Omaha Public Power District

444 South 16th Street Mall
Omaha, NE 68102-2247

April 23, 2013
LIC-13-0043

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Reference: Docket No. 50-285

SUBJECT: Fort Calhoun Station (FCS) Radiological Effluent Release Report and Radiological Environmental Operating Report

Pursuant to Fort Calhoun Station (FCS), Unit No. 1, Technical Specifications (TS) 5.9.4a and 5.9.4b, the Omaha Public Power District (OPPD) provides the Annual Radiological Effluent Release Report and the Annual Radiological Environmental Operating Report.

The Annual Radiological Effluent Release Report encompasses the period of January 1, 2012 through December 31, 2012 and is submitted in accordance with TS 5.9.4a. The report is presented in the format outlined in Regulatory Guide 1.21, Revision 1. In addition, the report provides the results of quarterly dose calculations performed in accordance with the Offsite Dose Calculation Manual (ODCM).

In accordance with TS 5.17d and 5.18d, Section VII of the Annual Radiological Effluent Release Report includes the latest revisions to the ODCM and Process Control Program.

The Annual Radiological Environmental Operating Report encompasses the period of January 1, 2012 through December 31, 2012 and is submitted in accordance with TS Section 5.9.4b. The data provided is consistent with the objectives specified in Section 5.2.2 of the ODCM.

No commitments to the NRC are made in this letter.

IE48
NRR

Please contact the Supervisor of Chemical Operations, Mr. James Shipman at (402) 533-7127 if you have any questions.

Sincerely,

T.W. Simpkin
Manager – Site Regulatory Assurance

TWS/imm

Enclosures:

1. Annual Radiological Effluent Release Report
2. Annual Radiological Environmental Operating Report

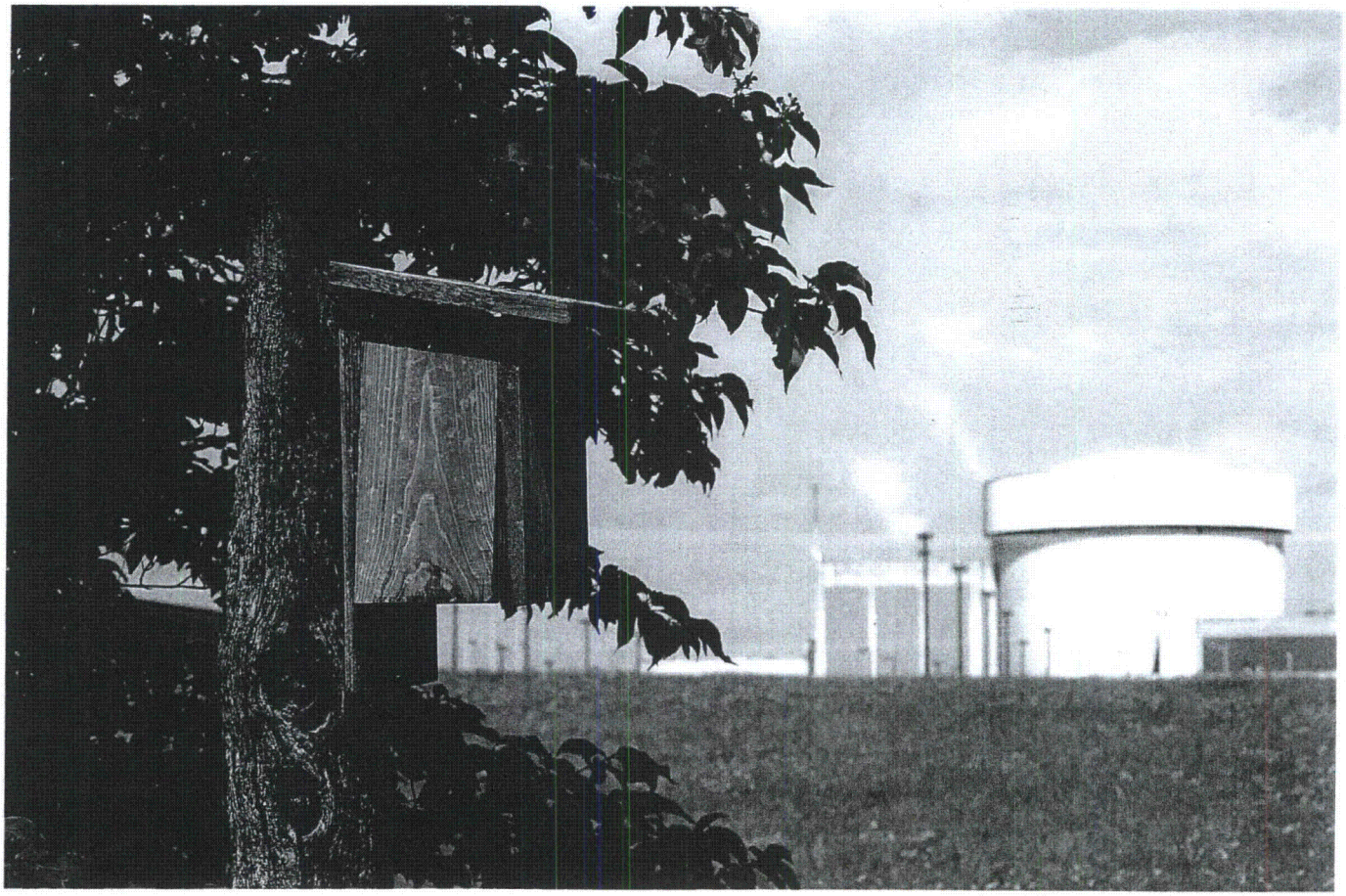
c: A. T. Howell, NRC Regional Administrator, Region IV
L. E. Wilkins, NRC Project Manager
J. M. Sebrosky, NRC Project Manager
J. C. Kirkland, NRC Senior Resident Inspector

Omaha Public Power District

Fort Calhoun Nuclear Station

2012

Radiological Operating Environmental Report



OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

TECHNICAL SPECIFICATION 5.9.4.b

January 01, 2012 – December 31, 2012

Annual Radiological Environmental Operating Report

This report is submitted in accordance with Section 5.9.4.b of the Technical Specifications of Fort Calhoun Station Unit No. 1, Facility Operating License DPR-40 for the period January 01, 2012 through December 31, 2012.

In addition, this report provides any observations and anomalies that occurred during the monitoring period.

Reviewed by:

Supervisor-System Chemistry

Approved by:

For Manager-Chemistry

Plant Manager

Site VP and CNO

Annual Radiological Environmental Operating Report

In accordance with Technical Specification 5.9.4.b, herein is the Fort Calhoun Station (FCS) Annual Radiological Environmental Operating Report for year 2012. The data provided is consistent with the objectives as specified in Section 5.2.2 of the Offsite Dose Calculation Manual (ODCM), "Annual Radiological Environmental Operating Report." The report is presented as follows:

1) An introductory discussion of the implementation of the Radiological Environmental Monitoring Program (REMP), including program observations and environmental impact relevant to the operation of FCS.

2) The sample class, sample collection frequency, number of sample locations, and the number of samples collected this reporting period for each parameter is delineated in Table 1.0.

3) A statistical evaluation of REMP data is summarized in Table 2.0, in accordance with Regulatory Guide 4.8, Table 1. For each type of sample media and analysis, Table 2.0 presents data separately for all **indicator** locations, all **control** (background) locations, and the location having the highest annual mean result. For each of these classes, Table 2.0 specifies the following:

   a. The total number of analyses
   b. The fraction of analyses yielding detectable results (i.e., results above the highest Lower Limit of Detection (LLD) for this period)
   c. The maximum, minimum, and average results
   d. Locations with the highest annual mean are specified by code, name, and by distance and direction from the center of plant reactor containment building.

4) Table 3.0 is a listing of missed samples and explanations

5) FC-801, 2012 Environmental Land Use Survey Report

6) Review of Environmental Inc. Quality Assurance Program

7) Appendix A describes the Interlaboratory Comparison Program

8) Appendix B describes the vendor Data Reporting Conventions utilized

9) Appendix C reports the information required when primary coolant specific activity has exceeded the limits of Technical Specification 2.1.3

10) Appendix D is the Sample Locations/Map

INTRODUCTION

Radiological Environmental Monitoring Program (REMP) – 2012

This report gives the results of the Radiological Environmental Monitoring Program (REMP) for the year 2012. The REMP is a requirement of the Fort Calhoun Station (FCS) operating license. It was initiated prior to plant operation in 1973.

The main purpose of the REMP is to ensure public safety by monitoring plant discharges and assessing the effect, if any, of plant operations, on the environment. Samples are collected that would account for various exposure pathways such as ingestion, inhalation, adsorption and direct exposure. Samples collected on a regular basis include: air, surface water, ground water, milk, vegetation, fish, sediment, and food crops. Direct radiation is measured by thermoluminescent dosimeters (TLDs). These samples and TLDs are sent to an independent vendor laboratory for analysis. The vendor uses analytical methods that are sensitive enough to detect a level of activity far below that which would be considered harmful. Locations for sample collection are based on radiological and meteorological data from the Annual Effluent Release Report and information obtained from the Environmental Land Use Survey.

Most samples, particularly indicator samples, are collected in a circular area within a five-mile radius of plant containment while control locations are usually outside of five miles. This circle is divided into sixteen equal sectors, each assigned an identification letter "A" through "R" (note: letters "I" and "O" are not used, as they may be mistaken for the numbers "1" and "0"). Sector "A" is centered on North or zero degrees. Sectors are also given directional labels such as "West-Southwest" ("WSW"). Sample locations are listed by number along with their respective distances and direction from plant containment, in the Offsite Dose Calculation Manual (ODCM).

When assessing sample results, data from indicator locations most likely to be effected by plant operations are compared to control locations least or not likely to be effected. Results from an indicator location which were significantly higher than those from a control location, could indicate a plant-attributable effect, and could require additional investigation.

The results of the sample analyses, as required by the FCS Offsite Dose Calculation Manual (ODCM), are presented in the attached statistical tables in accordance with Table 1 of Regulatory Guide 4.8, "Environmental Technical Specifications for Nuclear Power Plants." Sample collection was conducted by plant chemistry/environmental staff. A contract vendor (Environmental Inc., Northbrook, Illinois) performed sample analyses, preparation of monthly reports and the statistical evaluation of sample results. All vendor analysis techniques met the sensitivity requirements as stated in the ODCM.

Results for 2012 were within expected ranges and compared closely with historical results, with the following exceptions.

1) Ambient Gamma Radiation

Ambient gamma radiation is measured by thermoluminescent dosimeters (TLDs) provided by the vendor laboratory. These dosimeters contain calcium sulfate phosphors and are processed quarterly. Thirty-two new thermoluminescent dosimeters were added to the program during the fourth quarter of 2010.

All sample results are within the range of historical data and displayed less than 10% difference when compared to historical averages. Vendor analytical results displayed a high bias for the 2nd half of the year. A vendor investigation determined a math error at calibration, and results were corrected by the vendor. One TLD could not be retrieved. The power pole that the TLD was attached to was removed during flood reconstruction efforts. No discrepancy between released effluents and resultant radiation dose measured was observed. No changes in plant operation/procedures are required based upon observed impacts to the environment to date.

10-Year Trend Comparison of TLD Locations

Location	Avg. Dose (mr/week)	2012 Avg. Dose (mr/week)
A	1.36	1.35
B	1.45	1.48
C	1.48	1.60
D	1.27	1.35
F	1.44	1.53
G	1.34	1.48
H	1.48	1.55
I	1.54	1.68
J	1.59	1.60
K	1.51	1.60
N	1.40	1.50
O	1.40	1.50
P*	1.44	1.60
S*	1.45	1.58
L (Control)	1.29	1.35

* At least 8-Year comparison due to data availability

2) Milk/Pasture

Milk samples or pasture grasses, if milk is temporarily unavailable, are collected every two weeks during the pasture season from the beginning of May through September, and monthly the rest of the calendar year. Indicator samples are collected from a herd of milk goats at a family farm located approximately 0.7 miles from the plant in Sector K (South-Southwest). The control samples are collected from a commercial dairy cow herd located approximately 9.9 miles from the plant in Sector J (South). These locations are unchanged from last year.

All sample results for Cesium-134, Cesium-137 and other gammas were at the LLD for both indicator and control locations. No plant-related effects were observed.

3) **Fish**

Fish are collected on an annual basis. Control samples are collected at a location approximately twenty miles upstream of the plant (river miles 665 – 667). Indicator samples are collected in the immediate vicinity of the power plant (river miles 644 – 646). Several species of fish, important to commercial and recreational interest, representing all levels of the aquatic food chain are collected at both locations.

All sample results are within the range of historical data. Results from both control and indicator locations were less than LLD for all gamma emitters, indicating no plant-related effects.

4) **Food Crop**

Based on the results of the biennial Land Use Survey, the nearest high deposition pathway for food crops is the Alvin Pechnik Farm in Sector H (0.94 miles, 163°). Accordingly, vegetable samples were collected at Alvin Pechnik Farm for the purposes of the 2012 REMP.

Samples were comparable with historical results and within the range of results reported from the control location garden at Mohr Dairy.

All results were at the LLD for all non-naturally occurring radionuclides. No plant-related effects were observed.

5) **Sediment**

River sediment samples are collected twice a year at an upstream control location (0.09 miles, 4° N) and a downstream indicator location (0.45 miles, 108° ESE).

All results were at the LLD for all non-naturally occurring radionuclides. No plant-related effects were observed.

6) **Air Monitoring**

Air sample results for 2012 were well within historical limits for all locations. Additionally, all indicator locations showed results very similar to the control locations.

All sample results are within the range of historical data. All indicator locations displayed less than 17% difference when compared to historical average. All 2012 results when compared to historical averages are within the stated vendor error acceptance tolerance.

Results from both control and indicator locations were less than LLD for gamma emitters and iodine. No changes in plant operation/procedures are required based upon observed impacts to the environment to date.

10-Year Trend Comparison of Air Sampling Locations

Location	Avg. Beta (pCi/m^3)	2012 Avg. Beta (pCi/m^3)
Sector B	0.030	.034
Sector D	0.030	.035
Sector I	0.030	.033
Sector J	0.026	.031
Sector K*	0.028	.029
Sector F (Control)	0.029	.032

* At least a 5-Year comparison due to data availability

7) Surface Water

Water samples are collected upstream of the plant (control location) as well as half-mile downstream and at a municipal water treatment plant on the north edge of Omaha.

Results for Cs-134, Cs-137, and other gammas were all less than LLD. Tritium results were also less than LLD. No plant-related effects were detected.

8) Ground Water

Quarterly residential well water samples are collected at the following locations: Station No. 15, Smith Farm, Station No. 20, Mohr Dairy, Station No. 33, Bansen Farm and Station No. 40, Herber Acreage. All sample results to date have been at the LLD except gross beta due to naturally occurring radionuclides. Gross beta results have ranged from a low of 4.2 pCi/liter to a high of 81.7 pCi/liter, with an average gross beta for the year of 24.2 pCi/liter. Strontium-90 analysis is being conducted on wells as part of the station's groundwater protection program. No plant-related effects were detected.

Table 1.0

Sample Collection Program

Sample Class	Collection Frequency	Number of Sample Locations	Samples Collected this Period.
Background Radiation (TLDs)	Quarterly	47	187[1]
Air Particulates	Weekly	6	318[2]
Airborne Iodine	Weekly	6	318[2]
Milk	Biweekly May thru Sept	2	22[3]
Surface Water	Monthly	3	36
Ground Water	Quarterly	4	16
Fish	Annually	2	5[4]
Sediment	Semi-annually	2	4
Food Crops	Annually	3	8[5]
		TOTAL	**914**

Note 1: One sample collection was missed due to missing TLD (CR 2012-06762).
Note 2: Weekly sampling periods overlapped 2013 resulting in extra samples being collected.
Note 3: Milk sample collection totals include vegetation when milk is unavailability.
Note 4: Includes one background sample.
Note 5: Variety of samples collected during period.

Table 2.0 Radiological Environmental Monitoring Program Summary — Reporting Period January-December, 2012

Name of Facility: Fort Calhoun Nuclear Power Station - Unit 1 — Docket No. 50-285

Location of Facility: Washington, Nebraska (County, State)

Sample Type (Units)	Type and Number of Analyses[a]			LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Location with Highest Annual Mean Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Background Radiation (TLD) (mR/week)	Gamma		183	0.5	1.6 (183/183) (1.2-2.1)	OTD-2K-(I), 2.52 mi. @ 205°	1.9 (4/4) (1.7-2.1)	1.4 (4/4) (1.3-1.4)	0
Airborne Particulates (pCi/m^3)	GB		318	0.005	0.032 (265/265) (0.007-0.096)	OAP-D-(I) 19.5 miles SW.	0.035 (53/53) (0.012-0.064)	0.032 (52/52) (0.019-0.076)	0
	GS		24						
		Cs-134		0.001	< LLD	-	-	< LLD	0
		Cs-137		0.001	< LLD	-	-	< LLD	0
		Other Gammas		0.001	< LLD	-	-	< LLD	0
Airborne Iodine (pCi/m3)		I-131	318	0.070	< LLD	-	-	< LLD	0
Milk (pCi/L)		I-131	11	0.5	< LLD	-	-	< LLD	0
	GS		11						
		K-40		150	1284 (11/11) (1200-1351)	OFM-D-(C), Mohr Dairy, 9.8 mi@187°	1284 (11/11) (1200-1351)	1284 (11/11) (1200-1351)	0
		Cs-134		15	< LLD	-	-	< LLD	0
		Cs-137		15	< LLD	-	-	< LLD	0
		Other Gammas		15	< LLD	-	-	< LLD	0
Ground Water (pCi/L)	GB		16		24.2 (12/12) (4.2-81.7)	OGW-A-(I), Smith Farm, 1.9 mi @ 133°	60.3 (4/4) (39.9-81.7)	5./8 (4/4) (5.3-6.4)	0
	H-3		16	300	< LLD	-	-	< LLD	0
	Sr-90		16	0.71	< LLD	-	-	< LLD	0
	GS		16						
(pCi/L)		Cs-134		15	< LLD	-	-	< LLD	0
		Cs-137		18	< LLD	-	-	< LLD	0
		Other Gammas		15	< LLD	-	-	< LLD	0
Surface Water (pCi/L)	GS		36						
		Cs-134		15	< LLD	-	-	< LLD	0
		Cs-137		18	< LLD	-	-	< LLD	0
		Other Gammas		15	< LLD	-	-	< LLD	0
									0
		H-3	12	300	< LLD	-	-	< LLD	

Name of Facility: Fort Calhoun Nuclear Power Station - Unit 1 Docket No. 50-285
Location of Facility: Washington, Nebraska
(County, State)

Sample Type (Units)	Type and Number of Analyses[a]		LLD[b]	Indicator Locations Mean (F)[c] Range[c]	Location with Highest Annual Mean Location[d]	Location with Highest Annual Mean Mean (F)[c] Range[c]	Control Locations Mean (F)[c] Range[c]	Number Non-Routine Results[e]
Fish (pCi/g wet)	GS	5						
	Mn-54		0.021	< LLD	-	-	< LLD	0
	Co-58		0.023	< LLD	-	-	< LLD	0
	Co-60		0.016	< LLD	-	-	< LLD	0
	Fe-59		0.071	< LLD	-	-	< LLD	0
	Zn-65		0.040	< LLD	-	-	< LLD	0
	Ru-103		0.031	< LLD	-	-	< LLD	0
	Cs-134		0.022	< LLD	-	-	< LLD	0
	Cs-137		0.019	< LLD	-	-	< LLD	0
Sediment pCi/g dry	GS	4						
	Mn-54		0.023	< LLD	-	-	< LLD	0
	Co-58		0.023	< LLD	-	-	< LLD	0
	Co-60		0.016	< LLD	-	-	< LLD	0
	Fe-59		0.066	< LLD	-	-	< LLD	0
	Zn-65		0.051	< LLD	-	-	< LLD	0
	Cs-134		0.015	< LLD	-	-	< LLD	0
	Cs-137		0.020	< LLD	-	-	< LLD	0
Food Crops (pCi/g wet)	GS	6						
	Mn-54		0.021	< LLD	-	-	< LLD	0
	Co-58		0.020	< LLD	-	-	< LLD	0
	Co-60		0.014	< LLD	-	-	< LLD	0
	Fe-59		0.045	< LLD	-	-	< LLD	0
	Zn-65		0.043	< LLD	-	-	< LLD	0
	Zr-Nb-95		0.023	< LLD	-	-	< LLD	0
	Cs-134		0.017	< LLD	-	-	< LLD	0
	Cs-137		0.016	< LLD	-	-	< LLD	0
	Ba-La-140		0.015	< LLD	-	-	< LLD	0
Vegetation (MI) (pCi/g wet)	GS	11						
	Mn-54		0.033	< LLD	-	-	< LLD	0
	Co-58		0.029	< LLD	-	-	< LLD	0
	Co-60		0.026	< LLD	-	-	< LLD	0
	Fe-59		0.050	< LLD	-	-	< LLD	0
	Zn-65		0.052	< LLD	-	-	< LLD	0
	Zr-Nb-95		0.035	< LLD	-	-	< LLD	0
	I-131		0.046	< LLD			< LLD	0
	Cs-134		0.026	< LLD	-	-	< LLD	0
	Cs-137		0.029	< LLD	-	-	< LLD	0
	Ba-La-140		0.027	< LLD	-	-	< LLD	0

[a] GB = gross beta, GS = gamma scan.
[b] LLD = nominal lower limit of detection based on a 95% confidence level.
[c] Mean and range are based on detectable measurements only (i.e., >LLD) Fraction of detectable measurements at specified locations is indicated in parentheses (F).
[d] Locations are specified: (1) by code, (2) by name, and (3) by distance and direction relative to the Reactor Containment Building.
[e] Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds the typical pre-operational value for the medium or location.

Table 3.0 Listing of Missed Samples (samples scheduled but not collected)

Sample Type	Date	Location	Reason
TLD	7/2/2012	OTD-2A-(I)	The pole on which the TLD had been placed had been removed during flood cleanup activities at the cottonwood marina campground. The TLD could not be located. (CR 2012-06762).

Environmental Land Use Survey Report

Sector	Dir	Land Use	Owner	Miles	Meters	Deg	Survey Technique	Age Group				XOQ	DOQ	Remarks
								Adult	Teen	Child	Infant			
A	N	RESIDENCE	WRIGHT	4.36	7016.74	351	INTERVIEW	X		X				
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION												
		GROUNDWATER	WRIGHT	4.36	7016.74	351	INTERVIEW	X		X				
B	NNE	RESIDENCE	RAND,J	1.93	3106.03	12	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION												
		GROUNDWATER	RAND,J	1.93	3106.03	12	INTERVIEW	X						
C	NE	RESIDENCE	HANSEN,S	1.52	2446.20	42	INTERVIEW	X		X				
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION	THIELE	1.59	2558.86	52	MAIL SURVEY	X						
		GROUNDWATER	HANSEN,S	1.52	2446.20	42	MAIL SURVEY	X		X				
D	ENE	RESIDENCE	MEADE,G	4.79	7708.76	63	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION	MEADE,G	4.79	7708.76	63	INTERVIEW	X						
		GROUNDWATER	MEADE,G	4.79	7708.76	63	INTERVIEW	X						
E	E	RESIDENCE	DOTY,J	4.67	7515.64	89	MAIL SURVEY	X						
		MILK ANIMAL												
		MEAT ANIMAL	BROTHERS,D	4.91	7901.88	90	INTERVIEW	X						
		VEGETATION												
		GROUNDWATER	DOTY,J	4.67	7515.64	89	INTERVIEW	X						
F	ESE	RESIDENCE	WILSON ISLAND	4.22	6791.43	121	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION												
		GROUNDWATER	WILSON ISLAND	4.22	6791.43	121	INTERVIEW	X						
G	SE	RESIDENCE	CARTER,T	1.67	2687.60	145	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION	KALIN,W	1.74	2800.26	145	INTERVIEW	X						
		GROUNDWATER	SMITH	1.99	3202.59	134	INTERVIEW	X						

Environmental Land Use Survey Report

Sector	Dir	Land Use	Owner	Miles	Meters	Deg	Survey Technique	Age Group				XOQ	DOQ	Remarks
								Adult	Teen	Child	Infant			
H	SSE	RESIDENCE	LOMP	.65	1046.07	163	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL	HINELINE,R	1.82	2929.01	148	INTERVIEW	X						
		VEGETATION	PECHNIK,A	.94	1512.78	163	INTERVIEW	X						
		GROUNDWATER	LOMP	.65	1046.07	163	INTERVIEW	X						
J	S	RESIDENCE	DOWLER	.73	1174.82	175	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL	DICKES,L	2.60	4184.29	170	INTERVIEW	X						
		VEGETATION	DOWLER	.73	1174.82	175	INTERVIEW	X						
		GROUNDWATER	DOWLER	.73	1174.82	175	INTERVIEW	X						
K	SSW	RESIDENCE	D.MILLER	.65	1046.07	203	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL	T. DEIN	2.00	3218.69	189	INTERVIEW	X						
		VEGETATION	T.DEIN	2.00	3218.69	189	INTERVIEW	X						
		GROUNDWATER	D.MILLER	.65	1046.07	203	INTERVIEW	X						
L	SW	RESIDENCE	ROBERTSON,D	.73	1174.82	224	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL	ROBERTSON,D	.73	1174.82	224	INTERVIEW	X						
		VEGETATION	ROBERTSON,D	.73	1174.82	224	INTERVIEW	X						
		GROUNDWATER	ROBERTSON,D	.73	1174.82	224	INTERVIEW	X						
M	WSW	RESIDENCE	BENSEN,M	1.06	1705.90	257	MAIL SURVEY	X						
		MILK ANIMAL												
		MEAT ANIMAL	WRICH,B	2.42	3894.61	250	MAIL SURVEY	X						
		VEGETATION	RUSSELL,D	1.21	1947.31	246	MAIL SURVEY	X						
		GROUNDWATER	BENSEN,M	1.06	1705.90	257	MAIL SURVEY	X						
N	W	RESIDENCE	NIELSEN,D	1.20	1931.21	263	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL	ANDERSON,J	3.25	5230.37	281	INTERVIEW	X						
		VEGETATION	ASMUSSEN,G	1.30	2092.15	270	MAIL SURVEY	X						
		GROUNDWATER	ANDERSON,J	3.25	5230.37	281	INTERVIEW	X						
P	WNW	RESIDENCE	WACHTER,G	2.27	3653.21	302	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL	WACHTER,G	2.27	3653.21	302	INTERVIEW	X						
		VEGETATION	WACHTER,G	2.27	3653.21	302	INTERVIEW	X						
		GROUNDWATER	WACHTER,G	2.27	3653.21	302	INTERVIEW	X						

Environmental Land Use Survey Report

Sector	Dir	Land Use	Owner	Miles	Meters	Deg	Survey Technique	Age Group				XOQ	DOQ	Remarks
								Adult	Teen	Child	Infant			
Q	NW	RESIDENCE	HANSEN,R	2.40	3862.43	318	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION	HANSEN,R	2.40	3862.43	318	INTERVIEW	X						
		GROUNDWATER	HANSEN,R	2.40	3862.43	318	INTERVIEW	X						
R	NNW	RESIDENCE	SHUBERT,B	2.08	3347.44	330	INTERVIEW	X						
		MILK ANIMAL												
		MEAT ANIMAL	SONDERUP	3.73	6002.85	328	INTERVIEW	X						
		VEGETATION	SONDERUP	3.73	6002.85	328	INTERVIEW	X						
		GROUNDWATER	SONDERUP	3.73	6002.85	328	INTERVIEW	X						

Performed by Anthony A Colangelo

Reviewed by

Review of Environmental Inc., Quality Assurance Program

Fort Calhoun Station contracts with Environmental Inc., Midwest Laboratory (vendor lab) to perform radioanalysis of environmental samples. Environmental Inc. participates in interlaboratory comparison (cross-check) programs as part of its quality control program. These programs are operated by such agencies as the Department of Energy, which supply blind-spike samples such as milk or water containing concentrations of radionuclides unknown to the testing laboratory. This type of program provides an independent check of the analytical laboratory's procedures and processes, and provides indication of possible weaknesses. In addition, Environmental Inc. has its own in-house QA program of blind-spike and duplicate analyses.

Vendor in-house spike sampling was performed without a failure and in-house blank analyses were performed within acceptable ranges.

Three failures were observed from QA samples performed as part of the Environmental Resource Associates Inter-laboratory Comparison Cross-check Program. Drinking water sample ERW-1789, experienced high results for a Gross Beta. Gross beta was measured at 76.2 +/- 1.8 pCi/L with an acceptable band of 29.6-51.5 pCi/l. The stated error was a sample dilution problem. A new sample dilution was prepared; the analysis was re-performed, and produced acceptable results. The stated error was a sample dilution problem. Gross Beta performed for Department of Energy's MAPEP was performed successfully for 2012. Gross Beta sampling at FCS indicator stations displayed normal trends. One location had its well replaced after flooding from last year damaged it. This locale did show an increase over previous trending; however connecting of these results to this sample dilution issue seems unwarranted. Water sample ERW-1257 was performed to determine isotopes of Radium. Determinations for Ra-226 and Ra-228 displayed a high bias. Reanalysis of both samples produced acceptable results. No reason was given for the failures. A new test was ordered from ERA to be performed in the first quarter of 2013 and will be evaluated then. Radium analysis is not part of the FCS REMP program. OPPD results were not negatively impacted by these vendor identified issues.

Five DOE mixed analytic failures occurred during the calendar year. Soil sample STSO-1766 failed low on Am-241. Sample result was 88.50 +/- 8.30 Bq/kg for a range of 111-207 Bq/kg. Investigation of anomalous result was inconclusive, and insufficient sample was available to perform reanalysis. ERA soil analysis for AM-241 produced acceptable results. All isotopes analyzed as part of the FCS REMP program produced acceptable results. Water sample STW-5445, failed low on Am-241. Sample result was 0.64 +/- 0.04 Bq/L for a range of 0.74-1.38 Bq/L. An issue with sample recovery for the matrix was identified as the cause of the failure. A correction using the blank to determine recovery and reanalysis produced acceptable results. Air particulate filter, STAP-5401 failed high for Am-241 and low for uranium 233/234 analyses. Eleven other analyses performed on the filter were completed satisfactorily. All three failed analyses were successfully re-performed.

Performing the testing on a larger sample size resulted in the reduction in counting error. Gamma scans for the FCS REMP programs had no positive detections at control or indicator stations, and Uranium analyses are not part of the station's program. Vegetation sample, STVE-5395, failed high on cobalt 57 activity. The original sample result was 7.44 +/- 0.04 Bq/total sample, for an acceptable range of 3.96-7.36 Bq/total sample. The gamma counting for five nuclides show a high bias, however 4 out of the 5 five test results were in the acceptable range. Four acceptable test results included isotopes that are in FCS REMP program. No gamma counts from control or indicator spectrums had plant related nuclides present. A sample geometry adjustment was made and the sample recounted. The re-performed analysis was within acceptable limits (6.74).

No test results failed both the ERA and DOE methodologies for a given sample type. Reanalysis produced acceptable results. Documentation of bias being present, despite falling within acceptable performance, visibly demonstrates the vendor's commitment to reporting and resolving deficiencies.

These results indicate the vendor's ability to self-identify and correct any deviations from acceptable or expected results. The test results had no impact on Fort Calhoun samples and were documented as such by the vendor.

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APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS

NOTE: Environmental Inc., Midwest Laboratory participates in intercomparison studies administered by Environmental Resources Associates, and serves as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. Results are reported in Appendix A. TLD Intercomparison results, in-house spikes, blanks, duplicates and mixed analyte performance evaluation program results are also reported. Appendix A is updated four times a year; the complete Appendix is included in March, June, September and December monthly progress reports only.

January, 2012 through December, 2012

Appendix A

Interlaboratory Comparison Program Results

Environmental, Inc., Midwest Laboratory has participated in interlaboratory comparison (crosscheck) programs since the formulation of it's quality control program in December 1971. These programs are operated by agencies which supply environmental type samples containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on a laboratory's analytical procedures and to alert it of any possible problems.

Participant laboratories measure the concentration of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

Results in Table A-1 were obtained through participation in the environmental sample crosscheck program administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

Table A-2 lists results for thermoluminescent dosimeters (TLDs), via International Intercomparison of Environmental Dosimeters, when available, and internal laboratory testing.

Table A-3 lists results of the analyses on in-house "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

Table A-4 lists results of the analyses on in-house "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-5 lists REMP specific analytical results from the in-house "duplicate" program for the past twelve months. Acceptance is based on the difference of the results being less than the sum of the errors. Complete analytical data for duplicate analyses is available upon request.

The results in Table A-6 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

Results in Table A-7 were obtained through participation in the environmental sample crosscheck program administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the Environmental Measurement Laboratory Quality Assessment Program (EML).

Attachment A lists the laboratory precision at the 1 sigma level for various analyses. The acceptance criteria in Table A-3 is set at ± 2 sigma.

Out-of-limit results are explained directly below the result.

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code	Date	Analysis	Concentration (pCi/L) Laboratory Result [b]	ERA Result [c]	Control Limits	Acceptance
ERW-1783	04/09/12	Sr-89	62.2 ± 6.0	58.5	46.9 - 66.3	Pass
ERW-1783	04/09/12	Sr-90	33.7 ± 2.1	37.4	27.4 - 43.1	Pass
ERW-1786	04/09/12	Ba-133	75.7 ± 4.1	82.3	69.1 - 90.5	Pass
ERW-1786	04/09/12	Co-60	71.9 ± 4.0	72.9	65.6 - 82.6	Pass
ERW-1786	04/09/12	Cs-134	70.0 ± 4.3	74.2	60.6 - 81.6	Pass
ERW-1786	04/09/12	Cs-137	151.5 ± 6.1	155.0	140.0 - 172.0	Pass
ERW-1786	04/09/12	Zn-65	108.3 ± 89.0	105.0	94.5 - 125.0	Pass
ERW-1789	04/09/12	Gr. Alpha	55.0 ± 2.4	62.9	33.0 - 78.0	Pass
ERW-1789 [d]	04/09/12	Gr. Beta	38.3 ± 1.3	44.2	29.6 - 51.5	Pass
ERW-1795	04/09/12	Ra-226	6.4 ± 0.4	5.7	4.3 - 6.9	Pass
ERW-1795	04/09/12	Ra-228	5.4 ± 1.2	4.6	2.7 - 6.3	Pass
ERW-1795	04/09/12	Uranium	56.2 ± 2.6	61.5	50.0 - 68.2	Pass
ERW-1798	04/09/12	H-3	16023 ± 355	15800	13800 - 17400	Pass
ERW-6283	10/05/12	Sr-89	41.5 ± 4.1	39.1	29.7 - 46.1	Pass
ERW-6283	10/05/12	Sr-90	19.7 ± 1.6	20.1	14.4 - 23.8	Pass
ERW-6286	10/05/12	Ba-133	82.7 ± 4.4	84.8	71.3 - 93.3	Pass
ERW-6286	10/05/12	Co-60	77.2 ± 3.7	78.3	70.5 - 88.5	Pass
ERW-6286	10/05/12	Cs-134	74.4 ± 1.5	76.6	62.6 - 84.3	Pass
ERW-6286	10/05/12	Cs-137	183.0 ± 6.2	183.0	165.0 - 203.0	Pass
ERW-6286	10/05/12	Zn-65	211.0 ± 9.9	204.0	184.0 - 240.0	Pass
ERW-6288	10/05/12	Gr. Alpha	47.0 ± 2.3	58.6	30.6 - 72.9	Pass
ERW-6288	10/05/12	Gr. Beta	33.4 ± 1.2	39.2	26.0 - 46.7	Pass
ERW-6290	10/05/12	I-131	23.3 ± 1.0	24.8	20.6 - 29.4	Pass
ERW-6295 [e]	10/05/12	Ra-226	16.5 ± 0.7	15.0	11.2 - 17.2	Pass
ERW-6295 [e]	10/05/12	Ra-228	4.9 ± 1.1	4.6	2.7 - 6.2	Pass
ERW-6295	10/05/12	Uranium	61.2 ± 1.8	62.5	50.8 - 69.3	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resources Associates (ERA).

[b] Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.

[c] Results are presented as the known values, expected laboratory precision (1 sigma, 1 determination) and control limits as provided by ERA.

[d] Result of reanalysis. Sample dilution problem suspected. A new dilution was prepared and the sample reanalyzed. Original analysis results, 76.2 ± 1.8 pCi/L.

[e] Results of reanalyses, original submission (pCi/L): Ra-226, 17.52 ± 0.69 Ra-228, 7.44 ± 1.1.49.
A new test was ordered from Environmental Resources Associates, results will be updated for first quarter, 2013.

Attachment A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

LABORATORY PRECISION: ONE STANDARD DEVIATION VALUES FOR VARIOUS ANALYSES[a]

Analysis	Level	One standard deviation for single determination
Gamma Emitters	5 to 100 pCi/liter or kg	5.0 pCi/liter
	> 100 pCi/liter or kg	5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg	5.0 pCi/liter
	> 50 pCi/liter or kg	10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg	5.0 pCi/liter
	> 30 pCi/liter or kg	10% of known value
Potassium-40	≥ 0.1 g/liter or kg	5% of known value
Gross alpha	≤ 20 pCi/liter	5.0 pCi/liter
	> 20 pCi/liter	25% of known value
Gross beta	≤ 100 pCi/liter	5.0 pCi/liter
	> 100 pCi/liter	5% of known value
Tritium	≤ 4,000 pCi/liter	$\pm 1\sigma = 169.85 \times (\text{known})^{0.0933}$
	> 4,000 pCi/liter	10% of known value
Radium-226,-228	≥ 0.1 pCi/liter	15% of known value
Plutonium	≥ 0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131,	≤ 55 pCi/liter	6 pCi/liter
Iodine-129[b]	> 55 pCi/liter	10% of known value
Uranium-238,	≤ 35 pCi/liter	6 pCi/liter
Nickel-63[b]	> 35 pCi/liter	15% of known value
Technetium-99[b]		
Iron-55[b]	50 to 100 pCi/liter	10 pCi/liter
	> 100 pCi/liter	10% of known value
Other Analyses [b]	---	20% of known value

[a] From EPA publication, "Environmental Radioactivity Laboratory Intercomparison Studies Program, Fiscal Year, 1981-1982, EPA-600/4-81-004.

[b] Laboratory limit.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, $CaSO_4$: Dy Cards).

Lab Code	Date	Description	mR Known Value	Lab Result ± 2 sigma	Control Limits	Acceptance
Environmental, Inc.						
2012-1	2/7/2012	30 cm.	74.87	87.22 ± 2.86	52.41 - 97.33	Pass
2012-1	2/7/2012	40 cm.	42.12	53.70 ± 4.53	29.48 - 54.76	Pass
2012-1	2/7/2012	50 cm.	26.95	33.04 ± 1.96	18.87 - 35.04	Pass
2012-1	2/7/2012	70 cm.	13.75	13.26 ± 1.15	9.63 - 17.88	Pass
2012-1	2/7/2012	75 cm.	11.98	13.38 ± 1.68	8.39 - 15.57	Pass
2012-1	2/7/2012	80 cm.	10.53	11.27 ± 0.95	7.37 - 13.69	Pass
2012-1	2/7/2012	90 cm.	8.32	7.79 ± 0.83	5.82 - 10.82	Pass
2012-1	2/7/2012	100 cm.	6.74	5.91 ± 0.25	4.72 - 8.76	Pass
2012-1	2/7/2012	110 cm.	5.57	4.63 ± 0.83	3.90 - 7.24	Pass
2012-1	2/7/2012	120 cm.	4.68	3.96 ± 1.68	3.28 - 6.08	Pass
2012-1	2/7/2012	150 cm.	2.99	2.41 ± 0.08	2.09 - 3.89	Pass
2012-1	2/7/2012	180 cm.	2.08	2.02 ± 0.25	1.46 - 2.70	Pass
Environmental, Inc.						
2012-2	9/11/2012	40 cm.	33.75	43.74 ± 1.31	23.63 - 43.88	Pass
2012-2	9/11/2012	50 cm.	21.6	25.37 ± 0.82	15.12 - 28.08	Pass
2012-2	9/11/2012	60 cm.	15	16.63 ± 0.45	10.50 - 19.50	Pass
2012-2	9/11/2012	70 cm.	11.02	10.58 ± 0.20	7.71 - 14.33	Pass
2012-2	9/11/2012	80 cm.	8.44	8.55 ± 1.18	5.91 - 10.97	Pass
2012-2	9/11/2012	90 cm.	6.67	5.75 ± 0.33	4.67 - 8.67	Pass
2012-2	9/11/2012	100 cm.	5.4	4.44 ± 0.22	3.78 - 7.02	Pass
2012-2	9/11/2012	110 cm.	4.46	3.85 ± 0.05	3.12 - 5.80	Pass
2012-2	9/11/2012	120 cm.	3.75	3.03 ± 0.71	2.63 - 4.88	Pass
2012-2	9/11/2012	150 cm.	2.4	1.82 ± 0.10	1.68 - 3.12	Pass
2012-2	9/11/2012	180 cm.	1.67	1.19 ± 0.34	1.17 - 2.17	Pass

TABLE A-3. In-House "Spiked" Samples

Lab Code [b]	Date	Analysis	Concentration (pCi/L)[a] Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-41824	2/15/2012	Ra-228	24.85 ± 2.14	28.75	20.13 - 37.38	Pass
W-22712	2/27/2012	Gr. Alpha	14.59 ± 0.34	20.00	10.00 - 30.00	Pass
W-22712	2/27/2012	Gr. Alpha	43.57 ± 0.40	41.70	20.85 - 62.55	Pass
SPAP-1032	3/5/2012	Cs-134	7.06 ± 1.71	5.26	0.00 - 15.26	Pass
SPAP-1032	3/5/2012	Cs-137	102.63 ± 3.13	104.24	93.82 - 114.66	Pass
SPAP-1034	3/5/2012	Gr. Beta	44.30 ± 0.11	46.88	28.13 - 65.63	Pass
SPW-1036	3/5/2012	Cs-134	43.23 ± 3.84	39.42	29.42 - 49.42	Pass
SPW-1036	3/5/2012	Cs-137	57.44 ± 4.60	52.12	42.12 - 62.12	Pass
SPW-1036	3/5/2012	Sr-90	60.51 ± 1.93	61.52	49.22 - 73.82	Pass
SPMI-1038	3/5/2012	Cs-134	37.79 ± 4.06	39.42	29.42 - 49.42	Pass
SPMI-1038	3/5/2012	Cs-137	54.75 ± 5.09	52.12	42.12 - 62.12	Pass
SPW-1045	3/5/2012	H-3	68022 ± 746	69048	55238 - 82858	Pass
SPW-1047	3/5/2012	Ni-63	217.10 ± 3.64	206.64	144.65 - 268.63	Pass
SPW-1049	3/5/2012	C-14	3858.90 ± 12.79	4738.80	2843.28 - 6634.32	Pass
W-31412	3/14/2012	Ra-226	13.13 ± 0.36	16.70	11.69 - 21.71	Pass
SPW-1520	3/23/2012	U-238	45.67 ± 2.02	41.70	29.19 - 54.21	Pass
SPW-41825	4/10/2012	Ra-228	28.48 ± 2.51	28.35	19.85 - 36.86	Pass
WW-1547	4/16/2012	Ba-133	18.99 ± 4.67	26.70	16.70 - 36.70	Pass
WW-1547	4/16/2012	Cs-134	9.28 ± 2.82	8.68	0.00 - 18.68	Pass
WW-1547	4/16/2012	Cs-137	27.77 ± 4.49	29.70	19.70 - 39.70	Pass
W-51712	5/17/2012	Ra-226	17.29 ± 0.43	16.70	11.69 - 21.71	Pass
W-61112	6/11/2012	Gr. Alpha	22.16 ± 0.45	20.00	10.00 - 30.00	Pass
W-61112	6/11/2012	Gr. Beta	43.57 ± 0.40	45.20	35.20 - 55.20	Pass
SPAP-4418	7/25/2012	Gr. Beta	43.74 ± 0.11	46.50	27.90 - 65.10	Pass
SPAP-4420	7/25/2012	Cs-134	4.54 ± 0.73	4.60	2.76 - 6.44	Pass
SPAP-4420	7/25/2012	Cs-137	104.70 ± 2.77	103.30	92.97 - 113.63	Pass
SPMI-4422	7/25/2012	Co-60	31.43 ± 2.12	31.62	21.62 - 41.62	Pass
SPMI-4422	7/25/2012	Cs-134	16.50 ± 1.17	16.15	6.15 - 26.15	Pass
SPMI-4422	7/25/2012	Cs-137	29.60 ± 2.61	26.64	16.64 - 36.64	Pass
SPMI-4422	7/25/2012	Sr-90	31.60 ± 1.35	30.47	24.38 - 36.56	Pass
SPW-4424	7/25/2012	Co-60	38.52 ± 1.76	37.95	27.95 - 47.95	Pass
SPW-4424	7/25/2012	Cs-137	33.23 ± 2.27	32.01	22.01 - 42.01	Pass
SPW-4424	7/25/2012	Sr-90	36.56 ± 1.58	40.60	32.48 - 48.72	Pass
SPF-4426	7/25/2012	Cs-134	947.50 ± 42.50	1025.00	922.50 - 1127.50	Pass
SPF-4426	7/25/2012	Cs-137	2692.00 ± 62.40	2480.00	2232.00 - 2728.00	Pass
SPW-4428	7/25/2012	C-14	4325.70 ± 15.80	4738.80	2843.28 - 6634.32	Pass
SPW-4430	7/25/2012	H-3	70119.40 ± 773.40	67570.00	54056.00 - 81084.00	Pass
SPW-4432	7/25/2012	Ni-63	187.20 ± 3.85	206.80	144.76 - 268.84	Pass
W-81712	8/17/2012	Ra-226	14.94 ± 0.40	16.70	11.69 - 21.71	Pass
SPW-5407	8/29/2012	U-238	42.95 ± 0.11	41.70	29.19 - 54.21	Pass
SPW-18022	9/10/2012	Ra-228	29.03 ± 2.80	28.21	19.75 - 36.67	Pass

TABLE A-3. In-House "Spiked" Samples

Lab Code [b]	Date	Concentration (pCi/L)[a] Analysis	Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
W-91012	9/10/2012	Gr. Alpha	19.95 ± 0.42	20.00	10.00 - 30.00	Pass
W-91012	9/10/2012	Gr. Beta	43.47 ± 0.40	45.20	35.20 - 55.20	Pass
W-100312	10/3/2012	Gr. Alpha	19.95 ± 0.41	20.00	10.00 - 30.00	Pass
W-100312	10/3/2012	Gr. Beta	44.21 ± 0.40	45.20	35.20 - 55.20	Pass
W-101812	10/18/2012	Ra-226	18.80 ± 0.43	16.70	11.69 - 21.71	Pass
ESO-7235	12/6/2012	Sr-90	138.79 ± 2.67	161.05	128.84 - 193.26	Pass
SPW-7753	12/6/2012	U-238	45.55 ± 5.05	41.70	29.19 - 54.21	Pass
SPW-18023	12/18/2012	Ra-228	31.59 ± 2.99	25.98	18.19 - 33.77	Pass

[a] Liquid sample results are reported in pCi/Liter, air filters(pCi/filter), charcoal (pCi/m^3), and solid samples (pCi/g).

[b] Laboratory codes : W (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

[c] Results are based on single determinations.

[d] Control limits are established from the precision values listed in Attachment A of this report, adjusted to ± 2σ.

NOTE: For fish, Jello is used for the Spike matrix. For Vegetation, cabbage is used for the Spike matrix.

TABLE A-4. In-House "Blank" Samples

Lab Code	Sample Type	Date	Analysis[b]	Concentration (pCi/L)[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-41814	Water	2/15/2012	Ra-228	0.65	0.49 ± 0.36	2
W-22712	Water	2/27/2012	Gr. Alpha	0.42	-0.04 ± 0.29	1
W-22712	Water	2/27/2012	Gr. Beta	0.74	-0.54 ± 0.50	3.2
SPAP-1031	Air Filter	3/5/2012	Cs-134	1.89	-	100
SPAP-1031	Air Filter	3/5/2012	Cs-137	1.16	-	100
SPAP-1033	Air Filter	3/5/2012	Gr. Beta	0.003	0.013 ± 0.003	0.01
SPW-1035	Water	3/5/2012	Cs-134	2.40	-	10
SPW-1035	Water	3/5/2012	Cs-137	2.88	-	10
SPW-1035	Water	3/5/2012	I-131(G)	2.35	-	20
SPW-1035	Water	3/5/2012	Sr-90	0.60	-0.11 ± 0.26	1
SPMI-1037	Milk	3/5/2012	Cs-134	2.85	-	10
SPMI-1037	Milk	3/5/2012	Cs-137	3.73	-	10
SPMI-1037	Milk	3/5/2012	I-131(G)	3.24	-	20
SPW-1044	Water	3/5/2012	H-3	146.10	37.10 ± 74.40	200
SPW-1046	Water	3/5/2012	Ni-63	19.07	8.30 ± 11.79	20
SPW-1048	Water	3/5/2012	C-14	5.70	2.99 ± 3.04	200
SPW-1166	water	3/9/2012	C-14	6.79	1.11	200
W-31412	Water	3/14/2012	Ra-226	0.034	0.043 ± 0.027	1
SPW-1521	Water	3/23/2012	U-238	0.10	0.09 ± 0.11	1
W-51712	Water	4/24/2012	Ra-226	0.04	0.04 ± 0.03	1
W-61112	Water	6/11/2012	Gr. Alpha	0.47	-0.14 ± 0.32	1
W-61112	Water	6/11/2012	Gr. Beta	0.71	0.29 ± 0.51	3.2
SPW-41815	Water	7/7/2011	Ra-228	0.77	0.52 ± 0.42	2
SPAP-4417	Air Filter	7/25/2012	Gr. Beta	0.001	0.021 ± 0.003	0.01
SPMI-4421	Milk	7/25/2012	Co-60	4.29	-	10
SPMI-4421	Milk	7/25/2012	Cs-134	3.58	-	10
SPMI-4421	Milk	7/25/2012	Cs-137	4.60	-	10
SPMI-4421	Milk	7/25/2012	Sr-90	0.45	0.53 ± 0.27	1
SPW-4423	Water	7/25/2012	Co-60	1.88	-	10
SPW-4423	Water	7/25/2012	Cs-134	2.38	-	10
SPW-4423	Water	7/25/2012	Cs-137	2.80	-	10
SPW-4423	water	7/25/2012	Sr-90	0.45	0.08 ± 0.22	1
SPF-4425	Fish	7/25/2012	Co-60	6.74	-	100
SPF-4425	Fish	7/25/2012	Cs-134	7.47	-	100
SPF-4425	Fish	7/25/2012	Cs-137	9.62	-	100
SPW-4427	Water	7/25/2012	C-14	10.93	3.54 ± 5.84	200
SPW-4431	Water	7/25/2012	Ni-63	19.00	5.50 ± 11.70	20
W-81712	Water	8/17/2012	Ra-226	0.038	0.035 ± 0.030	1
SPW-5408	Water	8/29/2012	U-238	0.039	0.015 ± 0.057	1

TABLE A-4. In-House "Blank" Samples

Lab Code	Sample Type	Date	Analysis[b]	Concentration (pCi/L)[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-18032	Water	9/10/2012	Ra-228	0.78	0.85 ± 0.46	2
W-91012	Water	9/10/2012	Gr. Alpha	0.42	0.027 ± 0.29	1
W-91012	Water	9/10/2012	Gr. Beta	0.75	-0.13 ± 0.52	3.2
W-100312	Water	10/3/2012	Gr. Beta	0.77	-0.32 ± 0.53	3.2
W-100312	Water	10/3/2012	Gr. Beta	0.43	0.06 ± 0.30	3.2
W-101812	Water	10/18/2012	Ra-226	0.04	0.04 ± 0.03	1
SPW-7754	Water	12/6/2012	U-238	0.10	0.02 ± 0.08	1
SPW-18033	Water	12/18/2012	Ra-228	0.98	0.43 ± 0.50	2

[a] Liquid sample results are reported in pCi/Liter, air filters(pCi/filter), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

[b] I-131(G); iodine-131 as analyzed by gamma spectroscopy.

[c] Activity reported is a net activity result. For gamma spectroscopic analysis, activity detected below the LLD value is not reported.

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
CF-20, 21	1/3/2012	Gr. Beta	14.50 ± 0.29	15.02 ± 0.30	14.76 ± 0.21	Pass
CF-20, 21	1/3/2012	K-40	12.88 ± 0.55	12.40 ± 0.53	12.64 ± 0.38	Pass
CF-20, 21	1/3/2012	Sr-90	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.00	Pass
P-9133, 9134	1/3/2012	H-3	108.86 ± 83.03	206.60 ± 86.38	157.73 ± 59.91	Pass
U-302, 303	1/17/2012	Beta (-K40)	6.84 ± 2.91	5.24 ± 2.56	6.04 ± 1.94	Pass
S-386, 387	1/23/2012	Ac-228	0.77 ± 0.11	0.79 ± 0.14	0.78 ± 0.09	Pass
S-386, 387	1/23/2012	Bi-214	0.80 ± 0.07	0.73 ± 0.11	0.77 ± 0.07	Pass
S-386, 387	1/23/2012	Pb-214	0.74 ± 0.06	0.75 ± 0.11	0.75 ± 0.06	Pass
S-386, 387	1/23/2012	Tl-208	0.21 ± 0.02	0.21 ± 0.04	0.21 ± 0.02	Pass
S-386, 387	1/23/2012	U-235	0.05 ± 0.02	0.12 ± 0.05	0.09 ± 0.03	Pass
WW-619, 620	1/31/2012	H-3	257.20 ± 86.00	305.80 ± 88.30	281.50 ± 61.63	Pass
MI-702, 703	2/6/2012	K-40	1337.00 ± 123.00	1460.40 ± 102.00	1398.70 ± 79.90	Pass
WW-892, 893	2/17/2012	Gr. Beta	3.46 ± 0.56	3.77 ± 0.59	3.61 ± 0.41	Pass
S-850, 851	2/22/2012	Cs-134	0.14 ± 0.02	0.13 ± 0.02	0.14 ± 0.01	Pass
S-850, 851	2/22/2012	Cs-137	0.21 ± 0.03	0.22 ± 0.03	0.22 ± 0.02	Pass
W-1251, 1252	3/6/2012	Gr. Alpha	1.20 ± 0.62	1.27 ± 0.92	1.24 ± 0.55	Pass
W-1251, 1252	3/6/2012	Gr. Beta	16.86 ± 1.43	15.14 ± 1.34	16.00 ± 0.98	Pass
W-1251, 1252	3/6/2012	H-3	5235.52 ± 230.91	4893.24 ± 224.55	5064.38 ± 161.05	Pass
W-1251, 1252	3/6/2012	Tc-99	19.67 ± 3.60	14.46 ± 3.51	17.07 ± 2.51	Pass
AP-1209, 1210	3/8/2012	Be-7	0.24 ± 0.12	0.20 ± 0.11	0.22 ± 0.08	Pass
XWW-1564, 1565	3/14/2012	H-3	308.00 ± 88.00	293.00 ± 87.00	300.50 ± 61.87	Pass
SG-1438, 1439	3/19/2012	Ac-228	6.01 ± 0.30	6.23 ± 0.31	6.12 ± 0.22	Pass
SG-1438, 1439	3/19/2012	Pb-214	4.69 ± 0.49	5.20 ± 0.54	4.95 ± 0.36	Pass
WW-1585, 1586	3/19/2012	H-3	3124.50 ± 176.96	2982.38 ± 173.62	3053.44 ± 123.96	Pass
AP-2103, 2104	3/28/2012	Be-7	0.080 ± 0.016	0.076 ± 0.013	0.078 ± 0.010	Pass
AP-2166, 2167	3/28/2012	Be-7	0.061 ± 0.020	0.071 ± 0.016	0.066 ± 0.013	Pass
AP-1632, 1633	3/29/2012	Be-7	0.26 ± 0.12	0.24 ± 0.12	0.25 ± 0.08	Pass
E-1653, 1654	4/2/2012	Gr. Beta	1.53 ± 0.05	1.55 ± 0.04	1.54 ± 0.03	Pass
E-1653, 1654	4/2/2012	K-40	1.34 ± 0.13	1.36 ± 0.14	1.35 ± 0.10	Pass
SG-1677, 1678	4/2/2012	Ac-228	6.63 ± 0.37	6.49 ± 0.33	6.56 ± 0.25	Pass
SG-1677, 1678	4/2/2012	Pb-214	4.77 ± 0.16	5.07 ± 0.14	4.92 ± 0.11	Pass
SWU-1719, 1720	4/3/2012	Gr. Beta	1.16 ± 0.41	1.53 ± 0.44	1.35 ± 0.30	Pass
W-1698, 1699	4/5/2012	Gr. Beta	10.86 ± 1.49	9.42 ± 1.32	10.14 ± 1.00	Pass
W-1698, 1699	4/5/2012	Ra-226	0.41 ± 0.15	0.67 ± 0.18	0.54 ± 0.12	Pass
W-1698, 1699	4/5/2012	Ra-228	1.46 ± 0.76	1.48 ± 0.74	1.47 ± 0.53	Pass
SG-1761, 1762	4/10/2012	Ac-228	16.26 ± 0.53	16.55 ± 0.44	16.41 ± 0.34	Pass
SG-1761, 1762	4/10/2012	Pb-214	14.16 ± 1.44	15.40 ± 1.56	14.78 ± 1.06	Pass
AP-2019, 2020	4/12/2012	Be-7	0.17 ± 0.10	0.17 ± 0.08	0.17 ± 0.07	Pass
DW-2272, 2273	4/20/2012	I-131	0.52 ± 0.24	0.49 ± 0.27	0.51 ± 0.18	Pass
DW-2356, 2357	4/24/2012	Gr. Beta	12.82 ± 2.01	9.47 ± 1.74	11.14 ± 1.33	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
G-2403, 2404	5/1/2012	Be-7	1.77 ± 0.21	1.55 ± 0.33	1.66 ± 0.20	Pass
G-2403, 2404	5/1/2012	K-40	6.38 ± 0.50	6.93 ± 0.72	6.66 ± 0.44	Pass
BS-2445, 2446	5/1/2012	Gr. Beta	8.92 ± 1.52	9.29 ± 1.63	9.11 ± 1.11	Pass
BS-2445, 2446	5/1/2012	K-40	5.86 ± 0.38	6.22 ± 0.48	6.04 ± 0.31	Pass
SWU-2550, 2551	5/1/2012	Gr. Beta	2.07 ± 0.65	1.59 ± 0.62	1.83 ± 0.45	Pass
WW-2614, 2615	5/1/2012	Gr. Beta	2.03 ± 1.04	2.36 ± 1.14	2.20 ± 0.77	Pass
WW-2614, 2615	5/1/2012	H-3	750.60 ± 106.20	653.20 ± 102.30	701.90 ± 73.73	Pass
BS-2656, 2657	5/2/2012	Cs-137	0.13 ± 0.07	0.07 ± 0.04	0.10 ± 0.04	Pass
BS-2656, 2657	5/2/2012	K-40	10.15 ± 0.97	11.13 ± 0.90	10.64 ± 0.66	Pass
SO-2635, 2636	5/3/2012	Cs-137	0.046 ± 0.024	0.050 ± 0.027	0.048 ± 0.018	Pass
SO-2635, 2636	5/3/2012	K-40	13.20 ± 0.74	14.01 ± 0.67	13.61 ± 0.50	Pass
MI-2677, 2678	5/7/2012	K-40	1415.30 ± 131.40	1348.10 ± 109.00	1381.70 ± 85.36	Pass
VE-2719, 2720	5/7/2012	K-40	4.15 ± 0.36	4.19 ± 0.38	4.17 ± 0.26	Pass
SWU-3221, 3222	5/8/2012	Gr. Beta	1.67 ± 0.47	1.39 ± 0.45	1.53 ± 0.33	Pass
SWU-3221, 3222	5/8/2012	H-3	236.90 ± 101.90	281.90 ± 103.70	259.40 ± 72.69	Pass
WW-3073, 3074	5/14/2012	H-3	339.12 ± 145.45	337.23 ± 98.19	338.18 ± 87.74	Pass
AP-2968, 2969	5/17/2012	Be-7	0.25 ± 0.12	0.21 ± 0.09	0.23 ± 0.07	Pass
F-3031, 3032	5/22/2012	H-3	11291.00 ± 372.80	11167.00 ± 315.00	11229.00 ± 244.03	Pass
F-3031, 3032	5/22/2012	K-40	3528.90 ± 372.80	3677.20 ± 392.40	3603.05 ± 270.63	Pass
G-3094, 3095	5/23/2012	Gr. Beta	7.89 ± 0.16	8.01 ± 0.16	7.95 ± 0.11	Pass
F-3412, 3413	5/23/2012	Gr. Beta	3.46 ± 0.10	3.33 ± 0.10	3.40 ± 0.07	Pass
F-3412, 3413	5/23/2012	K-40	2.40 ± 0.38	2.55 ± 0.43	2.48 ± 0.29	Pass
MI-3067, 3068	5/24/2012	K-40	1267.20 ± 105.00	1305.70 ± 109.80	1286.45 ± 75.96	Pass
SO-3305, 3306	5/30/2012	Cs-137	0.024 ± 0.013	0.030 ± 0.015	0.027 ± 0.010	Pass
SO-3305, 3306	5/30/2012	Gr. Beta	10.95 ± 0.89	10.86 ± 0.89	10.91 ± 0.63	Pass
SO-3305, 3306	5/30/2012	Tl-208	0.068 ± 0.018	0.062 ± 0.017	0.065 ± 0.012	Pass
LW-3454, 3455	5/31/2012	Gr. Beta	2.12 ± 0.86	2.27 ± 0.77	2.20 ± 0.58	Pass
BS-3697, 3698	6/14/2012	Be-7	2.05 ± 0.19	2.27 ± 0.38	2.16 ± 0.21	Pass
BS-3697, 3698	6/14/2012	Cs-137	2.32 ± 0.39	2.26 ± 0.66	2.29 ± 0.38	Pass
BS-3697, 3698	6/14/2012	K-40	6.67 ± 0.28	6.64 ± 0.42	6.66 ± 0.25	Pass
VE-3798, 3799	6/20/2012	K-40	5.93 ± 0.38	6.03 ± 0.37	5.98 ± 0.26	Pass
WW-4790, 4791	6/20/2012	H-3	251.33 ± 86.51	372.48 ± 92.27	311.90 ± 63.24	Pass
DW-30103, 30104	6/27/2012	Ra-226	0.30 ± 0.08	0.42 ± 0.09	0.36 ± 0.06	Pass
DW-30103, 30104	6/27/2012	Ra-228	0.76 ± 0.54	0.78 ± 0.54	0.77 ± 0.38	Pass
LW-3970, 3971	6/28/2012	Gr. Beta	1.49 ± 1.06	0.72 ± 0.53	1.11 ± 0.59	Pass
DW-3949, 3950	6/29/2012	I-131	0.54 ± 0.26	0.25 ± 0.26	0.40 ± 0.18	Pass
SG-4075, 4076	7/2/2012	Ac-228	0.33 ± 0.09	0.34 ± 0.06	0.34 ± 0.05	Pass
SG-4075, 4076	7/2/2012	K-40	6.71 ± 0.58	7.20 ± 0.32	6.96 ± 0.33	Pass
SG-4075, 4076	7/2/2012	Pb-214	0.46 ± 0.05	0.49 ± 0.03	0.48 ± 0.03	Pass
AP-4390, 4391	7/3/2012	Be-7	0.09 ± 0.02	0.09 ± 0.01	0.09 ± 0.01	Pass
AP-4390, 4391	7/3/2012	Be-7	0.11 ± 0.02	0.10 ± 0.01	0.11 ± 0.01	Pass
AP-4012, 4013	7/5/2012	Be-7	0.27 ± 0.09	0.29 ± 0.16	0.28 ± 0.09	Pass
SW-4033, 4034	7/5/2012	H-3	614.99 ± 107.99	512.31 ± 103.83	563.65 ± 74.91	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
VE-4054, 4055	7/9/2012	K-40	7.28 ± 0.56	7.42 ± 0.63	7.35 ± 0.42	Pass
VE-4222, 4223	7/13/2012	Be-7	0.16 ± 0.08	0.22 ± 0.09	0.19 ± 0.06	Pass
VE-4222, 4223	7/13/2012	K-40	7.20 ± 0.30	6.60 ± 0.30	6.90 ± 0.21	Pass
DW-30113, 30114	7/13/2012	Ra-228	1.93 ± 0.66	1.03 ± 0.53	1.48 ± 0.42	Pass
DW-30115, 30116	7/13/2012	Gr. Alpha	7.46 ± 1.21	7.02 ± 1.14	7.24 ± 0.83	Pass
DW-30124, 30125	7/13/2012	Ra-226	1.16 ± 0.15	0.90 ± 0.12	1.03 ± 0.10	Pass
DW-30124, 30125	7/13/2012	Ra-228	1.38 ± 0.56	1.72 ± 0.60	1.55 ± 0.41	Pass
DW-30126, 30127	7/13/2012	Gr. Alpha	6.23 ± 1.16	6.75 ± 1.29	6.49 ± 0.87	Pass
AP-4433, 4434	7/19/2012	Be-7	0.17 ± 0.09	0.21 ± 0.10	0.19 ± 0.07	Pass
SG-4475, 4476	7/19/2012	Gr. Alpha	17.03 ± 4.17	15.56 ± 3.96	16.30 ± 2.88	Pass
SG-4475, 4476	7/19/2012	Gr. Beta	13.23 ± 2.61	14.36 ± 2.47	13.80 ± 1.80	Pass
WW-4685, 4686	7/24/2012	H-3	289.00 ± 99.00	375.00 ± 103.00	332.00 ± 71.43	Pass
AP-4706, 4707	7/26/2012	Be-7	0.28 ± 0.14	0.24 ± 0.14	0.26 ± 0.10	Pass
SO-4748, 4749	7/26/2012	Gr. Beta	20.45 ± 1.04	19.22 ± 0.94	19.84 ± 0.70	Pass
SO-4748, 4749	7/26/2012	Gr. Beta	20.45 ± 1.04	19.22 ± 0.94	19.84 ± 0.70	Pass
SO-4748, 4749	7/26/2012	U-233/4	0.11 ± 0.02	0.10 ± 0.01	0.11 ± 0.01	Pass
SO-4748, 4749	7/26/2012	U-238	0.12 ± 0.02	0.11 ± 0.01	0.12 ± 0.01	Pass
VE-4832, 4833	8/1/2012	K-40	4.06 ± 0.22	4.08 ± 0.24	4.07 ± 0.16	Pass
DW-30149, 30150	8/1/2012	Ra-226	2.69 ± 0.22	2.79 ± 0.22	2.74 ± 0.16	Pass
DW-30149, 30150	8/1/2012	Ra-228	2.77 ± 0.75	1.61 ± 0.57	2.19 ± 0.47	Pass
SG-4916, 4917	8/3/2012	Ac-228	11.03 ± 0.33	11.08 ± 0.44	11.06 ± 0.28	Pass
SG-4916, 4917	8/3/2012	K-40	6.39 ± 0.80	6.98 ± 0.88	6.69 ± 0.59	Pass
F-5313, 5314	8/9/2012	Cs-137	0.05 ± 0.02	0.05 ± 0.02	0.05 ± 0.01	Pass
F-5313, 5314	8/9/2012	Gr. Beta	4.12 ± 0.08	4.10 ± 0.08	4.11 ± 0.06	Pass
F-5313, 5314	8/9/2012	K-40	3.07 ± 0.42	3.14 ± 0.40	3.11 ± 0.29	Pass
VE-5166, 5167	8/15/2012	K-40	4.26 ± 0.28	3.66 ± 0.47	3.96 ± 0.27	Pass
VE-5376, 5377	8/22/2012	Gr. Beta	7.72 ± 0.17	7.61 ± 0.16	7.67 ± 0.12	Pass
VE-5334, 5335	8/27/2012	K-40	1.65 ± 0.17	1.72 ± 0.15	1.68 ± 0.12	Pass
VE-5481, 5482	8/28/2012	Be-7	2.52 ± 0.19	2.65 ± 0.21	2.59 ± 0.14	Pass
VE-5481, 5482	8/28/2012	K-40	5.05 ± 0.37	4.79 ± 0.39	4.92 ± 0.27	Pass
VE-5481, 5482	8/28/2012	Sr-90	0.01 ± 0.00	0.01 ± 0.01	0.01 ± 0.00	Pass
DW-30164, 30165	8/30/2012	Ra-226	1.33 ± 0.15	1.59 ± 0.17	1.46 ± 0.11	Pass
DW-30164, 30165	8/30/2012	Ra-228	2.76 ± 0.66	1.54 ± 0.56	2.15 ± 0.43	Pass
VE-5166, 5167	9/4/2012	K-40	2.05 ± 0.32	2.53 ± 0.36	2.29 ± 0.24	Pass
ME-5607, 5608	9/4/2012	Gr. Beta	2.92 ± 0.08	2.89 ± 0.08	2.90 ± 0.06	Pass
ME-5607, 5608	9/4/2012	K-40	2.06 ± 0.32	2.53 ± 0.36	2.29 ± 0.24	Pass
SW-5901, 5902	9/17/2012	H-3	10909.00 ± 311.00	10817.00 ± 310.00	10863.00 ± 219.56	Pass
BS-6048, 6049	9/24/2012	K-40	1.24 ± 0.20	1.18 ± 0.21	1.21 ± 0.14	Pass
AP-6482, 6483	9/27/2012	Be-7	0.09 ± 0.02	0.09 ± 0.03	0.09 ± 0.02	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
G-6090, 6091	10/1/2012	Be-7	3.74 ± 0.33	3.54 ± 0.30	3.64 ± 0.22	Pass
G-6090, 6091	10/1/2012	Gr. Beta	10.81 ± 0.34	10.72 ± 0.33	10.77 ± 0.24	Pass
G-6090, 6091	10/1/2012	K-40	5.99 ± 0.47	5.45 ± 0.44	5.72 ± 0.32	Pass
SO-6111, 6112	10/1/2012	Cs-137	0.06 ± 0.03	0.04 ± 0.02	0.05 ± 0.02	Pass
SO-6111, 6112	10/1/2012	K-40	19.66 ± 0.84	20.09 ± 0.80	19.88 ± 0.58	Pass
W-6795, 6796	10/1/2012	H-3	215.20 ± 88.00	292.80 ± 91.60	254.00 ± 63.51	Pass
AP-6461, 6462	10/2/2012	Be-7	0.07 ± 0.01	0.07 ± 0.02	0.07 ± 0.01	Pass
WW-6279, 6280	10/3/2012	Gr. Beta	1.54 ± 0.68	1.67 ± 0.75	1.61 ± 0.51	Pass
W-6346, 6347	10/3/2012	Ra-226	0.30 ± 0.10	0.36 ± 0.10	0.33 ± 0.07	Pass
VE-6503, 6504	10/9/2012	K-40	5.23 ± 0.83	6.00 ± 0.45	5.04 ± 0.27	Pass
WW-6606, 6607	10/10/2012	Gr. Beta	3.18 ± 1.31	2.42 ± 1.27	2.80 ± 0.91	Pass
WW-6606, 6607	10/10/2012	H-3	273.10 ± 85.70	219.80 ± 83.10	246.45 ± 59.69	Pass
WW-7237, 7238	10/12/2012	H-3	175.44 ± 99.84	180.75 ± 100.03	178.10 ± 70.66	Pass
F-6627, 6628	10/15/2012	K-40	3.05 ± 0.39	3.23 ± 0.37	3.14 ± 0.27	Pass
VE-6669, 6670	10/16/2012	Be-7	0.48 ± 0.26	0.50 ± 0.13	0.49 ± 0.15	Pass
VE-6669, 6670	10/16/2012	K-40	4.06 ± 0.28	3.68 ± 0.26	3.87 ± 0.19	Pass
SS-6711, 6712	10/16/2012	Ac-228	0.16 ± 0.05	0.17 ± 0.06	0.17 ± 0.04	Pass
SS-6711, 6712	10/16/2012	Bi-214	0.13 ± 0.03	0.16 ± 0.03	0.14 ± 0.02	Pass
SS-6711, 6712	10/16/2012	Gr. Beta	14.20 ± 0.89	12.67 ± 0.88	13.44 ± 0.63	Pass
SS-6711, 6712	10/16/2012	Pb-212	0.15 ± 0.06	0.13 ± 0.02	0.14 ± 0.03	Pass
SS-6711, 6712	10/16/2012	Tl-208	0.06 ± 0.02	0.04 ± 0.02	0.05 ± 0.01	Pass
WW-7258, 7259	10/22/2012	H-3	214.69 ± 85.42	314.60 ± 90.25	264.65 ± 62.13	Pass
WW-7655, 7656	10/25/2012	H-3	159.00 ± 86.10	159.00 ± 86.10	159.00 ± 60.88	Pass
WW-7747, 7748	10/25/2012	H-3	156.50 ± 84.70	170.20 ± 85.30	163.35 ± 60.10	Pass
MI-6963, 6964	10/28/2012	K-40	1384.60 ± 111.70	1421.60 ± 107.60	1403.10 ± 77.55	Pass
MI-7174, 7175	11/5/2012	K-40	1283.60 ± 97.45	1293.20 ± 91.37	1288.40 ± 66.79	Pass
SG-7221, 7222	11/9/2012	Pb-214	31.49 ± 0.70	30.11 ± 0.80	30.80 ± 0.53	Pass
DW-30216, 30217	11/9/2012	Gr. Alpha	2.23 ± 0.86	2.31 ± 0.92	2.27 ± 0.63	Pass
DW-30216, 30217	11/9/2012	Ra-226	0.72 ± 0.12	0.82 ± 0.14	0.77 ± 0.09	Pass
DW-30216, 30217	11/9/2012	Ra-228	0.92 ± 0.52	1.26 ± 0.53	1.09 ± 0.37	Pass
MI-7363, 7364	11/13/2012	K-40	1304.40 ± 103.30	1496.10 ± 121.30	1400.25 ± 79.66	Pass
CF-7384, 7385	11/13/2012	K-40	11.75 ± 0.52	10.94 ± 0.59	11.35 ± 0.39	Pass
VE-7489, 7490	11/16/2012	K-40	2.22 ± 0.23	1.91 ± 0.22	2.06 ± 0.16	Pass
AP-7531, 7532	11/21/2012	Be-7	0.19 ± 0.10	0.29 ± 0.17	0.24 ± 0.10	Pass
BS-7573, 7574	11/24/2012	K-40	7.21 ± 0.41	7.57 ± 0.39	7.39 ± 0.28	Pass
LW-7865, 7866	12/5/2012	Gr. Beta	2.16 ± 0.56	1.64 ± 0.62	1.90 ± 0.42	Pass
SG-8095, 8096	12/19/2012	Ac-228	25.15 ± 0.73	25.47 ± 0.54	25.31 ± 0.45	Pass
SG-8095, 8096	12/19/2012	Gamma	26.98 ± 2.72	28.68 ± 2.89	27.83 ± 1.98	Pass

Note: Duplicate analyses are performed on every twentieth sample received in-house. Results are not listed for those analyses with activities that measure below the LLD.

[a] Results are reported in units of pCi/L, except for air filters (pCi/Filter), food products, vegetation, soil, sediment (pCi/g).

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
STW-1670	02/01/12	I-129	9.31 ± 0.31	12.29	8.60 - 15.98	Pass
STSO-1766 [d]	02/01/12	Am-241	88.50 ± 8.30	159.00	111.00 - 207.00	Fail
STSO-1766	02/01/12	Co-57	1352.10 ± 4.00	1179.00	825.00 - 1533.00	Pass
STSO-1766	02/01/12	Co-60	1.70 ± 0.70	1.56	1.00 - 2.00	Pass
STSO-1766	02/01/12	Cs-134	842.20 ± 4.30	828.00	580.00 - 1076.00	Pass
STSO-1766	02/01/12	Cs-137	0.40 ± 0.90	0.00	0.00 - 1.00	Pass
STSO-1766	02/01/12	K-40	1729.60 ± 22.20	1491.00	1044.00 - 1938.00	Pass
STSO-1766	02/01/12	Mn-54	647.60 ± 4.20	558.00	391.00 - 725.00	Pass
STSO-1766	02/01/12	Ni-63	781.50 ± 9.70	862.00	603.00 - 1121.00	Pass
STSO-1766	02/01/12	Pu-238	142.40 ± 9.70	136.00	97.00 - 177.00	Pass
STSO-1766	02/01/12	Pu-239/40	66.10 ± 6.40	65.80	46.10 - 85.50	Pass
STSO-1766	02/01/12	Sr-90	383.20 ± 15.30	392.00	274.00 - 510.00	Pass
STSO-1766	02/01/12	Tc-99	289.60 ± 10.90	374.00	262.00 - 486.00	Pass
STSO-1766	02/01/12	U-233/4	63.20 ± 5.40	68.10	47.70 - 88.50	Pass
STSO-1766	02/01/12	U-238	310.80 ± 12.10	329.00	230.00 - 428.00	Pass
STSO-1766	02/01/12	Zn-65	766.70 ± 6.70	642.00	449.00 - 835.00	Pass
STAP-1772	02/01/12	Am-241	0.062 ± 0.02	0.073	0.051 - 0.10	Pass
STAP-1772	02/01/12	Co-57	0.010 ± 0.01	0.00	0.000 - 1.00	Pass
STAP-1772	02/01/12	Co-60	2.40 ± 0.08	2.18	1.53 - 2.84	Pass
STAP-1772	02/01/12	Cs-134	2.33 ± 0.13	2.38	1.67 - 3.09	Pass
STAP-1772	02/01/12	Cs-137	2.07 ± 0.10	1.79	1.25 - 2.33	Pass
STAP-1772	02/01/12	Mn-54	3.77 ± 0.14	3.24	2.27 - 4.21	Pass
STAP-1772	02/01/12	Pu-238	0.003 ± 0.004	0.002	0.000 - 0.10	Pass
STAP-1772	02/01/12	Pu-239/40	0.098 ± 0.017	0.097	0.07 - 0.13	Pass
STAP-1772	02/01/12	Sr-90	-0.010 ± 0.060	0.000	-0.10 - 0.13	Pass
STAP-1772 [e]	02/01/12	U-233/4	0.016 ± 0.006	0.019	0.013 - 0.024	Pass
STAP-1772	02/01/12	U-238	0.11 ± 0.02	0.12	0.09 - 0.16	Pass
STAP-1772	02/01/12	Zn-65	3.67 ± 0.20	2.99	2.09 - 3.89	Pass
STAP-1773	02/01/12	Gr. Alpha	0.51 ± 0.05	1.20	0.40 - 2.00	Pass
STAP-1773	02/01/12	Gr. Beta	2.75 ± 0.10	2.40	1.20 - 3.60	Pass
STVE-1776	02/01/12	Co-57	14.57 ± 0.28	12.00	8.40 - 15.60	Pass
STVE-1776	02/01/12	Co-60	6.45 ± 0.23	6.05	4.24 - 7.87	Pass
STVE-1776	02/01/12	Cs-134	8.39 ± 0.29	8.43	5.90 - 10.96	Pass
STVE-1776	02/01/12	Cs-137	0.01 ± 0.09	0.00	0.00 - 0.10	Pass
STVE-1776	02/01/12	Mn-54	0.03 ± 0.08	0.00	0.00 - 0.10	Pass
STVE-1776	02/01/12	Zn-65	10.31 ± 0.67	8.90	6.23 - 11.57	Pass
STW-1960	02/01/12	Gr. Alpha	1.68 ± 0.09	2.14	0.64 - 3.64	Pass
STW-1960	02/01/12	Gr. Beta	6.33 ± 0.10	6.36	3.18 - 9.54	Pass

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
STW-1964	02/01/12	Am-241	1.28 ± 0.12	1.63	1.14 - 2.12	Pass
STW-1964	02/01/12	Co-57	33.30 ± 0.40	32.90	23.00 - 42.80	Pass
STW-1964	02/01/12	Co-60	23.20 ± 0.40	23.72	16.60 - 30.84	Pass
STW-1964	02/01/12	Cs-134	0.30 ± 3.00	0.00	0.00 - 1.00	Pass
STW-1964	02/01/12	Cs-137	40.10 ± 0.60	39.90	27.90 - 51.90	Pass
STW-1964 [f]	02/01/12	Fe-55	65.10 ± 9.50	81.90	57.30 - 106.50	Pass
STW-1964	02/01/12	H-3	460.00 ± 12.10	437.00	306.00 - 568.00	Pass
STW-1964	02/01/12	K-40	153.00 ± 4.20	142.00	99.00 - 185.00	Pass
STW-1964	02/01/12	Mn-54	32.70 ± 0.60	31.80	22.30 - 41.30	Pass
STW-1964	02/01/12	Ni-63	49.80 ± 2.90	60.00	42.00 - 78.00	Pass
STW-1964	02/01/12	Pu-238	0.58 ± 0.06	0.63	0.44 - 0.82	Pass
STW-1964	02/01/12	Pu-239/40	1.30 ± 0.15	1.34	0.94 - 1.74	Pass
STW-1964	02/01/12	Sr-90	0.10 ± 0.20	0.00	0.00 - 1.00	Pass
STW-1964	02/01/12	Tc-99	23.70 ± 0.80	27.90	19.50 - 36.30	Pass
STW-1964	02/01/12	U-233/4	0.40 ± 0.05	0.39	0.27 - 0.51	Pass
STW-1964	02/01/12	U-238	2.67 ± 0.13	2.76	1.93 - 3.59	Pass
STW-1964	02/01/12	Zn-65	0.01 ± 0.20	0.00	0.00 - 1.00	Pass
STW-5391	08/01/12	I-129	5.73 ± 0.28	6.82	4.77 - 8.87	Pass
STSO-5392	08/01/12	Am-241	129.30 ± 12.70	111.00	78.00 - 144.00	Pass
STSO-5392	08/01/12	Ni-63	376.20 ± 20.60	406.00	284.00 - 528.00	Pass
STSO-5392	08/01/12	Pu-238	118.70 ± 9.30	105.80	74.10 - 137.50	Pass
STSO-5392	08/01/12	Pu-239/40	140.70 ± 9.90	134.00	94.00 - 174.00	Pass
STSO-5392	08/01/12	Sr-90	483.52 ± 16.47	508.00	356.00 - 660.00	Pass
STSO-5392	08/01/12	Tc-99	432.50 ± 23.10	469.00	328.00 - 610.00	Pass
STSO-5394	08/01/12	Co-57	1528.00 ± 4.10	1316.00	921.00 - 1711.00	Pass
STSO-5394	08/01/12	Co-60	592.00 ± 3.20	531.00	372.00 - 690.00	Pass
STSO-5394	08/01/12	Cs-134	933.60 ± 5.82	939.00	657.00 - 1221.00	Pass
STSO-5394	08/01/12	Cs-137	1319.80 ± 5.50	1150.00	805.00 - 1495.00	Pass
STSO-5394	08/01/12	K-40	737.30 ± 17.70	632.00	442.00 - 822.00	Pass
STSO-5394	08/01/12	Mn-54	1083.20 ± 5.20	920.00	644.00 - 1196.00	Pass
STSO-5394	08/01/12	U-233/4	55.80 ± 4.20	60.30	42.20 - 78.40	Pass
STSO-5394	08/01/12	U-238	231.20 ± 8.60	263.00	184.00 - 342.00	Pass
STSO-5394	08/01/12	Zn-65	696.10 ± 7.00	606.00	424.00 - 788.00	Pass

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
STVE-5395 [g]	08/01/12	Co-57	7.44 ± 0.17	5.66	3.96 - 7.36	Fail
STVE-5395	08/01/12	Co-60	5.90 ± 0.15	5.12	3.58 - 6.66	Pass
STVE-5395	08/01/12	Cs-134	7.40 ± 0.31	6.51	4.56 - 8.46	Pass
STVE-5395	08/01/12	Cs-137	5.45 ± 0.18	4.38	3.07 - 5.69	Pass
STVE-5395	08/01/12	Mn-54	4.06 ± 0.21	3.27	2.29 - 4.25	Pass
STAP-5398	08/01/12	Gr. Alpha	0.41 ± 0.05	0.97	0.29 - 1.65	Pass
STAP-5398	08/01/12	Gr. Beta	2.11 ± 0.09	1.92	0.96 - 2.88	Pass
STAP-5401 [h]	08/01/12	Am-241	0.12 ± 0.02	0.08	0.05 - 0.10	Fail
STAP-5403	08/01/12	Co-57	1.96 ± 0.05	1.91	1.34 - 2.48	Pass
STAP-5403	08/01/12	Co-60	1.76 ± 0.07	1.73	1.21 - 2.25	Pass
STAP-5403	08/01/12	Cs-134	2.74 ± 0.18	2.74	1.92 - 3.56	Pass
STAP-5403	08/01/12	Cs-137	0.00 ± 0.03	0.00	-0.01 - 0.01	Pass
STAP-5403	08/01/12	Mn-54	2.52 ± 0.10	2.36	1.65 - 3.07	Pass
STAP-5403	08/01/12	Pu-238	0.050 ± 0.015	0.063	0.044 - 0.081	Pass
STAP-5403	08/01/12	Pu-239/40	0.001 ± 0.004	0.00081	0.000 - 0.010	Pass
STAP-5403 [i]	08/01/12	U-233/4	0.009 ± 0.011	0.014	0.010 - 0.018	Fail
STAP-5403	08/01/12	U-238	0.08 ± 0.02	0.10	0.070 - 0.130	Pass
STAP-5403	08/01/12	Zn-65	0.01 ± 0.06	0.00	-0.010 - 0.010	Pass
STW-5445	08/01/12	Fe-55	79.80 ± 4.10	89.30	62.50 - 116.10	Pass
STW-5445	08/01/12	Ni-63	74.30 ± 3.40	66.30	46.40 - 86.20	Pass
STW-5445	08/01/12	U-233/4	0.46 ± 0.05	0.45	0.32 - 0.59	Pass
STW-5445	08/01/12	U-238	3.14 ± 0.14	3.33	2.33 - 4.33	Pass
STW-5445 [j]	08/01/12	Am-241	0.64 ± 0.04	1.06	0.74 - 1.38	Fail

[a] Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).

[b] Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation).

[c] MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". MAPEP does not provide control limits.

[d] Investigation was inconclusive, there was not enough sample for reanalysis. ERA results (A-7) for the same matrix were acceptable.

[e] No errors found in calculation or procedure, original analysis result; 0.010 ± 0.010 Bq/filter.

[f] Reanalysis results were within limits, but low. ERA results (A-7) for the same matrix were acceptable. The efficiency factor was recalculated for the second round of MAPEP testing. Original analysis results 55.8 ± 12.6 Bq/L.

[g] Result of reanalysis; 6.74 ± 0.15 Bq/sample. Gamma emitters for the vegetation matrix exhibited a high bias, only Co-57 exceeded acceptance limits. Recounted using a geometry more closely matched to the MAPEP sample size.

[h] Result of reanalysis; 0.070 ± 0.013 Bq/filter.

[i] Result of reanalysis; 0.013 ± 0.005 pCi/filter. A larger sample size was used to reduce the counting error.

[j] Result of reanalysis 1.07 ± 0.06 pCi/L. The analyses of the MAPEP sample matrix resulted in recovery factors greater than 100%. A correction was made using recovery based on analysis of blank samples. A new tracer solution is on order, future samples for MAPEP testing will include batch spike and blank samples.

TABLE A-7. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code [b]	Date	Analysis	Concentration (pCi/L) [b] Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
ERAP-1393	03/19/12	Co-60	917.5 ± 7.0	880.0	681.0 - 1100.0	Pass
ERAP-1393	03/19/12	Cs-134	586.6 ± 7.4	656.0	417.0 - 814.0	Pass
ERAP-1393	03/19/12	Cs-137	1255.9 ± 9.4	1130.0	849.0 - 1480.0	Pass
ERAP-1393	03/19/12	Mn-54	< 3.4	0.0	-	Pass
ERAP-1393	03/19/12	Zn-65	1085.2 ± 18.0	897.0	642.0 - 1240.0	Pass
ERAP-1394	03/19/12	Am-241	86.9 ± 2.9	68.8	42.4 - 93.1	Pass
ERAP-1394	03/19/12	Pu-238	70.2 ± 3.6	63.2	43.3 - 83.1	Pass
ERAP-1394	03/19/12	Pu-239/40	66.0 ± 1.0	63.0	45.6 - 82.4	Pass
ERAP-1394	03/19/12	Sr-90	112.5 ± 15.4	89.6	43.8 - 134.0	Pass
ERAP-1394	03/19/12	U-233/4	43.4 ± 0.8	47.5	29.4 - 71.6	Pass
ERAP-1394	03/19/12	U-238	44.0 ± 1.2	47.1	30.4 - 65.1	Pass
ERAP-1394	03/19/12	Uranium	89.1 ± 2.2	96.7	53.5 - 147.0	Pass
ERAP-1396	03/19/12	Gr. Alpha	81.1 ± 1.5	77.8	26.1 - 121.0	Pass
ERAP-1396	03/19/12	Gr. Beta	68.4 ± 0.7	52.5	33.2 - 76.5	Pass
ERSO-1397	03/19/12	Ac-228	1303.4 ± 89.3	1570.0	1010.0 - 2180.0	Pass
ERSO-1397	03/19/12	Am-241	856.0 ± 123.7	938.0	549.0 - 1220.0	Pass
ERSO-1397	03/19/12	Bi-212	1379.2 ± 247.2	1550.0	413.0 - 2280.0	Pass
ERSO-1397	03/19/12	Bi-214	965.2 ± 38.4	1100.0	665.0 - 1590.0	Pass
ERSO-1397	03/19/12	Co-60	3693.6 ± 32.1	3500.0	2370.0 - 4820.0	Pass
ERSO-1397	03/19/12	Cs-134	2257.3 ± 45.4	2180.0	1420.0 - 2620.0	Pass
ERSO-1397	03/19/12	Cs-137	9444.5 ± 58.4	8770.0	6720.0 - 11300.0	Pass
ERSO-1397	03/19/12	K-40	11277.0 ± 275.1	11600.0	8470.0 - 15600.0	Pass
ERSO-1397	03/19/12	Mn-54	< 21.0	0.0	-	Pass
ERSO-1397	03/19/12	Pb-212	1208.4 ± 26.3	1510.0	992.0 - 2110.0	Pass
ERSO-1397	03/19/12	Pb-214	1041.6 ± 46.9	1110.0	647.0 - 1650.0	Pass
ERSO-1397	03/19/12	Pu-238	921.0 ± 112.6	984.0	592.0 - 1360.0	Pass
ERSO-1397	03/19/12	Pu-239/40	1028.0 ± 112.6	879.0	575.0 - 1210.0	Pass
ERSO-1397	03/19/12	Sr-90	8128.0 ± 329.0	8800.0	3360.0 - 13900.0	Pass
ERSO-1397	03/19/12	Th-234	2711.3 ± 253.6	2000.0	632.0 - 3760.0	Pass
ERSO-1397	03/19/12	U-233/4	1859.3 ± 126.6	1960.0	1200.0 - 2510.0	Pass
ERSO-1397	03/19/12	U-238	2003.3 ± 130.3	2000.0	1240.0 - 2540.0	Pass
ERSO-1397	03/19/12	Uranium	3939.5 ± 283.8	4030.0	2190.0 - 5320.0	Pass
ERSO-1397	03/19/12	Zn-65	4200.4 ± 65.9	3650.0	2910.0 - 4850.0	Pass

TABLE A-7. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code [b]	Date	Analysis	Concentration (pCi/L) [b] Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
ERVE-1400	03/19/12	Am-241	4194.8 ± 199.5	4540.0	2780.0 - 6040.0	Pass
ERVE-1400	03/19/12	Cm-244	1471.2 ± 113.1	1590.0	779.0 - 2480.0	Pass
ERVE-1400	03/19/12	Co-60	2347.8 ± 47.9	2210.0	1520.0 - 3090.0	Pass
ERVE-1400	03/19/12	Cs-134	2847.5 ± 64.0	2920.0	1880.0 - 3790.0	Pass
ERVE-1400	03/19/12	Cs-137	1503.5 ± 52.5	1340.0	972.0 - 1860.0	Pass
ERVE-1400	03/19/12	K-40	34105.7 ± 745.3	28600.0	20700.0 - 40100.0	Pass
ERVE-1400	03/19/12	Mn-54	< 26.8	0.0	-	Pass
ERVE-1400	03/19/12	Pu-238	2509.0 ± 213.6	2350.0	1400.0 - 3220.0	Pass
ERVE-1400	03/19/12	Pu-239/40	2690.4 ± 208.9	2570.0	1580.0 - 3540.0	Pass
ERVE-1400	03/19/12	Sr-90	7881.5 ± 470.8	8520.0	4860.0 - 11300.0	Pass
ERVE-1400	03/19/12	U-233/4	3149.6 ± 165.2	3610.0	2370.0 - 4640.0	Pass
ERVE-1400	03/19/12	U-238	3203.6 ± 166.5	3580.0	2390.0 - 4550.0	Pass
ERVE-1400	03/19/12	Uranium	6463.7 ± 363.2	7350.0	4980.0 - 9150.0	Pass
ERVE-1400	03/19/12	Zn-65	2701.9 ± 105.5	2310.0	1670.0 - 3240.0	Pass
ERW-1403	03/19/12	Am-241	119.9 ± 3.2	135.0	91.0 - 181.0	Pass
ERW-1403	03/19/12	Fe-55	713.7 ± 127.4	863.0	514.0 - 1170.0	Pass
ERW-1403	03/19/12	Pu-238	131.9 ± 6.4	135.0	99.9 - 168.0	Pass
ERW-1403	03/19/12	Pu-239/40	108.9 ± 10.2	112.0	86.9 - 141.0	Pass
ERW-1403	03/19/12	U-233/4	93.1 ± 7.9	105.0	78.9 - 135.0	Pass
ERW-1403	03/19/12	U-238	96.9 ± 5.5	104.0	79.3 - 128.0	Pass
ERW-1403	03/19/12	Uranium	190.0 ± 13.8	214.0	157.0 - 277.0	Pass
ERW-1405	03/19/12	Co-60	858.7 ± 5.6	875.0	760.0 - 1020.0	Pass
ERW-1405	03/19/12	Cs-134	560.4 ± 4.4	609.0	447.0 - 700.0	Pass
ERW-1405	03/19/12	Cs-137	1239.9 ± 7.4	1250.0	1060.0 - 1500.0	Pass
ERW-1405	03/19/12	Mn-54	< 7.4	0.0	-	Pass
ERW-1405	03/19/12	Sr-90	944.3 ± 26.2	989.0	644.0 - 1310.0	Pass
ERW-1405	03/19/12	Zn-65	786.9 ± 20.6	749.0	624.0 - 945.0	Pass
ERW-1406	03/19/12	Gr. Alpha	85.9 ± 3.0	103.0	36.6 - 160.0	Pass
ERW-1406	03/19/12	Gr. Beta	45.7 ± 1.6	43.7	25.0 - 64.7	Pass
ERW-1409	03/19/12	H-3	9045.0 ± 284.0	9150.0	6130.0 - 13000.0	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the Environmental Measurements Laboratory Quality Assessment Program (EML).

[b] Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation). Results are reported in units of pCi/L, except for air filters (pCi/Filter), vegetation and soil (pCi/kg).

[c] Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.

[d] Results are presented as the known values, expected laboratory precision (1 sigma, 1 determination) and control limits as provided by ERA. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". Control limits are not provided.

APPENDIX B

DATA REPORTING CONVENTIONS

Data Reporting Conventions

1.0. All activities, except gross alpha and gross beta, are decay corrected to collection time or the end of the collection period.

2.0. Single Measurements

Each single measurement is reported as follows: $x \pm s$

where: x = value of the measurement;

s = 2s counting uncertainty (corresponding to the 95% confidence level).

In cases where the activity is less than the lower limit of detection L, it is reported as: <L,

where L = the lower limit of detection based on 4.66s uncertainty for a background sample.

3.0. Duplicate analyses

3.1 Individual results: For two analysis results; $x_1 \pm s_1$ and $x_2 \pm s_2$

Reported result: $x \pm s$; where $x = (1/2)(x_1 + x_2)$ and $s = (1/2)\sqrt{s_1^2 + s_2^2}$

3.2. Individual results: $<L_1$, $<L_2$ Reported result: <L, where L = lower of L_1 and L_2

3.3. Individual results: $x \pm s$, <L Reported result: $x \pm s$ if $x \geq L$; <L otherwise.

4.0. Computation of Averages and Standard Deviations

4.1 Averages and standard deviations listed in the tables are computed from all of the individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average $\bar{x}$ and standard deviation s of a set of n numbers $x_1, x_2 \ldots x_n$ are defined as follows:

$$\bar{x} = \frac{1}{n} \sum x \qquad s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

4.2 Values below the highest lower limit of detection are not included in the average.

4.3 If all values in the averaging group are less than the highest LLD, the highest LLD is reported.

4.4 If all but one of the values are less than the highest LLD, the single value x and associated two sigma error is reported.

4.5 In rounding off, the following rules are followed:

4.5.1. If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged. As an example, 11.443 is rounded off to 11.44.

4.5.2. If the figure following those to be retained is equal to or greater than 5, the figure is dropped and the last retained figure is raised by 1. As an example, 11.445 is rounded off to 11.45.

4.6 Composite samples which overlap the next month or year are reported for the month or year in which most of the sample is collected.

APPENDIX C

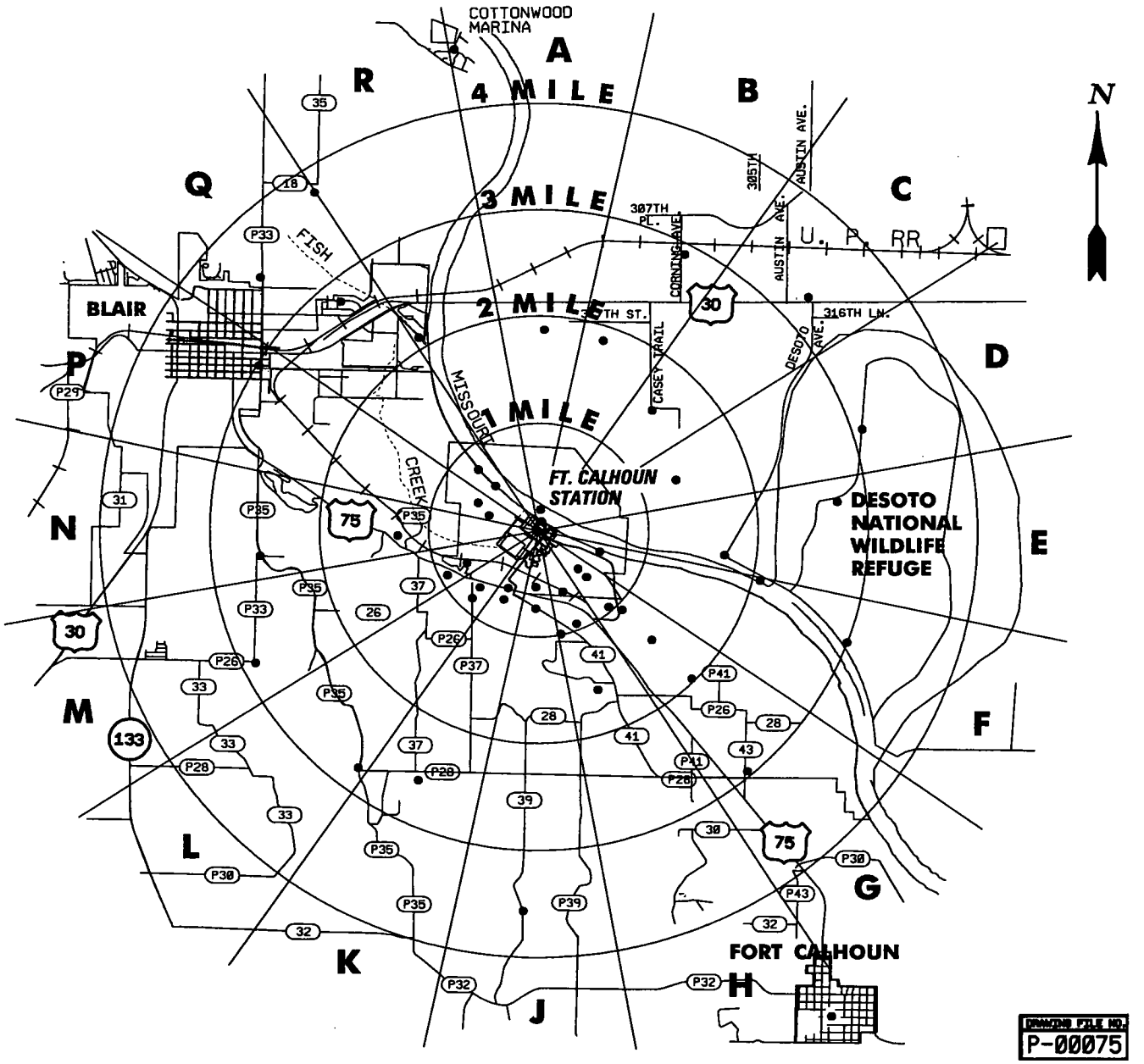
TECHNICAL SPECIFICATION 2.1.3

REACTOR COOLANT DOSE EQUIVALENT IODINE ABOVE TECHNICAL SPECIFICATION LIMIT

During the 2012 reporting period, radioactivity of primary coolant did not exceed the limits of Technical Specification 2.1.3.

APPENDIX D

SAMPLE LOCATIONS/MAP


COTTONWOOD MARINA
A
4 MILE
B
3 MILE
C
2 MILE
1 MILE
D
E
F
G
H
J
K
L
M
N
P
Q
R
N
BLAIR
FISH
MISSOURI
CREEK
FT. CALHOUN STATION
DESOTO NATIONAL WILDLIFE REFUGE
FORT CALHOUN
U. P. RR
CASEY JAIL
CORNING AVE.
AUSTIN AVE.
DESOTO AVE.
305TH
307TH PL.
316TH LN.
35TH ST.
DRAWING FILE NO.
P-00075

Radiological Environmental Sampling Locations And Media

Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring		TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
				Airborne Particulate	Airborne Iodine							
Onsite Station, 110-meter weather tower	0.53	293°/WNW	P			X						
Onsite Station, adjacent to old plant access road	0.59	207°/SSW	K	X	X	X						
Offsite Station, Intersection of Hwy. 75 and farm access road	0.94	145°/SE	G			X						
Blair OPPD office	2.86	305°/NW	Q	X	X	X						
Fort Calhoun, NE City Hall	5.18	150°/SSE	H			X						
Fence around intake gate, Desoto Wildlife Refuge	2.07	102°/ESE	F			X						
Onsite Station, entrance to Plant Site from Hwy. 75	0.55	191°/S	J			X						
Onsite Station, NW of Plant	0.68	305°/NW	Q			X						
Onsite Station, WSW of Plant	0.61	242°/WSW	M			X						

Radiological Environmental Sampling Locations And Media

Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring		TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
				Airborne Particulate	Airborne Iodine							
Offsite Station, SE of Plant	1.07	39°/SE	G			X						
Metropolitan Utilities Dist., Florence Treatment Plant North Omaha, NE	14.3	154°/SSE	H				X					
West bank Missouri River, downstream from Plant discharge	0.45	108°/ESE	F				X		X			
Upstream from Intake Bldg., west bank of river	0.09	4°/N	A				X		X			
Smith Farm	1.99	134°/SE	G									X
Mohr Dairy	9.86	186°/S	J								X	X
Fish Sampling Area, Missouri River	0.08 (R.M. 645.0)	6°/N	A							X		
Fish Sampling Area, Missouri River	17.9 (R.M. 666.0)	358°/N	A							X		
Alvin Pechnik Farm	0.94	163°/SSE	H								X	
Valley Substation #902	19.6	221°/SW	L	X	X	X						

Radiological Environmental Sampling Locations And Media

Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring		TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
				Airborne Particulate	Airborne Iodine							
Bansen Farm	0.65	203°/SSW	K									X
Herber Acreage	0.65	163°/SSE	H	X	X	X						X
Onsite Farm Field	0.52	118°/ESE	F								X	
Offsite Station Intersection Hwy 75/Co. Rd. P37	0.75	227°/SW	L			X						
Offsite Station Desoto Township	1.57	144°/SE	G	X	X	X						
Dowler Acreage	0.73	175°/S	J	X	X	X						
Sector A-1	1.94	0°/NORTH	A			X						
Sector B-1	1.97	16°/NNE	B			X						
Sector C-1	1.56	41°/NE	C			X						
Sector D-1	1.34	71°/ENE	D			X						
Sector E-1	1.54	90°/EAST	E			X						
Sector F-1	0.45	108°/ESE	F			X						
Sector G-1	1.99	134°/SE	G			X						
Sector H-1	1.04	159°/SSE	H			X						
Sector J-1	0.71	179°/SOUTH	J			X						
Sector K-1	0.61	205°/SSW	K			X						
Sector L-1	0.74	229°/SW	L			X						
Sector M-1	0.93	248°/WSW	M			X						
Sector N-1	1.31	266°/WEST	N			X						

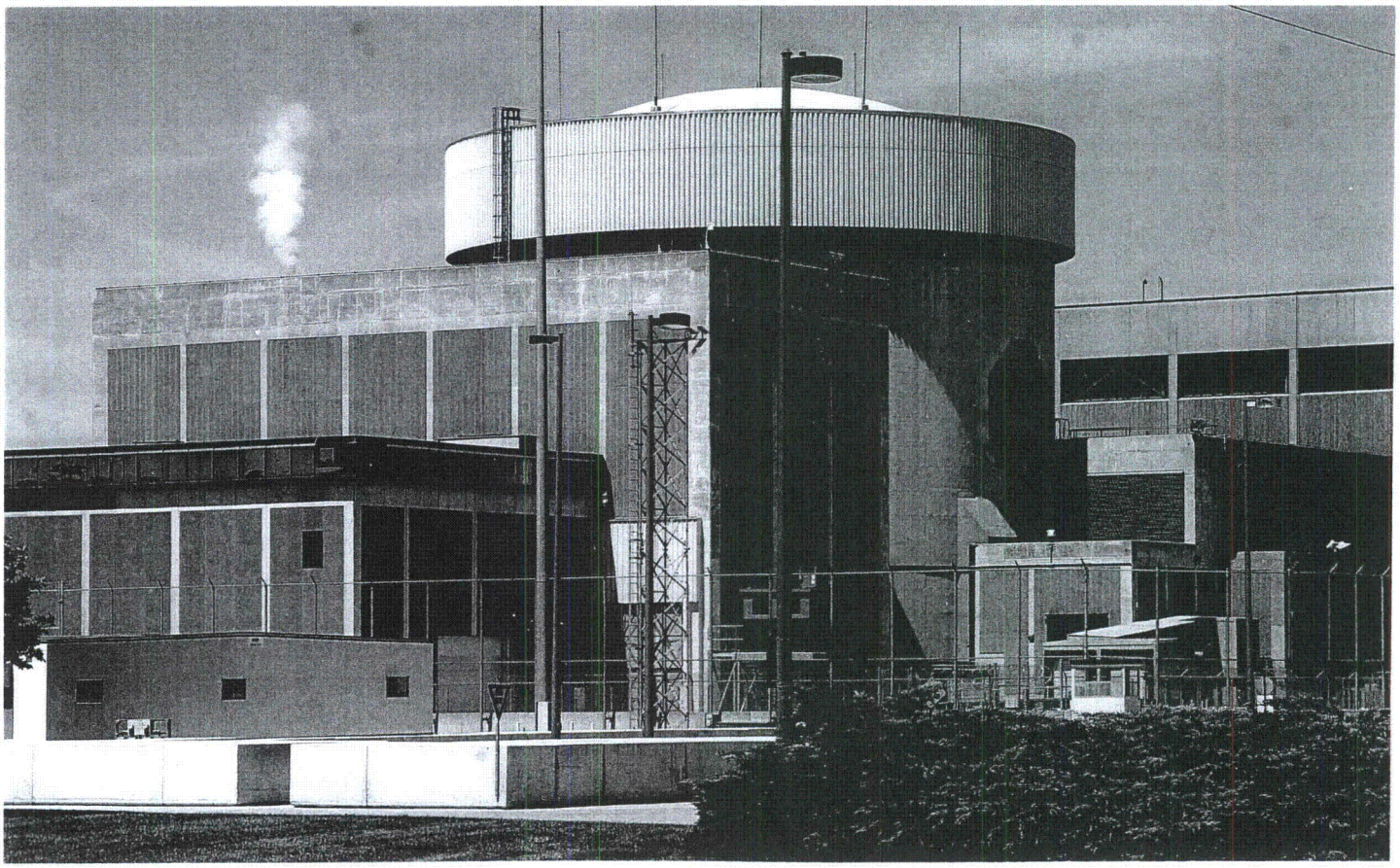
Radiological Environmental Sampling Locations And Media

Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring		TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
				Airborne Particulate	Airborne Iodine							
Sector P-1	0.60	291°/WNW	P			X						
Sector Q-1	0.67	307°/NW	Q			X						
Sector R-1	2.32	328°/NNW	R			X						
Sector A-2	4.54	350°/NORTH	A			X						
Sector B-2	2.95	26°/NNE	B			X						
Sector C-2	3.32	50°/NE	C			X						
Sector D-2	3.11	75°/ENE	D			X						
Sector E-2	2.51	90°/EAST	E			X						
Sector F-2	2.91	110°/ESE	F			X						
Sector G-2	3.00	140°/SE	G			X						
Sector H-2	2.58	154°/SSE	H			X						
Sector J-2	3.53	181°/SOUTH	J			X						
Sector K-2	2.52	205°/SSW	K			X						
Sector L-2	2.77	214°/SW	L			X						
Sector M-2	2.86	243°/WSW	M			X						
Sector N-2	2.54	263°/WEST	N			X						
Sector P-2	2.99	299°/WNW	P			X						
Sector Q-2	3.37	311°/NW	Q			X						
Sector R-2	3.81	328°/NNW	R			X						

Omaha Public Power District
Fort Calhoun Station Unit No. 1

Annual Report
For
Technical Specification
Section 5.9.4.a

January 1, 2012 to December 31, 2012



DOCKET NO. 50-285

OPERATING LICENSE DPR-40

Omaha Public Power District
Fort Calhoun Station Unit No. 1

Annual Report
For
Technical Specifications,
Section 5.9.4.a

January 1, 2012 to December 31, 2012

DOCKET NO. 50-285 OPERATING LICENSE DPR-40

Annual Radiological Effluent Release Report

This report is submitted in accordance with Section 5.9.4.a of the Technical Specifications of Fort Calhoun Station Unit No. 1, Facility Operating License DPR-40 for the period January 1, 2012 through December 31, 2012. The Effluent Report is presented in the format outlined in Regulatory Guide 1.21, Revision 2.

In addition, this report provides the results of quarterly dose calculations performed in accordance with the Offsite Dose Calculation Manual. Results are presented by quarter for the period January 1, 2012 through December 31, 2012.

Descriptions of any changes made during the preceding twelve months to the Offsite Dose Calculation Manual and/or the Process Control Program for the Fort Calhoun Station are presented.

PRC RECOMMENDS APPROVAL

APR 10 2013

PRC MTG. MINUTES

Division Manager Nuclear Operations/Plant Manager

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2. Joint Frequency Distribution Wind Direction vs. Wind Speed by Stability Class and Meteorological Data

1.0 INTRODUCTION

This Annual Radiological Effluent Release Report, for Fort Calhoun Station Unit No. 1, is submitted as required by Technical Specification 5.9.4.a for the period January 1, 2012 through December 31, 2012.

1.1 Executive Summary

The Radioactive Effluent Monitoring program for the year 2012 was conducted as described in the following report. Major efforts were made to maintain the release of radioactive effluents to the environment as low as reasonably achievable. The station was offline the entire year while performing NRC Chapter 0350 inspection.

The total airborne activity released from noble gas was 0.00 curies. This was a decrease from the 2011 activity of 0.823 curies. This decrease is attributed to the station being off line the entire year.

The total airborne activity from I-131, I-133, and particulates with half-lives > 8 days in 2012 was 0.00 curies. This was a decrease from the 2011 activity of 1.09E-5 curies. This decrease is attributed to the station being off line the entire year. Additionally last year's curie total contained activity associated with worldwide release from Dai-Ichi plant, Fukushima Japan.

The total airborne activity from Tritium was 1.314 curies. This was a decrease from the 2011 activity of 4.79 curies. This decrease is attributed to the station being off line the entire year.

The total airborne activity from C-14 was 0.00 curies. This was a decrease from the 2011 activity of 0.68 curies. This decrease is attributed to the station being off line the entire year. Airborne activity from C-14 is included in the 2012 annual report, per Regulatory Guide 1.21, Revision 2. This is a calculated value based on power generation and days of operation. Critical organ doses from C-14 were calculated using a ratio of 15% as CO_2. This ratio was determined during an NRC in-plant source term study conducted at the Fort Calhoun Station between 1976 and 1977, NUREG/CR-0140.

Dose contributions from airborne effluents at the unrestricted area boundary were; 0.00 mRad gamma air dose, 0.00 mRad beta air dose, 3.16E-03 mRem total body dose, and 3.16E-03 mRem critical organ dose. Gamma and beta dose showed a decrease from 2011 levels of 9.72-04 mRad gamma air dose and 1.53E-03

mRad beta air dose. This decrease is attributed to the station being off line the entire year. Whole body and critical organ doses decreased from 2011 levels of 2.94E-01 mRem total body dose and 1.26E+00 mRem critical organ dose. This decrease is attributed to the station being off line the entire year, with airborne tritium being the only airborne activity being released.

Total water activity (excluding tritium, dissolved gases, and alpha) released in 2012 in liquid effluents was 1.08E-03 curies. This was a decrease from the 2011 activity of 1.97E-03 curies.
The total water tritium activity released in 2012 in liquid effluents was 2.94 curies. This was a decrease from the 2011 activity of 83.2 curies. This decrease is attributed to the station being off line the entire year, and draining the reactor cavity to repair an existing liner to containment sump leak. The combination of decreased volume released (~30% reduction) and lower source term led to this improvement.

The calculated whole body dose due to liquid effluents at the site discharge from all sources in 2012 was 2.00E-01 mRem. This was an increase from the 2011 dose of 2.64E-02 mRem. This increase is attributed to the station circulating water pumps being secured for nearly the entire year, lowering dilution flow.

The calculated critical organ dose due to liquid effluents at the site discharge from all sources in 2012 was 2.98E-01 mRem. This was an increase from the 2011 dose of 4.79E-02 mRem. This increase is attributed to the station circulating water pumps being secured for nearly the entire year, lowering dilution flow.

The Fort Calhoun Station meteorological system had a cumulative recovery rate of 80.84% from the station meteorological tower with the remaining 19.16% provided by the National Weather Service, for the joint frequency parameters required by Regulatory Guide 1.23 for wind speed, wind direction, and delta temperature. The low recovery rate was due to the loss of the onsite tower from flood damage. The tower was repaired on March 8, 2012.

There were no abnormal releases during 2012.

During 2012 there were was no changes to the Offsite Dose Calculations Manual (ODCM) and one change to the Process Control Program (PCP).

For 2012, the total volume of solid radwaste released from the unit was 295.3 cubic meters. This was a decrease from the 578.4 cubic

meters of solid waste released from the unit in 2011.

The total activity released from the unit for 2012 was 0.207 curies, 0.00 curies from spent resin and 0.207 curies from dry compressables. This was a decrease from the 2011 value of 5.24 curies. Overall, the radioactive effluent monitoring program was conducted in a manner to ensure the activity released and associated dose to the public were maintained as low as reasonably achievable.

2.0 SUPPLEMENTAL INFORMATION

2.1 Regulatory Limits

The ODCM Radiological Effluent Control Specifications applicable to the release of radioactive material in liquid and gaseous effluents are described in the following sections.

2.1.1 Fission and Activation Gases (Noble Gases)

The release rate of radioactive material in airborne effluents shall be controlled such that the instantaneous concentrations of radionuclides do not exceed the values specified in 10 CFR 20 for airborne effluents at the unrestricted area boundary. To support plant operations, Supervisor - System Chemistry may increase this limit up to the limits specified in Technical Specification 5.16.1.g.

Technical Specification 5.16.1.g establishes the administrative control limit on the concentration resulting from radioactive material, other than noble gases, released in gaseous effluents to unrestricted areas conforming to ten times 10 CFR 20.1001-20.2401, Appendix B, Table 2, Column 1. For noble gases, the concentration shall be limited to five times 10 CFR 20.1001-20.2401, Appendix B, Table 2, Column 1.

The air dose due to noble gases released in gaseous effluents to areas at or beyond the unrestricted area boundary shall be limited to the following:

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

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

2.1.2 Doses from I-131, I-133, C-14, Tritium, and Radioactive Material in Particulate Form with Half Lives Greater than 8 Days (Other than Noble Gases).

a. The dose to an individual or dose commitment to any organ of an individual in unrestricted areas due to the release of I-131, I-133, C-14, H-3, and radioactive material in particulate form with half-lives greater than eight days (other than noble gases) in airborne effluents shall not exceed 7.5 millirem from all exposure pathways during any calendar quarter.

b. The dose to an individual or dose commitment to any organ of an individual in unrestricted areas due to the release of I-131, I-133, C-14, H-3, and radioactive materials in particulate form with half-lives greater than eight days (other than noble gases) in airborne effluents shall not exceed 15 millirem from all exposure pathways during any calendar year.

2.1.3 Liquid Effluents

The release rate of radioactive material in liquid effluents shall be controlled such that the instantaneous concentrations for radionuclides, other than dissolved or entrained noble gases, do not exceed the values specified in 10 CFR 20 for liquid effluents at site discharge. To support plant operations, the Supervisor - System Chemistry may increase this limit up to the limit specified in Technical Specifications 5.16.1.b.

Technical Specification 5.16.1.b establishes the administrative control limit on concentration of radioactive material, other than dissolved or entrained noble gases, released in liquid effluents to unrestricted areas conforming to ten times 10 CFR 20.1001-20.2401, Appendix B, Table 2, Column 2. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-04 µCi/mL total activity.

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents

released to unrestricted areas shall be limited to:

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

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

2.1.4 Total Dose-Uranium Fuel Cycle

The dose to any individual from uranium fuel cycle sources shall be limited to ≤ 25 mRem to the total body or any organ (except the thyroid, which shall be limited to ≤ 75 mRem) during each calendar year.

2.2 Effluent Concentration Limits (ECL)

2.2.1 Liquid Effluents

The values specified in 10 CFR Part 20, Appendix B, Column 2 are used as the ECL for liquid radioactive effluents released to unrestricted areas. A value of 2.0E-04 µCi/mL is used as the ECL for dissolved and entrained noble gases in liquid effluents.

2.2.2 Gaseous Effluents

The values specified in 10 CFR Part 20, Appendix B, Column 1 are used as the ECL for gaseous radioactive effluents released to unrestricted areas.

2.3 Measurements and Approximations of Total Radioactivity

Measurements of total radioactivity in liquid and gaseous radioactive effluents were accomplished in accordance with the sampling and analysis requirements of Tables 3.1 and 3.2 of Part I of the ODCM.

2.3.1 Liquid Radioactive Effluents

Each batch was sampled and analyzed for gamma emitting radionuclides using gamma spectroscopy, prior to release. Composite samples were analyzed monthly and quarterly for the Monitor Tanks and Steam Generators. Composite

samples were analyzed monthly in the onsite laboratory for tritium and gross alpha radioactivity, using liquid scintillation and proportional counting techniques respectively. Composite samples were analyzed quarterly for Sr-89, Sr-90, Fe-55, Ni-63, and Gross Alpha by a contract laboratory (Teledyne Brown Engineering, Inc.). A software program was used to project the total body and critical organ dose contribution at the unrestricted area boundary for each release and the percent contribution to the annual objective dose.

There were no continuous releases from the Steam Generator blowdown during the reporting period.

2.3.2 Gaseous Radioactive Effluents

Each gaseous batch release was sampled and analyzed for radioactivity prior to release. For release of Waste Gas Decay Tanks, noble gas grab samples were analyzed for gamma emitting radionuclides using gamma spectroscopy. For releases from the Containment Building, samples were taken using charcoal and particulate filters, in addition to noble gas and Tritium grab samples, and analyzed for gamma emitting radionuclides prior to each release. The results of the analysis and the total volume of effluent released were used to determine the total amount of radioactivity released in the batch mode. A software program was developed and installed that can project the total body and critical organ dose contribution at the unrestricted area boundary for each release and the percent contribution to the annual objective dose. This program also adds the projected dose to the current actual dose totals in a temporary file, until it is updated with actual release data at the completion of a purge.

Continuous release effluent pathways were continuously sampled using charcoal and particulate filters and analyzed weekly for gamma emitting radionuclides using gamma spectroscopy. Weekly particulate filters were analyzed for gross alpha radioactivity in the onsite laboratory using proportional counting techniques. Quarterly composites of particulate filters were analyzed for Sr-89, Sr-90, and Gross Alpha by a contract laboratory (Teledyne Brown Engineering, Inc.).

2.4 Estimation of Total Percent Error

The estimated total percent error is calculated as follows:

Total Percent Error = $(E_1^2 + E_2^2 + E_3^2 + ... + E_n^2)^{0.5}$
Where E_n = percent error associated with each contributing parameter.

Sample counting error is estimated by the Canberra Genie System Software for samples analyzed by gamma spectroscopy. This calculation can include the error associated with peak area determination, gamma ray abundance, efficiency and half-life. Systematic error is estimated for gaseous and liquid effluent analyses and dilution and wastewater volume.

2.5 Batch Releases

A summary of information for liquid and gaseous batch releases is included in Table III.1.

2.6 Abnormal Releases

Abnormal Releases are defined as unplanned and unmonitored releases of radioactive material from the site.

A summary of information for liquid and gaseous abnormal releases is included in Table III.2.

3.0 GASEOUS EFFLUENTS

The quantities of radioactive material released in gaseous effluents are summarized in Tables III.3, III.4 and III.5. All radioactive materials released in gaseous form are considered to be ground level releases.

4.0 LIQUID EFFLUENTS

The quantities of radioactive material released in liquid effluents are summarized in Tables III.6, III.7 and III.8.

5.0 SOLID WASTES

The quantities of radioactive material released as solid effluents are summarized in Section VI.

6.0 RELATED INFORMATION

6.1 Operability of Liquid and Gaseous Monitoring Instrumentation

During the reporting period there were two instrument used to monitor radioactive effluent releases that failed to meet the minimum reportable instrument operability requirements listed in the ODCM during the reporting period.

RM-043, Laboratory and Radioactive Waste Processing Building Exhaust Stack Monitor, was inoperable for 44 days (11/18/2012-12/31/2012) due to sample pump issues. The unavailability of replacement parts prevented the monitor from being repaired in less than 30 days. Alternate particulate and iodine sampling was established and shiftly gas grab samples were performed as required in ODCM Table 3.2.1.

RM-063 Post Accident Radiation Monitor was inoperable for 249 days (4/27/2012 – 12/31/2012) due to a defective signal cable. The unavailability of replacement parts has prevented the monitor from being repaired. Procedure CH-SMP-PA-0005, Post Accident Sampling of the Auxiliary Building Exhaust Stack, provides in part the sampling requirements of the Off-Site Dose Calculation Manual (ODCM) and was a backup contingency plan for obtaining the required inputs to perform dose assessment for auxiliary building releases in the event of a declared emergency.

6.2 Changes to the Offsite Dose Calculation Manual (ODCM) and/or Process Control Program (PCP)

During 2012, no changes were made to the ODCM:

During 2012, the following change was made to the PCP:

- Superseding RW-200 with RW-AD-300.
- Remove out of date activities, unnecessary editorial statements and incorrect references.

6.3 New Locations or Modifications for Dose Calculations or Environmental Monitoring

- No new sample locations were added to the REMP program.

6.4 Noncompliance with Radiological Effluent Control Requirements

This section provides a list of any event that did not comply with the

applicable requirements of the Radiological Effluent Controls given in the Offsite Dose Calculation Manual (ODCM). Detailed documentation concerning the evaluations and corrective actions is maintained onsite.

6.4.1 Abnormal Gaseous and Liquid Releases

No abnormal releases were made during the calendar year of 2012.

6.4.2 Failure to Meet Specified Sampling Requirements

During 2012, there were no instances in which specified sampling requirements were not met.

6.5 Modifications to Liquid and Gaseous Waste Treatment and Ventilation Exhaust Systems

During the reporting period no design modifications were approved nor implemented involving major changes to the Liquid and Gaseous Waste Treatment Systems.

6.6 Meteorological Monitoring Program

A summary of hourly meteorological data, collected during 2012, is retained onsite and is maintained as documentation as required by Regulatory Guide 1.21 Rev 2. This data is available for review by the Nuclear Regulatory Commission upon request. Joint Frequency tables are included in Section VII, Attachment 2

Real time hourly meteorological data is used to calculate the annual air effluent dose to individuals. For quarterly estimates during the year an annual average X/Q is used, which is an average of the highest X/Q's calculated for each of the previous two years. Due to station flooding in 2011 damaging the on-site weather tower electronics, 19.16% of the meteorological data used the Joint Frequency tables and station doses were supplied by Eppley Airfield Weather Station, a branch of the National Weather Service.

6.7 Assessment of Doses

6.7.1 Doses Due to Liquid Effluents

Total body, skin, and organ dose for liquid releases were calculated in mRem for all significant liquid pathways using the annual configuration of the LADTAP II program. The site

discharge location was chosen to present a most conservative estimate of dose for an average adult, teenager, child, and infant. A conservative approach is also presented by the assumption that Omaha and Council Bluffs receive all drinking water from the Missouri River.

The LADTAP II program in its annual configuration was also used to calculate the total body and organ doses for the population of 950,006 within a 50-mile radius of the plant (based on the 2010 census). The results of the calculations are listed in Section V.

The doses due to liquid effluents for total body and critical organ are also calculated quarterly using the methods in the ODCM. The results are listed in Section II.

6.7.2 Doses Due to Gaseous Effluents

Total body, skin and organ doses from ground releases were calculated in mRem to an average adult, teenager, child, and infant in each receptor using the annual configuration of the GASPAR II program. Also, the doses to the same groups, in units of mRad due to gamma and beta radiation carried by air, were computed using GASPAR II.
The GASPAR II program in its annual configuration was also used to calculate the ALARA integrated population dose summary for the total body, skin and organ doses in person-rem for all individuals within a 50-mile radius. The results of the calculations are shown in Section IV.

The doses due to gaseous effluents for total body gamma and beta noble gas air dose are calculated quarterly using the methods in the ODCM with an annual average X/Q. The results are listed in Section II.

6.7.3 Doses Due to I-131, I-133, C-14, H-3, and Particulates with Half Lives Greater than 8 days.

The doses due to I-131, I-133, C-14, H-3, and Particulates with half-lives greater than 8 days for total body and critical organ dose are calculated quarterly using the highest of infant or child dose factors and an annual average X/Q. The results are listed in Section II for inhalation, ground and food.

6.7.4 Direct Radiation Dose to Individuals and Populations

Direct radiation doses attributed to the gamma radiation emitted from the containment structure were not observed above local background at any TLD sample locations for this annual period.

6.7.5 40 CFR 190 Dose Evaluation

ODCM Radiological Effluent Controls require dose evaluations to demonstrate compliance with 40 CFR Part 190 only if calculated yearly doses exceed two times the annual design objectives for liquid and/or gaseous effluents. At no time during 2012 were any of these limits exceeded; therefore, no evaluations were required.

6.8 Groundwater Monitoring Program and Observations

- OPPD conducted groundwater sampling from 19 wells, 2 surface water sites, and 4 storm water headers within the site property per NEI 07-07. Two storm water headers were added in the 3rd quarter per ANI recommendations. Additionally Nebraska requirements regarding avoidance of snow runoff were deleted, so storm water sampling is now performed quarterly, if available.

- No new monitoring wells were added to the sampling program during 2012. A rainwater sampling program was initiated prior to station flooding. Ten sample locations in sectors experiencing significant (>10%) wind direction were established to assess potential atmospheric deposition. After an initial sampling regime in all ten sectors displayed no detectable tritium, the sampling program was switched to 2 affected sectors per rain event and an upwind background test. Three sampling events were conducted. No tritium activity in excess of the vendor's Minimum Detectable Activity (MDA) was reported.

- No tritium activity in excess of the vendor's Minimum Detectable Activity (MDA) was reported in Table III.9. One result greater than a 2 sigma threshold but less than MDA was maintained by plant staff. This result was reported at MW-6. A duplicate sample at MW-6 also showed tritium greater than 2 sigma threshold but less than MDA. MW-6 is hydro-geologically connected to the river and is in close proximity to the licensed effluent release point. MW-6 has historically had activity identified in excess of the MDA when river levels are high. All Table III.9 Sr-90 reported concentrations represent values greater than a 2 sigma

threshold but less than MDA, which are evaluated by the plant staff as required by the site groundwater monitoring program. EPRI Report No. 1011730, Groundwater Monitoring Guidance for Nuclear Power Plants, documents plant shallow monitoring well Sr-90 results as typically showing a positive bias toward detection (i.e. background greater than zero). The Fort Calhoun Station Sr-90 results reflect this same bias. Although the data set is too small to perform a complete statistical analysis, the measured values have not exceeded a threshold by which the results could be called "significantly different" from a true background value and therefore cannot be attributed to a plant environmental impact. The results are all below NRC, EPA, NEI and FCS groundwater protection program administrative reporting limits. Some hard to detect nuclides, were reduced to an annual sample frequency (Ni-63, Fe-55, Sr-90 in deep wells) based on 2 years of quarterly sampling with no detections above MDA.

- The Fort Calhoun REMP sampling showed no detected tritium within the Missouri River downstream at the sight boundary or at the nearest municipal drinking water facility. No groundwater drinking pathway exists on site. No state or federal drinking water limits, and no site groundwater protection program administrative limits were exceeded.

- Semi-annual storm water sampling wasn't performed during the 1st quarter due to Nebraska regulations against snow runoff in samples. The SW-6 ISFSI storm water header sample point was not performed for the 3rd quarter due to drought conditions.

SECTION II

QUARTERLY DOSES FROM EFFLUENTS

Offsite Dose Calculation Manual

January 1, 2012 - December 31, 2012

Quarterly Dose Calculation Results

January 1, 2012 through December 31, 2012

With the implementation of the Fort Calhoun Station Radiological Effluent Technical Specifications (RETS) on October 1, 1985, radiation doses in the unrestricted area from liquid and gaseous effluents must be calculated on a quarterly basis in accordance with the Offsite Dose Calculation Manual (ODCM). These calculations are performed to ensure the annual dose limits delineated in Appendix I of 10 CFR 50 and implemented by RETS are not exceeded. If the results of the quarterly calculations exceed fifty percent (50%) of the annual limits of Appendix I, actions are taken to reduce effluents so that the resultant doses do not exceed the annual limits during the remainder of the year and a special report is submitted to the Nuclear Regulatory Commission. No special reports were required for 2012 calculated doses.

This section presents the results of the quarterly dose calculations performed during the period January 1, 2012 through December 31, 2012. Details are shown as to the types, sources and resultant doses from the effluents, the annual limits and a comparison to the annual limits.

QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
FORT CALHOUN FIRST QUARTER 2012 DOSE PROJECTIONS

I. Liquid Effluents:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Batch:	2.92E-03	4.51E-03
Continuous:	0.00E+00	0.00E+00
Totals:	2.92E-03	4.51E-03
ODCM Quarterly Objective:	1.50E+00	5.00E+00
Percent of Quarterly Obj:	0.19 %	0.09 %
ODCM Annual Objective:	3.00E+00	1.00E+01
YTD Percent of Annual Obj:	0.10 %	0.05 %

II. Gaseous Effluents:	Total Body Gamma Dose (mrad)	Total Body Beta Dose (mrad)
A. Noble Gas Air Dose:	0.00E+00	0.00E+00
ODCM Quarterly Objective:	5.00E+00	1.00E+01
Percent of Quarterly Obj:	0.00 %	0.00 %
ODCM Annual Objective:	1.00E+01	2.00E+01
YTD Percent of Annual Obj:	0.00 %	0.00 %

B. I-131, I-133, Tritium, C-14, and Particulates with Half-Lives > 8 Days:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Inhalation:	1.22E-04	1.22E-04
Ground and Food:	5.64E-04	5.64E-04
Totals:	6.86E-04	6.86E-04
ODCM Quarterly Objective:	7.50E+00	7.50E+00
Percent of Quarterly Obj:	0.01 %	0.01 %
ODCM Annual Objective:	1.50E+01	1.50E+01
YTD Percent of Annual Obj:	0.00 %	0.00 %

Reviewed by: _____

QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
FORT CALHOUN SECOND QUARTER 2012 DOSE PROJECTIONS

I. Liquid Effluents:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Batch:	5.91E-04	8.60E-04
Continuous:	0.00E+00	0.00E+00
Totals:	5.91E-04	8.60E-04
ODCM Quarterly Objective:	1.50E+00	5.00E+00
Percent of Quarterly Obj:	0.04 %	0.02 %
ODCM Annual Objective:	3.00E+00	1.00E+01
YTD Percent of Annual Obj:	0.12 %	0.05 %

II. Gaseous Effluents:	Total Body Gamma Dose (mrad)	Total Body Beta Dose (mrad)
A. Noble Gas Air Dose:	0.00E+00	0.00E+00
ODCM Quarterly Objective:	5.00E+00	1.00E+01
Percent of Quarterly Obj:	0.00 %	0.00 %
ODCM Annual Objective:	1.00E+01	2.00E+01
YTD Percent of Annual Obj:	0.00 %	0.00 %

B. I-131, I-133, Tritium, C-14, and Particulates with Half-Lives > 8 Days:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Inhalation:	9.25E-05	9.25E-05
Ground and Food:	4.28E-04	4.28E-04
Totals:	5.21E-04	5.21E-04
ODCM Quarterly Objective:	7.50E+00	7.50E+00
Percent of Quarterly Obj:	0.01 %	0.01 %
ODCM Annual Objective:	1.50E+01	1.50E+01
YTD Percent of Annual Obj:	0.01 %	0.01 %

Reviewed by: _____

QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
FORT CALHOUN THIRD QUARTER 2012 DOSE PROJECTIONS

I. Liquid Effluents:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Batch:	2.24E-03	3.51E-03
Continuous:	0.00E+00	0.00E+00
Totals:	2.24E-03	3.51E-03
ODCM Quarterly Objective:	1.50E+00	5.00E+00
Percent of Quarterly Obj:	0.15 %	0.07 %
ODCM Annual Objective:	3.00E+00	1.00E+01
YTD Percent of Annual Obj:	0.15 %	0.07 %

II. Gaseous Effluents:	Total Body Gamma Dose (mrad)	Total Body Beta Dose (mrad)
A. Noble Gas Air Dose:	0.00E+00	0.00E+00
ODCM Quarterly Objective:	5.00E+00	1.00E+01
Percent of Quarterly Obj:	0.00 %	0.00 %
ODCM Annual Objective:	1.00E+01	2.00E+01
YTD Percent of Annual Obj:	0.00 %	0.00 %

B. I-131, I-133, Tritium, C-14, and Particulates with Half-Lives > 8 Days:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Inhalation:	1.38E-04	1.38E-04
Ground and Food:	6.37E-04	6.37E-04
Totals:	7.75E-04	7.75E-04
ODCM Quarterly Objective:	7.50E+00	7.50E+00
Percent of Quarterly Obj:	0.01 %	0.01 %
ODCM Annual Objective:	1.50E+01	1.50E+01
YTD Percent of Annual Obj:	0.01 %	0.01 %

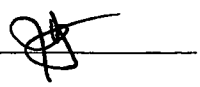
Reviewed by: _____

QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
FORT CALHOUN FOURTH QUARTER 2012 DOSE PROJECTIONS

I. Liquid Effluents:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Batch:	6.36E-04	9.47E-04
Continuous:	0.00E+00	0.00E+00
Totals:	6.36E-04	9.47E-04
ODCM Quarterly Objective:	1.50E+00	5.00E+00
Percent of Quarterly Obj:	0.04 %	0.02 %
ODCM Annual Objective:	3.00E+00	1.00E+01
YTD Percent of Annual Obj:	0.17 %	0.08 %

II. Gaseous Effluents:	Total Body Gamma Dose (mrad)	Total Body Beta Dose (mrad)
A. Noble Gas Air Dose:	0.00E+00	0.00E+00
ODCM Quarterly Objective:	5.00E+00	1.00E+01
Percent of Quarterly Obj:	0.00 %	0.00 %
ODCM Annual Objective:	1.00E+01	2.00E+01
YTD Percent of Annual Obj:	0.00 %	0.00 %

B. I-131, I-133, Tritium, C-14, and Particulates with Half-Lives > 8 Days:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Inhalation:	7.97E-05	7.97E-05
Ground and Food:	3.68E-04	3.68E-04
Totals:	4.48E-04	4.48E-04
ODCM Quarterly Objective:	7.50E+00	7.50E+00
Percent of Quarterly Obj:	0.01 %	0.01 %
ODCM Annual Objective:	1.50E+01	1.50E+01
YTD Percent of Annual Obj:	0.02 %	0.02 %

Reviewed by: 

SECTION III

RADIOLOGICAL EFFLUENT RELEASES

Technical Specification (5.9.4.a)

Table III.1	Batch Liquid and Gas Release Summary
Table III.2	Abnormal Batch Liquid and Gaseous Release Summary
Table III.3	Gaseous Effluents - Summation of all Releases
Table III.4	Gaseous Effluent Releases - Batch Mode
Table III.5	Gaseous Effluent Releases - Continuous Mode
Table III.6	Liquid Effluents - Summation of all Releases
Table III.7	Liquid Effluent Releases - Batch Mode
Table III.8	Liquid Effluent Releases - Continuous Mode
Table III.9	Groundwater Tritium Results

January 1, 2012 - December 31, 2012

TABLE III.1

BATCH LIQUID AND GASEOUS RELEASE SUMMARY

JANUARY THROUGH DECEMBER 2012

A. Liquid Releases All Sources	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Year
1. Number of Batch Releases:	21	26	29	27	103
2. Total Time Period for Batch Releases(min):	9,357	10,929	12,509	12,139	44,934
3. Maximum Time Period for Batch Releases(min):	512	488	546	569	569
4. Average Time Period for Batch Releases(min):	446	420	431	450	436
5. Minimum Time Period for Batch Releases(min):	380	70	219	346	70
6. Average Dilution Stream Flow During Periods of Release into the Missouri River(mls/min):	2.730E+07	2.637E+07	2.730E+07	2.730E+07	2.707E+07

B. Gaseous Releases All Sources	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Year
1. Number of Batch Releases:	12	11	14	14	51
2. Total Time Period for Batch Releases(min):	98,185	73,272	110,254	118,089	399,800
3. Maximum Time Period for Batch Releases(min):	17,183	10,114	11,135	10,060	17,183
4. Average Time Period for Batch Releases(min):	8,182	6,661	7,875	8,435	7,839
5. Minimum Time Period for Batch Releases(min):	1,749	179	255	520	179

TABLE III.2

ABNORMAL BATCH LIQUID AND GASEOUS RELEASE SUMMARY

JANUARY THROUGH DECEMBER 2012

A. Liquid Releases All Sources	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Year
Number of Releases:	0	0	0	0	0
Total Activity Releases(Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

B. Gaseous Releases All Sources	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Year
Number of Releases:	0	0	0	0	0
Total Activity Releases (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE III.3

GASEOUS EFFLUENTS--SUMMATION OF ALL RELEASES

JANUARY THROUGH DECEMBER 2012

		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year
A.	Fission & Activation Gases					
	Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Average Release Rate (uCi/sec):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total Error (%): 21.2					
B.	Iodines					
	Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Average Release Rate (uCi/sec):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total Error (%): 21.2					
C.	Particulates					
	Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Average Release Rate (uCi/sec):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total Error (%): 20.62					
	Gross Alpha:					
	Total Error (%): 20.62	4.13E-06	1.92E-06	4.02E-06	5.84E-06	1.59E-05
D.	Tritium					
	Total Release (Ci):	3.71E-01	2.81E-01	4.19E-01	2.43E-01	1.31E+00
	Average Release Rate (uCi/sec):	1.91E-03	1.51E-03	2.13E-03	1.19E-03	1.67E-03
	Total Error (%): 25.08					
E.	Carbon-14					
	Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Average Release Rate (uCi/sec):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total Error (%): 20.62					

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).

TABLE III.4

GASEOUS EFFLUENTS--GROUND LEVEL RELEASES

JANUARY THROUGH DECEMBER 2012

Batch Mode

Nuclides(Ci)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	YEAR
Fission & Activation Gases					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium and Gross Alpha					
H-3	2.52E-01	1.76E-01	2.43E-01	1.20E-01	7.90E-01

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).

TABLE III.5
GASEOUS EFFLUENTS--GROUND LEVEL RELEASES
JANUARY THROUGH DECEMBER 2012
Continuous Mode

Nuclides(Ci)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year
Fission & Activation Gases					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium and Gross Alpha					
ALPHA	4.13E-06	1.92E-06	4.02E-06	5.84E-06	1.59E-05
H-3	1.20E-01	1.05E-01	1.76E-01	1.23E-01	5.25E-01

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).

TABLE III.6

LIQUID EFFLUENTS--SUMMATION OF ALL RELEASES

JANUARY THROUGH DECEMBER 2012

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year
A. Fission & Activiation Products					
Total Release (No H-3,Gas,Alpha) (Ci):	4.17E-04	1.07E-04	4.33E-04	1.20E-04	1.08E-03
Average Diluted Concentration (uCi/mL):	3.43E-08	9.37E-09	3.68E-08	9.76E-09	9.05E-08
10 CFR 20, App. B Limit 1.00E-06(uCi/mL) Percent of Limit (%):	3.43E+00	9.37E-01	3.68E+00	9.76E-01	9.05E+00
Total Error (%): 29.68					
B. Tritium					
Total Release (Ci):	7.09E-01	7.15E-01	6.31E-01	8.83E-01	2.94E+00
Average Diluted Concentration (uCi/mL):	5.83E-05	6.26E-05	5.36E-05	7.19E-05	2.47E-04
10 CFR 20, App. B Limit 1.00E-03 (uCi/mL) Percent of Limit (%):	5.83E+00	6.26E+00	5.36E+00	7.19E+00	2.47E+01
Total Error (%): 25.08					
C. Dissolved & Entrained Gases					
Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Average Diluted Concentration (uCi/mL):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ODCM Limit 2.00E-04 (uCi/mL) Percent of Limit (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Error (%): 18.14					
D. Gross Alpha Radioactivity					
Total Release (Ci):	0.00E+00	0.00E+00	9.61E-06	0.00E+00	9.61E-06
Total Error (%): 25.08					
E. Volume of Waste Released Prior to Dilution (Liters):	4.14E+05	4.94E+05	5.67E+05	6.10E+05	2.08E+06
F. Volume of Dilution Water During Releases (Liters):	2.55E+08	2.96E+08	3.41E+08	3.31E+08	1.22E+09

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).

TABLE III.7
LIQUID EFFLUENTS

JANUARY THROUGH DECEMBER 2012
Batch Mode

Nuclides(Ci)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year
Fission & Activation Gases					
CS-137	3.08E-04	5.69E-05	3.88E-04	1.01E-04	8.55E-04
CS-134	1.03E-05	4.42E-07	7.48E-06	1.20E-06	1.94E-05
CO-58	5.13E-05	7.49E-06	3.25E-07	0.00E+00	5.91E-05
SB-125	2.31E-05	3.12E-05	2.77E-05	1.28E-05	9.48E-05
SB-124	7.31E-07	3.01E-07	0.00E+00	0.00E+00	1.03E-06
CO-60	2.30E-05	1.06E-05	9.05E-06	4.42E-06	4.70E-05
Totals for Period:	4.17E-04	1.07E-04	4.33E-04	1.20E-04	1.08E-03
Dissolved & Entrained Gases					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium and Gross Alpha					
ALPHA	0.00E+00	0.00E+00	9.61E-06	0.00E+00	9.61E-06
H-3	7.09E-01	7.15E-01	6.31E-01	8.83E-01	2.94E+00

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD) values.
Reported Alpha activity was attributed to natural short-lived radionuclides. This was confirmed by quarterly offside vendor analysis.

TABLE III.8
LIQUID EFFLUENTS

JANUARY THROUGH DECEMBER 2012
Continuous Mode

Nuclides(Ci)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year
Fission & Activation Products					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dissolved & Entrained Gases					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium and Gross Alpha					
ALPHA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H-3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).

TABLE III.9

GROUNDWATER ANALYSIS RESULTS

pCi/L

JANUARY THROUGH DECEMBER 2012

		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
MW-1A					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55		0.00E+00		
	NI-63		0.00E+00		
	Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-1B					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55		0.00E+00		
	NI-63		0.00E+00		
	Sr-90		0.00E+00		
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-2					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55			0.00E+00	
	NI-63			0.00E+00	
	Sr-90		0.00E+00		
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-2A					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55		0.00E+00		
	NI-63		0.00E+00		
	Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-2B					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55		0.00E+00		
	NI-63		0.00E+00		
	Sr-90		0.00E+00		
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-3					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55			0.00E+00	
	NI-63			0.00E+00	
	Sr-90		0.00E+00		
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-3A					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55		0.00E+00		
	NI-63		0.00E+00		
	Sr-90	0.00E+00	6.32E-01	0.00E+00	5.47E-01
	Total Gamma	0.00E+00	0.00E+00		0.00E+00
MW-3B					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55		0.00E+00		
	NI-63		0.00E+00		
	Sr-90			0.00E+00	
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-4A					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55		0.00E+00		
	NI-63		0.00E+00		
	Sr-90	0.00E+00	0.00E+00	5.53E-01	0.00E+00
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE III.9

GROUNDWATER ANALYSIS RESULTS

pCi/L

JANUARY THROUGH DECEMBER 2012

		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
MW-4B					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55		0.00E+00		
	NI-63		0.00E+00		
	Sr-90			0.00E+00	
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-5A					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55			0.00E+00	
	NI-63			0.00E+00	
	Sr-90	0.00E+00	0.00E+00	6.01E-01	0.00E+00
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-6					
	Tritium	0.00E+00	0.00E+00	1.28E+02	0.00E+00
	FE-55			0.00E+00	
	NI-63			0.00E+00	
	Sr-90	0.00E+00	4.72E-01	0.00E+00	0.00E+00
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-5B					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55			0.00E+00	
	NI-63			0.00E+00	
	Sr-90			0.00E+00	
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-7					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55			0.00E+00	
	NI-63			0.00E+00	
	Sr-90	5.15E-01	5.46E-01	7.39E-01	0.00E+00
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-9					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Sr-90	0.00E+00	0.00E+00	6.73E-01	8.90E-01
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-10					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-11					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MW-12A					
	Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Sr-90	0.00E+00	0.00E+00	4.75E-01	6.43E-01
	Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE III.9

GROUNDWATER ANALYSIS RESULTS

pCi/L

JANUARY THROUGH DECEMBER 2012

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
MW-12B				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EAST LAGOON				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55				
NI-63				
Sr-90				
Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WEST LAGOON				
Tritium		0.00E+00	0.00E+00	0.00E+00
FE-55				
NI-63				
Sr-90				
Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NORTH STORMWATER HDR				
Tritium		0.00E+00	0.00E+00	0.00E+00
FE-55				0.00E+00
NI-63				0.00E+00
Sr-90				0.00E+00
Total Gamma		0.00E+00	0.00E+00	0.00E+00
SOUTH STORMWATER HDR				
Tritium		0.00E+00	0.00E+00	0.00E+00
FE-55				0.00E+00
NI-63				0.00E+00
Sr-90				0.00E+00
Total Gamma		0.00E+00	0.00E+00	0.00E+00
SW-8 NORTH PA				
Tritium			0.00E+00	0.00E+00
FE-55				
NI-63				
Sr-90				
Total Gamma			0.00E+00	0.00E+00
SW-6 ISFSI				
Tritium				0.00E+00
FE-55				
NI-63				
Sr-90				
Total Gamma				0.00E+00

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).
Only Tritium and Gamma are required for each sampling event.
Hard to detect (HTD) nuclide sampling frequency is per station procedures.
Missed sampling events are covered in the executive summary.

SECTION IV

DOSE FROM GASEOUS EFFLUENTS

Technical Specification 5.9.4.a

GASPAR II OUTPUT

January 1, 2012 - December 31, 2012

Radioactive Effluent Releases - First, Second, Third and Fourth Quarters 2012

GASEOUS EFFLUENTS

Radioactive gaseous releases for the reporting period totaled 0.00E+00 curies of inert gas. The gross gaseous activity release rates were 0.00E+00 µCi/sec for the first quarter, 0.00E+00 µCi/sec for the second quarter, 0.00E+00 µCi/sec for the third quarter, and 0.00E+00 µCi/sec for the fourth quarter.

Radioactive halogens releases for the reporting period totaled 0.00E+00 curies. The halogen activity release rates were 0.00E+00 µCi/sec for the first quarter, 0.00E+00 µCi/sec for the second quarter, 0.00E+00 µCi/sec for the third quarter, and 0.00E+00 µCi/sec for the fourth quarter from gaseous effluent discharges.
No radioactive particulates with half-lives greater that eight days were released during the reporting period from gaseous effluent discharges.

Radioactive tritium released during the reporting period totaled 1.314 curies.

Carbon-14 released for the reporting period totaled 0.00 curies, this is a calculated value based on reactor power and days of operation.

Off-site vendor analysis of weekly composite samples indicated that no gross alpha radioactivity was released during the reporting period.

POTENTIAL DOSES TO INDIVIDUALS AND POPULATIONS

A. Potential Annual Doses to Individuals from Gaseous Releases

Total body, skin, and organ doses from ground releases were calculated in mRem to an average adult, teenager, child, and infant using the annual configuration of the GASPAR II program. Results to each receptor are shown in Tables IV-A-1 through IV-A-39. Also, the doses to the same groups, Table IV-B-1, in units of mRad, due to gamma and beta radiation carried by air, were computed using GASPAR II. In its annual configuration, GASPAR II assumes that all release rates are entered in curies per year (Ci/yr).

The inputs to GASPAR II for the annual period from January 1, 2012 through December 31, 2012 were as follows:

(1) All gaseous effluents

(2) Entrained gases (Ar-41, Xe-131M, Xe-133M, Xe-133, Xe-135M, Xe-135, Kr-85M, Kr-87, and Kr-88) from liquid effluents.

(3) Annual X/Q at the actual receptor locations, which are corrected for open terrain and plume depletion, are calculated according to Regulatory Guide 1.111. Also included are annual deposition rates corrected for the open terrain factor.

(4) The production, intake and grazing fractions were as follows: 1.0 for leafy vegetables grown in garden of interest, 0.76 for produce grown in garden of interest, 0.5 for the pasture grazing season of the milk animal, 1.0 for pasture grazing season of the meat animal, and 8 g/m^3 for the air water (humidity) concentrations.

(5) All dose factors, transport times from receptor to individual, and usage factors are defined by Regulatory Guide 1.109 and NUREG-0172.

(6) Site specific information, within a five-mile radius of the plant, on types of receptors located in each sector was used. That is, if a cow was not present in a sector, then the milk pathway for that sector was not considered. If it was present, then the actual sector distance was used.

These inputs introduce a most conservative approach for the following reasons:

(1) The open terrain and deposition corrections increase annual X/Q by a factor ranging between 1.0 and 4.0

(2) The production, intake, and grazing fractions, as defined in the input definition statement, represent the environment in an extremely conservative manner.

B. Potential Semiannual Doses to Population from Gaseous Releases

The GASPAR II program in its annual configuration was also used to calculate the ALARA integrated population dose summary for the total body, skin, and organ doses in man-rem for all individuals within a 50-mile radius. The population-integrated dose is the summation of the dose received by all individuals and has units of man-thyroid-rem when applied to the summation of thyroid doses. The same inputs were used as in the individual case with the addition of the following:

(1) A total population of 950,006 (based on the 2010 census) was used to define the sector segments within a 50-mile radius of the plant.

(2) Production of milk, meat, and vegetation is based on 1973 annual data for Nebraska as recommended by the Nuclear Regulatory Commission for use in GASPAR II.

TABLE IV-A- 1

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 1 RES
AT 4.36 MILES N

ANNUAL_BETA_AIR_DOSE = 5.03E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.69E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.85E-21	9.85E-21	9.85E-21	9.85E-21	9.85E-21	9.85E-21	1.04E-20	2.78E-20
GROUND	1.44E-18	1.44E-18	1.44E-18	1.44E-18	1.44E-18	1.44E-18	1.44E-18	1.75E-18
INHAL								
ADULT	4.79E-06	4.79E-06	1.09E-18	4.79E-06	4.79E-06	4.79E-06	4.79E-06	4.79E-06
TEEN	4.83E-06	4.83E-06	1.54E-18	4.83E-06	4.83E-06	4.83E-06	4.83E-06	4.83E-06
CHILD	4.27E-06	4.27E-06	2.09E-18	4.27E-06	4.27E-06	4.27E-06	4.27E-06	4.27E-06
INFANT	2.46E-06	2.46E-06	1.65E-18	2.46E-06	2.46E-06	2.46E-06	2.46E-06	2.46E-06

TABLE IV-A- 2

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 2 RES
AT 1.93 MILES NNE

ANNUAL_BETA_AIR_DOSE = 4.18E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.41E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	8.19E-20	8.19E-20	8.19E-20	8.19E-20	8.19E-20	8.19E-20	8.61E-20	2.31E-19
GROUND	6.67E-18	6.67E-18	6.67E-18	6.67E-18	6.67E-18	6.67E-18	6.67E-18	8.09E-18
INHAL								
ADULT	3.89E-05	3.89E-05	9.47E-18	3.89E-05	3.89E-05	3.89E-05	3.89E-05	3.89E-05
TEEN	3.93E-05	3.93E-05	1.33E-17	3.93E-05	3.93E-05	3.93E-05	3.93E-05	3.93E-05
CHILD	3.47E-05	3.47E-05	1.81E-17	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.47E-05
INFANT	2.00E-05	2.00E-05	1.43E-17	2.00E-05	2.00E-05	2.00E-05	2.00E-05	2.00E-05

TABLE IV-A- 3

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 3 RES
AT 1.52 MILES NE

ANNUAL_BETA_AIR_DOSE = 5.51E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.85E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.08E-19	1.08E-19	1.08E-19	1.08E-19	1.08E-19	1.08E-19	1.14E-19	3.05E-19
GROUND	4.83E-18	4.83E-18	4.83E-18	4.83E-18	4.83E-18	4.83E-18	4.83E-18	5.86E-18
INHAL								
ADULT	5.09E-05	5.09E-05	1.23E-17	5.09E-05	5.09E-05	5.09E-05	5.09E-05	5.09E-05
TEEN	5.14E-05	5.14E-05	1.73E-17	5.14E-05	5.14E-05	5.14E-05	5.14E-05	5.14E-05
CHILD	4.54E-05	4.54E-05	2.34E-17	4.54E-05	4.54E-05	4.54E-05	4.54E-05	4.54E-05
INFANT	2.61E-05	2.61E-05	1.85E-17	2.61E-05	2.61E-05	2.61E-05	2.61E-05	2.61E-05

TABLE IV-A- 4

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 4 RES
AT 4.79 MILES ENE

ANNUAL_BETA_AIR_DOSE = 4.70E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.58E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.22E-21	9.22E-21	9.22E-21	9.22E-21	9.22E-21	9.22E-21	9.69E-21	2.60E-20
GROUND	2.11E-19	2.11E-19	2.11E-19	2.11E-19	2.11E-19	2.11E-19	2.11E-19	2.57E-19
INHAL								
ADULT	4.79E-06	4.79E-06	1.03E-18	4.79E-06	4.79E-06	4.79E-06	4.79E-06	4.79E-06
TEEN	4.83E-06	4.83E-06	1.45E-18	4.83E-06	4.83E-06	4.83E-06	4.83E-06	4.83E-06
CHILD	4.27E-06	4.27E-06	1.96E-18	4.27E-06	4.27E-06	4.27E-06	4.27E-06	4.27E-06
INFANT	2.46E-06	2.46E-06	1.55E-18	2.46E-06	2.46E-06	2.46E-06	2.46E-06	2.46E-06

TABLE IV-A- 5

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 5 RES
AT 4.67 MILES E

ANNUAL_BETA_AIR_DOSE = 7.22E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.43E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.42E-20	1.42E-20	1.42E-20	1.42E-20	1.42E-20	1.42E-20	1.49E-20	3.99E-20
GROUND	3.48E-19	3.48E-19	3.48E-19	3.48E-19	3.48E-19	3.48E-19	3.48E-19	4.23E-19
INHAL								
ADULT	7.49E-06	7.49E-06	1.59E-18	7.49E-06	7.49E-06	7.49E-06	7.49E-06	7.49E-06
TEEN	7.55E-06	7.55E-06	2.24E-18	7.55E-06	7.55E-06	7.55E-06	7.55E-06	7.55E-06
CHILD	6.67E-06	6.67E-06	3.03E-18	6.67E-06	6.67E-06	6.67E-06	6.67E-06	6.67E-06
INFANT	3.84E-06	3.84E-06	2.39E-18	3.84E-06	3.84E-06	3.84E-06	3.84E-06	3.84E-06

TABLE IV-A- 6

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 6 RES
AT 4.22 MILES ESE

ANNUAL_BETA_AIR_DOSE = 7.05E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.37E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.38E-20	1.38E-20	1.38E-20	1.38E-20	1.38E-20	1.38E-20	1.45E-20	3.90E-20
GROUND	6.72E-19	6.72E-19	6.72E-19	6.72E-19	6.72E-19	6.72E-19	6.72E-19	8.16E-19
INHAL								
ADULT	6.89E-06	6.89E-06	1.55E-18	6.89E-06	6.89E-06	6.89E-06	6.89E-06	6.89E-06
TEEN	6.95E-06	6.95E-06	2.18E-18	6.95E-06	6.95E-06	6.95E-06	6.95E-06	6.95E-06
CHILD	6.14E-06	6.14E-06	2.96E-18	6.14E-06	6.14E-06	6.14E-06	6.14E-06	6.14E-06
INFANT	3.53E-06	3.53E-06	2.33E-18	3.53E-06	3.53E-06	3.53E-06	3.53E-06	3.53E-06

TABLE IV-A- 7

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 7 RES
AT 1.67 MILES SE

ANNUAL_BETA_AIR_DOSE = 5.03E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.69E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.85E-20	9.85E-20	9.85E-20	9.85E-20	9.85E-20	9.85E-20	1.04E-19	2.78E-19
GROUND	1.26E-17	1.26E-17	1.26E-17	1.26E-17	1.26E-17	1.26E-17	1.26E-17	1.53E-17
INHAL								
ADULT	4.79E-05	4.79E-05	1.13E-17	4.79E-05	4.79E-05	4.79E-05	4.79E-05	4.79E-05
TEEN	4.83E-05	4.83E-05	1.60E-17	4.83E-05	4.83E-05	4.83E-05	4.83E-05	4.83E-05
CHILD	4.27E-05	4.27E-05	2.17E-17	4.27E-05	4.27E-05	4.27E-05	4.27E-05	4.27E-05
INFANT	2.46E-05	2.46E-05	1.71E-17	2.46E-05	2.46E-05	2.46E-05	2.46E-05	2.46E-05

TABLE IV-A- 8

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 8 RES
AT 0.65 MILES SSE

ANNUAL_BETA_AIR_DOSE = 3.66E-18 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.23E-18 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	7.18E-19	7.18E-19	7.18E-19	7.18E-19	7.18E-19	7.18E-19	7.54E-19	2.02E-18
GROUND	1.58E-16	1.58E-16	1.58E-16	1.58E-16	1.58E-16	1.58E-16	1.58E-16	1.92E-16
INHAL								
ADULT	3.29E-04	3.29E-04	8.23E-17	3.29E-04	3.29E-04	3.29E-04	3.29E-04	3.29E-04
TEEN	3.32E-04	3.32E-04	1.16E-16	3.32E-04	3.32E-04	3.32E-04	3.32E-04	3.32E-04
CHILD	2.94E-04	2.94E-04	1.57E-16	2.94E-04	2.94E-04	2.94E-04	2.94E-04	2.94E-04
INFANT	1.69E-04	1.69E-04	1.24E-16	1.69E-04	1.69E-04	1.69E-04	1.69E-04	1.69E-04

TABLE IV-A- 9

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 9 RES
AT 0.73 MILES S

ANNUAL_BETA_AIR_DOSE = 1.88E-18 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 6.33E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.69E-19	3.69E-19	3.69E-19	3.69E-19	3.69E-19	3.69E-19	3.88E-19	1.04E-18
GROUND	6.78E-17	6.78E-17	6.78E-17	6.78E-17	6.78E-17	6.78E-17	6.78E-17	8.24E-17
INHAL								
ADULT	1.71E-04	1.71E-04	4.30E-17	1.71E-04	1.71E-04	1.71E-04	1.71E-04	1.71E-04
TEEN	1.72E-04	1.72E-04	6.05E-17	1.72E-04	1.72E-04	1.72E-04	1.72E-04	1.72E-04
CHILD	1.52E-04	1.52E-04	8.21E-17	1.52E-04	1.52E-04	1.52E-04	1.52E-04	1.52E-04
INFANT	8.75E-05	8.75E-05	6.48E-17	8.75E-05	8.75E-05	8.75E-05	8.75E-05	8.75E-05

TABLE IV-A-10

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 10 RES
AT 0.65 MILES SSW

ANNUAL_BETA_AIR_DOSE = 1.13E-18 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 3.80E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.22E-19	2.22E-19	2.22E-19	2.22E-19	2.22E-19	2.22E-19	2.33E-19	6.25E-19
GROUND	2.73E-17	2.73E-17	2.73E-17	2.73E-17	2.73E-17	2.73E-17	2.73E-17	3.31E-17
INHAL								
ADULT	1.02E-04	1.02E-04	2.60E-17	1.02E-04	1.02E-04	1.02E-04	1.02E-04	1.02E-04
TEEN	1.03E-04	1.03E-04	3.65E-17	1.03E-04	1.03E-04	1.03E-04	1.03E-04	1.03E-04
CHILD	9.07E-05	9.07E-05	4.96E-17	9.07E-05	9.07E-05	9.07E-05	9.07E-05	9.07E-05
INFANT	5.22E-05	5.22E-05	3.91E-17	5.22E-05	5.22E-05	5.22E-05	5.22E-05	5.22E-05

TABLE IV-A-11

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 11 RES
AT 0.73 MILES SW

ANNUAL_BETA_AIR_DOSE = 1.25E-18 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 4.20E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.45E-19	2.45E-19	2.45E-19	2.45E-19	2.45E-19	2.45E-19	2.58E-19	6.91E-19
GROUND	1.95E-17	1.95E-17	1.95E-17	1.95E-17	1.95E-17	1.95E-17	1.95E-17	2.37E-17
INHAL								
ADULT	1.14E-04	1.14E-04	2.86E-17	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04
TEEN	1.15E-04	1.15E-04	4.03E-17	1.15E-04	1.15E-04	1.15E-04	1.15E-04	1.15E-04
CHILD	1.01E-04	1.01E-04	5.47E-17	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04
INFANT	5.83E-05	5.83E-05	4.31E-17	5.83E-05	5.83E-05	5.83E-05	5.83E-05	5.83E-05

TABLE IV-A-12

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 12 RES
AT 1.06 MILES WSW

ANNUAL_BETA_AIR_DOSE = 1.15E-18 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 3.88E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.26E-19	2.26E-19	2.26E-19	2.26E-19	2.26E-19	2.26E-19	2.38E-19	6.38E-19
GROUND	1.01E-17	1.01E-17	1.01E-17	1.01E-17	1.01E-17	1.01E-17	1.01E-17	1.23E-17
INHAL								
ADULT	1.08E-04	1.08E-04	2.64E-17	1.08E-04	1.08E-04	1.08E-04	1.08E-04	1.08E-04
TEEN	1.09E-04	1.09E-04	3.71E-17	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.09E-04
CHILD	9.61E-05	9.61E-05	5.04E-17	9.61E-05	9.61E-05	9.61E-05	9.61E-05	9.61E-05
INFANT	5.53E-05	5.53E-05	3.98E-17	5.53E-05	5.53E-05	5.53E-05	5.53E-05	5.53E-05

TABLE IV-A-13

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 13 RES
AT 1.20 MILES W

ANNUAL_BETA_AIR_DOSE = 7.84E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.64E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.54E-19	1.54E-19	1.54E-19	1.54E-19	1.54E-19	1.54E-19	1.62E-19	4.33E-19
GROUND	1.02E-17	1.02E-17	1.02E-17	1.02E-17	1.02E-17	1.02E-17	1.02E-17	1.24E-17
INHAL								
ADULT	7.19E-05	7.19E-05	1.79E-17	7.19E-05	7.19E-05	7.19E-05	7.19E-05	7.19E-05
TEEN	7.25E-05	7.25E-05	2.51E-17	7.25E-05	7.25E-05	7.25E-05	7.25E-05	7.25E-05
CHILD	6.40E-05	6.40E-05	3.41E-17	6.40E-05	6.40E-05	6.40E-05	6.40E-05	6.40E-05
INFANT	3.68E-05	3.68E-05	2.69E-17	3.68E-05	3.68E-05	3.68E-05	3.68E-05	3.68E-05

TABLE IV-A-14

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 14 RES
AT 2.27 MILES WNW

ANNUAL_BETA_AIR_DOSE = 1.96E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 6.58E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.84E-20	3.84E-20	3.84E-20	3.84E-20	3.84E-20	3.84E-20	4.03E-20	1.08E-19
GROUND	2.93E-18	2.93E-18	2.93E-18	2.93E-18	2.93E-18	2.93E-18	2.93E-18	3.56E-18
INHAL								
ADULT	1.83E-05	1.83E-05	4.34E-18	1.83E-05	1.83E-05	1.83E-05	1.83E-05	1.83E-05
TEEN	1.84E-05	1.84E-05	6.10E-18	1.84E-05	1.84E-05	1.84E-05	1.84E-05	1.84E-05
CHILD	1.63E-05	1.63E-05	8.28E-18	1.63E-05	1.63E-05	1.63E-05	1.63E-05	1.63E-05
INFANT	9.36E-06	9.36E-06	6.53E-18	9.36E-06	9.36E-06	9.36E-06	9.36E-06	9.36E-06

TABLE IV-A-15

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 15 RES
AT 2.40 MILES NW

ANNUAL_BETA_AIR_DOSE = 1.99E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 6.69E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.90E-20	3.90E-20	3.90E-20	3.90E-20	3.90E-20	3.90E-20	4.10E-20	1.10E-19
GROUND	4.53E-18	4.53E-18	4.53E-18	4.53E-18	4.53E-18	4.53E-18	4.53E-18	5.50E-18
INHAL								
ADULT	1.86E-05	1.86E-05	4.38E-18	1.86E-05	1.86E-05	1.86E-05	1.86E-05	1.86E-05
TEEN	1.87E-05	1.87E-05	6.15E-18	1.87E-05	1.87E-05	1.87E-05	1.87E-05	1.87E-05
CHILD	1.65E-05	1.65E-05	8.35E-18	1.65E-05	1.65E-05	1.65E-05	1.65E-05	1.65E-05
INFANT	9.52E-06	9.52E-06	6.59E-18	9.52E-06	9.52E-06	9.52E-06	9.52E-06	9.52E-06

TABLE IV-A-16

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 16 RES
AT 2.08 MILES NNW

ANNUAL_BETA_AIR_DOSE = 3.03E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.02E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	5.93E-20	5.93E-20	5.93E-20	5.93E-20	5.93E-20	5.93E-20	6.23E-20	1.67E-19
GROUND	9.07E-18	9.07E-18	9.07E-18	9.07E-18	9.07E-18	9.07E-18	9.07E-18	1.10E-17
INHAL								
ADULT	2.82E-05	2.82E-05	6.71E-18	2.82E-05	2.82E-05	2.82E-05	2.82E-05	2.82E-05
TEEN	2.84E-05	2.84E-05	9.44E-18	2.84E-05	2.84E-05	2.84E-05	2.84E-05	2.84E-05
CHILD	2.51E-05	2.51E-05	1.28E-17	2.51E-05	2.51E-05	2.51E-05	2.51E-05	2.51E-05
INFANT	1.44E-05	1.44E-05	1.01E-17	1.44E-05	1.44E-05	1.44E-05	1.44E-05	1.44E-05

TABLE IV-A-17

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 17 VEG
AT 1.59 MILES NE

ANNUAL_BETA_AIR_DOSE = 5.03E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.69E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.85E-20	9.85E-20	9.85E-20	9.85E-20	9.85E-20	9.85E-20	1.04E-19	2.78E-19
GROUND	4.46E-18	4.46E-18	4.46E-18	4.46E-18	4.46E-18	4.46E-18	4.46E-18	5.42E-18
VEGET								
ADULT	8.68E-05	8.68E-05	6.08E-17	8.68E-05	8.68E-05	8.68E-05	8.68E-05	8.68E-05
TEEN	9.93E-05	9.93E-05	8.78E-17	9.93E-05	9.93E-05	9.93E-05	9.93E-05	9.93E-05
CHILD	1.54E-04	1.54E-04	2.02E-16	1.54E-04	1.54E-04	1.54E-04	1.54E-04	1.54E-04

TABLE IV-A-18

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 18 VEG
AT 4.79 MILES ENE

ANNUAL_BETA_AIR_DOSE = 4.70E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.58E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.22E-21	9.22E-21	9.22E-21	9.22E-21	9.22E-21	9.22E-21	9.69E-21	2.60E-20
GROUND	2.11E-19	2.11E-19	2.11E-19	2.11E-19	2.11E-19	2.11E-19	2.11E-19	2.57E-19
VEGET								
ADULT	8.68E-06	8.68E-06	2.88E-18	8.68E-06	8.68E-06	8.68E-06	8.68E-06	8.68E-06
TEEN	9.93E-06	9.93E-06	4.15E-18	9.93E-06	9.93E-06	9.93E-06	9.93E-06	9.93E-06
CHILD	1.54E-05	1.54E-05	9.54E-18	1.54E-05	1.54E-05	1.54E-05	1.54E-05	1.54E-05

TABLE IV-A-19

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 19 VEG
AT 1.74 MILES SE

ANNUAL_BETA_AIR_DOSE = 4.69E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.58E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.20E-20	9.20E-20	9.20E-20	9.20E-20	9.20E-20	9.20E-20	9.67E-20	2.59E-19
GROUND	1.18E-17	1.18E-17	1.18E-17	1.18E-17	1.18E-17	1.18E-17	1.18E-17	1.43E-17
VEGET								
ADULT	8.14E-05	8.14E-05	1.60E-16	8.14E-05	8.14E-05	8.14E-05	8.14E-05	8.14E-05
TEEN	9.31E-05	9.31E-05	2.32E-16	9.31E-05	9.31E-05	9.31E-05	9.31E-05	9.31E-05
CHILD	1.45E-04	1.45E-04	5.33E-16	1.45E-04	1.45E-04	1.45E-04	1.45E-04	1.45E-04

TABLE IV-A-20

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 20 VEG
AT 0.94 MILES SSE

ANNUAL_BETA_AIR_DOSE = 1.57E-18 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 5.27E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.07E-19	3.07E-19	3.07E-19	3.07E-19	3.07E-19	3.07E-19	3.23E-19	8.67E-19
GROUND	7.01E-17	7.01E-17	7.01E-17	7.01E-17	7.01E-17	7.01E-17	7.01E-17	8.51E-17
VEGET								
ADULT	2.60E-04	2.60E-04	9.53E-16	2.60E-04	2.60E-04	2.60E-04	2.60E-04	2.60E-04
TEEN	2.98E-04	2.98E-04	1.38E-15	2.98E-04	2.98E-04	2.98E-04	2.98E-04	2.98E-04
CHILD	4.63E-04	4.63E-04	3.16E-15	4.63E-04	4.63E-04	4.63E-04	4.63E-04	4.63E-04

TABLE IV-A-21

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 21 VEG
AT 2.60 MILES S

ANNUAL_BETA_AIR_DOSE = 8.21E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.76E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.69E-20	4.54E-20
GROUND	2.48E-18	2.48E-18	2.48E-18	2.48E-18	2.48E-18	2.48E-18	2.48E-18	3.01E-18
VEGET								
ADULT	1.41E-05	1.41E-05	3.37E-17	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05
TEEN	1.61E-05	1.61E-05	4.87E-17	1.61E-05	1.61E-05	1.61E-05	1.61E-05	1.61E-05
CHILD	2.51E-05	2.51E-05	1.12E-16	2.51E-05	2.51E-05	2.51E-05	2.51E-05	2.51E-05

TABLE IV-A-22

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 22 VEG
AT 2.00 MILES SSW

ANNUAL_BETA_AIR_DOSE = 8.03E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.70E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.57E-20	1.57E-20	1.57E-20	1.57E-20	1.57E-20	1.57E-20	1.65E-20	4.44E-20
GROUND	1.78E-18	1.78E-18	1.78E-18	1.78E-18	1.78E-18	1.78E-18	1.78E-18	2.17E-18
VEGET								
ADULT	1.36E-05	1.36E-05	2.43E-17	1.36E-05	1.36E-05	1.36E-05	1.36E-05	1.36E-05
TEEN	1.55E-05	1.55E-05	3.51E-17	1.55E-05	1.55E-05	1.55E-05	1.55E-05	1.55E-05
CHILD	2.41E-05	2.41E-05	8.06E-17	2.41E-05	2.41E-05	2.41E-05	2.41E-05	2.41E-05

TABLE IV-A-23

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 23 VEG
AT 0.73 MILES SW

ANNUAL_BETA_AIR_DOSE = 1.25E-18 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 4.20E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.45E-19	2.45E-19	2.45E-19	2.45E-19	2.45E-19	2.45E-19	2.58E-19	6.91E-19
GROUND	1.95E-17	1.95E-17	1.95E-17	1.95E-17	1.95E-17	1.95E-17	1.95E-17	2.37E-17
VEGET								
ADULT	2.06E-04	2.06E-04	2.65E-16	2.06E-04	2.06E-04	2.06E-04	2.06E-04	2.06E-04
TEEN	2.36E-04	2.36E-04	3.83E-16	2.36E-04	2.36E-04	2.36E-04	2.36E-04	2.36E-04
CHILD	3.66E-04	3.66E-04	8.80E-16	3.66E-04	3.66E-04	3.66E-04	3.66E-04	3.66E-04

TABLE IV-A-24

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 24 VEG
AT 1.21 MILES WSW

ANNUAL_BETA_AIR_DOSE = 7.88E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.65E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.54E-19	1.54E-19	1.54E-19	1.54E-19	1.54E-19	1.54E-19	1.62E-19	4.35E-19
GROUND	6.58E-18	6.58E-18	6.58E-18	6.58E-18	6.58E-18	6.58E-18	6.58E-18	7.99E-18
VEGET								
ADULT	1.36E-04	1.36E-04	8.95E-17	1.36E-04	1.36E-04	1.36E-04	1.36E-04	1.36E-04
TEEN	1.55E-04	1.55E-04	1.29E-16	1.55E-04	1.55E-04	1.55E-04	1.55E-04	1.55E-04
CHILD	2.41E-04	2.41E-04	2.97E-16	2.41E-04	2.41E-04	2.41E-04	2.41E-04	2.41E-04

TABLE IV-A-25

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 25 VEG
AT 1.30 MILES W

ANNUAL_BETA_AIR_DOSE = 6.18E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.08E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.21E-19	1.21E-19	1.21E-19	1.21E-19	1.21E-19	1.21E-19	1.27E-19	3.41E-19
GROUND	8.06E-18	8.06E-18	8.06E-18	8.06E-18	8.06E-18	8.06E-18	8.06E-18	9.78E-18
VEGET								
ADULT	1.03E-04	1.03E-04	1.10E-16	1.03E-04	1.03E-04	1.03E-04	1.03E-04	1.03E-04
TEEN	1.18E-04	1.18E-04	1.58E-16	1.18E-04	1.18E-04	1.18E-04	1.18E-04	1.18E-04
CHILD	1.83E-04	1.83E-04	3.64E-16	1.83E-04	1.83E-04	1.83E-04	1.83E-04	1.83E-04

TABLE IV-A-26

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 26 VEG
AT 2.27 MILES WNW

ANNUAL_BETA_AIR_DOSE = 1.96E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 6.58E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.84E-20	3.84E-20	3.84E-20	3.84E-20	3.84E-20	3.84E-20	4.03E-20	1.08E-19
GROUND	2.93E-18	2.93E-18	2.93E-18	2.93E-18	2.93E-18	2.93E-18	2.93E-18	3.56E-18
VEGET								
ADULT	3.31E-05	3.31E-05	3.99E-17	3.31E-05	3.31E-05	3.31E-05	3.31E-05	3.31E-05
TEEN	3.78E-05	3.78E-05	5.76E-17	3.78E-05	3.78E-05	3.78E-05	3.78E-05	3.78E-05
CHILD	5.88E-05	5.88E-05	1.32E-16	5.88E-05	5.88E-05	5.88E-05	5.88E-05	5.88E-05

TABLE IV-A-27

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 27 VEG
AT 2.40 MILES NW

ANNUAL_BETA_AIR_DOSE = 1.99E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 6.69E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.90E-20	3.90E-20	3.90E-20	3.90E-20	3.90E-20	3.90E-20	4.10E-20	1.10E-19
GROUND	4.53E-18	4.53E-18	4.53E-18	4.53E-18	4.53E-18	4.53E-18	4.53E-18	5.50E-18
VEGET								
ADULT	3.36E-05	3.36E-05	6.16E-17	3.36E-05	3.36E-05	3.36E-05	3.36E-05	3.36E-05
TEEN	3.85E-05	3.85E-05	8.90E-17	3.85E-05	3.85E-05	3.85E-05	3.85E-05	3.85E-05
CHILD	5.98E-05	5.98E-05	2.05E-16	5.98E-05	5.98E-05	5.98E-05	5.98E-05	5.98E-05

TABLE IV-A-28

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 28 VEG
AT 3.73 MILES NNW

ANNUAL_BETA_AIR_DOSE = 8.21E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.76E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.69E-20	4.54E-20
GROUND	2.00E-18	2.00E-18	2.00E-18	2.00E-18	2.00E-18	2.00E-18	2.00E-18	2.43E-18
VEGET								
ADULT	1.41E-05	1.41E-05	2.72E-17	1.41E-05	1.41E-05	1.41E-05	1.41E-05	1.41E-05
TEEN	1.61E-05	1.61E-05	3.94E-17	1.61E-05	1.61E-05	1.61E-05	1.61E-05	1.61E-05
CHILD	2.51E-05	2.51E-05	9.05E-17	2.51E-05	2.51E-05	2.51E-05	2.51E-05	2.51E-05

TABLE IV-A-29

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 29 BEEF
AT 4.91 MILES E

ANNUAL_BETA_AIR_DOSE = 6.72E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.26E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.32E-20	1.32E-20	1.32E-20	1.32E-20	1.32E-20	1.32E-20	1.38E-20	3.71E-20
GROUND	3.01E-19	3.01E-19	3.01E-19	3.01E-19	3.01E-19	3.01E-19	3.01E-19	3.65E-19
MEAT								
ADULT	1.79E-06	1.79E-06	1.84E-19	1.79E-06	1.79E-06	1.79E-06	1.79E-06	1.79E-06
TEEN	1.07E-06	1.07E-06	1.53E-19	1.07E-06	1.07E-06	1.07E-06	1.07E-06	1.07E-06
CHILD	1.29E-06	1.29E-06	2.84E-19	1.29E-06	1.29E-06	1.29E-06	1.29E-06	1.29E-06

TABLE IV-A-30

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 30 BEEF
AT 1.82 MILES SSE

ANNUAL_BETA_AIR_DOSE = 3.27E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.10E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	6.41E-20	6.41E-20	6.41E-20	6.41E-20	6.41E-20	6.41E-20	6.74E-20	1.81E-19
GROUND	1.37E-17	1.37E-17	1.37E-17	1.37E-17	1.37E-17	1.37E-17	1.37E-17	1.67E-17
MEAT								
ADULT	7.80E-06	7.80E-06	8.43E-18	7.80E-06	7.80E-06	7.80E-06	7.80E-06	7.80E-06
TEEN	4.65E-06	4.65E-06	7.01E-18	4.65E-06	4.65E-06	4.65E-06	4.65E-06	4.65E-06
CHILD	5.63E-06	5.63E-06	1.30E-17	5.63E-06	5.63E-06	5.63E-06	5.63E-06	5.63E-06

TABLE IV-A-31

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 31 BEEF
AT 2.60 MILES S

ANNUAL_BETA_AIR_DOSE = 8.21E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.76E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.69E-20	4.54E-20
GROUND	2.48E-18	2.48E-18	2.48E-18	2.48E-18	2.48E-18	2.48E-18	2.48E-18	3.01E-18
MEAT								
ADULT	2.03E-06	2.03E-06	1.52E-18	2.03E-06	2.03E-06	2.03E-06	2.03E-06	2.03E-06
TEEN	1.21E-06	1.21E-06	1.26E-18	1.21E-06	1.21E-06	1.21E-06	1.21E-06	1.21E-06
CHILD	1.46E-06	1.46E-06	2.34E-18	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06

TABLE IV-A-32

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 32 BEEF
AT 2.00 MILES SSW

ANNUAL_BETA_AIR_DOSE = 8.03E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.70E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.57E-20	1.57E-20	1.57E-20	1.57E-20	1.57E-20	1.57E-20	1.65E-20	4.44E-20
GROUND	1.78E-18	1.78E-18	1.78E-18	1.78E-18	1.78E-18	1.78E-18	1.78E-18	2.17E-18
MEAT								
ADULT	1.95E-06	1.95E-06	1.09E-18	1.95E-06	1.95E-06	1.95E-06	1.95E-06	1.95E-06
TEEN	1.16E-06	1.16E-06	9.10E-19	1.16E-06	1.16E-06	1.16E-06	1.16E-06	1.16E-06
CHILD	1.41E-06	1.41E-06	1.69E-18	1.41E-06	1.41E-06	1.41E-06	1.41E-06	1.41E-06

TABLE IV-A-33

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 33 BEEF
AT 0.73 MILES SW

ANNUAL_BETA_AIR_DOSE = 1.25E-18 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 4.20E-19 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.45E-19	2.45E-19	2.45E-19	2.45E-19	2.45E-19	2.45E-19	2.58E-19	6.91E-19
GROUND	1.95E-17	1.95E-17	1.95E-17	1.95E-17	1.95E-17	1.95E-17	1.95E-17	2.37E-17
MEAT								
ADULT	2.96E-05	2.96E-05	1.20E-17	2.96E-05	2.96E-05	2.96E-05	2.96E-05	2.96E-05
TEEN	1.77E-05	1.77E-05	9.93E-18	1.77E-05	1.77E-05	1.77E-05	1.77E-05	1.77E-05
CHILD	2.14E-05	2.14E-05	1.84E-17	2.14E-05	2.14E-05	2.14E-05	2.14E-05	2.14E-05

TABLE IV-A-34

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 34 BEEF
AT 2.42 MILES WSW

ANNUAL_BETA_AIR_DOSE = 1.39E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 4.69E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.73E-20	2.73E-20	2.73E-20	2.73E-20	2.73E-20	2.73E-20	2.87E-20	7.70E-20
GROUND	1.08E-18	1.08E-18	1.08E-18	1.08E-18	1.08E-18	1.08E-18	1.08E-18	1.31E-18
MEAT								
ADULT	3.59E-06	3.59E-06	6.61E-19	3.59E-06	3.59E-06	3.59E-06	3.59E-06	3.59E-06
TEEN	2.14E-06	2.14E-06	5.49E-19	2.14E-06	2.14E-06	2.14E-06	2.14E-06	2.14E-06
CHILD	2.59E-06	2.59E-06	1.02E-18	2.59E-06	2.59E-06	2.59E-06	2.59E-06	2.59E-06

TABLE IV-A-35

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 35 BEEF
AT 3.25 MILES W

ANNUAL_BETA_AIR_DOSE = 7.38E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.48E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.45E-20	1.45E-20	1.45E-20	1.45E-20	1.45E-20	1.45E-20	1.52E-20	4.08E-20
GROUND	7.25E-19	7.25E-19	7.25E-19	7.25E-19	7.25E-19	7.25E-19	7.25E-19	8.81E-19
MEAT								
ADULT	1.87E-06	1.87E-06	4.45E-19	1.87E-06	1.87E-06	1.87E-06	1.87E-06	1.87E-06
TEEN	1.12E-06	1.12E-06	3.70E-19	1.12E-06	1.12E-06	1.12E-06	1.12E-06	1.12E-06
CHILD	1.35E-06	1.35E-06	6.86E-19	1.35E-06	1.35E-06	1.35E-06	1.35E-06	1.35E-06

TABLE IV-A-36

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 36 BEEF
AT 2.27 MILES WNW

ANNUAL_BETA_AIR_DOSE = 1.96E-19 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 6.58E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.84E-20	3.84E-20	3.84E-20	3.84E-20	3.84E-20	3.84E-20	4.03E-20	1.08E-19
GROUND	2.93E-18	2.93E-18	2.93E-18	2.93E-18	2.93E-18	2.93E-18	2.93E-18	3.56E-18
MEAT								
ADULT	4.76E-06	4.76E-06	1.80E-18	4.76E-06	4.76E-06	4.76E-06	4.76E-06	4.76E-06
TEEN	2.83E-06	2.83E-06	1.49E-18	2.83E-06	2.83E-06	2.83E-06	2.83E-06	2.83E-06
CHILD	3.43E-06	3.43E-06	2.77E-18	3.43E-06	3.43E-06	3.43E-06	3.43E-06	3.43E-06

TABLE IV-A-37

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 37 BEEF
AT 3.73 MILES NNW

ANNUAL_BETA_AIR_DOSE = 8.21E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 2.76E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.61E-20	1.69E-20	4.54E-20
GROUND	2.00E-18	2.00E-18	2.00E-18	2.00E-18	2.00E-18	2.00E-18	2.00E-18	2.43E-18
MEAT								
ADULT	2.03E-06	2.03E-06	1.23E-18	2.03E-06	2.03E-06	2.03E-06	2.03E-06	2.03E-06
TEEN	1.21E-06	1.21E-06	1.02E-18	1.21E-06	1.21E-06	1.21E-06	1.21E-06	1.21E-06
CHILD	1.46E-06	1.46E-06	1.89E-18	1.46E-06	1.46E-06	1.46E-06	1.46E-06	1.46E-06

TABLE IV-A-38

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
SPECIAL LOCATION NO. 38 COW
AT 3.50 MILES S

ANNUAL_BETA_AIR_DOSE = 4.51E-20 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 1.52E-20 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	8.85E-21	8.85E-21	8.85E-21	8.85E-21	8.85E-21	8.85E-21	9.30E-21	2.49E-20
GROUND	1.28E-18	1.28E-18	1.28E-18	1.28E-18	1.28E-18	1.28E-18	1.28E-18	1.56E-18
COW MILK								
ADULT	2.56E-06	2.56E-06	1.08E-17	2.56E-06	2.56E-06	2.56E-06	2.56E-06	2.56E-06
TEEN	3.34E-06	3.34E-06	1.97E-17	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06
CHILD	5.29E-06	5.29E-06	4.77E-17	5.29E-06	5.29E-06	5.29E-06	5.29E-06	5.29E-06
INFANT	8.02E-06	8.02E-06	9.96E-17	8.02E-06	8.02E-06	8.02E-06	8.02E-06	8.02E-06

TABLE IV-B-1

FORT CALHOUN 1 DOSE CONTRIBUTIONS FROM GASEOUS EFFLUENTS
UNRESTRICTED AREA BOUNDARY
REQUIRED BY TECHNICAL SPECIFICATION 5.9.4.a.
JANUARY 1, 2012 TO DECEMBER 31, 2012

MAXIMUM SITE BOUNDARY GAMMA AIR DOSE - 0.00E+00 MILLRADS

MAXIMUM SITE BOUNDARY BETA AIR DOSE - 0.00E+00 MILLRADS

TABLE IV-C-1

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS
ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (PERSON-REM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	7.57E-19	7.57E-19	7.57E-19	7.57E-19	7.57E-19	7.57E-19	8.11E-19	2.58E-18
	0.00%	0.00%	0.15%	0.00%	0.00%	0.00%	0.00%	0.00%
GROUND	6.24E-17	6.24E-17	6.24E-17	6.24E-17	6.24E-17	6.24E-17	6.24E-17	7.58E-17
	0.00%	0.00%	12.20%	0.00%	0.00%	0.00%	0.00%	0.00%
INHAL	5.69E-04	5.69E-04	1.34E-16	5.69E-04	5.69E-04	5.69E-04	5.69E-04	5.69E-04
	38.33%	38.33%	26.27%	38.33%	38.33%	38.33%	38.33%	38.33%
VEGET	6.43E-04	6.43E-04	1.15E-17	6.43E-04	6.43E-04	6.43E-04	6.43E-04	6.43E-04
	43.29%	43.29%	2.24%	43.29%	43.29%	43.29%	43.29%	43.29%
COW MILK	1.28E-04	1.28E-04	2.55E-16	1.28E-04	1.28E-04	1.28E-04	1.28E-04	1.28E-04
	8.62%	8.62%	49.87%	8.62%	8.62%	8.62%	8.62%	8.62%
MEAT	1.45E-04	1.45E-04	4.74E-17	1.45E-04	1.45E-04	1.45E-04	1.45E-04	1.45E-04
	9.76%	9.76%	9.27%	9.76%	9.76%	9.76%	9.76%	9.76%
TOTAL	1.49E-03	1.49E-03	5.11E-16	1.49E-03	1.49E-03	1.49E-03	1.49E-03	1.49E-03

SECTION V

DOSE FROM LIQUID EFFLUENTS

LADTAP II OUTPUT

Technical Specification 5.9.4.a

January 1, 2012 - December 31, 2012

Radioactive Effluent Releases - First, Second, Third, and Fourth Quarters 2012

LIQUID EFFLUENTS

During the reporting period, a total of 1.08E-03 curies of radioactive liquid materials less tritium, dissolved noble gases, and alpha were released to the Missouri River at an average concentration of 9.05E-10 µCi/mL. This represents 9.05E-02 percent of the limits specified in Appendix B to 10 CFR 20 (1.0E-06 µCi/mL for unrestricted areas), 2.94 curies of tritium were discharged at an average diluted concentration of 2.43E-06 µCi/mL or 0.243 percent of ECL (1.0E-03 µCi/mL).

No gross alpha radioactivity or Ni-63 was identified by Off-site vendor analysis of quarterly liquid composites for the reporting period.

Dilution water during the period amounted to 1.22E+9 liters, while liquid waste discharges consisted of 2.08E+06 liters of radioactive liquid waste.

A. Potential Annual Doses to Individuals from Liquid Releases

Total body, skin, and organ mRem for liquid releases were calculated for all significant liquid pathways using the annual configuration of the LADTAP II program.

The inputs to LADTAP II for the annual period from January 1, 2012 through December 31, 2012 were as follows:

(1) All liquid effluents were as described in Section IV except for entrained noble gases (Ar-41, Xe-131M, Xe-133M, Xe-133, Xe-135M, Xe-135, Kr-85M, Kr-87, and Kr-88).

(2) An average plant discharge rate of 15.9 cubic feet per second (CFS) was utilized for 2012. The average discharge rate during releases was 1.61 cubic feet per second (CFS).

(3) Dilution factors (inverse of the mixing ratios) were computed based on Regulatory Guide 1.113 (equation 7 in Section 2.a.1 of Appendix A) for a one dimensional transport model.

(4) Drinking water transport times of 6.6 hours to the Omaha intake and 7.0 hours to the Council Bluffs intake were used for dose calculations.

(5) A shorewidth factor of 0.2 was used.

(6) All dose factors, transport times from receptor to individual, and usage factors are defined by Regulatory Guide 1.109 and NUREG-0172.

The discharge site was chosen to present the most conservative estimate of mRem dose for an average adult, teenager, child, and infant. A conservative approach is also presented by the assumption that Omaha and Council Bluffs receive all drinking water from the Missouri River.

B. Potential Annual Doses to Population from Liquid Releases

The LADTAP II program in its annual configuration was also used to calculate to total body and organ doses for the population of 950,006 within a 50-mile radius of the plant (based on the 2010 census). The same input was used as in the individual cases with the addition of the following:

(1) Dilution factors and transport times for the pathways of sport fish, commercial fish, recreation and biota were calculated based on a distance of two miles downstream as approximately the distance to the nearest recreation facility - DeSoto National Wildlife Preserve.

(2) The total fish harvest for both sport and commercial purposes was calculated using an average commercial fish catch for Nebraska.

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L       AAA   DDDD   TTTTT   AAA   PPPP     IIIII IIIII
L      A   A  D   D    T    A   A  P   P      I     I
L      A   A  D   D    T    A   A  P   P      I     I
L      AAAAA  D   D    T    AAAAA  PPPP       I     I
L      A   A  D   D    T    A   A  P          I     I
LLLLL  A   A  DDDD     T    A   A  P        IIIII IIIII
```

EVALUATION OF RADIATION DOSES FROM RELEASES OF RADIACTIVITY

IN NUCLEAR POWER PLANTS LIQUID EFFLUENTS

REVISION DATE: PNL VAX - OCTOBER 1985

FORT CALHOUN ANNUAL 2012, DOSE PROJECTIONS

RADIOLOGICAL ASSESSMENT BRANCH

DIVISION OF SYSTEMS INTEGRATION

U. S. NUCLEAR REGULATORY COMMISSION

WASHINGTON, D. C.

LOCATION FRESHWATER INTAKE

A D U L T D O S E S

	DOSE (MREM PER YEAR INTAKE)							
PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		2.81E-02	3.89E-02	2.57E-02	3.21E-05	1.32E-02	4.42E-03	8.11E-04
DRINKING		1.16E-04	4.54E-04	4.00E-04	2.94E-04	3.48E-04	3.12E-04	3.04E-04
SHORELINE	4.45E-05	3.82E-05	3.82E-05	3.82E-05	3.82E-05	3.82E-05	3.82E-05	3.82E-05
SWIMMING		1.52E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07
BOATING		7.59E-08	7.59E-08	7.59E-08	7.59E-08	7.59E-08	7.59E-08	7.59E-08
TOTAL	4.45E-05	2.82E-02	3.94E-02	2.61E-02	3.64E-04	1.36E-02	4.77E-03	1.15E-03

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	21.0	7.3	24.00	
DRINKING	730.0	30.8	18.60	
SHORELINE	12.0	7.3	0.00	
SWIMMING	12.0	7.3	0.00	
BOATING	12.0	7.3	0.00	

T E E N A G E R D O S E S

	DOSE (MREM PER YEAR INTAKE)							
PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		3.00E-02	4.05E-02	1.43E-02	2.46E-05	1.38E-02	5.36E-03	6.18E-04
DRINKING		1.14E-04	3.60E-04	2.61E-04	2.07E-04	2.59E-04	2.27E-04	2.14E-04
SHORELINE	2.49E-04	2.13E-04	2.13E-04	2.13E-04	2.13E-04	2.13E-04	2.13E-04	2.13E-04
SWIMMING		8.47E-07	8.47E-07	8.47E-07	8.47E-07	8.47E-07	8.47E-07	8.47E-07
BOATING		4.24E-07	4.24E-07	4.24E-07	4.24E-07	4.24E-07	4.24E-07	4.24E-07
TOTAL	2.49E-04	3.04E-02	4.11E-02	1.47E-02	4.46E-04	1.42E-02	5.81E-03	1.05E-03

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	16.0	7.3	24.00	
DRINKING	510.0	30.8	18.60	
SHORELINE	67.0	7.3	0.00	
SWIMMING	67.0	7.3	0.00	
BOATING	67.0	7.3	0.00	

C H I L D D O S E S

	DOSE (MREM PER YEAR INTAKE)							
PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		3.78E-02	3.66E-02	5.49E-03	2.04E-05	1.19E-02	4.31E-03	2.55E-04
DRINKING		3.32E-04	7.18E-04	4.46E-04	3.97E-04	5.01E-04	4.35E-04	4.03E-04
SHORELINE	5.19E-05	4.45E-05	4.45E-05	4.45E-05	4.45E-05	4.45E-05	4.45E-05	4.45E-05
SWIMMING		1.77E-07	1.77E-07	1.77E-07	1.77E-07	1.77E-07	1.77E-07	1.77E-07
BOATING		8.85E-08	8.85E-08	8.85E-08	8.85E-08	8.85E-08	8.85E-08	8.85E-08
TOTAL	5.19E-05	3.82E-02	3.74E-02	5.98E-03	4.62E-04	1.25E-02	4.79E-03	7.04E-04

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	6.9	7.3	24.00	
DRINKING	510.0	30.8	18.60	
SHORELINE	14.0	7.3	0.00	
SWIMMING	14.0	7.3	0.00	
BOATING	14.0	7.3	0.00	

I N F A N T D O S E S

	DOSE (MREM PER YEAR INTAKE)							
PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
DRINKING		3.43E-04	7.95E-04	4.20E-04	3.90E-04	4.98E-04	4.34E-04	3.94E-04
SHORELINE	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	0.00E+00	3.43E-04	7.95E-04	4.20E-04	3.90E-04	4.98E-04	4.34E-04	3.94E-04

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	0.0	7.3	24.00	
DRINKING	330.0	30.8	18.60	

LOCATION IS SITE DISCHG.

A D U L T D O S E S

	DOSE (MREM PER YEAR INTAKE)							
PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		2.05E-01	2.84E-01	1.88E-01	2.34E-04	9.65E-02	3.22E-02	5.92E-03
DRINKING		3.57E-03	1.40E-02	1.23E-02	9.04E-03	1.07E-02	9.60E-03	9.38E-03
SHORELINE	3.25E-04	2.79E-04	2.79E-04	2.79E-04	2.79E-04	2.79E-04	2.79E-04	2.79E-04
SWIMMING		1.11E-06	1.11E-06	1.11E-06	1.11E-06	1.11E-06	1.11E-06	1.11E-06
BOATING		5.54E-07	5.54E-07	5.54E-07	5.54E-07	5.54E-07	5.54E-07	5.54E-07
TOTAL	3.25E-04	2.09E-01	2.98E-01	2.00E-01	9.55E-03	1.07E-01	4.21E-02	1.56E-02

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	21.0	1.0	24.00	
DRINKING	730.0	1.0	12.00	
SHORELINE	12.0	1.0	0.00	
SWIMMING	12.0	1.0	0.00	
BOATING	12.0	1.0	0.00	

T E E N A G E R D O S E S

	DOSE (MREM PER YEAR INTAKE)							
PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		2.19E-01	2.96E-01	1.04E-01	1.80E-04	1.01E-01	3.92E-02	4.51E-03
DRINKING		3.50E-03	1.11E-02	8.04E-03	6.37E-03	7.97E-03	7.00E-03	6.59E-03
SHORELINE	1.81E-03	1.55E-03	1.55E-03	1.55E-03	1.55E-03	1.55E-03	1.55E-03	1.55E-03
SWIMMING		6.19E-06	6.19E-06	6.19E-06	6.19E-06	6.19E-06	6.19E-06	6.19E-06
BOATING		3.09E-06	3.09E-06	3.09E-06	3.09E-06	3.09E-06	3.09E-06	3.09E-06
TOTAL	1.81E-03	2.24E-01	3.08E-01	1.14E-01	8.11E-03	1.10E-01	4.77E-02	1.27E-02

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	16.0	1.0	24.00	
DRINKING	510.0	1.0	12.00	
SHORELINE	67.0	1.0	0.00	
SWIMMING	67.0	1.0	0.00	
BOATING	67.0	1.0	0.00	

C H I L D D O S E S

	DOSE (MREM PER YEAR INTAKE)							
PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		2.76E-01	2.67E-01	4.01E-02	1.49E-04	8.71E-02	3.14E-02	1.86E-03
DRINKING		1.02E-02	2.21E-02	1.37E-02	1.22E-02	1.54E-02	1.34E-02	1.24E-02
SHORELINE	3.79E-04	3.25E-04	3.25E-04	3.25E-04	3.25E-04	3.25E-04	3.25E-04	3.25E-04
SWIMMING		1.29E-06	1.29E-06	1.29E-06	1.29E-06	1.29E-06	1.29E-06	1.29E-06
BOATING		6.46E-07	6.46E-07	6.46E-07	6.46E-07	6.46E-07	6.46E-07	6.46E-07
TOTAL	3.79E-04	2.87E-01	2.90E-01	5.41E-02	1.27E-02	1.03E-01	4.52E-02	1.46E-02

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	6.9	1.0	24.00	
DRINKING	510.0	1.0	12.00	
SHORELINE	14.0	1.0	0.00	
SWIMMING	14.0	1.0	0.00	
BOATING	14.0	1.0	0.00	

I N F A N T D O S E S

	DOSE (MREM PER YEAR INTAKE)							
PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
DRINKING		1.06E-02	2.45E-02	1.29E-02	1.20E-02	1.53E-02	1.34E-02	1.21E-02
SHORELINE	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	0.00E+00	1.06E-02	2.45E-02	1.29E-02	1.20E-02	1.53E-02	1.34E-02	1.21E-02

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	0.0	1.0	24.00	
DRINKING	330.0	1.0	12.00	

* * * FISH CONSUMPTION POPULATION DOSES * * *
PERSON-REM

SPORT HARVEST

			DOSE (PERSON-REM)						
PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH	ADULT	6.10E+04	8.15E-02	1.13E-01	7.46E-02	9.30E-05	3.83E-02	1.28E-02	2.35E-03
FISH	TEENAGER	7.12E+03	1.34E-02	1.80E-02	6.34E-03	1.09E-05	6.12E-03	2.38E-03	2.75E-04
FISH	CHILD	4.93E+03	2.70E-02	2.61E-02	3.92E-03	1.46E-05	8.52E-03	3.07E-03	1.82E-04
FISH	TOTAL	7.30E+04	1.22E-01	1.57E-01	8.48E-02	1.18E-04	5.30E-02	1.83E-02	2.81E-03

LOCATION	DILUTION	CATCH	TIME(HR)-INCLUDES FOOD PROCESSING TIME OF 1.68E+02 HR	POPULATION=1.24E+04
	7.30E+00	7.30E+04	1.69E+02	

AVERAGE INDIVIDUAL CONSUMPTION (KG/YR) ADULT=6.90E+00 TEEN=5.20E+00 CHILD=2.20E+00

COMMERCIAL HARVEST

			DOSE (PERSON-REM)						
PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH	ADULT	4.18E+06	9.27E-03	1.28E-02	8.48E-03	1.06E-05	4.36E-03	1.46E-03	2.67E-04
FISH	TEENAGER	4.88E+05	1.52E-03	2.05E-03	7.21E-04	1.24E-06	6.96E-04	2.71E-04	3.12E-05
FISH	CHILD	3.38E+05	3.07E-03	2.97E-03	4.46E-04	1.66E-06	9.69E-04	3.50E-04	2.07E-05
FISH	TOTAL	5.01E+06	1.39E-02	1.79E-02	9.65E-03	1.35E-05	6.03E-03	2.08E-03	3.19E-04

LOCATION	DILUTION	CATCH	TIME(HR)-INCLUDES FOOD PROCESSING TIME OF 2.40E+02 HR	POPULATION=8.53E+05
	7.30E+00	7.30E+04	2.41E+02	

AVERAGE INDIVIDUAL CONSUMPTION (KG/YR) ADULT=6.90E+00 TEEN=5.20E+00 CHILD=2.20E+00

* * * POPULATION WATER CONSUMPTION DOSES * * *

SUPPLIER-OMAHA

			DOSE (PERSON-REM)						
PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
DRINKING	ADULT	1.39E+08	2.21E-02	8.64E-02	7.61E-02	5.59E-02	6.62E-02	5.94E-02	5.80E-02
DRINKING	TEENAGER	1.51E+07	3.37E-03	1.07E-02	7.75E-03	6.13E-03	7.67E-03	6.74E-03	6.35E-03
DRINKING	CHILD	2.48E+07	1.61E-02	3.49E-02	2.17E-02	1.93E-02	2.43E-02	2.11E-02	1.96E-02
DRINKING	TOTAL	1.79E+08	4.16E-02	1.32E-01	1.06E-01	8.13E-02	9.82E-02	8.72E-02	8.39E-02

POPULATION=5.29E+05 DILUTION=3.08E+01 TRANSIT TIME=3.06E+01 HR (INCLUDING 24 HR FOR TREATMENT FACILITY)

AVERAGE INDIVIDUAL CONSUMPTION (L/YR) ADULT=3.70E+02 TEEN=2.60E+02 CHILD=2.60E+02

SUPPLIER-COUNCIL BLUFFS

			DOSE (PERSON-REM)						
PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
DRINKING	ADULT	2.29E+07	3.57E-03	1.40E-02	1.23E-02	9.04E-03	1.07E-02	9.61E-03	9.38E-03
DRINKING	TEENAGER	2.49E+06	5.46E-04	1.73E-03	1.25E-03	9.93E-04	1.24E-03	1.09E-03	1.03E-03
DRINKING	CHILD	4.07E+06	2.61E-03	5.64E-03	3.51E-03	3.12E-03	3.94E-03	3.42E-03	3.17E-03
DRINKING	TOTAL	2.94E+07	6.73E-03	2.14E-02	1.71E-02	1.32E-02	1.59E-02	1.41E-02	1.36E-02

POPULATION=8.70E+04 DILUTION=3.13E+01 TRANSIT TIME=3.10E+01 HR (INCLUDING 24 HR FOR TREATMENT FACILITY)

AVERAGE INDIVIDUAL CONSUMPTION (L/YR) ADULT=3.70E+02 TEEN=2.60E+02 CHILD=2.60E+02

-----CUMULATIVE TOTAL-----

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
DRINKING	CUMUL TOTAL	2.08E+08	4.83E-02	1.53E-01	1.23E-01	9.44E-02	1.14E-01	1.01E-01	9.75E-02

_____NEPA DOSES_____

NOTE--TOTAL NEPA DOSE INCLUDES SPORT CATCH

			DOSE (PERSON-REM)						
PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH	ADULT	1.22E+05	1.63E-01	2.26E-01	1.49E-01	1.86E-04	7.67E-02	2.56E-02	4.70E-03
FISH	TEENAGER	1.42E+04	2.67E-02	3.60E-02	1.27E-02	2.19E-05	1.22E-02	4.77E-03	5.49E-04
FISH	CHILD	9.85E+03	5.40E-02	5.23E-02	7.83E-03	2.91E-05	1.70E-02	6.14E-03	3.64E-04
FISH	TOTAL	1.46E+05	2.44E-01	3.14E-01	1.70E-01	2.37E-04	1.06E-01	3.65E-02	5.62E-03

_____HYDROSPHERE TRITIUM DOSE_____

AVERAGE INDIVIDUAL WATER CONSUMPTION = 3.0 L/DAY

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
WATER	TOTAL	2.86E+11	0.00E+00	2.24E-05	2.24E-05	2.24E-05	2.24E-05	2.24E-05	2.24E-05

* * * RECREATION POPULATION DOSES * * *

LOCATION- DOWN STREAM SWIMMING
DILUTION= 7.30E+00 TRANSIT TIME= 6.70E-01 HR SWF= 0.2

PATHWAY	AGE GROUP	USAGE	DOSE (PERSON-REM) SKIN	TOTAL BODY	THYROID
SHORELINE	TOTAL POPUL	4.10E+07	1.52E-01	1.30E-01	1.30E-01

LOCATION- DOWN STREAM SWIMMING
DILUTION= 7.30E+00 TRANSIT TIME= 6.70E-01 HR

PATHWAY	AGE GROUP	USAGE	DOSE (PERSON-REM) SKIN	TOTAL BODY	THYROID
SWIMMING	TOTAL POPUL	4.10E+07		5.19E-04	5.19E-04

LOCATION- DOWN STREAM BOATING
DILUTION= 7.30E+00 TRANSIT TIME= 6.70E-01 HR

PATHWAY	AGE GROUP	USAGE	DOSE (PERSON-REM) SKIN	TOTAL BODY	THYROID
BOATING	TOTAL POPUL	4.10E+07		2.59E-04	2.59E-04

* * * DOSE TO BIOTA * * *
MRADS PER YEAR

BIOTA DILUTION= 1.00E+00 TRANSIT TIME= 0.00E+00 HR

	INTERNAL	EXTERNAL	TOTAL
FISH	6.21E-01	1.02E+00	1.64E+00
INVERTEBRATE	3.16E-01	2.03E+00	2.35E+00
ALGAE	1.84E-01	8.09E-04	1.85E-01
MUSKRAT	3.39E+00	6.78E-01	4.07E+00
RACCOON	1.26E+00	5.09E-01	1.77E+00
HERON	1.97E+01	6.78E-01	2.04E+01
DUCK	3.09E+00	1.02E+00	4.11E+00

SECTION VI

RADIOACTIVE EFFLUENT RELEASES - SOLID RADIOACTIVE WASTE

Technical Specifications 5.9.4.a

January 1, 2012 - December 31, 2012

III. RADIOACTIVE EFFLUENT RELEASE – SOLID RADIOACTIVE WASTE EFFLUENT AND WASTE DISPOSAL REPORT

January 1, 2012 through December 31, 2012

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (NOT IRRADIATED)

1.	Type of Waste	Month Shipped	Number of Shipments	Volume Cu. Meter	Curie Content	Est. Total % Error
a.	Spent resins, filter sludges, evaporator bottoms, etc.	January	0	0	0	N/A
		February	0	0	0	N/A
		March	0	0	0	N/A
		April	0	0	0	N/A
		May	0	0	0	N/A
		June	0	0	0	N/A
		July	0	0	0	N/A
		August	0	0	0	N/A
		September	0	0	0	N/A
		October	0	0	0	N/A
		November	0	0	0	N/A
		December	0	0	0	N/A
Total		(Type a)	0	0	0	N/A
b.	Dry compressable, contaminated equipment, etc.	January	0	0	0	N/A
		February	1	36.25	1.37 E-2	20
		March	0	0	0	N/A
		April	0	0	0	N/A
		May	1	41.55	1.52 E-2	20
		June	0	0	0	N/A
		July	0	0	0	N/A
		August	1	72.5	2.32 E-2	20
		September	0	0	0	N/A
		October	1	72.5	8.97 E-2	20
		November	1	72.5	6.53 E-2	20
		December	0	0	0	N/A
Total		(Type b)	5	295.3	2.07 E-1	20

III. RADIOACTIVE EFFLUENT RELEASE – SOLID RADIOACTIVE WASTE EFFLUENT AND WASTE DISPOSAL REPORT

(Continued)

1. Type of Waste	Month Shipped	Number of Shipments	Volume Cu. Meter	Curie Content	Est. Total % Error
c. Irradiated components and other categories.	January	0	0	0	N/A
	February	0	0	0	N/A
	March	0	0	0	N/A
	April	0	0	0	N/A
	May	0	0	0	N/A
	June	0	0	0	N/A
	July	0	0	0	N/A
	August	0	0	0	N/A
	September	0	0	0	N/A
	October	0	0	0	N/A
	November	0	0	0	N/A
	December	0	0	0	N/A
Total	(Type c)	0	0	0	N/A
d. Other	January	0	0	0	N/A
	February	0	0	0	N/A
	March	0	0	0	N/A
	April	0	0	0	N/A
	May	0	0	0	N/A
	June	0	0	0	N/A
	July	0	0	0	N/A
	August	0	0	0	N/A
	September	0	0	0	N/A
	October	0	0	0	N/A
	November	0	0	0	N/A
	December	0	0	0	N/A
Total	(Type d)	0	0	0	N/A

III. RADIOACTIVE EFFLUENT RELEASES–SOLID RADIOACTIVE

(Continued)

B. ESTIMATE OF MAJOR NUCLIDE COMPOSITION (By Type of Waste)

1. Percentage of Curies from Represented Isotopes

	Isotope	Percent	Curies	
a.	N/A	N/A	N/A	
b.	Cs-137	45.0	9.33 E-2	
	Ni-63	36.8	7.63 E-2	
	Co-60	5.6	1.16 E-2	
	Co-58	4.2	8.67 E-3	All other Nuclides constitute
	H-3	2.0	4.24 E-3	less than 1%
	Nb-95	1.6	3.29 E-3	
	Tc-99	1.02	2.11 E-3	
	Cs-134	1.0	2.00 E-3	
c.	N/A	N/A	N/A	
d.	N/A	N/A	N/A	

C. SOLID WASTE (DISPOSITION)

Number of Shipments	Transportation Mode	Destination
5	Sole Use Vehicle	Energy Solutions Bear Creek, Tennessee

D. IRRADIATED FUEL SHIPMENTS (DISPOSITION)

Number of Shipments	Transportation Mode	Destination
N/A	N/A	N/A

SECTION VII

ATTACHMENT 1

ODCM and PCP revisions for the period January 1, 2012 through December 31, 2012 in accordance with Technical Specification 5.17.d and 5.18.d, the radioactive effluent release report shall include any revisions to the Offsite Dose Calculation Manual (ODCM) and the Process Control Program (PCP).

___0___ revision(s) made to the Offsite Dose Calculation Manual (ODCM).

___1___ revision(s) made to the Process Control Program (PCP).

RW-AD-300

Process Control Program

Revision 0

Safety Classification: Non-Safety

Usage Level: Information

Change No.:	EC 54576
Reason for Change:	Superseding RW-200 with RW-AD-300. Remove out of date activities, unnecessary editorial statements and incorrect references.
Requestor:	E. Breault
Preparer:	E. Breault
Issued:	01-17-12 3:00 pm

Fort Calhoun Station

1.0 PURPOSE AND SCOPE

1.1 Purpose

1.1.1 To provide guidance and boundary conditions for preparation of specific procedures for processing, sampling, analyzing, packaging and shipping solid radioactive waste in accordance with State and Federal regulatory requirements.

1.2 Scope

1.2.1 This program is applicable to the Fort Calhoun Station Unit No. 1 solid radwaste system. Wastes considered in this program are primary and radwaste liquid processing resins, oil and filters. Dry Active Waste is only included as it applies to assurance that packaged waste is suitable for shipment and burial in accordance with applicable State and Federal regulations. Concentrates and aqueous liquids are not considered due to the present decisions not to utilize the waste evaporator as a means for processing liquid wastes.

2.0 DEFINITIONS

2.1 Batch – The specific quantity of waste transferred to a disposal container to be sampled, classified and characterized.

2.2 Chelating Agent - For the purpose of this program, CHELATING AGENTS are amine polycarboxylic acids (e.g., EDTA, DTPA), hydroxy-carboxylic acids, and polycarboxylic acids (e.g., citric acid, carbolic acid, picolanic acid and gluconic acid) as defined in 10CFR61.2.

2.3 Low-Level Radioactive Waste (LLW) - Those low-level radioactive wastes containing source, special nuclear, or by-product material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level radioactive waste has the same meaning as in the Low-Level Waste policy Act, that is radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product material as defined in Section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste).

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

2.5 Processing – Modifying the physical form and packaging of radioactive waste to meet the requirements of 10 CFR 61.56.

2.6 Quality Assurance/Quality Control - As used in this document, "quality assurance" comprises those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to the physical characteristics of a material, structure, component, or system which provide a means to control the quality of the material, structure, component, or system to predetermined requirements.

2.7 Sampling Plan - A sampling program implemented to ensure that representative samples from the feed waste and the final waste form are obtained and tested for conformance with parameters stated in the Process Control Program and waste form acceptance criteria.

2.8 Stability - As used in this program, STABILITY means structural stability. Stability requires that the waste form maintain its structural integrity under the expected disposal conditions.

2.9 Waste Container - A vessel of any shape, size, and composition used to contain the final processed waste.

2.10 Waste Form - Waste in a waste container acceptable for disposal at a licensed disposal facility.

3.0 RESPONSIBILITIES

3.1 The Supervisor-Radioactive Waste Operations is responsible for:

3.1.1 Maintenance of and compliance with this Process Control Program;

3.1.2 Record keeping and document control of shipping and processing data; and

3.1.3 Assuring Radwaste Personnel are appropriately trained and qualified to perform waste processing and packaging activities.

3.2 The Manager-Shift Operations is responsible for:

3.2.1 Providing trained personnel to operate appropriate radwaste process equipment; and

3.2.2 Defining those Operations positions which require training.

3.3 The Manager Training is responsible for:

3.3.1 Development and implementation of performance-based training for designated personnel in accordance with Training Division procedures.

3.4 All OPPD and OPPD contract personnel are responsible for:

3.4.1 Implementation of procedures and good practices so as to provide Quality Assurance and maintain exposures ALARA.

3.5 The Nuclear Quality Assurance Department is responsible for:

3.5.1 Establishment of a Quality Assurance Program addressing Radwaste processing and packaging; and

3.5.2 Performing audits of activities associated with this Process Control Program to assure compliance with the Quality Assurance Plan.

3.6 The Plant Review Committee is responsible for:

3.6.1 Reviewing and approving changes to this Process Control Program prior to implementation of the changes; and

3.6.2 Reviewing and approving engineering and 50.59 reviews performed in support of changes to this Process Control Program.

3.7 The Station Engineering Manager is responsible for:

3.7.1 Ensuring engineering and 50.59 and/or 72.48 reviews are performed for changes made to this Process Control Program; and

3.7.2 Submitting these reviews to the Plant Review Committee for review and approval prior to implementation of the changes evaluated.

4.0 TOOLS AND EQUIPMENT

None

5.0 PRECAUTIONS AND LIMITATIONS

None

6.0 PREREQUISITES AND INITIAL CONDITIONS

6.1 All personnel performing activities under the control of and described by this Process Control Program shall have been successfully trained and qualified to perform the described activities before actually performing the activities.

6.2 Procedures have been developed for implementation of this Process Control Program.

7.0 PROCEDURE

7.1 Waste Types

7.1.1 Primary Resin

A. The contaminated waste product generated as a result of reactor water purification and demineralization, cation ion exchange, deborating ion exchange and spent fuel pool demineralization.

B. Waste consists of contaminated bead ion exchange resins at varying degrees of exhaustion, small concentrations of various solids, activated and non-activated corrosion products and fission products.

7.1.2 Radwaste Liquid Processing Resin

A. The contaminated waste product generated as a result of processing radwaste liquids using a demineralization system. This system may be vendor supplied.

B. Waste consists of contaminated bead ion exchange resins at varying degrees of exhaustion, small concentrations of various solids, activated and non-activated corrosion products and fission products.

7.1.3 Filters

A. The contaminated waste product generated as a result of liquid processing activities and the removal of cartridge elements from the processing systems.

B. Waste consists of contaminated mechanical filtration cartridges containing various amounts of particulate solids, corrosion products, activation and fission products.

7.1.4 Oil

A. The contaminated waste product generated as a result of leakage or intentional drainage and replacement of various plant component lubricating and/or control fluids.

B. Waste consists of contaminated oils and greases of various grades both synthetic and natural, in free form or containing various amounts of solid material.

7.1.5 Dry Active Waste

A. The contaminated waste product generated as a result of plant maintenance and repair and routine plant operations.

B. Waste generally consists of contaminated trash in the form of plastics, papers, wood, steel and cloth items with varying concentrations of corrosion, activation and fission products.

7.1.6 Non-Standard Wastes

A. The contaminated waste product generated as a result of non-routine plant operation, maintenance and or repair activities.

B. Waste consists of plant components, irradiated hardware and other specialty items contaminated with varying concentrations of corrosion, activation and fission products. The waste may also be those items which have become activated with contamination being a minimal fraction of the total radioactivity.

7.2 Process Description

7.2.1 Primary Resin

A. Primary resins are obtained from the CVCS, purification ion exchangers, and the spent fuel storage pool demineralizer. These resins are collected in the Spent Resin Storage Tank.

B. The contents of the tank are pumped into a disposal/transport container within a shielded shipping cask or process shield after which the contents are dewatered and shipped from the plant.

7.2.2 Radwaste Liquid Processing Resin

A. Radwaste liquids are processed using a Filtration-Ion Exchanger (FIX) system.

B. Radioactive liquids are normally transferred from the waste holdup tanks to the demineralization system using the waste holdup transfer pumps. Specific maintenance and/or decontamination activities may require the use of portable transfer pumps and hoses.

C. The processed liquids are directed to the monitor tanks to be analyzed and discharged to the Missouri River through the overboard discharge piping.

D. The depleted resins in the demineralization system vessels are sluiced into a transport container to be shipped off-site.

7.2.2 (continued)

E. When stabilization is required (i.e., Class B or C), then a High Integrity Container (HIC) shall be used.

7.2.3 Filters

A. Used filter cartridges originate from the purification filters, the waste filters, the spent fuel pool cooling system filter, and ultrasonic cleaning unit.

B. Filters are removed from their respective system and permitted to drain excess liquids from the elements.

C. The filters are then transferred in a container for disposal.

1. When stabilization is required, (i.e. Class B or C) the filters shall be disposed of in a HIC.

7.2.4 Oil

A. Oil generated during operation and maintenance is collected in containers in appropriate approved areas of the plant.

B. The filled and labeled containers are sealed and moved to available areas for temporary storage.

C. Oils may be shipped off site to a contracted and licensed vendor for processing or incineration.

7.2.5 Dry Active Waste

A. Dry Active Wastes are collected from radiologically controlled areas throughout the plant.

B. The waste is sorted to remove reusable and wet items at the source of generation.

C. The Dry Waste material is then collected in a vendor's container, metal boxes or metal drums. Material with elevated dose rates will be segregated for shielded transport (cask) to the vendor processing facility.

7.2.6 Non-Standard Waste

A. Reactor components and irradiated hardware are waste which are not routinely generated.

B. These types of non-standard waste will be handled on a case-by-case basis through the implementation of special procedures approved by the Plant Review Committee.

7.3 Process Control

7.3.1 Radioactive waste processing instrumentation and equipment shall be subject to formal calibration and preventative maintenance programs.

7.3.2 Primary and Radwaste Liquid Processing Resin

A. Primary resins will be transferred into containers for processing using plant installed and vendor supplied equipment.

B. Radwaste Liquid Processing will be performed using a vendor supplied FIX system.

C. Referenced Radwaste Procedures controlling the processing, transfer and dewatering activities shall be observed.

D. The vendor supplied system shall be operated in accordance with the system operating procedures and applicable station Radwaste Procedures.

7.3.3 Filters

A. Filter processing is controlled by referenced Radwaste Procedures.

B. Filters requiring stability are packaged as described in Section 7.2.3.

7.3.4 Oil

A. Waste oil is collected in metal containers, sampled and transferred to a processing vendor.

7.3.5 Dry Active Waste

A. Dry Active Waste is processed in accordance with referenced Radwaste Procedures.

7.3.6 Non-Standard Waste

A. These procedures would have to be written after the non-standard waste is identified.

7.4 Product Control

7.4.1 A sample from each batch of waste shall be analyzed quantitatively for activity and isotopic identity as required in station procedures. If radionuclide distributions are shown to be consistent between similar batches, consideration may be given to decreasing the frequency of routine measurements. Frequency of sampling is as described in Radiation Protection Procedure RW-221, "10CFR61 Sampling". This constitutes the sampling plan.

7.4.2 Scaling factors for nuclides which are hard to identify are established for waste streams by using analyses performed and provided by an off-site vendor.

7.4.3 This frequency of sampling shall be raised or lowered based upon consideration of waste stream or radionuclide characteristics. Factors which would influence this consideration include the frequency of process vessel changeout or waste shipment, the difficulty (e.g. Costs, occupational exposures) in obtaining a representative sample of a particular waste stream, the variability of the radionuclide distribution within the waste stream over time, and the availability of analytical capability for particular radionuclides. If radionuclide distributions are shown to be consistent between similar batches, consideration may be given to decreasing the frequency of routine measurements. If onsite samples show a variation from presently used scaling factors by more than a factor of 10, samples will be sent offsite for analysis to establish new scaling factors.

7.5 Training

7.5.1 Processing of solid radioactive waste shall be performed by qualified and trained personnel.

7.5.2 Training records of processing personnel shall be maintained by the Training Division.

7.6 Procedure Control

7.6.1 On site processing of radioactive waste shall be performed in accordance with approved station procedures.

7.6.2 Procedures for processing, containerization and transport of wastes shall ensure that specific DOT, 10CFR and burial site requirements are satisfied.

7.6.3 Procedures for specific radwaste systems supplied by vendors for on-site processing shall be reviewed and referenced in station procedures.

7.7 Records

7.7.1 Waste classification records, waste form records and other records required for the preparation of the Fort Calhoun Station Unit No. 1 Annual Radioactive Effluent Release Report shall be prepared and retained in accordance with the requirements of 10CFR20, 10CFR71, 10CFR72, 49CFR170-178 and the Fort Calhoun Station Technical Specifications.

7.7.2 Records of processing data, test and analysis results and results of training, inspection and audits are retained in accordance with the Fort Calhoun Station Quality Assurance Plan and applicable station Administrative Procedures.

7.7.3 All certificates of compliance, licenses, criteria and regulations pertaining to processing, packaging, shipment and disposal of radioactive materials controlled under this Process Control Program shall be maintained in the most current status. OPPD, Fort Calhoun Station Unit No. 1 shall be currently registered, as necessary, to use applicable packagings.

7.8 Quality Assurance

7.8.1 Quality Assurance shall be maintained as defined by the Fort Calhoun Station Quality Assurance Plan, Section 11.

7.8.2 The QA Plan shall ensure compliance with NRC and burial site criteria for waste classification and waste form.

7.8.3 Audits shall be conducted in accordance with NQA Audit Section Instructions.

7.8.4 The Topical Reports of vendor supplied radwaste processing systems shall undergo review either by the Supervisor-Radioactive Waste Operations or the Manager-Radiation Protection. The review shall ensure the vendor supplied system will be compatible with plant operations and that the Topical report has been submitted to the NRC for review. The review shall be documented by a memo addressed to file.

7.8.5 Audits of a sampling of implementing procedures shall be performed at least once every 24 months. Procedures should be reviewed to ensure continual compliance with the requirements and process parameters of this Process Control Program.

7.8.6 Radioactive wastes not described within this document must be evaluated and approved for inclusion in this Process Control Program or in a vendor Process Control Program prior to processing.

7.9 Revisions

7.9.1 Changes or modifications made to design and/or operation of radioactive waste processing, treatment and/or packaging systems or activities, as described within this Process Control Program, shall require formal engineering evaluation and performance of a 50.59 review in accordance with 10CFR50.59.

7.9.2 Changes made to this Process Control Program and supporting engineering, 50.59 reviews shall be reviewed and approved by the Plant review Committee prior to implementing the changes.

7.9.3 Changes to the Process Control Program approved by the Plant Review Committee shall be submitted to the Nuclear Engineer-In-Charge of Licensing, for input to the Annual Radioactive Effluent Release Report and USAR applicability.

8.0 REFERENCES AND COMMITMENTS

8.1 Fort Calhoun Station Unit No. 1 Technical Specifications Sections 5.18 and 5.9.4

8.2 Fort Calhoun Station Unit No. 1, Updated Safety Analysis Report

8.3 RW-201, Control of Containers

8.4 RW-202, Collection/Sorting/Segregation of Dry Active Waste (DAW)

8.5 RW-204, Packaging Non-Compactable Dry Active Waste

8.6 RW-206, Transfer of Spent Primary Resin to Disposal Containers

8.7 RW-207, Operation of the Fix Radwaste Liquid Processing System

8.8 RW-208, Transfer of Spent Fix System Resin to Disposal Containers

8.9 RW-209, Dewatering Spent Radwaste Liquid Processing Resin and Primary Resin in Disposal Containers

8.10 RW-211, Storage of Filters from Radwaste Systems

8.11 RW-214, Collection of Oils

8.12 RW-216, Testing of Sorbent Materials

8.13 RW-218, 10CFR61 Classification

8.14 RW-221, 10CFR61 Sampling

8.15 Current Vendor Processing Topical Report

8.16 Current Vendor Operating Procedures as referenced in RW-207

8.17 49CFR Parts 170 through 178

8.18 10CFR Parts 20, 50, 61, and 71

8.19 USNRC Low Level Waste Licensing Branch; Technical Position on Radioactive Waste Classification, Current Revision

8.20 USNRC Low Level Waste Licensing Branch; Technical Position on Waste Form, Current Revision

8.21 FCS Quality Assurance Plan, Section 11.1 and 11.2

9.0 ATTACHMENTS

None

SECTION VII

ATTACHMENT 2

JOINT FREQUENCY DISTRIBUTION WIND DIRECTION VS. WIND SPEED
BY STABILITY CLASS AND METEOROLOGICAL DATA

(Regulatory Guide 1.21)

January 1, 2012 - December 31, 2012

JOINT FREQUENCY DISTRIBUTION WIND DIRECTION VS. WIND SPEED BY STABILITY CLASS AND METEOROLOGICAL DATA

A. Meteorological Data Recovery

Data availability from the on-site weather tower for the period January 1, 2012 through December 31, 2012 was greater than the previous 12 months due to the onsite meteorological tower being repaired on March 8, 2012 following the 2011 damage from flood waters. This resulted in a cumulative recovery rate of 80.84% from the meteorological tower with the remaining 19.16% provided by Eppley Airfield Weather Station, a branch of the National Weather Service. The data provided by Eppley Airfield Weather Station was treated in accordance with monthly correction factors and a proceduralized Pasquill-Turner transformation which utilizes solar angle, time of day, cloud cover, and wind speed to determine the Pasquill Class. The following table is a summary of the parameters and their respective recovery rates for the period. The higher fraction of offsite data produced more conservative results than a data set calculated using > 95% onsite data. The 2012 calculations, although statistically different from previous data sets, is bounded by USAR estimates.

The tabulations of the Weather Tower Data for the period January 1, 2012 through December 31, 2012 look appropriate for the season indicated. The Pasquill Classes observed for the twelve-month period are detailed below.

Pasquill Class	A	B	C	D	E	F	G	Total
% Obs.	2.42	3.19	6.10	47.89	24.26	9.68	6.46	100

On the basis of the data and its cross-checks, the weather data as amended is completely valid for use in tabulating atmospheric releases.

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
EXTREMELY UNSTABLE (delta T/ delta z < -1.9)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL A
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	0	0	2	1	7	9	4	1	0	0	0	24
NNE	0	0	1	0	1	3	0	0	0	0	0	5
NE	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	1	0	0	0	0	0	1
E	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	1	0	0	0	0	0	1
SE	0	0	0	0	1	1	0	1	0	0	0	3
SSE	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	1	1	0	0	2
SSW	0	0	1	0	0	0	1	2	2	0	0	6
SW	0	0	0	1	1	2	0	0	0	0	0	4
WSW	0	0	0	1	4	4	0	0	0	0	0	9
W	0	0	1	1	8	5	1	0	0	0	0	16
WNW	0	1	1	6	9	11	3	4	0	0	0	35
NW	0	0	1	2	9	17	15	13	9	0	0	66
NNW	0	0	2	1	9	12	9	3	1	0	0	38
Total	0	1	9	13	49	66	33	25	13	0	0	209

Number of Calms 1
Number of Invalid Hours 0
Number of Valid Hours 210

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
MODERATELY UNSTABLE (-1.9 <= delta T/ delta z <= -1.7)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL B
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	0	1	5	7	21	10	1	0	0	0	0	48
NNE	0	0	0	0	2	0	1	0	0	0	0	3
NE	0	0	1	2	1	0	0	0	0	0	0	4
ENE	0	0	0	1	2	0	0	0	0	0	0	3
E	0	1	1	0	0	0	0	0	0	0	0	3
ESE	0	0	0	0	0	2	4	0	0	0	0	6
SE	0	0	0	0	0	1	3	0	1	0	0	5
SSE	0	0	0	1	1	0	0	1	0	0	0	3
S	0	0	0	0	0	0	1	3	4	0	0	8
SSW	0	0	0	0	0	3	5	0	6	0	0	14
SW	0	0	0	2	0	0	3	0	1	0	0	6
WSW	0	0	1	0	3	0	0	1	0	0	0	5
W	0	0	0	1	3	1	1	0	0	0	0	6
WNW	1	0	0	2	4	1	1	1	1	0	0	11
NW	0	1	1	5	8	12	9	6	3	0	0	46
NNW	0	0	2	4	27	33	23	9	7	1	0	106
Total	1	3	11	25	72	63	52	21	23	1	0	272

Number of Calms 5
Number of Invalid Hours 0
Number of Valid Hours 277

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
SLIGHTLY UNSTABLE (-1.7 < delta T/ delta z <= -1.5)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL C
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	0	10	14	13	19	11	2	1	0	0	0	78
NNE	0	2	1	3	6	2	0	0	0	0	0	19
NE	0	1	3	1	4	0	0	0	0	0	0	9
ENE	0	0	3	1	5	2	0	0	0	0	0	11
E	0	4	0	2	3	2	0	0	0	0	0	12
ESE	0	5	2	0	2	3	3	0	5	4	0	33
SE	0	3	3	7	1	2	3	9	2	0	0	34
SSE	0	1	3	9	2	1	1	3	3	1	0	32
S	0	5	4	6	1	3	1	3	4	1	0	33
SSW	0	2	1	0	1	1	6	7	5	4	1	30
SW	0	1	2	3	4	2	1	2	1	0	0	21
WSW	0	1	1	2	3	4	0	0	0	0	0	11
W	0	1	4	4	2	1	1	0	0	0	0	14
WNW	0	2	2	7	2	4	1	3	0	0	0	24
NW	1	2	1	6	10	10	6	4	5	0	0	50
NNW	0	3	8	16	29	27	18	9	2	1	0	119
Total	1	43	52	80	94	75	43	41	27	11	1	468

Number of Calms 62
Number of Invalid Hours 0
Number of Valid Hours 530

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
NEUTRAL (-1.5 < delta T/ delta z <= -0.5)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL D
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	0	21	40	74	94	91	43	15	6	0	0	392
NNE	0	24	28	34	31	9	6	3	0	0	0	138
NE	0	9	21	32	25	11	0	0	0	0	0	98
ENE	2	10	16	21	39	20	2	1	0	0	0	111
E	0	8	13	26	59	36	12	0	1	0	0	159
ESE	0	11	7	20	62	43	19	7	7	4	1	187
SE	0	7	10	35	61	59	68	50	52	7	0	359
SSE	0	4	7	32	79	102	79	95	138	35	3	576
S	0	1	5	22	67	67	78	107	121	46	6	522
SSW	1	2	6	16	28	32	54	40	59	27	6	271
SW	0	4	6	20	20	17	11	7	7	2	0	95
WSW	0	5	4	13	11	10	4	2	3	0	0	54
W	1	10	7	8	24	10	4	5	6	3	0	81
WNW	0	8	8	9	29	37	15	17	3	1	0	127
NW	1	7	27	33	80	69	57	46	33	5	0	363
NNW	0	11	28	76	177	145	110	49	21	4	0	628
Total	5	142	233	471	886	758	562	444	457	134	16	4108

Number of Calms 53
Number of Invalid Hours 0
Number of Valid Hours 4161

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
SLIGHTLY STABLE (-0.5 < delta T/ delta z <= 1.5)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL E
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	5	9	12	10	8	1	2	0	0	0	0	47
NNE	1	13	3	3	1	1	0	0	0	0	0	22
NE	0	15	10	8	2	0	0	0	0	0	0	35
ENE	3	16	10	8	3	0	0	0	0	0	0	40
E	0	15	27	10	13	4	1	0	0	0	0	70
ESE	0	11	23	34	46	11	1	1	0	0	0	127
SE	1	13	26	36	81	62	34	8	1	0	0	262
SSE	2	13	9	25	107	91	42	20	14	1	0	324
S	2	7	4	12	66	101	84	41	30	8	0	355
SSW	1	8	5	6	28	41	51	33	27	3	0	203
SW	3	6	4	6	13	11	10	8	2	0	0	63
WSW	5	8	6	1	6	5	0	0	0	0	0	31
W	2	20	10	7	11	7	1	0	0	0	0	58
WNW	8	49	25	10	15	6	0	0	0	0	0	113
NW	3	38	38	46	56	21	6	2	2	0	0	212
NNW	3	20	22	30	48	17	6	0	0	0	0	146
Total	39	261	234	252	504	379	238	113	76	12	0	2108

Number of Calms 0
Number of Invalid Hours 0
Number of Valid Hours 2108

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
MODERATELY STABLE (1.5 < delta T/ delta z <= 4.0)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL F
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	2	5	0	4	2	0	0	0	0	0	0	20
NNE	0	1	1	0	0	0	0	0	0	0	0	2
NE	1	5	3	1	0	0	0	0	0	0	0	10
ENE	0	6	3	0	0	0	0	0	0	0	0	9
E	4	13	11	2	3	0	0	0	0	0	0	33
ESE	1	17	15	7	12	0	0	0	0	0	0	62
SE	5	16	20	23	37	13	3	2	0	0	0	120
SSE	3	13	8	16	40	6	1	0	0	0	0	87
S	2	23	4	5	22	14	1	0	1	0	0	75
SSW	5	13	2	2	6	10	3	2	0	0	0	43
SW	12	16	5	2	5	0	0	0	0	0	0	42
WSW	16	21	2	1	1	2	1	0	0	0	0	44
W	14	40	8	1	3	2	0	0	0	0	0	68
WNW	14	77	17	4	4	2	0	0	0	0	0	118
NW	6	27	13	12	9	6	0	0	0	0	0	76
NNW	2	10	3	4	4	3	0	0	0	0	0	32
Total	87	303	115	84	148	58	9	4	1	0	0	809

Number of Calms 32
Number of Invalid Hours 0
Number of Valid Hours 841

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
EXTREMELY STABLE (delta T/ delta z > 4.0)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL G
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	5	2	4	1	0	0	0	0	0	0	0	19
NNE	3	6	1	0	0	0	0	0	0	0	0	10
NE	5	7	2	0	0	0	0	0	0	0	0	15
ENE	4	12	2	0	0	0	0	0	0	0	0	18
E	10	20	3	3	1	0	0	0	0	0	0	37
ESE	9	41	15	6	5	3	0	0	0	0	0	81
SE	6	33	18	9	4	1	1	0	0	0	0	74
SSE	10	27	9	8	3	0	1	0	0	0	0	58
S	8	16	4	4	3	0	0	0	0	0	0	35
SSW	14	24	4	3	4	4	3	0	0	0	0	57
SW	11	17	1	0	3	1	0	0	0	0	0	37
WSW	9	14	2	1	0	0	0	0	0	0	0	29
W	15	8	2	1	0	0	0	0	0	0	0	30
WNW	4	13	6	2	1	0	0	0	0	0	0	26
NW	3	5	1	1	0	0	0	0	0	0	0	15
NNW	8	4	3	0	0	0	0	0	0	0	0	20
Total	124	249	77	39	24	9	5	0	0	0	0	527

Number of Calms 34
Number of Invalid Hours 0
Number of Valid Hours 561

Hours Accounted For: 8688

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
EXTREMELY UNSTABLE (delta T/ delta z < -1.9)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL A
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	0.00	0.00	0.02	0.01	0.08	0.10	0.05	0.01	0.00	0.00	0.00	0.28
NNE	0.00	0.00	0.01	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.06
NE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ESE	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01
SE	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.03
SSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.02
SSW	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.07
SW	0.00	0.00	0.00	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.05
WSW	0.00	0.00	0.00	0.01	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.10
W	0.00	0.00	0.01	0.01	0.09	0.06	0.01	0.00	0.00	0.00	0.00	0.18
WNW	0.00	0.01	0.01	0.07	0.10	0.13	0.03	0.05	0.00	0.00	0.00	0.40
NW	0.00	0.00	0.01	0.02	0.10	0.20	0.17	0.15	0.10	0.00	0.00	0.76
NNW	0.00	0.00	0.02	0.01	0.10	0.14	0.10	0.03	0.01	0.00	0.00	0.44
Total	0.00	0.01	0.10	0.15	0.56	0.76	0.38	0.29	0.15	0.00	0.00	2.41

Percent of Calms 0.01
Percent of Invalid Hours 0.00
Percent of Valid Hours 2.42

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
MODERATELY UNSTABLE (-1.9 <= delta T/ delta z <= -1.7)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL B
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0.00	0.01	0.06	0.08	0.24	0.12	0.01	0.00	0.00	0.00	0.00	0.55
NNE	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.03
NE	0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.05
ENE	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.03
E	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
ESE	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.00	0.00	0.00	0.00	0.07
SE	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.00	0.00	0.06
SSE	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.03
S	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.00	0.00	0.09
SSW	0.00	0.00	0.00	0.00	0.00	0.03	0.06	0.00	0.07	0.00	0.00	0.16
SW	0.00	0.00	0.00	0.02	0.00	0.00	0.03	0.00	0.01	0.00	0.00	0.07
WSW	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.06
W	0.00	0.00	0.00	0.01	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.07
WNW	0.01	0.00	0.00	0.02	0.05	0.01	0.01	0.01	0.01	0.00	0.00	0.13
NW	0.00	0.01	0.01	0.06	0.09	0.14	0.10	0.07	0.03	0.00	0.00	0.53
NNW	0.00	0.00	0.02	0.05	0.31	0.38	0.26	0.10	0.08	0.01	0.00	1.22
Total	0.01	0.03	0.13	0.29	0.83	0.73	0.60	0.24	0.26	0.01	0.00	3.13

Percent of Calms 0.06
Percent of Invalid Hours 0.00
Percent of Valid Hours 3.19

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
SLIGHTLY UNSTABLE (-1.7 < delta T/ delta z <= -1.5)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL C
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	0.00	0.12	0.16	0.15	0.22	0.13	0.02	0.01	0.00	0.00	0.00	0.90
NNE	0.00	0.02	0.01	0.03	0.07	0.02	0.00	0.00	0.00	0.00	0.00	0.22
NE	0.00	0.01	0.03	0.01	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.10
ENE	0.00	0.00	0.03	0.01	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.13
E	0.00	0.05	0.00	0.02	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.14
ESE	0.00	0.06	0.02	0.00	0.02	0.03	0.03	0.00	0.06	0.05	0.00	0.38
SE	0.00	0.03	0.03	0.08	0.01	0.02	0.03	0.10	0.02	0.00	0.00	0.39
SSE	0.00	0.01	0.03	0.10	0.02	0.01	0.01	0.03	0.03	0.01	0.00	0.37
S	0.00	0.06	0.05	0.07	0.01	0.03	0.01	0.03	0.05	0.01	0.00	0.38
SSW	0.00	0.02	0.01	0.00	0.01	0.01	0.07	0.08	0.06	0.05	0.01	0.35
SW	0.00	0.01	0.02	0.03	0.05	0.02	0.01	0.02	0.01	0.00	0.00	0.24
WSW	0.00	0.01	0.01	0.02	0.03	0.05	0.00	0.00	0.00	0.00	0.00	0.13
W	0.00	0.01	0.05	0.05	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.16
WNW	0.00	0.02	0.02	0.08	0.02	0.05	0.01	0.03	0.00	0.00	0.00	0.28
NW	0.01	0.02	0.01	0.07	0.12	0.12	0.07	0.05	0.06	0.00	0.00	0.58
NNW	0.00	0.03	0.09	0.18	0.33	0.31	0.21	0.10	0.02	0.01	0.00	1.37
Total	0.01	0.49	0.60	0.92	1.08	0.86	0.49	0.47	0.31	0.13	0.01	5.39

Percent of Calms 0.71
Percent of Invalid Hours 0.00
Percent of Valid Hours 6.10

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
NEUTRAL (-1.5 < delta T/ delta z <= -0.5)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL D
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	0.00	0.24	0.46	0.85	1.08	1.05	0.49	0.17	0.07	0.00	0.00	4.51
NNE	0.00	0.28	0.32	0.39	0.36	0.10	0.07	0.03	0.00	0.00	0.00	1.59
NE	0.00	0.10	0.24	0.37	0.29	0.13	0.00	0.00	0.00	0.00	0.00	1.13
ENE	0.02	0.12	0.18	0.24	0.45	0.23	0.02	0.01	0.00	0.00	0.00	1.28
E	0.00	0.09	0.15	0.30	0.68	0.41	0.14	0.00	0.01	0.00	0.00	1.83
ESE	0.00	0.13	0.08	0.23	0.71	0.49	0.22	0.08	0.08	0.05	0.01	2.15
SE	0.00	0.08	0.12	0.40	0.70	0.68	0.78	0.58	0.60	0.08	0.00	4.13
SSE	0.00	0.05	0.08	0.37	0.91	1.17	0.91	1.09	1.59	0.40	0.03	6.63
S	0.00	0.01	0.06	0.25	0.77	0.77	0.90	1.23	1.39	0.53	0.07	6.01
SSW	0.01	0.02	0.07	0.18	0.32	0.37	0.62	0.46	0.68	0.31	0.07	3.12
SW	0.00	0.05	0.07	0.23	0.23	0.20	0.13	0.08	0.08	0.02	0.00	1.09
WSW	0.00	0.06	0.05	0.15	0.13	0.12	0.05	0.02	0.03	0.00	0.00	0.62
W	0.01	0.12	0.08	0.09	0.28	0.12	0.05	0.06	0.07	0.03	0.00	0.93
WNW	0.00	0.09	0.09	0.10	0.33	0.43	0.17	0.20	0.03	0.01	0.00	1.46
NW	0.01	0.08	0.31	0.38	0.92	0.79	0.66	0.53	0.38	0.06	0.00	4.18
NNW	0.00	0.13	0.32	0.87	2.04	1.67	1.27	0.56	0.24	0.05	0.00	7.23
Total	0.06	1.63	2.68	5.42	10.20	8.72	6.47	5.11	5.26	1.54	0.18	47.28

Percent of Calms 0.61
Percent of Invalid Hours 0.00
Percent of Valid Hours 47.89

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
SLIGHTLY STABLE (-0.5 < delta T/ delta z <= 1.5)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL E
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0.06	0.10	0.14	0.12	0.09	0.01	0.02	0.00	0.00	0.00	0.00	0.54
NNE	0.01	0.15	0.03	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.25
NE	0.00	0.17	0.12	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.40
ENE	0.03	0.18	0.12	0.09	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.46
E	0.00	0.17	0.31	0.12	0.15	0.05	0.01	0.00	0.00	0.00	0.00	0.81
ESE	0.00	0.13	0.26	0.39	0.53	0.13	0.01	0.01	0.00	0.00	0.00	1.46
SE	0.01	0.15	0.30	0.41	0.93	0.71	0.39	0.09	0.01	0.00	0.00	3.02
SSE	0.02	0.15	0.10	0.29	1.23	1.05	0.48	0.23	0.16	0.01	0.00	3.73
S	0.02	0.08	0.05	0.14	0.76	1.16	0.97	0.47	0.35	0.09	0.00	4.09
SSW	0.01	0.09	0.06	0.07	0.32	0.47	0.59	0.38	0.31	0.03	0.00	2.34
SW	0.03	0.07	0.05	0.07	0.15	0.13	0.12	0.09	0.02	0.00	0.00	0.73
WSW	0.06	0.09	0.07	0.01	0.07	0.06	0.00	0.00	0.00	0.00	0.00	0.36
W	0.02	0.23	0.12	0.08	0.13	0.08	0.01	0.00	0.00	0.00	0.00	0.67
WNW	0.09	0.56	0.29	0.12	0.17	0.07	0.00	0.00	0.00	0.00	0.00	1.30
NW	0.03	0.44	0.44	0.53	0.64	0.24	0.07	0.02	0.02	0.00	0.00	2.44
NNW	0.03	0.23	0.25	0.35	0.55	0.20	0.07	0.00	0.00	0.00	0.00	1.68
Total	0.45	3.00	2.69	2.90	5.80	4.36	2.74	1.30	0.87	0.14	0.00	24.26

Percent of Calms 0.00
Percent of Invalid Hours 0.00
Percent of Valid Hours 24.26

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
MODERATELY STABLE (1.5 < delta T/ delta z <= 4.0)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL F
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	0.02	0.06	0.00	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.23
NNE	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
NE	0.01	0.06	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
ENE	0.00	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
E	0.05	0.15	0.13	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.38
ESE	0.01	0.20	0.17	0.08	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.71
SE	0.06	0.18	0.23	0.26	0.43	0.15	0.03	0.02	0.00	0.00	0.00	1.38
SSE	0.03	0.15	0.09	0.18	0.46	0.07	0.01	0.00	0.00	0.00	0.00	1.00
S	0.02	0.26	0.05	0.06	0.25	0.16	0.01	0.00	0.01	0.00	0.00	0.86
SSW	0.06	0.15	0.02	0.02	0.07	0.12	0.03	0.02	0.00	0.00	0.00	0.49
SW	0.14	0.18	0.06	0.02	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.48
WSW	0.18	0.24	0.02	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.51
W	0.16	0.46	0.09	0.01	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.78
WNW	0.16	0.89	0.20	0.05	0.05	0.02	0.00	0.00	0.00	0.00	0.00	1.36
NW	0.07	0.31	0.15	0.14	0.10	0.07	0.00	0.00	0.00	0.00	0.00	0.87
NNW	0.02	0.12	0.03	0.05	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.37
Total	1.00	3.49	1.32	0.97	1.70	0.67	0.10	0.05	0.01	0.00	0.00	9.31

Percent of Calms 0.37
Percent of Invalid Hours 0.00
Percent of Valid Hours 9.68

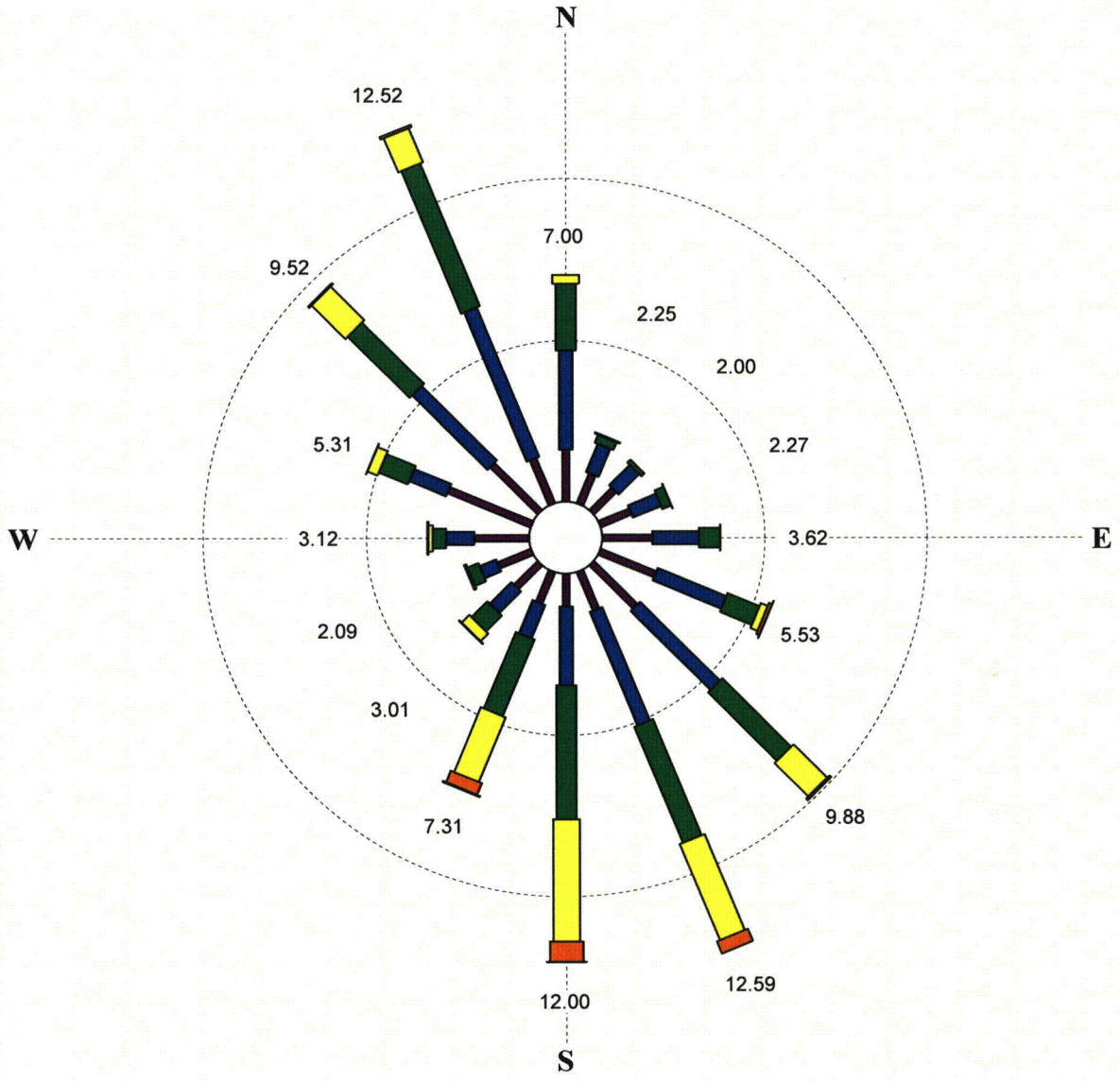
Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
EXTREMELY STABLE (delta T/ delta z > 4.0)
PERIOD OF RECORD: JAN 2012 - DEC 2012
PASQUILL G
WIND SPEED (m/s) AT 10-m LEVEL

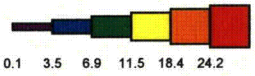
Wind Direct	< 0.5	0.5-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-8.0	8.1-10.0	> 10.0	Total
N	0.06	0.02	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22
NNE	0.03	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
NE	0.06	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
ENE	0.05	0.14	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
E	0.12	0.23	0.03	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.43
ESE	0.10	0.47	0.17	0.07	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.93
SE	0.07	0.38	0.21	0.10	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.85
SSE	0.12	0.31	0.10	0.09	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.67
S	0.09	0.18	0.05	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.40
SSW	0.16	0.28	0.05	0.03	0.05	0.05	0.03	0.00	0.00	0.00	0.00	0.66
SW	0.13	0.20	0.01	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.43
WSW	0.10	0.16	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
W	0.17	0.09	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35
WNW	0.05	0.15	0.07	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.30
NW	0.03	0.06	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
NNW	0.09	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
Total	1.43	2.87	0.89	0.45	0.28	0.10	0.06	0.00	0.00	0.00	0.00	6.07

Percent of Calms 0.39
Percent of Invalid Hours 0.00
Percent of Valid Hours 6.46

Percent of Hours Accounted For: 100.00

Joint Frequency Distribution
2012 FCS Meterological Tower





Wind Speed (Miles Per Hour)

Calms excluded.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.