued)

Stability Class: E

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	7	9	5	5	12	7	13	16	12	5	6	2	6	10	14	13	142
2.2	4.5	16	14	20	11	8	15	23	21	30	13	17	20	18	15	23	13	277
4.5	6.7	10	9	15	8	2	3	15	27	23	17	10	10	11	23	22	21	226
6.7	8.9	13	12	17	5	3	4	11	27	29	15	5	10	19	21	36	16	243
8.9	11.2	6	4	7	2	1	4	23	24	26	13	9	8	14	19	19	8	187
11.2	13.4	7	0	1	1	0	1	9	22	24	21	7	9	11	22	18	5	158
13.4	17.9	2	1	3	0	0	4	5	20	55	35	22	10	18	57	52	20	304
17.9	22.4	3	2	1	0	0	0	2	5	22	45	26	17	8	66	37	5	239
22.4	29.1	1	8	0	0	0	0	0	2	6	36	18	6	7	41	7	5	137
29.1	40.3	0	1	0	0	0	0	0	1	0	22	9	5	1	3	1	0	43
40.3	90.0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTALS		65	60	69	32	26	38	101	165	227	222	130	97	113	277	229	106	1957

Stability Class: F

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	6	12	13	6	15	13	11	18	16	6	8	8	8	12	10	11	173
2.2	4.5	20	22	28	23	13	13	24	28	22	14	19	24	12	12	21	22	317
4.5	6.7	25	22	28	7	4	3	11	36	25	16	11	9	8	13	21	24	263
6.7	8.9	10	9	13	5	1	2	14	32	25	15	6	4	8	15	20	20	199
8.9	11.2	10	4	14	3	0	2	17	32	31	8	8	3	2	16	21	13	184
11.2	13.4	2	1	0	1	1	0	6	24	18	19	5	0	8	13	22	8	128
13.4	17.9	3	2	1	0	0	0	7	32	26	27	5	0	6	39	26	14	188
17.9	22.4	0	1	1	1	0	0	1	5	5	16	1	0	7	21	7	0	66
22.4	29.1	0	0	0	0	0	0	0	0	0	7	2	0	4	3	0	0	16
29.1	40.3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		76	73	98	46	34	33	91	207	168	129	65	48	63	144	148	112	1535

Stability Class: G

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	10	9	13	12	3	8	14	22	17	9	12	6	3	3	9	8	158
2.2	4.5	22	25	37	21	7	5	20	36	45	26	16	14	12	11	27	20	344
4.5	6.7	28	15	25	7	0	2	20	49	35	22	7	3	5	5	15	39	277
6.7	8.9	17	10	18	5	0	1	6	33	26	23	8	4	1	6	19	39	216
8.9	11.2	4	0	4	1	0	0	3	16	23	12	2	4	3	2	22	21	117
11.2	13.4	2	0	1	0	0	0	2	10	8	13	2	1	1	3	16	11	70
13.4	17.9	1	0	0	0	0	0	4	6	13	7	4	0	1	12	9	2	59
17.9	22.4	0	0	1	1	0	0	0	1	2	2	0	0	0	7	0	0	14
22.4	29.1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		84	59	100	48	10	16	69	173	169	114	51	32	26	49	117	140	1257

Stability Class: All

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	52	68	55	36	43	49	65	84	71	38	40	23	27	44	63	64	822
2.2	4.5	125	119	147	82	49	55	116	157	162	95	81	80	64	76	137	133	1678
4.5	6.7	117	106	115	40	23	37	100	185	173	94	50	42	36	65	86	146	1415
6.7	8.9	82	59	74	34	23	31	63	144	149	90	38	29	39	52	112	123	1142
8.9	11.2	52	21	35	15	14	29	65	109	138	66	33	26	28	53	93	76	853
11.2	13.4	31	4	8	2	8	9	27	72	100	83	21	15	25	51	77	50	583
13.4	17.9	33	16	10	0	1	13	21	70	147	131	57	30	42	138	105	57	871
17.9	22.4	6	9	12	2	0	0	5	13	39	115	42	28	29	115	57	13	485
22.4	29.1	11	15	2	1	0	0	0	2	10	75	47	28	32	64	27	5	319
29.1	40.3	1	17	0	0	0	0	0	1	0	40	33	11	8	7	4	0	122
40.3	90.0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	4
TOTALS		510	434	458	212	161	223	462	837	989	829	444	312	330	665	761	667	8294

Periods of Calm while in Stability Class:

A	B	C	D	E	F	G	Total
2	0	13	172	74	70	60	391

Table 5-11 Year 2013 Growing Season - Daylight Hours

(Solar Irradiance > 5 watts/m^2; 33 Ft AGL)

Elevation: 33 | Start Date: 4/15/2013 | Total number of Periods: 2635
Period: Growing Season | Stop Date: 10/15/2013 | Periods of No Data Recovery: 33
Daylight Hours | System Percent Data Recovery: 98.7%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2.2	4.5	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	3
4.5	6.7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
6.7	8.9	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5
8.9	11.2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
11.2	13.4	5	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	8
13.4	17.9	9	0	0	0	0	0	0	0	2	3	0	0	0	0	0	2	16
17.9	22.4	1	3	4	0	0	0	0	0	0	3	0	0	0	0	1	0	12
22.4	29.1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	5
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		22	4	5	0	0	0	0	0	4	9	0	0	0	1	3	7	55

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4.5	6.7	6	3	1	0	0	0	0	0	0	1	0	0	0	0	0	2	13
6.7	8.9	10	3	0	0	0	0	0	0	0	0	0	0	0	0	2	2	17
8.9	11.2	5	3	0	0	0	0	0	0	1	0	0	0	0	0	2	3	14
11.2	13.4	5	0	2	0	0	0	0	1	1	1	0	0	0	0	0	1	11
13.4	17.9	9	1	3	0	0	0	0	0	3	5	1	0	0	2	0	0	24
17.9	22.4	0	1	1	0	0	0	0	0	0	2	1	1	1	1	0	0	8
22.4	29.1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		35	12	7	0	0	0	0	1	5	9	3	1	2	3	4	8	90

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	3	1	1	1	1	0	0	0	0	0	1	1	0	0	1	0	10
2.2	4.5	11	11	9	2	2	0	2	1	2	2	2	1	1	1	3	6	56
4.5	6.7	13	15	13	3	0	1	4	2	6	3	4	1	1	3	0	12	81
6.7	8.9	8	12	3	3	1	1	1	3	11	5	2	1	2	1	2	10	66
8.9	11.2	7	3	0	1	0	1	0	7	15	3	6	0	0	2	2	6	53
11.2	13.4	6	4	0	0	0	0	1	2	9	5	2	5	2	1	1	5	43
13.4	17.9	4	2	1	0	0	0	0	2	7	7	1	3	7	1	2	3	40
17.9	22.4	0	0	1	0	0	0	0	0	2	3	3	4	0	0	0	0	13
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	4
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		52	48	28	10	4	3	8	17	52	28	21	17	14	9	13	42	366

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	5	3	9	7	10	5	11	8	5	6	4	5	5	1	6	9	99
2.2	4.5	12	23	33	14	26	25	43	49	29	21	12	12	6	14	10	15	344
4.5	6.7	13	28	32	16	17	35	70	77	56	20	9	9	8	11	9	14	424
6.7	8.9	9	12	23	9	19	14	31	38	37	11	9	11	7	7	10	9	256
8.9	11.2	8	8	12	6	2	10	21	29	24	7	8	4	5	5	8	12	169
11.2	13.4	5	1	3	0	0	1	11	13	26	7	3	4	2	6	2	3	87
13.4	17.9	4	3	1	0	0	0	5	5	13	29	13	2	7	11	11	3	107
17.9	22.4	2	0	0	0	0	0	0	1	1	10	0	2	5	9	5	3	38
22.4	29.1	0	0	0	0	0	0	0	0	0	2	3	1	2	1	5	0	14
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		58	78	113	52	74	90	192	220	191	113	61	50	47	65	66	68	1538

Table 5-11 Year 2013 Growing Season – Daylight Hours (Continued)

(Solar Irradiance > 5 watts/m^2; 33 Ft AGL)

Stability Class: E

Wind Speed Min	Wind Speed Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	2	4	2	1	1	3	5	3	2	1	2	1	4	2	1	0	34
2.2	4.5	2	3	5	4	1	7	8	12	4	2	1	0	2	1	0	2	54
4.5	6.7	1	3	8	2	2	2	10	13	7	5	0	2	2	0	2	8	67
6.7	8.9	4	4	3	1	1	2	10	15	10	5	0	3	2	1	2	2	65
8.9	11.2	1	0	0	0	0	3	8	4	9	1	1	1	0	6	0	3	37
11.2	13.4	0	1	0	0	0	0	3	8	3	5	1	0	1	0	5	1	28
13.4	17.9	1	1	0	0	0	0	0	1	4	2	1	0	1	1	2	0	14
17.9	22.4	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	3
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		11	16	18	8	5	17	44	56	40	23	6	7	12	11	12	16	302

Stability Class: F

Wind Speed Min	Wind Speed Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	2	4	1	1	0	2	3	0	1	2	1	0	1	0	0	19
2.2	4.5	6	8	5	1	1	2	10	6	3	0	1	1	0	0	1	5	50
4.5	6.7	2	0	4	0	0	1	5	11	4	0	1	0	0	0	0	1	29
6.7	8.9	0	0	1	1	0	1	0	8	2	0	0	1	0	0	3	0	17
8.9	11.2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
11.2	13.4	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	2
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		9	10	14	3	2	4	19	29	9	1	4	3	0	2	4	6	119

Stability Class: G

Wind Speed Min	Wind Speed Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	1	2	2	0	0	2	2	0	2	0	0	0	0	0	1	2	14
2.2	4.5	7	2	3	0	0	1	2	10	5	0	0	1	0	0	0	3	34
4.5	6.7	1	3	1	0	0	0	1	5	5	0	0	0	0	0	1	0	17
6.7	8.9	0	0	0	0	0	0	2	5	4	0	0	0	0	0	0	1	12
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		9	7	6	0	0	3	7	20	16	0	0	1	0	0	2	6	77

Stability Class: All

Wind Speed Min	Wind Speed Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	13	12	18	10	13	10	20	14	9	8	9	8	9	4	9	11	177
2.2	4.5	39	48	56	21	30	35	65	78	43	25	16	15	9	17	14	31	542
4.5	6.7	38	52	59	21	19	39	90	108	78	29	14	12	11	14	12	37	633
6.7	8.9	31	32	30	14	21	18	44	69	64	21	11	16	11	9	19	28	438
8.9	11.2	24	14	12	7	2	14	31	40	49	11	15	5	5	13	12	24	278
11.2	13.4	21	6	5	0	0	1	15	25	41	18	6	9	5	8	8	11	179
13.4	17.9	27	7	5	0	0	0	5	8	29	46	16	5	15	15	15	8	201
17.9	22.4	3	4	6	0	0	0	0	1	4	20	4	7	6	10	6	3	74
22.4	29.1	0	0	0	0	0	0	0	0	0	5	4	2	4	1	9	0	25
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		196	175	191	73	85	117	270	343	317	183	95	79	75	91	104	153	2547

Periods of Calm while in Stability Class:							
A	B	C	D	E	F	G	Total
0	0	0	30	6	11	8	55

Table 5-12 Seal Steam Relief Valve Lift

Elevation: 33' Start Date: 9/22/2013 Total number of Periods: 14
Period: Seal Steam Release Stop Date: 9/23/2013 Periods of No Data Recovery: 0
System Percent Data Recovery: 100.0%

Stability Class: A

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Stability Class: B

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Stability Class: C

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Stability Class: D

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-12 Seal Steam Relief Valve Lift (Continued)

Stability Class: E

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
4.5	6.7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
6.7	8.9	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	4
8.9	11.2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
11.2	13.4	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
13.4	17.9	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	3
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		0	0	0	0	0	0	0	3	3	4	1	1	0	0	0	0	12

Stability Class: F

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.9	11.2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1

Stability Class: G

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.5	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.7	8.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.9	11.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.2	13.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.4	17.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Stability Class: All

Wind Speed Min	Max	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
1.0	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	4.5	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
4.5	6.7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
6.7	8.9	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	4
8.9	11.2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
11.2	13.4	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2
13.4	17.9	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	3
17.9	22.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22.4	29.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29.1	40.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40.3	90.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS		0	0	0	0	0	0	0	3	4	4	1	1	0	0	0	0	13

Periods of Calm while in Stability Class:

A	B	C	D	E	F	G	Total
0	0	0	0	1	0	0	1

6.0 DOSE ASSESSMENT -- IMPACT ON MAN

Liquid Effluents - There were no liquid discharges from the radwaste processing system to the Columbia River during calendar year 2013.

Gaseous Effluents - The NRC GASPAR II computer code was used to calculate doses at and beyond the site boundary using quarterly and annual meteorological data and site-specific variables as required and defined in the ODCM. Table 6-1 shows the highest calculated doses at the site boundary and beyond the site boundary. Table 6-1 also shows the quarterly and annual dose for the nearest and highest exposed resident identified in the land use census. Table 6-2 provides the population collective dose within a 50-mile radius. These values were obtained from the As Low As Reasonably Achievable (ALARA) annual integrated population dose summary (in person-rem) of the GASPAR computer code output file. Table 6-2 also provides the annual average individual doses associated with each pathway. These values were obtained by dividing the ALARA integrated dose (person-rem) by the estimated year 2010 50-mile population (448,383) and converting to mrem.

During the growing season, Columbia Generating Station conducts a five-mile land use census to determine the locations of nearest residents, gardens, and milk animals or other livestock out to five miles in each sector. The 2013 Land Use Census did not identify broad leaf vegetable gardens or milk animals within the 5-mile radius. Cattle and horses were observed within 5-miles. As substantial commercial fruit orchards and corn crops were observed in all eastern sectors with residents, it was assumed that these crops were being consumed by the residents. Outside the 5-mile radius, dose is estimated for residents at 7.33 miles ESE due to a cow-milk ingestion pathway. The GASPAR code consumption rates were revised to reflect these differences.

Carbon-14

Carbon-14 (in the form of $^{14}CO_2$) is a non-depositing, gaseous effluent, and enters the food chain through plant photosynthesis. Since Columbia Generating Station is a continuous release plant, normally, offsite dose is based on meteorological data throughout the year. For ^{14}C dose analysis, however, a Joint Frequency Distribution (JFD) table of atmospheric data is developed based on daylight hours (solar irradiance > 5 watts per square meter) during the growing season of both garden produce and pasture grass for beef (April 15th through October 15th). The JFD table was used as input into the NRC XOQDOQ computer code from which dispersion estimates were obtained. This method provides a more accurate method of determining the average air concentration of $^{14}CO_2$ at locations of interest during times of photosynthesis.

Both inhalation and ingestion pathways contribute to dose from ^{14}C. The inhalation dose estimate assumes a full year ^{14}C inhalation of both $^{14}CH_4$ and $^{14}CO_2$. The ingestion pathway assumes ^{14}C ingestion from $^{14}CO_2$ incorporation into vegetation, meat, and milk during daylight hours of the growing season.

Dose from carbon-14 is shown in Tables 6.0-C through 6.0-H. The highest dose from ^{14}C calculated was for the resident at 4.26 miles in the ESE sector. The annual dose to the potential maximally exposed individual (child living at this

location) from gaseous releases of ^{14}C is 2.02E-02 mrem to the critical organ (bone) and 4.01E-03 mrem to the total body. The available dose pathways at this location from ^{14}C were inhalation and the ingestion of garden produce (fruits, grains, and non-leafy vegetables). Dose from ^{14}C is included in Tables 6.0-C through 6.0H of this section.

Disposal Cell – Diffuse Source

As stated earlier in this report, Cooling Tower and Spray Pond sediment are periodically sampled and disposed at a location within the site boundary authorized by the Washington State Energy Facility Site Evaluation Council. Due to the arid and windy conditions at CGS, resuspension of soil in the atmosphere could contribute dose to a Member of the Public onsite or offsite.

Normally the Offsite Dose Calculation Manual (ODCM) is used to determined dose to a Member of the Public in the unrestricted area. It contains the methodology and parameters needed to assess the offsite dose to a Member of the Public resulting from liquid and gaseous effluents. Regulatory Guide 1.109 (RG109) details the methodology for those exposure pathways that are expected to have the highest impact to a member of public.

Resuspension of particulate matter and the resultant dose is not addressed in RG109. It was therefore necessary to develop the appropriate equations for estimation of dose due to particulate resuspension. The exposure mechanisms examined were:

- Inhalation
- Indirect and direct ingestion
- Ground Plane
- Vegetation Consumption
- Beef Consumption

Conservative assessment of the above exposure pathways reveals that the resuspension of soil is not a significant contributor to the dose received by a Member of the Public, either onsite or offsite.

Details of the assumptions, equations and parameters used are discussed in the following sections.

Soil Resuspension Model

There are several approaches to dealing with the issues of soil resuspension.

- Resuspension factor in units of 1/m which is the ratio of the air concentration to the surface deposition.

- Resuspension rate in units of 1/sec describing the fraction of deposited material resuspended per unit time.
- Resuspension velocity (m/sec) which is a parallel to the deposition velocity used in determining ground plane deposition.
- Mass loading factor in units of kg-soil/m^3-air.

The resuspension factor, resuspension rate and resuspension velocity are dependent on two parameters (theoretical or empirical) which vary over a wide range. The mass loading factor approach is the methodology used in RESRAD as it uses a single parameter that can be easily measured directly should the need arise.

The dose models of this report reflect the RESRAD approach for resuspension of particulates which assume the mass loading factor remains constant over time. This implies a continuous resuspension process and therefore the airborne release concentration remains constant at the source. RESRAD uses a default mass loading value of 100 $\mu g/m^3$. This is a conservative value to account for short periods of high mass loading such as might occur during dust storms at CGS. It also takes into account sustained periods of soil resuspension resulting from excavation or farming activities.

Depletion of the source activity due to weathering and radiological decay processes is ignored. Also the dilution of redeposited soil by local soil is not considered.

These simplifications are justified based on wide variation in reported and observed values of the parameters associated with the aforementioned physical processes. The necessary site specific values could be determined for more sophisticated modeling purposes. However the estimated doses are sufficiently conservative and low enough to make such an effort unnecessary.

Dose From Inhalation of Resuspended Soil

The dose due to inhalation of resuspended soil is given by:

$$D^{IN}_{aij} = \chi/Q\ C_i\ P^{air}\ R^{air}\ BR_a\ DFA_{aij}$$

Where

D^{IN}_{aij} Is the dose due to inhalation of resuspended soil in mrem for age group "a", nuclide "i" and organ "j". The inhalation dose factors are taken from Tables E-7 to E-10 of Reg Guide 1.109.

χ/Q Is the atmospheric dispersion for ground level releases at the location of interest in sec/m^3.

C_i Is the concentration in soil of radionuclide "i" in pCi/kg-soil at the Disposal Cell area. Values are listed in Table 6a.

P^{air} Is the mass loading or concentration of particulate matter in air in kg-soil per m^3-air. Both NCRP Report No. 76 and the RESRAD User Manual recommend a value of 100 $\mu g/m^3$. The RESRAD documentation recommends this as a conservative default value that takes into account short periods of high mass load and sustained periods of normal activity as on a typical farm or excavation site.

R^{air} Is the hypothetical release rate in m^3-air/sec. It is based on considering the Disposal Cell as a continuous release source. (1.0 m^3-air/sec)

BR_a Is the breathing rate for age group "a" in m^3/yr taken from Table E-5 of Reg Guide 1.109.

DFA_{aij} Is the inhalation dose factor for age group "a", nuclide "i" and organ "j" in units of mrem/pCi. These dose factors are taken from Tables E-7 to E-10 of Reg Guide 1.109.

Dose Due to Ingestion of Resuspended Soils

Ingestion of resuspended soil can take place indirectly or directly.

Indirect ingestion occurs when suspended particles are inhaled, trapped in mucous and subsequently transported from the respiratory track to the gastrointestinal track.

Direct ingestion refers to soil that is orally consumed deliberately or accidentally.

Indirect Ingestion

Indirect ingestion (inhalation-ingestion) readily occurs in environments of high airborne soil concentration resulting from natural or anthropomorphic processes. Examples include dust storms, agricultural tillage and soil excavation.

Estimates of indirect soil ingestion rates vary widely. The EPA Exposure Factor Handbook published in 1997 suggested a soil intake rate for adults engaged in outdoor yard work of 480 mg/da. The 2011 EPA Exposure Factor Handbook suggests a general population upper percentile ingestion rate of 200 mg/da. The former value (480 mg/da) considers unintentional consumption during periods of high airborne concentrations of resuspended soil. Such cases may occur during mechanical excavation or dust storms at the Columbia Generating Station site.

Dose due to indirect ingestion (inhalation-ingestion) of resuspended soil is given by:

$$D^{II}_{aij} = \chi/Q\, C_i\, (P^{air}/\rho^{soil})\, R^{air}\, U^{soil}_a\, DFI_{aij}$$

Where:

D^{II}_{aij} Is the dose due to ingestion of resuspended soil in mrem for age group "a", nuclide "i" and organ "j". The ingestion dose factors are taken from Tables E-11 to E-14 of Reg Guide 1.109.

χ/Q Is the atmospheric dispersion for ground level releases at the location of interest in units of sec/m^3.

C_i Is the concentration in soil of radionuclide "i" in pCi/kg-soil at the SDP area. Values are listed in Table 6a.

P^{air} Is the mass loading or concentration of particulate matter in air in kg-soil per m^3-air. Both NCRP Report No. 76 and the RESRAD User Manual recommend a value of 100 $\mu g/m^3$. The RESRAD documentation recommends this as a conservative default value that takes into account short periods of high mass load and sustained periods of normal activity on a typical farm.

ρ^{soil} Is the bulk soil density in kg-soil/m^3-soil (1.5 gm/cc – Health Physics Handbook)

R^{air} Is the hypothetical release rate in m^3-air/sec. It is based on considering the Disposal Cell as a continuous release source. (1.0 m^3-air/sec)

U^{soil} Soil intake rate in kg-soil/yr. There is a wide range of values suggested for soil ingestion rates. A value of 480 mg-soil/da is the suggested ingestion rate for an adult engaged in outdoor activity. Taken from the EPA Exposure Factor Handbook, 1997.

DFI_{aij} Ingestion dose factor for for age group "a", nuclide "i" and organ "j" in units of mrem/pCi. These dose factors are taken from Tables E-11 to E-14 of Reg Guide 1.109.

Direct Ingestion

Direct ingestion considers the intentional or unintentional oral consumption of soil. Unintentional ingestion can occur from the adherence of soil to fruits, vegetables, etc. Deliberate ingestion – known as soil pica – is a common occurrence among children with consumption reaching as high as 1,000 to 5,000 mg/da for short periods of time.

Very high soil ingestion or geophagy is usually associated with cultural practices resulting in ingestion rates as high as 50,000 mg/da. However such high consumption rates are brief and surface soils are not usually the primary source of the ingested material.

Potential dose due to soil-pica and geophagy is likely to be higher than that of the inhalation-ingestion mechanism as these behaviors involve the direct ingestion of soil. Any resuspended particulates transported into the area will be mixed with and subsequently diluted by clean local soil. Nevertheless this dilution mechanism is not taken into account in this assessment thus providing an additional level of conservatism.

For purposes of this assessment doses have been estimated for soil consumption rates of 5,000 mg/da. This value is taken from the EPA Exposure Factor Handbook, 2011 and represents the upper limit of observed soil pica in children. This rate of ingestion is assumed to be sustained through the year.

Geophagy is not considered as the periods of high soil intake are short in duration. The annual soil consumption would not approach that of the consumption for child pica which assumes a continual 5,000 mg/da (~ 1.8 kg/yr) ingestion rate.

In considering oral soil ingestion it is assumed that source of the ingested material is the ground itself. Thus deposition and buildup of transported resuspended soil onto the ground plane must be taken into account.

The dose due to direct soil ingestion is given by:

$$D_{aij}^{DI} = D/Q\ C_i\ P^{air} R^{air} \left[\frac{(1-\exp(-\lambda_i t)}{\lambda_i}\right]\left[\frac{U_a}{\rho^{soil}\ T^{soil}}\right] DFI_{aij}$$

Where:

D^{DI}_{aij} Is the dose due to direct ingestion of resuspended soil in mrem for age group "a", nuclide "i" and organ "j". The ingestion dose factors are taken from Tables E-11 to E-14 of Reg Guide 1.109.

D/Q Is the atmospheric dispersion for ground level releases at the location of interest in units of $1/m^2$.

C_i Is the concentration in soil of radionuclide "i" in pCi/kg-soil at the Disposal Cell area. Values are listed in Table 6a.

P^{air} Is the mass loading or concentration of particulate matter in air in kg-soil per m^3-air. Both NCRP Report No. 76 and the RESRAD User Manual recommend a value of 100 $\mu g/m^3$. The RESRAD documentation recommends this as a conservative default value that takes into account short periods of high mass load and sustained periods of normal activity on a typical farm.

R^{air} Is the hypothetical release rate in m^3-air/sec. It is based on considering the Disposal Cell as a continuous release source. (1.0 m^3-air/sec)

λ_i Is the radiological decay constant for nuclide "i" in 1/sec.

t Is the effective exposure time in seconds (20 years) corresponding to one half of the facility lifetime.

U_a Soil intake rate in kg-soil/yr for age group "a",. There is a wide range of values suggested for soil ingestion rates. A value of 5000 mg-soil/da is the

suggested upper percentile for a child exhibiting soil pica behavior. Taken from the EPA Exposure Factor Handbook (2011).

ρ^{soil} Is the bulk soil density in kg-soil/m^3-soil (1.5 gm/cc – Health Physics Handbook)

T^{soil} Is the thickness or depth in meters of the top layer of soil available for ingestion in meters (1.5 cm – RESRAD).

DFI_{aij} Ingestion dose factor for age group "a", nuclide "i" and organ "j" in units of mrem/pCi. These dose factors are taken from Tables E-11 to E-14 of Reg Guide 1.109.

Other Dose Pathways

The methodologies for calculating dose from ground plane, vegetation ingestion and meat ingestion are those of Regulatory Guide 1.109, Appendix C, Equations C-5, C-12 and C-13. The source term is taken from Table 6a.

Dose Summary

Source Term

The limit of activity authorized to be deposited at the Disposal Cell was presumed to be homogenously distributed over the entire area. This was considered to be a continuous release source with resuspended soil airborne concentrations described by the mass loading factor. The assumption of continuous conditions is consistent with the approach used by RESRAD.

The release rate of Table 6a is based upon the hypothetical release rate of 1 m^3/sec and the RESRAD suggested mass loading factor of 100 µg-air/kg-soil.

Table 6a – Disposal Cell Release Rate

Nuclide	Highest Activity (pCi/kg-soil)	Release Rate (pCi/sec)
Mn-54	30	3.00E-03
Co-60	5	5.00E-04
Zn-65	50	5.00E-03
Cs-134	10	1.00E-03
Cs-137	20	2.00E-03

Dose Exposure Pathways Considered

For onsite dose estimates, the ground plane, inhalation, indirect ingestion and direct ingestion exposure pathways were considered to be present at all locations. The infant and child age groups were excluded from consideration as they would not be expected to be present on site. Estimates were based on the teen age group as the most radiosensitive group.

For offsite locations, dose estimates were evaluated for Members of the Public at locations identified in the most recent land use census with the highest dispersion and deposition values as well as for those with more ingestion pathways than others. Higher dose values resulted for residences located at 4.95 miles ENE and at 4.26 miles ESE. Vegetation and cattle meat pathways were considered present at 4.95 miles ENE and the vegetation pathway at 4.26 miles ESE.

Table 6b lists the either hypothetical or real locations, stay times, and assumed age groups for various onsite and offsite locations of interest.

Table 6b – Exposure Time, Pathways and Assumed Age Groups

Onsite Location	Hours per Year	Ground Plane	Inhalation	Indirect Ingestion	Direct Ingestion	Vegetation	Cattle Meat
Tour Visitors	8	Teen	Teen	Teen	Teen		
Firing Range	8	Teen	Teen	Teen	Teen		
DOE Site 618-11	59.5	Teen	Teen	Teen	Teen		
WNP-4 Warehouse 2-4	2600	Teen	Teen	Teen	Teen		
WNP-1 Bldg 121	2600	Teen	Teen	Teen	Teen		
Ash Substation	2080	Teen	Teen	Teen	Teen		
DOE Train	8	Teen	Teen	Teen	Teen		
Nat Guard at 0.5 mi N	8760	Teen	Teen	Teen	Teen		
Nat Guard at 0.5 mi S	8760	Teen	Teen	Teen	Teen		
Offsite Location	**Hours per Year**	**Ground Plane**	**Inhalation**	**Indirect Ingestion**	**Direct Ingestion**	**Vegetation**	**Cattle Meat**
Residence-4.95 mi ENE	8760	Any	Teen	Infant	Infant	Teen	Adult
Residence-4.26 mi ESE	8760	Any	Teen	Infant	Infant	Teen	Adult

Dose Calculation Results

Doses were evaluated for the locations in Table 6b. The onsite locations were those to which a Member of the Public might have access. The doses of Table 6c are the total doses for those pathways listed in Table 6b.

Table 6c - Estimated Dose Within the Site Boundary

Location	Bone	Liver	TBody	Thyroid	Kidney	Lung	GI-LLI	Skin
Tour Visitors	4.20E-11	4.56E-11	3.90E-11	3.49E-11	3.87E-11	5.12E-11	3.58E-11	4.07E-11
Firing Range	2.67E-13	2.84E-13	2.49E-13	2.28E-13	2.48E-13	2.67E-13	2.32E-13	2.67E-13
DOE Site 618-11	8.88E-12	9.47E-12	8.29E-12	7.60E-12	8.25E-12	8.95E-12	7.72E-12	8.88E-12
WNP-4 Whse.2-4	3.91E-12	4.19E-12	3.65E-12	3.32E-12	3.63E-12	4.16E-12	3.38E-12	3.88E-12
WNP-1Bldg 121	8.86E-10	9.43E-10	8.29E-10	7.62E-10	8.25E-10	8.68E-10	7.73E-10	8.90E-10
Ashe Substation	1.56E-09	1.66E-09	1.46E-09	1.34E-09	1.45E-09	1.50E-09	1.36E-09	1.57E-09
DOE Train	5.67E-12	6.03E-12	5.30E-12	4.87E-12	5.27E-12	5.57E-12	4.94E-12	5.69E-12
National Guard 0.5 mi N	6.57E-09	6.98E-09	6.15E-09	5.66E-09	6.12E-09	6.32E-09	5.74E-09	6.61E-09
National Guard 0.5 mi S	6.21E-09	6.60E-09	5.80E-09	5.33E-09	5.77E-09	6.10E-09	5.41E-09	6.23E-09

The offsite dose to a Member of the Public was assessed at both 4.95 miles in the ENE sector and 4.26 miles in the ESE sector. The dose for each pathway was determined for all age groups. The reported doses in Tables 6d and 6e are listed by exposure pathway. For each pathway the dose is reported for the age group receiving the highest dose. Thus the residence inhalation age group was teen, the indirect ingestion was infant, etc.

Table 6d - Estimated Dose at 4.95 miles ENE

(Pathways: Ground Plane, Inhalation, Indirect Ingestion, Direct Ingestion, Vegetation, and Meat)

Pathway	Bone	Liver	TBody	Thyroid	Kidney	Lung	GI-LLI	Skin
Ground Plane (Any)	7.83E-12	7.83E-12	7.83E-12	7.83E-12	7.83E-12	7.83E-12	7.83E-12	9.15E-12
Inhalation (Teen)	3.05E-13	5.48E-13	2.28E-13	0.00E+00	2.18E-13	2.54E-12	8.85E-14	0.00E+00
Indirect Ingestion (Infant)	2.76E-19	2.76E-19	2.76E-19	2.76E-19	2.76E-19	2.76E-19	2.76E-19	0.00E+00
Direct Ingestion (Infant)	7.80E-12	9.60E-12	8.02E-13	0.00E+00	2.59E-12	1.02E-12	1.92E-13	0.00E+00
Vegetation (Teen)	4.76E-12	8.49E-12	3.42E-12	0.00E+00	3.17E-12	9.03E-13	1.32E-12	0.00E+00
Cow - Meat (Adult)	6.77E-13	1.57E-12	8.89E-13	0.00E+00	8.30E-13	7.06E-14	7.19E-13	0.00E+00
Total Dose	2.14E-11	2.80E-11	1.32E-11	7.83E-12	1.46E-11	1.24E-11	1.01E-11	9.15E-12

Table 6e - Estimated Dose at 4.26 miles ESE

(Pathways: Ground Plane, Inhalation, Indirect Ingestion, Direct Ingestion, and Vegetation)

Pathway	Bone	Liver	TBody	Thyroid	Kidney	Lung	GI-LLI	Skin
Ground Plane (Any)	1.01E-11	1.01E-11	1.01E-11	1.01E-11	1.01E-11	1.01E-11	1.01E-11	1.18E-11
Inhalation (Teen)	3.87E-13	6.94E-13	2.88E-13	0.00E+00	2.76E-13	3.21E-12	1.12E-13	0.00E+00
Indirect Ingestion (Infant)	3.50E-19	3.50E-19	3.50E-19	3.50E-19	3.50E-19	3.50E-19	3.50E-19	0.00E+00
Direct Ingestion (Infant)	1.01E-11	1.24E-11	1.04E-12	0.00E+00	3.35E-12	1.32E-12	2.48E-13	0.00E+00
Vegetation (Teen)	6.16E-12	1.10E-11	4.42E-12	0.00E+00	4.10E-12	1.17E-12	1.70E-12	0.00E+00
Cow - Meat (Adult)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Dose	2.68E-11	3.42E-11	1.59E-11	1.01E-11	1.79E-11	1.58E-11	1.22E-11	1.18E-11

Discussion – Summary

The dose to a Member of the Public due to onsite activity is well below the 10 CFR 50 Appendix I limits. For onsite locations where actual Members of the Public are known to have been located, the highest organ dose was found to be 1.66E-09 mrem to the liver. The highest total body and thyroid doses were 1.46E-09 mrem and 1.34E-09 mrem respectively. This is a result of an estimated occupational exposure time of 2080 hours at the Ashe Substation.

For hypothetical situations, should the National Guard be stationed at 0.5 miles North of the site, the highest organ dose was found to be 6.98E-09 mrem to the liver. The highest total body and thyroid doses were 6.15E-09 mrem and 5.66E-09 mrem respectively. This is a result of the hypothetical exposure time of 1 year (8760 hours) of continuous residence.

The highest offsite dose to a Member of the Public was found to be at 4.26 miles ESE and was well below the 10 CFR 50 Appendix I limits. The highest organ dose was 1.24-011mrem to the liver. The highest total body and thyroid doses were 1.04E-12 mrem and 1.01E-11 mrem. The highest exposure pathways are ground plane and direct consumption of soil. Dose due to the consumption of produce and animal products was on the order of 1.10E-11 mrem or less.

Use of published default values and maximizing assumptions has resulted in a very conservative dose assessment. The lack of site specific empirical data and considering the parameter uncertainty associated with sophisticated models justifies this conservative approach. It provides a bounding estimate of exposure to a Member of the Public. The actual doses to a Member of the Public are most likely 2-3 orders of magnitude less than the doses of Tables 6c, 6d, and 6e.

References

- National Council on Radiation Protection and Measurements, *Radiological Assessment: Predicting the Transport, Bioaccumulation, and Uptake by Man of Radionuclides Released to the Environment.* NCRP Report No. 76; 1984.

- U.S. Department of Energy, *User's Manual for RETRAD Version 6.* ANL/EAD-4, 2001.
- U.S. Environmental Protection Agency, *Exposure Factors Handbook: 1997 Edition.*
- U.S. Environmental Protection Agency, *Exposure Factors Handbook: 2011 Edition.*
- "Handbook of Health Physics and Radiological Health." Third Edition, 1998.
- U.S. Nuclear Regulatory Commission, *Calculation of Annual Doses to Man for Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I.* Regulatory Guide 1.109, Revision 1, 1977.

Storm Drain Pond (SDP) – Diffuse Source

As the Storm Drain Pond is both within the Controlled Area and is fenced and posted, external exposure from activity in the ground or internal exposure from ingestion of food grown in the soil of the Storm Drain Pond is prevented.
The remaining potential routes to a Member of the Public.

- External exposure from standing on the ground above areas contaminated from resuspended activity.
- Ingestion of contaminated ground or river water as a result of vertical migration to the unconfined aquifer followed by horizontal movement toward the closest surface water (Columbia River).
- Inhalation and ingestion of resuspended radioactivity.

Ingestion of Potentially Contaminated Water

Relative to the potential ingestion of contaminated ground water, generally, the radionuclides of concern are H-3, Sr-90, and Cs-137. These three radionuclides are fairly representative in terms of sorption characteristics of those found in probable plant effluents. Tritium does not sorb onto soil particles at all, strontium is an intermediate sorber, and cesium strongly sorbs to soil particles. It was observed from previously-measured Storm Drain Pond activity that Co-60 sorption to soil is similar to that of Cs-137.

The CGS Final Safety Analysis Report calculates the transport time for these nuclides to the river for a ground release assuming no holdup or migration time through the soil to groundwater. This is a large assumption as sorption in soil has been observed to be quite high. The transport time from the unconfined aquifer to the river takes into account decay, dispersion, and sorption on the aquifer media. The transport time to the river for H-3 is 5.2 years, Sr-90 is 230 years, and Cs-137 is 2300 years. The concentration reduction factors are 7.7E5, 1.8E8, and 5.8E28 respectively based on dispersion, sorption, decay, and dilution. By the time it would take to reach the river, the nuclide concentrations in Table 6f would not be detectable.

Table 6f shows the projected reduction in nuclide concentrations.

Table 6f – Projected Concentration Reduction

	Max Activity In Soil (pCi/kg)	Concentration Reduction Factor	At Columbia River (pCi/kg)
Mn-54	45.6	5.80E+28	7.86E-28
Co-58	<MDA	5.80E+28	
Co-60	1860	5.80E+28	3.21E-26
Zn-65	119	5.80E+28	2.05E-27
Cs-134	<MDA	5.80E+28	
Cs-137	172	5.80E+28	2.97E-27

The resultant concentration at the Columbia River would not result in dose of any significance.

Based on the 2013 Radiological Environmental Monitoring Program (REMP) sampling of the water entering the SDP, Table 6g was constructed to project the concentration of tritium (H-3) reaching the Columbia River should the tritium reach the groundwater instantaneously without any reduction in concentration.

Table 6g – Tritium Concentration Reduction

	At SDP Outfall (pCi/liter)	Concentration reduction factor	At Columbia River (pCi/liter)
Maximum H-3 Concentration	4.95E+03	7.70E+05	6.43E-03
Average H-3 Concentration	9.87E+02	7.70E+05	1.28E-03

Tritium is a naturally-occurring radionuclide produced from cosmic radiation interactions with gases in the upper atmosphere. The worldwide inventory of natural tritium is estimated at 2.6E+19 pCi (National Council on Radiation Protection and Measurements Report #62). Levels of tritium in the Columbia River are monitored by the CGS REMP and documented in the Annual Radiological Environmental Operating Report (AREOR). The 2013 AREOR notes that tritium results for plant intake and river/drinking samples were below the analysis method *a priori* LLD (300 pCi/liter). The projected values in Table 6g are 10,000 to 100,000 times lower than both the REMP LLD and the EPA standard for drinking water (< 20,000 pCi/liter). With further dilution of the SDP tritium with Columbia River water, there would be insignificant dose above background values from drinking water taken from the Columbia River. There are currently no wells used for drinking water in the shallow (unconfined) aquifer. Use of water from future wells in this aquifer would be restricted due to the tritium contamination from DOE activities which are currently greater than drinking water standards.

Resuspension of SDP activity

The dose estimates in this section for the Storm Drain Pond follow the methodology described above for the Disposal Cell. The SDP soil is normally moist due to

routine water intrusion. This along with the vegetation cover reduces the resuspension of activity. To be conservative, the ground plane, inhalation, indirect ingestion and direct ingestion exposure pathways from resuspension were considered to be present at all locations. The infant and child age groups were excluded from onsite consideration as they would not be expected to be present. The onsite age group was assumed to be teen as this would be the most radiosensitive group. Based on this, the dose to a Member of the Public due to onsite activity was well below the Appendix I limits. Since no soil samples were taken in 2013 and the input was determined to be due to recapture of released activity during routine operations, the concentration of nuclides is assumed to have not changed significantly. Dispersion and deposition values used in the previous analysis were 5-year (2008 – 2012) averages. Potential dose to actual and hypothetical Members of the Public both onsite and offsite was calculated using the most recent land use census and shown below in Table 6h.

Table 6h – Dose to onsite MOP from Storm Drain Pond

Location	Bone	Liver	Tbody	Thyroid	Kidney	Lung	GI-LLI	Skin
Tour Visitors	3.22E-09	3.25E-09	3.21E-09	3.17E-09	3.19E-09	4.68E-09	3.28E-09	3.73E-09
Firing Range	2.11E-11	2.12E-11	2.10E-11	2.08E-11	2.09E-11	2.40E-11	2.13E-11	2.44E-11
DOE Site 618-11	7.01E-10	7.06E-10	6.98E-10	6.91E-10	6.96E-10	8.04E-10	7.09E-10	8.13E-10
WNP-4 Whse.2-4	3.06E-10	3.09E-10	3.05E-10	3.02E-10	3.04E-10	3.76E-10	3.10E-10	3.55E-10
WNP-1Bldg 121	7.02E-08	7.07E-08	7.00E-08	6.93E-08	6.97E-08	7.77E-08	7.10E-08	8.15E-08
Ashe Substation	1.24E-07	1.25E-07	1.23E-07	1.22E-07	1.23E-07	1.34E-07	1.25E-07	1.44E-07
DOE Train	4.49E-10	4.52E-10	4.47E-10	4.43E-10	4.46E-10	4.99E-10	4.54E-10	5.21E-10
Nation Guard 0.5 mi N	5.22E-07	5.25E-07	5.20E-07	5.15E-07	5.18E-07	5.65E-07	5.27E-07	6.05E-07
Nation Guard 0.5 mi SE	4.92E-07	4.95E-07	4.90E-07	4.85E-07	4.88E-07	5.47E-07	4.97E-07	5.70E-07

For onsite cases, the highest potential dose would result from the hypothetical case of the National Guard being onsite for the entire year (8760 hours). In this case, the highest organ dose was found to be 6.05E-07 mrem to the skin. The highest total body and thyroid doses were 5.20E-07 mrem and 5.15E-07 mrem respectively.

Offsite dose to a Member of the Public was evaluated and shown in Table 6i and 6j. In addition to the pathways considered for onsite exposure, ingestion pathways of garden produce and beef meat were considered based on the 2013 land use census. The offsite dose to a Member of the Public was found to be well below the Appendix I guidelines. The Total Dose listed in the following two tables is the addition of the highest organ dose from each pathway although the highest dose from each pathway is age specific. As a result, the Total Dose does not represent a real person. For example, an infant does not consume the same quantity of beef as an adult. The highest organ dose was found to be 1.08E-09 mrem to the skin. The highest total body and thyroid doses were both 9.22E-10 mrem. The highest exposure pathways are ground plane and inhalation. Dose due to the consumption of produce and animal products was on the order of 1.29E-10 mrem or less.

Table 6i – Dose to Resident at 4.95 miles ENE from Storm Drain Pond

Estimated Dose to Member of Public in Unrestricted Area
4.95 miles ENE

Pathway	Bone	Liver	Tbody	Thyroid	Kidney	Lung	GI-LLI	Skin
Ground Plane (Any)	7.12E-10	7.12E-10	7.12E-10	7.12E-10	7.12E-10	7.12E-10	7.12E-10	8.37E-10
Inhalation (Teen)	1.80E-12	2.88E-12	1.47E-12	0.00E+00	9.47E-13	2.47E-10	7.38E-12	0.00E+00
Indirect Ingestion (Infant)	1.68E-18	1.68E-18	1.68E-18	1.68E-18	1.68E-18	1.68E-18	1.68E-18	0.00E+00
Direct Ingestion (Infant)	6.26E-11	7.97E-11	1.99E-11	0.00E+00	1.98E-11	7.96E-12	1.51E-11	0.00E+00
Vegetation (Teen)	2.89E-11	4.80E-11	3.12E-11	0.00E+00	1.46E-11	4.94E-12	9.97E-11	0.00E+00
Cow – Meat (Adult)	3.11E-12	7.77E-12	8.14E-12	0.00E+00	2.59E-12	3.73E-13	4.39E-11	0.00E+00
Total Dose	8.09E-10	8.51E-10	7.73E-10	7.12E-10	7.50E-10	9.73E-10	8.78E-10	8.37E-10

Table 6j – Dose to Resident at 4.26 miles ESE from Storm Drain Pond

Estimated Dose to Member of Public in Unrestricted Area
4.26 miles ESE

Pathway	Bone	Liver	Tbody	Thyroid	Kidney	Lung	GI-LLI	Skin
Ground Plane (Any)	9.22E-10	9.22E-10	9.22E-10	9.22E-10	9.22E-10	9.22E-10	9.22E-10	1.08E-09
Inhalation (Teen)	2.28E-12	3.65E-12	1.87E-12	0.00E+00	1.20E-12	3.13E-10	9.35E-12	0.00E+00
Indirect Ingestion (Infant)	2.13E-18	2.13E-18	2.13E-18	2.13E-18	2.13E-18	2.13E-18	2.13E-18	0.00E+00
Direct Ingestion (Infant)	8.11E-11	1.03E-10	2.57E-11	0.00E+00	2.56E-11	1.03E-11	1.96E-11	0.00E+00
Vegetation (Teen)	3.74E-11	6.22E-11	4.04E-11	0.00E+00	1.90E-11	6.40E-12	1.29E-10	0.00E+00
Cow – Meat (Adult)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Dose	1.04E-09	1.09E-09	9.90E-10	9.22E-10	9.67E-10	1.25E-09	1.08E-09	1.08E-09

Abnormal Release – Seal Steam Relief Valve

A Joint Frequency Distribution table was developed from 9/22/13 at 1500 hours to 9/23/13 at 0400 hrs and the results shown in Table 5-12 of this report. From this, the dispersion and deposition values were derived. As winds were from the S to WSW, only Members of the Public in the N to ENE sectors would have been affected. As this release occurred after normal business hours, it is unlikely that a Member of the Public would have been in the N to ENE sectors of the site. Estimates of dose from Seal Steam is shown in Tables 6.0-C through 6.0-E.

Dose to Onsite Members of the Public

The term "Member of the Public" includes all persons who are not occupationally associated with the plant. This category does not include employees of the utility, its contractors or vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational or other purposes not associated with the plant.

Dose was evaluated to Members of the Public within the owner controlled area as well as beyond the site boundary. For those within the site boundary, the estimates included visitors to either the plant or the firing range as well as those that worked at the Industrial Development area in the E and ESE sectors and at the DOE 618-11 burial site in the W and WNW sectors. The maximum dose from gaseous effluents to these individuals was estimated assuming exposure to the plume, inhalation, and ground deposition pathways.

The following table (6.0-A) shows estimated dose to Members of the Public from gaseous effluents and direct radiation exposure within the site boundary of Columbia Generating Station for the total indicated hours spent at each location.

Table 6.0-A; Dose to Members of the Public within the Site Boundary

Location	Hours Spent	Total Body Dose (mrem)	Thyroid Dose (mrem)	Highest Other Organ Dose (mrem)	Beta Air Dose (mrad)	Gamma Air Dose (mrad)	Direct Radiation (mrem)
Tour Visitors	8.00E+00	1.71E-04	1.71E-04	2.66E-04	8.33E-05	2.36E-04	1.84E-02
Firing Range	8.00E+00	1.54E-06	1.54E-06	2.38E-06	7.08E-07	2.01E-06	0.00E+00
DOE Site 618-11	5.95E+01	2.99E-06	2.99E-06	4.60E-06	1.02E-05	2.90E-05	2.25E-01
WNP-4 Whse.2-4	1.04E+03	1.07E-03	1.07E-03	1.64E-03	4.88E-04	1.38E-03	0.00E+00
WNP-1 Bldg 121	2.60E+03	5.30E-03	5.31E-03	8.17E-03	2.44E-03	6.91E-03	0.00E+00

Dose to Offsite Members of the Public

For all routine gaseous releases (except C-14), the highest calculated dose to a child living at locations identified in the most recent land use census was 1.74E-03 mrem to the skin, 1.17E-03 mrem to the total body, and 1.21E-03 mrem to the thyroid. This location was at 4.26 miles in the East South East sector.

Table 6.0-B provides the results of annual dose calculations for the highest dose age group for each identified land use census location from all routine gaseous effluents except ^{14}C. The highest 'Other Organ' in all cases was the skin.

Table 6.0-B; Dose to Residents identified in the 2013 Land Use Census

Location	Total Body Dose (mrem)	Thyroid Dose (mrem)	Highest Other Organ Dose (mrem)	Beta Air Dose (mrad)	Gamma Air Dose (mrad)	Age Group
Resident (4.50 miles NE)	3.27E-04	3.38E-04	4.89E-04	1.42E-04	4.01E-04	Child
Resident (3.88 miles ENE)	3.50E-04	3.61E-04	5.22E-04	1.51E-04	4.27E-04	Child
Resident (4.95 miles E)	4.15E-04	4.34E-04	5.79E-04	1.43E-04	4.05E-04	Child
Resident (4.64 miles E)	1.17E-03	1.20E-03	1.74E-03	5.02E-04	1.42E-03	Child
Resident (4.26 miles ESE)	1.17E-03	1.21E-03	1.74E-03	5.02E-04	1.42E-03	Child
Resident (7.33 miles ESE)	4.07E-04	4.40E-04	5.33E-04	1.12E-04	3.16E-04	Child

Based on the available exposure pathways and the highest dispersion and deposition values, the critical receptor is a child resident at 4.26 miles ESE. Tables 6.0-C through 6.0-H adds the potential dose to a child from ^{14}C and from the seal steam release (for those potentially affected) to the dose from routine releases for all pathways of exposure identified in the 2013 Land Use Census.

Table 6.0-C; Dose to Receptor at 4.50 miles NE (in mrem)

PATHWAY	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
Plume Exposure	2.67E-04	2.67E-04	2.67E-04	2.67E-04	2.67E-04	2.67E-04	2.67E-04	4.28E-04
Plume Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Plume Seal Steam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ground Exposure	1.59E-05	1.59E-05	1.59E-05	1.59E-05	1.59E-05	1.59E-05	1.59E-05	1.87E-05
Ground Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground Seal Steam	3.74E-06	3.74E-06	3.74E-06	3.74E-06	3.74E-06	3.74E-06	3.74E-06	4.38E-06
Garden Produce	3.51E-05	3.51E-05	5.29E-05	3.38E-05	3.33E-05	4.52E-05	3.29E-05	3.29E-05
Garden Produce - C-14	2.63E-03	2.63E-03	1.32E-02	2.63E-03	2.63E-03	2.63E-03	2.63E-03	2.63E-03
Garden Prod Seal Steam	2.51E-06	2.17E-06	3.13E-06	5.00E-06	2.95E-06	1.97E-06	2.32E-06	1.97E-06
Inhalation	9.01E-06	9.02E-06	2.85E-07	9.00E-06	9.00E-06	9.69E-06	1.01E-05	8.99E-06
Inhalation - C-14	1.02E-04	1.02E-04	5.40E-04	1.02E-04	1.02E-04	1.02E-04	1.02E-04	1.02E-04
Inhalation Seal Steam	5.94E-07	5.93E-07	1.47E-08	6.05E-07	5.96E-07	5.92E-07	6.71E-07	5.92E-07
Total	3.07E-03	3.06E-03	1.41E-02	3.07E-03	3.06E-03	3.08E-03	3.06E-03	3.23E-03

Total from C-14	2.73E-03	2.73E-03	1.37E-02	2.73E-03	2.73E-03	2.73E-03	2.73E-03	2.73E-03
Total from Seal Steam	6.84E-06	6.50E-06	6.88E-06	9.35E-06	7.29E-06	6.30E-06	6.73E-06	6.94E-06
Total from Other Nuclides	3.27E-04	3.27E-04	3.36E-04	3.26E-04	3.25E-04	3.38E-04	3.26E-04	4.89E-04
Total from All Nuclides	3.07E-03	3.07E-03	1.41E-02	3.07E-03	3.06E-03	3.08E-03	3.06E-03	3.23E-03

Table 6.0-D; Dose to Receptor at 3.88 miles ENE (in mrem)

PATHWAY	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
Plume Exposure	2.11E-04	2.11E-04	2.11E-04	2.11E-04	2.11E-04	2.11E-04	2.11E-04	3.37E-04
Plume Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Plume Seal Steam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ground Exposure	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05
Ground Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground Seal Steam	5.12E-06	5.12E-06	5.12E-06	5.12E-06	5.12E-06	5.12E-06	5.12E-06	6.00E-06
Garden Produce	1.05E-04	1.05E-04	6.70E-05	1.03E-04	1.03E-04	1.19E-04	1.02E-04	1.02E-04
Garden Produce - C-14	1.69E-03	1.69E-03	8.47E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03
Garden Prod Seal Steam	1.01E-05	9.66E-06	4.29E-06	1.35E-05	1.07E-05	9.39E-06	9.87E-06	9.39E-06
Inhalation	2.80E-05	2.80E-05	6.42E-07	2.80E-05	2.80E-05	3.03E-05	3.11E-05	2.80E-05
Inhalation - C-14	2.56E-04	2.56E-04	8.47E-03	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04
Inhalation Seal Steam	2.83E-06	2.82E-06	7.14E-08	2.88E-06	2.84E-06	2.82E-06	3.2E-06	2.82E-06
Total	2.32E-03	2.32E-03	1.72E-02	2.33E-03	2.32E-03	2.34E-03	2.32E-03	2.45E-03

Total from C-14	1.95E-03	1.95E-03	1.69E-02	1.95E-03	1.95E-03	1.95E-03	1.95E-03	1.95E-03
Total from Seal Steam	1.81E-05	1.76E-05	9.48E-06	2.15E-05	1.87E-05	1.73E-05	1.82E-05	1.82E-05
Total from Other Nuclides	3.64E-04	3.64E-04	2.98E-04	3.62E-04	3.62E-04	3.80E-04	3.64E-04	4.87E-04
Total from All Nuclides	2.33E-03	2.33E-03	1.72E-02	2.33E-03	2.33E-03	2.34E-03	2.33E-03	2.45E-03

Table 6.0-E; Dose to Receptor at 4.95 miles ENE (in mrem)

PATHWAY	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
Plume Exposure	2.69E-04	2.69E-04	2.69E-04	2.69E-04	2.69E-04	2.69E-04	2.69E-04	4.32E-04
Plume Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Plume Seal Steam	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ground Exposure	2.18E-05	2.18E-05	2.18E-05	2.18E-05	2.18E-05	2.18E-05	2.18E-05	2.57E-05
Ground Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground Seal Steam	3.05E-06	3.05E-06	3.05E-06	3.05E-06	3.05E-06	3.05E-06	3.05E-06	3.58E-06
Garden Produce	9.37E-05	9.37E-05	7.47E-05	9.18E-05	9.12E-05	1.10E-04	9.06E-05	9.06E-05
Garden Produce - C-14	3.29E-03	3.29E-03	1.64E-02	3.29E-03	3.29E-03	3.29E-03	3.29E-03	3.29E-03
Garden Prod Seal Steam	6.39E-06	6.11E-06	2.56E-06	8.42E-06	6.74E-06	5.95E-06	6.23E-06	5.95E-06
Beef Meat Ingestion	5.85E-06	5.88E-06	4.04E-07	5.82E-06	5.73E-06	5.88E-06	5.64E-06	5.64E-06
Beef Meat Ingestion - C-14	5.29E-04	5.29E-04	2.64E-03	5.29E-04	5.29E-04	5.29E-04	5.29E-04	5.29E-04
Beef Meat Seal Steam	3.98E-07	3.93E-07	1.16E-07	4.85E-07	4.06E-07	3.7E-07	3.83E-07	3.7E-07
Inhalation	2.48E-05	2.48E-05	6.09E-07	2.48E-05	2.48E-05	2.69E-05	2.78E-05	2.48E-05
Inhalation - C-14	2.37E-04	2.37E-04	1.26E-03	2.37E-04	2.37E-04	2.37E-04	2.37E-04	2.37E-04
Inhalation Seal Steam	1.79E-06	1.79E-06	4.34E-08	1.82E-06	1.8E-06	1.79E-06	2.02E-06	1.79E-06
Total	4.48E-03	4.48E-03	2.07E-02	4.48E-03	4.48E-03	4.50E-03	4.48E-03	4.64E-03

Total from C-14	4.06E-03	4.06E-03	2.03E-02	4.06E-03	4.06E-03	4.06E-03	4.06E-03	4.06E-03
Total from Seal Steam	1.16E-05	1.13E-05	5.77E-06	1.38E-05	1.2E-05	1.12E-05	1.17E-05	1.17E-05
Total from Other Nuclides	4.15E-04	4.15E-04	3.67E-04	4.13E-04	4.13E-04	4.34E-04	4.15E-04	5.79E-04
Total from All Nuclides	4.48E-03	4.48E-03	2.07E-02	4.48E-03	4.48E-03	4.50E-03	4.48E-03	4.65E-03

Table 6.0-F; Dose to Receptor at 4.64 miles E (in mrem)

PATHWAY	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
Plume Exposure	9.47E-04	9.47E-04	9.47E-04	9.47E-04	9.47E-04	9.47E-04	9.47E-04	1.52E-03
Plume Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground Exposure	2.87E-05	2.87E-05	2.87E-05	2.87E-05	2.87E-05	2.87E-05	2.87E-05	3.38E-05
Ground Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Garden Produce	1.47E-04	1.47E-04	9.72E-05	1.44E-04	1.43E-04	1.68E-04	1.43E-04	1.43E-04
Garden Produce - C-14	3.16E-03	3.16E-03	1.58E-02	3.16E-03	3.16E-03	3.16E-03	3.16E-03	3.16E-03
Beef Meat Ingestion	9.15E-06	9.20E-06	5.27E-07	9.11E-06	8.99E-06	9.20E-06	8.88E-06	8.88E-06
Beef Meat Ingestion - C-14	5.08E-04	5.08E-04	2.54E-03	5.08E-04	5.08E-04	5.08E-04	5.08E-04	5.08E-04
Inhalation	3.91E-05	3.91E-05	9.69E-07	3.91E-05	3.90E-05	4.26E-05	4.38E-05	3.90E-05
Inhalation - C-14	3.62E-04	3.62E-04	1.93E-03	3.62E-04	3.62E-04	3.62E-04	3.62E-04	3.62E-04
Total	5.20E-03	5.20E-03	2.13E-02	5.20E-03	5.20E-03	5.23E-03	5.20E-03	5.77E-03

Total from C-14	4.03E-03	4.03E-03	2.03E-02	4.03E-03	4.03E-03	4.03E-03	4.03E-03	4.03E-03
Total from Other Nuclides	1.17E-03	1.17E-03	1.07E-03	1.17E-03	1.17E-03	1.20E-03	1.17E-03	1.74E-03
Total from All Nuclides	5.20E-03	5.20E-03	2.13E-02	5.20E-03	5.20E-03	5.23E-03	5.20E-03	5.77E-03

Table 6.0-G; Dose to Receptor at 4.26 miles ESE (in mrem)

PATHWAY	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
Plume Exposure	9.47E-04	9.47E-04	9.47E-04	9.47E-04	9.47E-04	9.47E-04	9.47E-04	1.52E-03
Plume Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground Exposure	3.82E-05	3.82E-05	3.82E-05	3.82E-05	3.82E-05	3.82E-05	3.82E-05	4.49E-05
Ground Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Garden Produce	1.45E-04	1.45E-04	1.80E-04	1.41E-04	1.40E-04	1.82E-04	1.39E-04	1.39E-04
Garden Produce - C-14	3.65E-03	3.65E-03	1.82E-02	3.65E-03	3.65E-03	3.65E-03	3.65E-03	3.65E-03
Beef Meat Ingestion								
Beef Meat Ingestion - C-14								
Inhalation	3.80E-05	3.80E-05	9.75E-07	3.80E-05	3.80E-05	4.09E-05	4.23E-05	3.80E-05
Inhalation - C-14	3.62E-04	3.62E-04	1.93E-03	3.62E-04	3.62E-04	3.62E-04	3.62E-04	3.62E-04
Total	5.18E-03	5.18E-03	2.13E-02	5.18E-03	5.18E-03	5.22E-03	5.18E-03	5.75E-03

Total from C-14	4.01E-03	4.01E-03	2.02E-02	4.01E-03	4.01E-03	4.01E-03	4.01E-03	4.01E-03
Total from Other Nuclides	1.17E-03	1.17E-03	1.17E-03	1.16E-03	1.16E-03	1.21E-03	1.17E-03	1.74E-03
Total from All Nuclides	5.18E-03	5.18E-03	2.13E-02	5.18E-03	5.18E-03	5.22E-03	5.18E-03	5.75E-03

Table 6.0-H; Dose to Receptor at 7.33 miles ESE (in mrem)

PATHWAY	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
Plume Exposure	2.11E-04	2.11E-04	2.11E-04	2.11E-04	2.11E-04	2.11E-04	2.11E-04	3.37E-04
Plume Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ground Exposure	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05	1.96E-05
Ground Exposure - C-14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Garden Produce	1.05E-04	1.05E-04	6.70E-05	1.03E-04	1.03E-04	1.19E-04	1.02E-04	1.02E-04
Garden Produce - C-14	1.69E-03	1.69E-03	8.47E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03
Cow Milk Ingestion	4.37E-05	4.31E-05	4.01E-06	4.41E-05	4.36E-05	6.02E-05	4.27E-05	4.27E-05
Cow Milk Ingestion - C-14	8.49E-04	8.49E-04	4.24E-03	8.49E-04	8.49E-04	8.49E-04	8.49E-04	8.49E-04
Inhalation	2.80E-05	2.80E-05	6.42E-07	2.80E-05	2.80E-05	3.03E-05	3.11E-05	2.80E-05
Inhalation - C-14	2.56E-04	2.56E-04	1.37E-03	2.56E-04	2.56E-04	2.56E-04	2.56E-04	2.56E-04
Total	3.20E-03	3.20E-03	1.44E-02	3.20E-03	3.20E-03	3.23E-03	3.20E-03	3.32E-03

Total from C-14	2.79E-03	2.79E-03	1.41E-02	2.79E-03	2.79E-03	2.79E-03	2.79E-03	2.79E-03
Total from Other Nuclides	4.07E-04	4.07E-04	3.02E-04	4.06E-04	4.05E-04	4.40E-04	4.06E-04	5.29E-04
Total from All Nuclides	3.20E-03	3.20E-03	1.44E-02	3.20E-03	3.20E-03	3.23E-03	3.20E-03	3.32E-03

For environmental thermoluminescent dosimeter (TLD) stations at or beyond the site boundary where preoperational (background) data was acquired, no increase in the average ambient exposure was observed in 2013 from the preoperational values.

Table 6-1 Summary of Doses from Gaseous Effluents

The information contained in Table 6-1 is provided consistent with all previous effluent release reports from Columbia Generating Station. Dose from carbon-14 is not included in these summary tables. Dose to Members of the Public from C-14 is detailed in the previous section. C-14 does not contribute to air dose, inhalation dose from C-14 is so small that it is not calculated by the NRC GASPAR computer code, and there are no ingestion pathways for hypothetical Members of the Public at the site boundary. Quarterly and annual dose estimates in this table are made with joint frequency distribution and dispersion and deposition values derived from meteorological data specific to each time period, whereas C-14 dose estimates provided earlier are made with joint frequency distribution and dispersion and deposition values derived from meteorological data during periods of photosynthesis in the defined growing season.

The first six tables in this section show maximum estimated exposure and dose at and beyond the site boundary. No residents were observed at the site boundary. The maximum exposure and dose beyond the site boundary is estimated for locations with actual residents.

1. Maximum Air Dose at the Site Boundary (1.2 miles)

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Cumulative*
Beta air dose (mrad)	1.30E-03	1.81E-04	1.12E-03	1.70E-03	4.47E-03
Gamma air dose (mrad)	3.69E-03	5.12E-04	3.17E-03	4.81E-03	1.27E-02

2. Maximum Air Dose Beyond the Site Boundary

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Cumulative*
Beta air dose (mrad)	1.43E-04	1.42E-05	4.87E-05	4.19E-04	5.02E-04
Gamma air dose (mrad)	4.05E-04	4.03E-05	1.38E-04	1.19E-03	1.42E-03

3. Maximum Annual Dose at the Site Boundary

	Annual Dose
Annual total body dose (mrem)	9.37E-03
Annual skin dose (mrem)	1.46E-02

Table 6-1 Summary of Doses from Gaseous Effluents (Continued)

4. Maximum Annual Dose Beyond the Site Boundary

	Annual Dose
Annual total body dose (mrem)	1.17E-03
Annual skin dose (mrem)	1.74E-03

5. Maximum Organ Dose at the Site Boundary (1.2 miles)

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Cumulative*
Maximum Organ dose (mrem)	4.36E-03	1.11E-03	3.41E-03	5.20E-03	1.46E-02

6. Maximum Organ Dose Beyond the Site Boundary

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Cumulative*
Maximum Organ dose (mrem)	6.01E-04	1.41E-04	1.61E-04	1.42E-03	1.74E-03

7. Dose to Nearest Residents within 5-Miles in each Sector with Residents

4.50 Miles NE

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Cumulative*
Beta Air Dose (mrad)	2.35E-05	7.24E-06	2.23E-05	6.79E-05	1.42E-04
Gamma Air Dose (mrad)	6.67E-05	2.05E-05	6.33E-05	1.92E-04	4.01E-04
Maximum Organ dose (mrem)	1.10E-04	6.06E-05	7.33E-05	2.25E-04	4.89E-04

3.88 Miles ENE

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Cumulative*
Beta Air Dose (mrad)	5.07E-05	9.23E-06	2.13E-05	7.19E-05	1.51E-04
Gamma Air Dose (mrad)	1.44E-04	2.62E-05	6.04E-05	2.04E-04	4.27E-04
Maximum Organ dose (mrem)	1.92E-04	7.07E-05	6.98E-05	2.40E-04	5.22E-04

Table 6-1 Summary of Doses from Gaseous Effluents (Continued)

7. Dose to Nearest Residents within 5-Miles in each Sector with Residents (Continued)

4.95 Miles ENE

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Cumulative*
Beta Air Dose (mrad)	4.70E-05	6.64E-06	1.35E-05	2.43E-05	1.43E-04
Gamma Air Dose (mrad)	1.33E-04	1.88E-05	3.82E-05	6.90E-05	4.05E-04
Maximum Organ dose (mrem)	2.35E-04	7.32E-05	5.11E-05	1.63E-04	5.79E-04

4.64 Miles E

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Cumulative*
Beta Air Dose (mrad)	8.53E-06	1.42E-05	3.42E-05	4.19E-04	5.02E-04
Gamma Air Dose (mrad)	2.42E-05	4.03E-05	9.70E-05	1.19E-03	1.42E-03
Maximum Organ dose (mrem)	1.52E-04	1.05E-04	1.27E-04	1.42E-03	1.74E-03

4.26 Miles ESE

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Cumulative*
Beta Air Dose (mrad)	3.08E-05	1.21E-05	4.87E-05	2.99E-04	5.02E-04
Gamma Air Dose (mrad)	8.74E-05	3.43E-05	1.38E-04	8.49E-04	1.42E-03
Maximum Organ dose (mrem)	2.76E-04	1.41E-04	1.61E-04	1.01E-03	1.74E-03

7.33 Miles ESE

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual Cumulative*
Beta Air Dose (mrad)	1.43E-04	4.72E-06	1.19E-05	2.60E-04	1.12E-04
Gamma Air Dose (mrad)	4.05E-04	1.34E-05	3.38E-05	7.36E-04	3.16E-04
Maximum Organ dose (mrem)	6.01E-04	5.47E-05	4.86E-05	9.12E-04	5.33E-04

* Rather than the sum of the quarters, the Annual Cumulative values are based on annual meteorological data and total annual effluents. For each time period, the dose estimate uses the radionuclide mix and release rate for that period along with an estimate of the dispersion in air and deposition on ground and vegetation calculated by the NRC computer code XOQDOQ using actual meteorological conditions during the respective quarters. The dose estimate of the NRC computer code GASPAR uses, as base methodology, NRC Regulatory Guide 1.109 (1977) which includes the prospective dose component arising from retention in the body beyond the period of environmental exposure.

Table 6-2 50-Mile Population Dose from Gaseous Effluents

A. 50-mile population collective dose

Exposure Pathway	Total Body (person-rem)	Max. Organ (person-rem)
Plume	3.96E-03	7.04E-03
Ground	8.05E-04	9.46E-04
Inhalation	2.15E-03	2.15E-03
Vegetables	1.93E-03	1.89E-03
Milk	6.74E-04	6.61E-04
Meat	2.75E-04	2.69E-04
Total	9.80E-03	1.30E-02

B. Average Individual*

Exposure Pathway	Total Body (mrem)	Max. Organ (mrem)
Plume	8.83E-06	1.57E-05
Ground	1.80E-06	2.11E-06
Inhalation	4.80E-06	4.80E-06
Vegetables	4.30E-06	4.22E-06
Milk	1.50E-06	1.47E-06
Meat	6.13E-07	6.00E-07
Total	2.18E-05	2.89E-05

* These values are derived by dividing the 50-mile population collective doses by the population within 50 miles of Columbia Generating Station (448,383). The population estimate is based on the 2010 census conducted by the United States Census Bureau tabulated/compiled by the Washington State Office of Financial Management, Small Area Estimate Program. The Maximum Organ was the skin.

7.0 REVISIONS TO THE ODCM

The following tables summarize the changes made to the ODCM during 2013. The ODCM is included as an enclosure to the letter transmitting this "Radioactive Effluent Release Report" in compliance with Columbia Technical Specification 5.5.1.

LDCN-ODCM-10-011 (Action Requests 227309 & 254942); POC approved March, 2013

ODCM 6.4.2	Change the submittal date for the Annual Radiological Effluent Release Report	Some data required as part of the report is provided by a vendor and is often not available in time to allow the report to be developed and reviewed in a timely manner. This change may require a one time exemption from the NRC to allow the report to be submitted at a later date. This change has been made at several other nuclear plants.

LDCN-ODCM-12-029 (Action Request 267638); Amendment 50; These changes to the ODCM were POC-approved in March, 2013.

ODCM Section Revised	Brief Description of Revision	Reason for Revision
All	Converted ODCM from Word Perfect to Word. Some page breaks changed causing pages to be added and/or removed. This caused some Section pages and Table pages to be renumbered.	Word Perfect is no longer a supported program. This did not change technical content or intent.
2.5 3.5.3 4.0 5.0 Most sections of the ODCM Appendix	Replaced all "capital letter" non-Technical Specification defined terms with lower case letters, except the initial letter. Example: "MEMBER OF THE PUBLIC" was changed to "Member of the Public". Section 6.0.1 included a statement that the defined terms of the ODCM appear in capitalized type and shall be applicable throughout the ODCM. This statement was	This is contrary to the Writer's guide and is not consistent with how the defined terms of the License Controlled Specifications were handled. Only defined Technical Specifications should appear as all "capital letters". Terms that are defined in other manuals should not be all "capital Letters". The formatting of the ODCM has been changed to follow TSTF-GG-05-01,

	removed.	Revision 1, "Writer's Guide for Plant-Specific Improved Technical Specifications." Consistency with guidance of the capitalization of TS defined terms does not change technical content or intent.
2.5 2.7.1 3.3.2.1 3.5.1 3.5.2 3.5.2.1 Table 3-1 Table 3-6 Table 3-7 Table 3-8 Table 3-13 6.0.1 Table 6.2.1.1-1 Table 6.2.2.1-1 Table 6.3.1-2 Table 6.3.1-3 B6.2.1.1	Changed superscript exponent to "E#" or "E-#". Example "2x10-2" changed to "2E-2".	Consistency with the number representation guidance in TSTF-GG-05-01, Revision 1, does not change technical content or intent
B6.1.1 B6.1.2 B6.2.1.1 B6.2.1.2 B6.2.1.3 B6.2.2.1 B6.2.2.2 B6.2.2.3 B6.2.2.4 B6.2.2.5 B6.2.2.6 B6.2.3 B6.3.1 B6.3.2 B6.3.3	Changed "Ref." to Reference(s) when used in the sentence vs. in parenthesis (Ref. #)	Consistency with the use of Reference(s) in TSTF-GG-05-01, Revision 1. This does not change technical content or intent.
2.3.2 2.4.1 3.1 3.4.2.1 4.2.1 6.0.1	This change is correcting capitalizations of words. Plant systems are indicated with a capital letter for each word in the system description. Phrases that describe systems do not have capital letters, and many of the changes for this change reflect the removal of capitalized letters.	Consistency with TSTF-GG-05-01, Revision 1, on the use of capital letters. This does not change technical content or intent.

6.1.2 B6.1.1 B6.1.2 B6.2.2.1 B6.2.2.2 B6.2.2.4 B6.2.3	Gaseous Offgas Treatment System Definition, capitalized system names Required Compensatory Measure F.1, capitalized "completion time" Requirement for Operability, 6 and Applicability, capitalized "System" RFO 3.a), RFO 3.c), Applicability, Compensatory Measures – changed from capital letter to lower case for component name Compensatory Measures and Surveillance Requirements – corrected capitalization Applicable Safety Analysis – corrected capitalizations Compensatory Measures – corrected capitalizations Compensatory Measures – corrected capitalizations	
Table 2-1 Table 2-2 Table 2-3 Table 3-1 Table 3.2 Table 3-3 Table 3-4 Table 3-5a-d Table 3-6 Table 3-7 Table 3-8 Table 3-9 Table 3-10 Table 3-11 Table 3-13 Table 3-14 Table 3-15 Table 3-16 Table 3-17 Tbale 5.1	Added "(page x of y)" to the tables and figures	Consistency with TSTF-GG-05-01, Revision 1, Figure and Table format. This does not change technical content or intent.

Table 6.1.1-1 Table 6.2.1.1-1 Table 6.3.1-2 Table 6.3.1-3 Figures 3-1,2,3,4		
3.5 6.2.1.1 Table 6.3.1-2 6.4.2 B6.2.1.1 B6.2.1.3 B6.2.2.5 B6.2.3	Deleted "Part" from 10 CFR reference and added "10 CFR" if needed	"Part" is not normally included in the citation of 10 CFR, consistency with other references
6.2.2.2 B6.2.2.1	RFO, changed "<=" to "<" Applicable Safety Analysis, changed "<=" to "<"	Consistency with TSTF-GG-05-01, Revision 1, on the use of number representation, symbols and units. This does not change technical content or intent.
6.2.3 B6.2.2.5	Condition A, added commas and deleted "or" Background, added comma	Editorial change. This does not change technical content or intent.
6.2.3 6.3.1	Aligned the Completion Time for Required Compensatory Measures with the Action not the Note.	Consistency with TSTF-GG-05-01, Revision 1, on the alignment of Completion Times to the action. This does not change technical content or intent.
6.4.3	Changed header on page 6.4.3-2 and moved section line to footer.	Consistency with TSTS-GG-05-01, Revision 1, on how titles and continued sections are displayed. This does not change technical content or intent.
B6.1.1 B6.2.2.5 B6.2.2.6 B6.3.1	Applicability, changed "SSW" to "SW" Background, replace wording with acronym ALARA Background, replace wording with acronym ALARA Applicability Safety Analysis, used acronym "REMP"	Consistency with TSTS-GG-05-01, Revision 1, on use of acronyms. This does not change technical content or intent.
B6.1.1 B6.1.2 B6.2.1.3	Added commas	Use a comma to separate elements of a series

B6.2.2.1 B6.2.2.6		connect two independent clauses set off introductory elements set off parenthetical elements separate coordinate adjectives set off quoted elements avoid confusion Editorial change that does not change technical content or intent.
B6.1.1	Compensatory Measures 2nd to last sentence, changed "this" to "it" and changed "this" to "flow"	Editorial change that does not change technical content or intent.
B6.1.2	RFO 3, Added colon after "the"	Use a lead-in to introduce a list of items, to indicate the meaning or purpose of the list (and punctuate it with a colon). Editorial change that does not change technical content or intent.
B6.1.2 B6.2.2.1	RFOs 3, 4, 5, and 6, added table reference Pages B6.2.2.1-4 & 8, added table reference	Table reference added for clarity. Editorial change that does not change technical content or intent.
B6.2.1.2 B6.3.1 B6.3.2	Added "Section" to reference 3	Consistency with other references
B6.2.2.1 B6.2.2.4 B6.2.2.6 B6.3.1 B6.3.2	Surveillance Requirements, changed "7 days" to "seven days," "between 2 and 6 hours" to "between two and six hours," and "8 hours" to "eight hours" Compensatory Measures and Surveillance Requirements, changed "7 days" to "seven days" Surveillance Requirements, changed "4" to "four" RFO, Airborne Pathway, changed "6" to "six" and Ingestion-Milk, changed "sixteen" to "16"	Consistency with TSTF-GG-05-01, Revision 1, on the use of number representation, symbols and units. This does not change technical content or intent.

	RFOs, changed "2" to "two," "4" to "four," and "5" to "five"	
B6.1.1 B6.1.2 B6.2.2.5	Compensatory Measures, deleted "also" Compensatory Measures, deleted "also" Background, changed "&" to "and," corrected verb tense, added "the" and "than"	Corrections made for clarity. Editorial change that does not change technical content or intent.
B6.2.2.6	RFO, added hyphen between 2 and inch	Consistency. Editorial change that does not change technical content or intent.
B6.3.1 B6.3.3	Background changed "to" to "of," Compensatory Measures changed "or" to "of" Compensatory Measures changed "to" to "of"	Sentence structure and consistency with other representations
TOC ODCM Appendix B6.2.2.1	Changed the Title of 6.2.2.5 and B6.2.2.5 to match the Section Title	Consistency. . Editorial change that does not change technical content or intent.
Most pages of the Appendix.	This revision changes the use of the "continued" identifier. The "continued" identifier will not appear at the bottom of a continued page, but will appear on the next page and its placement is dependent upon the information being continued. Repeat headers become single line.	Consistency with TSTF-GG-05-01, Revision 1. This does not change technical content or intent.
Table 2-1 Table 2-2 Table 3-1 Table 3-2 Table 3-3 Table 3-4 Table 3-6 Table 3-7 Table 3-8 Table 3-9 Table 3-10 Table 3-11 Table 3-13 Table 3-15 Table 3-16 Table 3-17	Changed footnotes from asterisk and numbers to letters in figures and tables. Removed footnotes from the body of the ODCM.	Consistency with TSTF-GG-05-01, Revision 1. Editorial change that does not change technical content or intent.

Table 5-1 Table 6.3.1-2 Table 6.3.1-3 6.4.1 6.4.3		
Table 3-14	Changed Reference 2 to the current revision 04-3	This is current revision of this document.
5.0	1st paragraph, changed the TS reference from 5.6.2 to 5.6.1	Editorial change to correct typo
Table 3-6	For parameter fp, moved the animals from the value column to the parameter column.	This was done for consistency. Editorial change that does not change technical content or intent.
3.5.2.1	Two locations, changed "Table 3-5" to "Tables 3-5a-d"	This was done for consistency. Editorial change that does not change technical content or intent.
B6.2.2.6-2	Delete "no movement of irradiated fuel assemblies in secondary containment, suspension of CORE ALTERATIONS, and"	This was changed with Amendment 199 to Technical Specifications, Alternate Source Term. This was removed as obsolete information.
2.4.4	Replaced "Equation 9a" with "Equations 5, 9, and 9a"	Corrected the location of definitions of terms used in Eq. 9b
3.4.2.1	Changed reference from Eq. (7) to Eq. (7a)	Correct a typo
Table 3-9	Added Reference number "4" to annual average temperature	This reference also includes information concerning annual average temperature
6.0.1	Deleted OPERATIONAL CONDITION	This term is no longer in the Technical Specifications
6.0.1 6.1.1 6.1.2 6.2.1.3 Table 6.2.2.1-1 6.2.2.4 6.2.2.5 B6.1.2 B6.2.1.3 B6.2.2.1 B6.2.2.4 B6.2.2.5	Added definition of Functional/Functionality. Replaced OPERABLE/OPERABILITY with Functional/Functionality	The terms OPERABLE/OPERABILITY is limited to SSC required by Technical Specifications. Functional/Functionality are the appropriate terms to be used in the ODCM.
ODCM 6.4.2	Change the submittal date for the Annual Radiological Effluent Release Report	Some data required as part of the report is provided by a vendor and is often not available

		in time to allow the report to be developed and reviewed in a timely manner. This change may require a one time exemption from the NRC to allow the report to be submitted at a later date. This change has been made at several other nuclear plants.

LDCN-13-101; Amendment 51 - These changes to the ODCM were approved by the Plant Operating Committee in December, 2013.

ODCM Section Revised	Brief Description of Revision	Reason for Revision
3.1 Table 3-16 Table 3-17	Eliminated the Visitor's Center	The Visitor's Center no longer exists. This is deletion of obsolete information.
5.3	Expanded discussion to include EN Environmental Services Interlaboratory Comparison Program	ODCM 6.3.3 requires an Interlaboratory Comparison Program radiological environmental analytical program. Presently information is for a vendor laboratory only. Environmental Services now performs some of the analyses, so this is an expansion of information to include the Energy Northwest laboratory.
Table 3-13	Turbine Building Exhaust was changed from "horizontal plane" to "vertical direction"	Per design drawings and field verification, the Turbine Building fans exhaust in a vertical direction. This corrects a minor inconsistency with the FSAR.
Table 3-13	Turbine Building exhaust effective vent area was changed from "8.74" to "7.29." Also basis information was added to footnotes c and e.	The original information was based on having 3 exhaust fans in operation continuously. The actual number of exhaust fans in operation varies through the year. This corrects a minor inconsistency with the FSAR.
Table 3-13	Turbine Building exhaust average velocity was changed from "19.5" to "21.0." Also basis information was added to footnote e.	The original information was based on having 3 exhaust fans in operation continuously. The actual number of exhaust fans in operation varies through the year. This corrects a minor

		inconsistency with the FSAR.
Table 3-13	The average annual building heat emission rate was changed from "1.06E6" to "1.6E5" for the Reactor Building, from "2.9E6" to "1.0E5" for the Radwaste Building, and from "9.1E5" to "8.0E5" for the Turbine Building. Also basis information was added to footnote f.	The original values for the building heat emissions rates were calculated from design basis maximum values, not actual building averages that would be more applicable for routine effluents releases. Calculation ME-02-10-05 determined average heat emission rates for the buildings. This change meets the requirements of TS 5.5.1.a and NUREG 1302.
B6.2.2.5	Requirements for Operability, Deleted last sentence of the 1st paragraph.	The sentence was not necessary and was confusing for Operations. Information was removed for clarity.
2.6.3 (new) TOC	This is a new section describing the approach to assessing dose resulting from ground water contamination.	The ODCM should contain descriptions of all methods used to calculate dose. This change meets the requirements of TS 5.5.1.a and NUREG 1302.
New Table 3-18 List of Tables Table 3-14	Added a new Table 3-18 with Stable Element Transfer Coefficients. Added References for Table 3-18 to Table 3-14	Added stable element transfer (SET) coefficients used in the determination of offsite dose through the ingestion pathways should be documented in the ODCM. Although some of the SET values are from RG 1.109, Table 1.109, not all nuclides are represented. SETs are not available for goat meat, sheep meat, and sheep milk in NRC guidance. SETs were taken from IAEA reports. Others were calculated using the methodology described in Section 6.2.2 of IAEA TRS 472. This change meets the requirements of TS 5.5.1.a and NUREG 1302.
B6.2.2.1	Revised wording related to noble gas dose rate limits.	As a result of revisions to 10CFR20, the references are no longer valid. This section was revised based on the information published in Federal Register, Vol 58, No. 245,

		December 23, 1993, page 68174 as well as from NRC Health Physics Paper QA 18. This does not change technical content or intent.
3.1	Eliminated "using desert sigmas"	This is obsolete/incorrect information. The desert sigma option was removed from the XOQ/DOQ source code. This does not change technical content or intent.
3.3.1 3.3.2 3.4.2.1 3.5.1 3.5.2 Table 3-2 Table 3-3 Table 3-11 Table 3-12	The effluent release rates for both the turbine and radwaste buildings had been combined into one term for dose calculations. This change provides for separate release rates for each building. Redefined the equation parameters so that each building had its own parameter. The deposition factors for both the turbine and radwaste buildings had been combined into one term for dose calculations. This change provides for separate deposition factors for each building. Redefined the equation parameters so that each building had its own parameter.	Actual effluent release rates and deposition factors are calculated for each building and entered separately into the software. This change reflects how the calculations are actually performed. This change meets the requirements of TS 5.5.1.a and NUREG 1302.
3.3.2 Table 3-9 Table 3-11 Table 3-12 List of Tables	Removed the turbine building from Table 3-11 and created a new Table 3-12 with turbine building D/Q and X/Q values	Actual effluent release rates and deposition factors are calculated for each building and entered separately into the software. This change reflects how the calculations are actually performed. This change meets the requirements of TS 5.5.1.a and NUREG 1302.
3.3.2.1 Table 3-4	Changed P_i^I to "P_i"	Consistency in the way this term is defined in Section 3.3.2. Editorial change that does not change technical content or intent.
Table 3-2 Table 3-3 Table 3-10 Table 3-11 Table 3-12	Updated the meteorological data from "1997 through 2000 plus 2002" to "2008 through 2012"	The most recent 5 year meteorological average data has the highest potential offsite dose in a different sector than was previously determined. In

		order to provide the most accurate dose projections, the meteorological data needs to be updated. This change meets the requirements of TS 5.5.1.a and NUREG 1302.
Table 3-2	Eliminated the resident from the SE sector	This house has been vacant for several years. This was removed since it was obsolete information. This does not change technical content or intent.
Table 3-2	Deleted footnotes on the type of release mode dispersion parameters.	The information removed was unnecessary and potentially incorrect. The type of release mode is calculated by the GASPAR II software as determined by the actual parameters of the release.
Table 3-4	Revised footnote (b) and added footnote (c)	The values in this Table are found in the GSAPAR II program used for the calculation of dose. The footnotes reference where the values are located.
Table 3-8	Added footnote to consumption factors to zero if Land Use Census does not identify leafy vegetation or garden produce.	As defined in NUREG 1302, 1.17, the ODCM shall contain the methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluents. This change meets the requirements of TS 5.5.1.a and NUREG 1302.
NA	NA	NA
Figure 3-1	Added "Outfall 001" location," "Owner Controlled Area," and two "Unrestricted Area" locations	Provide better clarity. Editorial change that does not change technical content or intent.
Figure 3-2	Changed "Elevated Release" to "To Atmosphere"	This was done for consistency. Editorial change that does not change technical content or intent.
3.1	Modified wording of the first paragraph of when a batch release might occur	This was done for consistency with ODCM and plant procedures. This does not change technical content or intent.

3.4.2	Reformatted to make the partitioning of effluents by building on the impact of setpoints more obvious.	Provide better clarity. Editorial change that does not change technical content or intent.
2.4.4	Added description of the factor 0.8 in Eq. 9b "0.8 is the fraction to account for maximum instrument drift and loop uncertainties"	This change provides clarity to factor used in the equation.
Table 6.1.2-1	Changed the required number of channels per function from 1 to 2 for the Main Condenser Offgas Post-Treatment Radiation Monitor	Two channels are required for the function to close OG-V-60 on a Hi-HI-Hi Radiation Alarm.
Figure 3-2	Changed the Noble Gas Activity Monitor Discharged to the Radwaste Bldg.	The Sample stream is vented to the room and not to the atmosphere.
Figure 3-2	Changed the Reactor Bldg "Noble Gas Activity Monitor" to "Low Range Activity Monitor"	This matches the description in ODCM Table 6.1.2-1
Table 3-6	Changed reference for fs from NUREG 0133 to NUREG/CR-4653	This is to ensure consistency in references. NUREG/CR-4653 is for the GASPAR program. There was no change in the actual value for this factor
3.5.2.1	Changed "Grass-Cow/Goat-Milk" to "Grass-Milk" and changed "cow/goat" to "milk animal" Changed "Grass-cow-meat pathway" to "Grass-meat pathway" and changed "cow" to "meat animal"	This change provides flexibility based on the type of animals detected in the Land Use Census. This change that does not change technical content or intent.
6.2.2.1	Changed "1500 rem" to 1500 mrem"	Corrected typo from conversion to Word
Table 3-13	Added a Reference to FSAR 11.3.3.1	ODCM Table 3-13 contains all information required to be in FSAR Table 11.3-6. FSAR Table 11.3-6 will be revised to delete the information and a reference to ODCM Table 3-13 will be added. This is to avoid having duplicate information in two locations.
page 41	Change "remb oval" to "removal"	Correct typo
Table 3-2	Updated distances to GPS values	The Land Use Census is now using distances measured by GPS
TOC Table 3-9	Change title from "...Calculating Dose..." to "...Calculating Annual Dose..."	This is a more accurate description.
Table 3-2	Added resident in ENE Sector at 4.95 miles	This was identified during the Land Use Census

Table 3-13	Changed Rx Bldg duct from 30.5 to 3.05	This was an inadvertent typo that was introduced during the conversion from Word Perfect to Word in Amendment 49.

8.0 REVISIONS TO THE PROCESS CONTROL PROGRAM (PCP)

There were no revisions to the Process Control Program, SWP-RMP-02 in 2013.

9.0 NEW OR DELETED LOCATIONS FOR DOSE ASSESSMENTS AND/OR ENVIRONMENTAL MONITORING LOCATIONS

9.1 There were no major changes observed in the 2013 Five-Mile Land Use Census (LUC). No broad leaf vegetation was observed in any gardens or fields within the 5-mile radius. However, because of the fruit, corn, and other crops being commercially grown in the area, the garden produce pathway is assumed for all residents. Dose from the cow-milk pathway was estimated for a resident at 7.33 miles ESE even though outside of the five-mile radius and as a result, estimates of gaseous effluent dispersion and deposition based on a straight-line Gaussian plume model will have significant error due to intervening topographic features.

				Ingestion		
Location	Plume	Ground Shine	Inhalation	Garden Produce	Beef Meat	Cow Milk
Resident (4.50 miles NE)	X	X	X	X		
Resident (3.88 miles ENE)	X	X	X	X		
Resident (4.95 miles ENE)	X	X	X	X	X	
Resident (4.64 miles E)	X	X	X	X	X	
Resident (4.26 miles ESE)	X	X	X	X		
Resident (7.33 miles ESE)	X	X	X	X		X

9.2 There were no new locations for environmental monitoring formally adopted into the program based on the 2013 Land Use Census. Milk samples are routinely collected at 7.33 miles ESE.

9.3 No dose assessment or environmental monitoring locations were deleted.

10.0 MAJOR CHANGES TO RADIOACTIVE LIQUID, GASEOUS, AND SOLID WASTE TREATMENT SYSTEMS

No major changes (as defined by ODCM Section 6.4.3) were made to the radioactive waste systems (liquid, gaseous, or solid) during this reporting period.