NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

Radiological Environmental Monitoring Program

2017 Annual Report

January 1, 2017 to December 31, 2017

Prepared by
Teledyne Brown Engineering
2508 Quality Lane
Knoxville, TN 37931-3133

TABLE OF CONTENTS

SECTION/TITLE		PAGE
	Preface	6
I.	Introduction	7
II.	Summary	10
III.	Sampling and Analysis Program	12
IV.	Summary and Discussion of 2017 Analytical Results	17
	A. Airborne Particulates	19
	B. Airborne Iodine	20
	C. Fish	21
	D. Milk – Nearest Producer	22
	E. Milk – Other Producers	23
	F. Ground Water	24
	G. River Water	25
	H. Thermoluminescent Dosimeters	26
	I. Food – Broadleaf Vegetation	27
	J. Shoreline Sediment	28
	K. Errata Data	29
V.	Conclusions	30
VI.	Radiological Environmental Monitoring Program Summary Table - 2017	32
VII.	Complete Data Tables	37
VIII.	References	96

TABLE OF CONTENTS (Cont)

APPENDICES

APPENDIX A – 2017 Land Use Census A-1

APPENDIX B – Summary of Interlaboratory Comparisons B-1

APPENDIX C – Synopsis of Analytical Procedures C-1

APPENDIX D – Detection Limits and Reporting Levels D-1

APPENDIX E – REMP Sampling and Analytical Exceptions E-1

APPENDIX F – Summary of Doses to a Member of the Public Offsite F-1

APPENDIX G – REMP Sample Station Descriptions G-1

APPENDIX H – Annual Radiological Groundwater Protection Program (ARGPP) Report H-1

APPENDIX I – Non-ODAM Required Sampling, Supplementary Stations I-1

LIST OF FIGURES

1. Maps of Sampling Stations 15

TABLE OF CONTENTS (Cont)

LIST OF TRENDING GRAPHS

1. Gross Beta in Air Particulates 19

2. Iodine-131 in Charcoal Filters 20

3. Cesium-137 in Fish 21

4. Iodine-131 and Cesium-137 in Milk – Nearest Producer 22

5. Iodine-131 and Cesium-137 in Milk – Other Producers 23

6. Tritium in Ground Water 24

7. Tritium in River Water 25

8. Thermoluminescent Dosimetry 26

9. Iodine-131 and Cesium-137 in Food – Broadleaf Vegetation 27

10. Cesium-134 and Cesium-137 in Shoreline Sediment 28

TABLE OF CONTENTS (Cont)

LIST OF TABLES

VII-1 Exposure Pathway – Airborne Air Particulate & Charcoal Filters 38

VII-2 Exposure Pathway – Airborne Composite Air Particulate Filters 58

VII-3 Exposure Pathway – Ingestion Fish 68

VII-4 Exposure Pathway – Ingestion Milk Nearest Producer 70

VII-5 Exposure Pathway – Ingestion Milk Other Producer 77

VII-6 Exposure Pathway – Ingestion Water – Ground 78

VII-7 Exposure Pathway – Ingestion Water – River 80

VII-8 Exposure Pathway – Thermoluminescent Dosimetry – TLD 86

VII-9 Exposure Pathway – Ingestion Vegetation – Terrestrial, Broadleaf 88

VII-10 Exposure Pathway – Airborne Shoreline Sediment 94

Preface

This report covers the period of January 1 through December 31, 2017. Personnel of the Nebraska Public Power District made all sample collections. Analyses were performed and reports of analyses were prepared by Teledyne Brown Engineering – Environmental Services and forwarded to Nebraska Public Power District. Environmental Thermoluminescent Dosimeter (TLD) analyses were performed and reports of analyses were prepared by Mirion Technologies.

SECTION I. INTRODUCTION

I. INTRODUCTION

This report contains a complete tabulation of data collected during the period January through December 2017, for the operational Radiological Environmental Monitoring Program (REMP) performed for the Cooper Nuclear Station (CNS) of the Nebraska Public Power District (NPPD) by Teledyne Brown Engineering - Environmental Services.

Cooper Nuclear Station is located in Nemaha County in the southeast corner of Nebraska on the Missouri River. A portion of the site extends into Missouri. The reactor is an 830-megawatt (net electrical) boiling water reactor. Initial criticality was attained on February 21, 1974.

Radiological environmental monitoring began in 1971 before the plant became operational and has continued to the present. The program monitors radiation levels in air, terrestrial and aquatic environments. All samples are collected by NPPD personnel. All samples are shipped for analysis to a contractor's laboratory where there exists special facilities required for measurements of extremely low levels of radioactivity. Teledyne Brown Engineering - Environmental Services has the responsibility for the analyses for Cooper Nuclear Station.

The United States Nuclear Regulatory Commission (USNRC) regulations (10CFR50.34a) require that nuclear power plants be designed, constructed, and operated to keep levels of radioactive material in effluents to unrestricted areas as low as is reasonably achievable (ALARA). Inplant monitoring is used to ensure that release limits are not exceeded. As a precaution against unexpected or undefined environmental processes, which might allow undue accumulation of radioactivity in the environment, a program for monitoring the plant environs is included in NPPD's CNS Offsite Dose Assessment Manual (ODAM).

A. Atmospheric Nuclear Tests and Nuclear Incidents

Three atmospheric nuclear detonations in the People's Republic of China influenced program results significantly in late 1976 and in 1977. Two of these detonations occurred in late 1976 (September 26 and November 17) and one in late 1977 (September 17). As a consequence of these tests elevated activities of gross beta in air particulate filters and iodine-131 in milk were observed throughout most of the United States. No atmospheric nuclear tests have been conducted since 1980, thus no short-lived fission products were detected in air particulate samples.

On April 26, 1986 the fire and explosion of Chernobyl Reactor No. 4 in the Soviet Union resulted in the release of fission products to the atmosphere and worldwide fallout. Following the explosion, elevated levels of gross beta activities in air particulates and iodine-131 in charcoal filters and milk samples were measured. Additionally, in 1986, cesium-137 and the short-lived radionuclides iodine-131, ruthenium-106, and cesium-134 were detected in broadleaf vegetation. Similar results occurred in other areas of the United States and the entire Northern Hemisphere.

B. Monitoring Program Objectives and Data Interpretation

The objective of the monitoring program is to detect and assess the impact of possible releases to the environs of radionuclides from the operations of the Cooper Nuclear Station. This objective requires measurements of low levels of radioactivity equal to or lower than pre-determined limits of detection. In addition the source of the environmental radiation must be established. Sources of environmental radiation include:

(1) Natural background radiation from cosmic rays (beryllium-7).

(2) Terrestrial, primordial radionuclides from the environment (potassium-40, radium-226, thorium-228).

(3) Fallout from atmospheric nuclear tests such as the September 1977 detonation by the Peoples' Republic of China and the atmospheric weapons test of October 16, 1980 (fission products and fusion products).

(4) Releases from nuclear power plants such as CNS (fission products and neutron activation products).

(5) Fallout from the Chernobyl nuclear reactor accident.

Radiation levels measured in the vicinity of an operating power station are compared with preoperational measurements at the same locations to distinguish power plant effects from other sources. Also, results of the monitoring program are related to events known to cause elevated levels of radiation in the environment, e.g., atmospheric nuclear detonations or abnormal plant releases.

SECTION II. SUMMARY

II. SUMMARY

Presented in this report are summaries and discussions of the data generated for the Radiological Environmental Monitoring Program (REMP) for the Cooper Nuclear Station (CNS) of the Nebraska Public Power District (NPPD) for 2017.

The sampling and analyses program is described in Section III. It contains the sampling schedule and required analyses in Table 1 and the site map.

A discussion of each type of sample analyzed and its impact, if any, on the environment is presented in Section IV. Included are graphs of the radionuclides of interest for the past several years and the statistical results for each quarter of the year.

Section V presents the yearly conclusions of the program.

Section VI is the Radiological Environmental Monitoring Program Summary. It contains the yearly summary of the program with the total number of samples of each type analyzed. It lists the yearly average and range for the control locations versus the indicator locations and the number of detections per total number of samples. It identifies the station with the highest yearly average, the distance and location of that station and provides the range of detection.

Section VII contains the complete data tables for the period.

References are presented in Section VIII.

SECTION III. SAMPLING AND ANALYSIS PROGRAM

III. SAMPLING AND ANALYSES PROGRAM

The 2017 sampling and analyses program is described in Table 1. Teledyne Brown Engineering - Environmental Services has a comprehensive quality assurance/quality control program designed to assure the reliability of data obtained. The results for the 2017 Interlaboratory Comparison Program conducted by Analytics, Inc., the Department of Energy's (DOE) Mixed Analyte Performance Evaluation Program (MAPEP) and Environmental Resource Associates (ERA) are contained in Appendix B.

Sampling locations are indicated in the map labeled Figure 1. The sample types collected at each location and the approximate distance and direction from the reactor elevated release point are specified.

The annual land use census for 2017 is described in Appendix A. There were no milk animals found within three miles of CNS in 2017 and no evidence of potable water use from the river. The nearest garden to CNS is in sector P, 1.7 miles from CNS. From year to year there is a slight variation in the number of gardens tended. The nearest resident to CNS is in sector Q, 0.9 miles from CNS.

All of the required 2017 environmental monitoring, including sampling and analyses, were conducted as specified in Table D4.1-1 of the CNS Offsite Dose Assessment Manual (ODAM), except as noted in Appendix E, REMP Sampling and Analytical Exceptions table.

TABLE 1

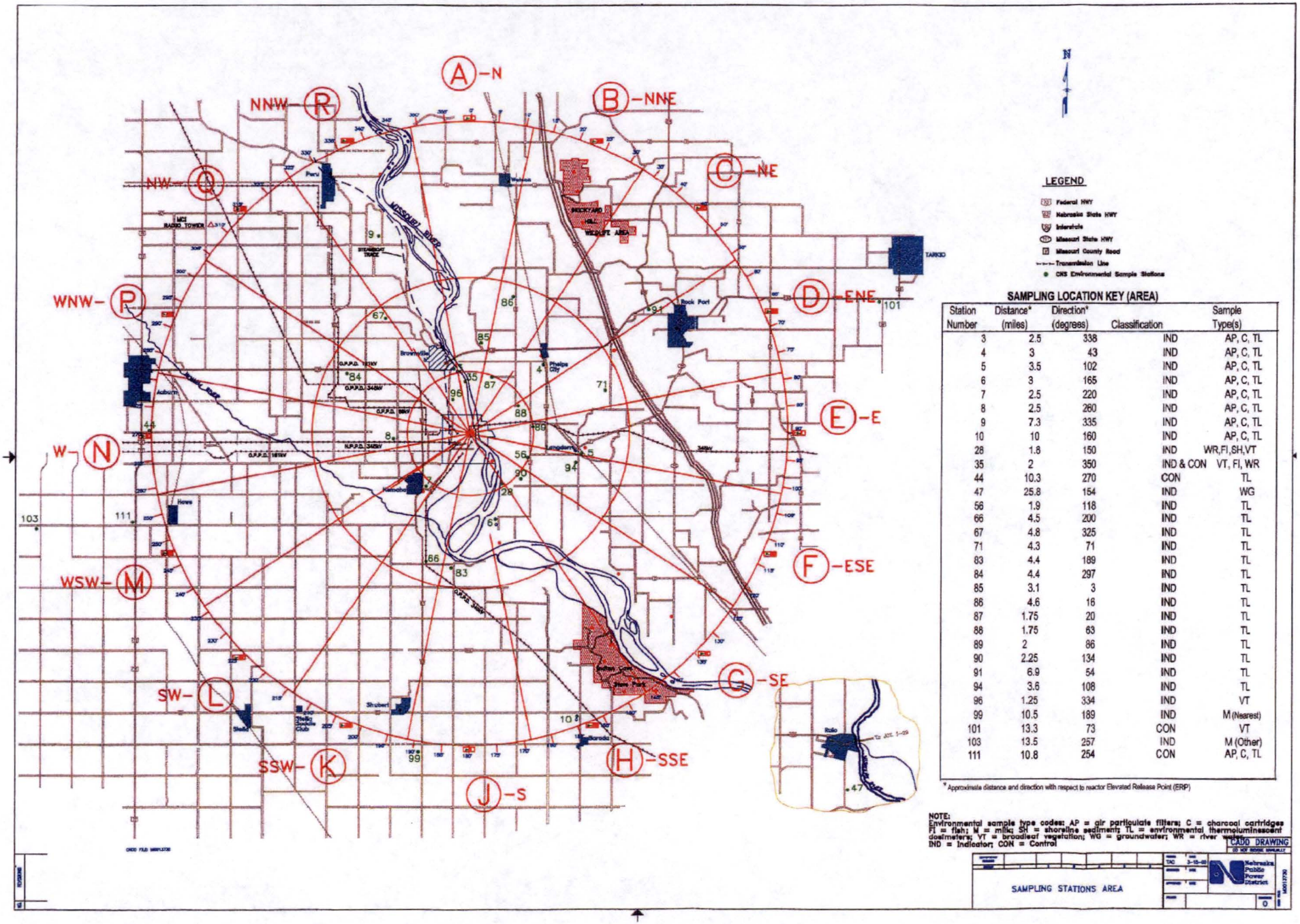
NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

Environmental Radiation Surveillance Program

Sampling Schedule and Analyses

Sample Type	***Station***	***Frequency***	***Analyses***
Airborne/ Particulate	1-10	Once per 7 days	Gross beta. Gamma Isotopic on quarterly composite of each station, and on each sample in which gross beta activity is >10 times the yearly mean of control samples
Airborne/Iodine	1-10	Once per 7 days	I-131
Milk / Nearest Producer peak pasture only	99	Once per 15 days	I-131 (low level), Gamma Isotopic analysis of each sample
River Water	28, 35	Once per 31 days	Gamma Isotopic, each sample Tritium on quarterly composite
Milk/ Nearest Producer Non-peak pasture	99	Once per 31 days	I-131 (low level), Gamma Isotopic analysis of each sample
Food Products / Broadleaf Vegetation	35, 96, 101	Monthly when required	I-131 (low level), Gamma Isotopic analysis of each sample
Background Radiation Thermoluminescent Dosimeters	1-10, 20, 44, 56, 58, 59, 66, 67, 71, 79-91, 94	Once per 92 days	TLD Readout (gamma dose)
Groundwater	11, 47	Once per 92 days	I-131 (low level), Gamma Isotopic, Tritium
Fish (Summer and Fall)	28, 35	Two times per year	Gamma Isotopic on edible portions
Shoreline Sediment	28, 35	Two times per year	Gamma Isotopic

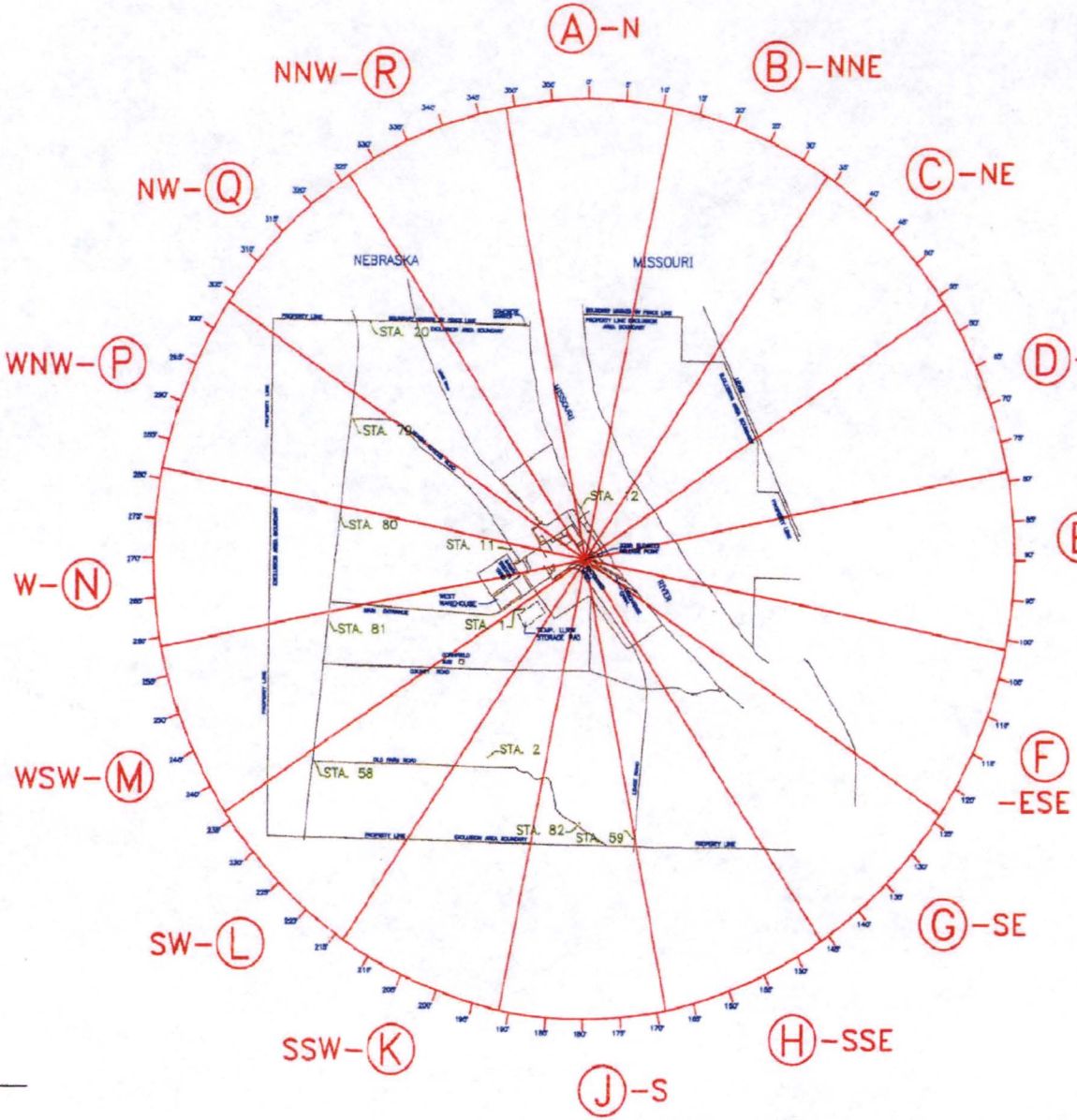


SAMPLING LOCATION KEY (AREA)

Station Number	Distance* (miles)	Direction* (degrees)	Classification	Sample Type(s)
3	2.5	338	IND	AP, C, TL
4	3	43	IND	AP, C, TL
5	3.5	102	IND	AP, C, TL
6	3	165	IND	AP, C, TL
7	2.5	220	IND	AP, C, TL
8	2.5	260	IND	AP, C, TL
9	7.3	335	IND	AP, C, TL
10	10	160	IND	AP, C, TL
28	1.8	150	IND	WR,FI,SH,VT
35	2	350	IND & CON	VT, FI, WR
44	10.3	270	CON	TL
47	25.8	154	IND	WG
56	1.9	118	IND	TL
66	4.5	200	IND	TL
67	4.8	325	IND	TL
71	4.3	71	IND	TL
83	4.4	189	IND	TL
84	4.4	297	IND	TL
85	3.1	3	IND	TL
86	4.6	16	IND	TL
87	1.75	20	IND	TL
88	1.75	63	IND	TL
89	2	86	IND	TL
90	2.25	134	IND	TL
91	6.9	54	IND	TL
94	3.6	108	IND	TL
96	1.25	334	IND	VT
99	10.5	189	IND	M (Nearest)
101	13.3	73	CON	VT
103	13.5	257	IND	M (Other)
111	10.8	254	CON	AP, C, TL

* Approximate distance and direction with respect to reactor Elevated Release Point (ERP)

NOTE:
Environmental sample type codes: AP = air particulate filters; C = charcoal cartridges FI = fish; M = milk; SH = shoreline sediment; TL = environmental thermoluminescent dosimeters; VT = broadleaf vegetation; WG = groundwater; WR = river water; IND = Indicator; CON = Control



N

LEGEND

- Federal HWY
- Nebraska State HWY
- Interstate
- Missouri State HWY
- Missouri County Road
- Transmission Line
- CNS Environmental Sample Stations

SAMPLING LOCATION KEY (SITE)

Station Number	Distance* (miles)	Direction* (degrees)	Classification	Sample Type(s)
1	0.1	230	IND	AP, C, TL
2	0.75	210	IND	AP, C, TL
11	0.15	275	IND	WG
12	0.1	355	CON	WR
20	0.96	315	IND	TL
58	1.1	234	IND	TL
59	1	170	IND	TL
79	0.85	299	IND	TL
80	0.75	280	IND	TL
81	0.8	255	IND	TL
82	0.8	185	IND	TL

* Approximate distance and direction with respect to reactor Elevated Release Point (ERP)

NOTE:
Environmental sample type codes: AP = air particulate filters; C = charcoal cartridges FI = fish; M = milk; SH = shoreline sediment; TL = environmental thermoluminescent dosimeters; VT = broadleaf vegetation; WG = groundwater; WR = river water.

CADD DRAWING
DO NOT REVISE MANUALLY

MAP OF SAMPLING STATIONS SITE

Nebraska Public Power District

REVISIONS

16

SECTION IV. SUMMARY AND DISCUSSION OF 2017 ANALYTICAL RESULTS

IV. SUMMARY AND DISCUSSION OF 2017 ANALYTICAL RESULTS

Data from the radiological analyses of environmental media collected during 2017 are tabulated and discussed in section A through J. The procedures and specifications followed in the laboratory for these analyses are as required in the Teledyne Brown Engineering Quality Assurance manual and are explained in the Teledyne Brown Engineering Analytical Procedures. A synopsis of analytical procedures used for the environmental samples is provided in Appendix C. In addition to internal quality control measures performed by Teledyne Brown Engineering, the laboratory also participates in an Interlaboratory Comparison Program. Participation in this program ensures that independent checks on the precision and accuracy of the measurements of radioactive material in environmental samples are performed. The results of the Interlaboratory Comparison are provided in Appendix B.

Radiological analyses of environmental media characteristically approach and frequently fall below the detection limits of state-of-the-art measurement methods. The "less than" values in the data tables were calculated from each specific analysis and are dependent on sample size, detector efficiency, length of counting time, chemical yield (when appropriate) and the radioactive decay factor from time of counting to time of collection. Teledyne Brown Engineering's analytical methods meet or are below the Lower Limit of Detection (LLD) requirements given in Table 2 of the USNRC Branch Technical Position, Radiological Monitoring Acceptable Program (November 1979, Revision 1). Appendix C contains a discussion of the LLD formulas.

The following is a discussion and summary of the results of the environmental measurements taken during the 2017 reporting period:

A. Airborne Particulates

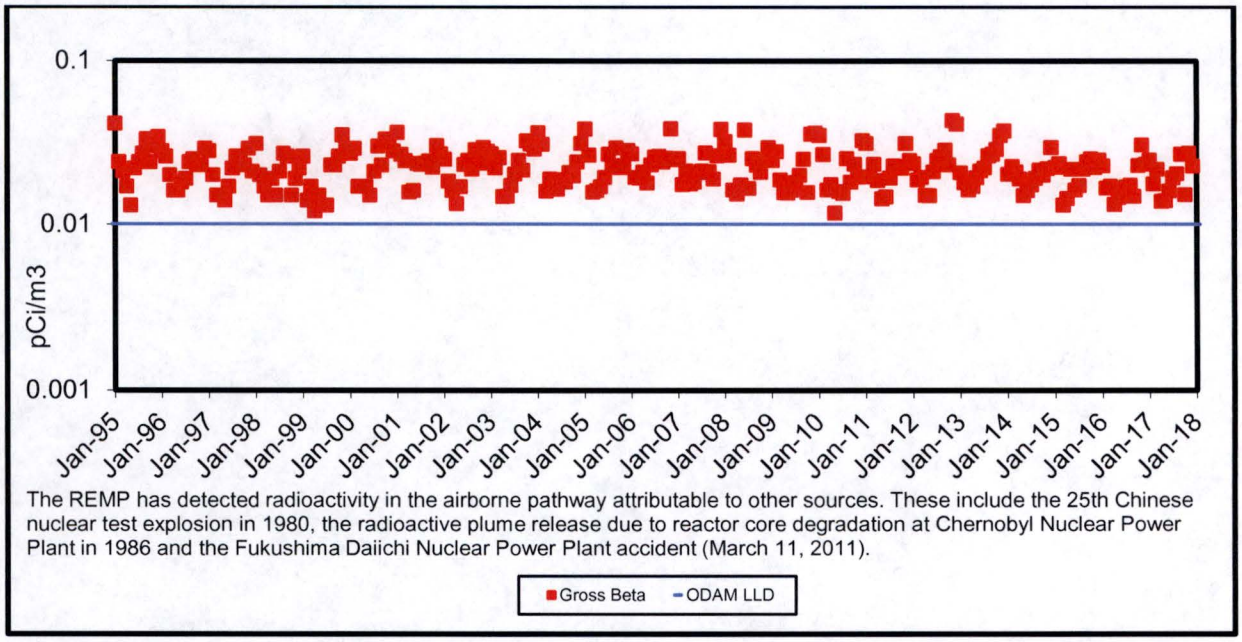
Gross beta activity was observed in 515 of the 520 indicator samples collected during 2017. The average concentration was 0.028 pCi/m^3 with a range of 0.006 to 4.070 pCi/m^3. The results of the gross beta activities are presented in Section VII-1 and Trending Graph 1. The gross beta activities for 2017 were comparable to levels measured in the previous several years. Prior to that period the gross beta activities were higher due to atmospheric nuclear weapons testing performed in other countries. The preoperational period of 1971 through 1974 averaged 0.098 pCi/m^3 gross beta.

Air particulate filters were collected weekly and composited by locations on a quarterly basis. They were analyzed by gamma ray spectroscopy. The results are presented in Section VII-2. Beryllium-7, which is produced continuously in the upper atmosphere by cosmic radiation, was measured in all 40 of the composite samples. The indicator locations had an average concentration of 0.13 pCi/m^3 with a range of 0.053 to 0.211 pCi/m^3. During the preoperational period, beryllium-7 was measured at comparable levels. All other gamma emitters were below the detection limits.

TRENDING GRAPH 1

GROSS BETA IN AIR PARTICULATES

MONTHLY AVERAGE – ALL LOCATIONS



The REMP has detected radioactivity in the airborne pathway attributable to other sources. These include the 25th Chinese nuclear test explosion in 1980, the radioactive plume release due to reactor core degradation at Chernobyl Nuclear Power Plant in 1986 and the Fukushima Daiichi Nuclear Power Plant accident (March 11, 2011).

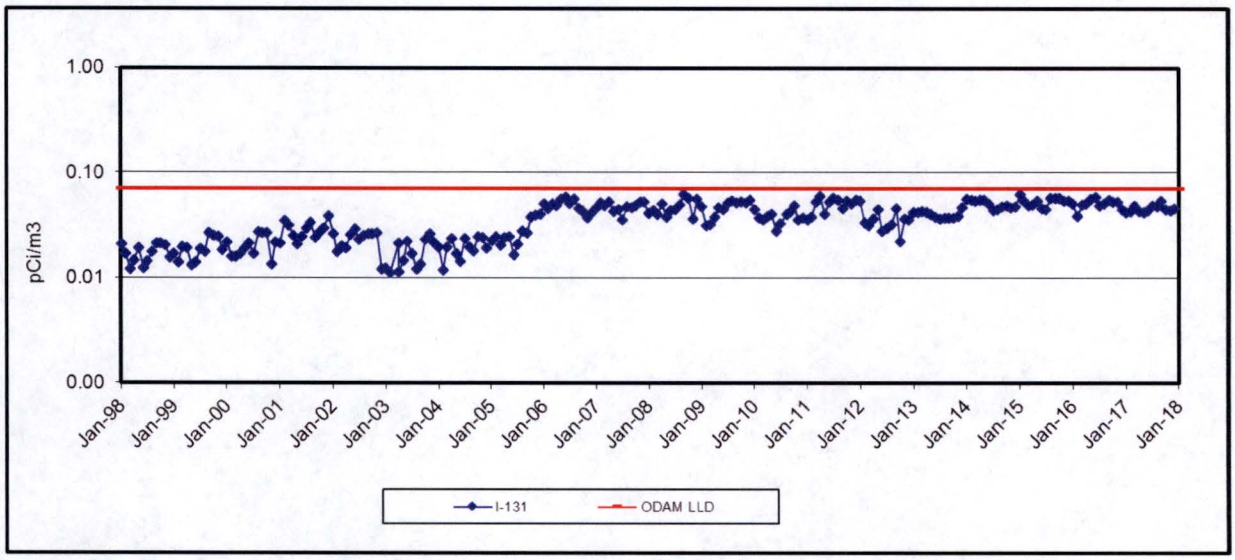
B. Airborne Iodine

Charcoal cartridges used to collect airborne iodine were collected weekly and analyzed by gamma spectrometry for iodine-131. Stations 1 through 10 were monitored. The results are presented in Section VII-1 and Trending Graph 2. Iodine-131 was below the lower limit of detection in 514 out of 520 samples.

TRENDING GRAPH 2

IODINE-131 IN CHARCOAL FILTERS

MONTHLY AVERAGE – ALL LOCATIONS



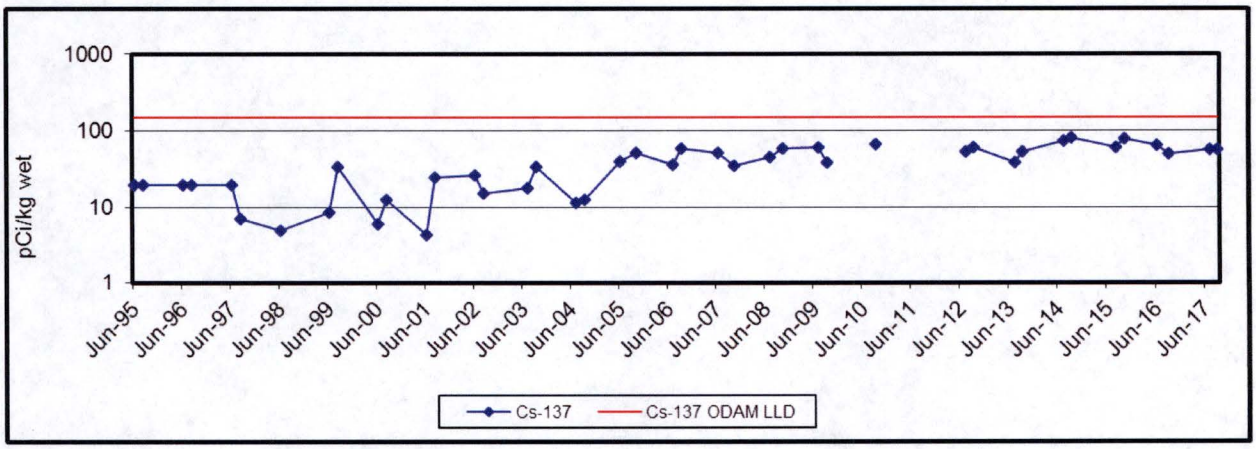
Trending Graph 2 represents minimum detectable concentration (MDC) results. This graph has the ODAM LLD trend line, showing the MDC results as below the ODAM required LLDs. The upward trend indicates shortened detector count time in order to maximize the number of samples counted each day, and is not an indication that the trend will continue to increase above the LLD limit.

C. *Fish*

Aquatic biota can be sensitive indicators of radionuclide accumulation in the environment because of their ability to concentrate certain chemical elements, which have radioisotopes. The results are presented in Table VII-3 and Trending Graph 3. Seven samples of fish were collected during the summer and fall of 2017. A middle-top feeding fish (carp) and a bottom feeding fish (catfish) were collected in July and September. These samples were analyzed by gamma ray spectroscopy. Naturally occurring potassium-40 was detected in all samples. The average concentration at the upstream control location was 2,816 pCi/kg (wet weight) with a range of 2,087 to 3,764 pCi/kg (wet weight). The average concentration for the indicator samples was 3,098 pCi/kg (wet weight) with a range of 2,129 to 4,114 pCi/kg (wet weight). The preoperational period of 1971 through 1974 averaged 2,400 pCi/kg potassium-40. All other gamma emitters were below their detection levels.

TRENDING GRAPH 3

CESIUM-137 IN FISH
ALL LOCATIONS



Trending Graph 3 represents minimum detectable concentration (MDC) results. This graph has the ODAM LLD trend line, showing the MDC results as below the ODAM required LLDs. The upward trend indicates shortened detector count time in order to maximize the number of samples counted each day, and is not an indication that the trend will continue to increase above the LLD limit.
July samples were not collected in July 2010.
Flooding of the Missouri River prevented collection of fish in 2011.

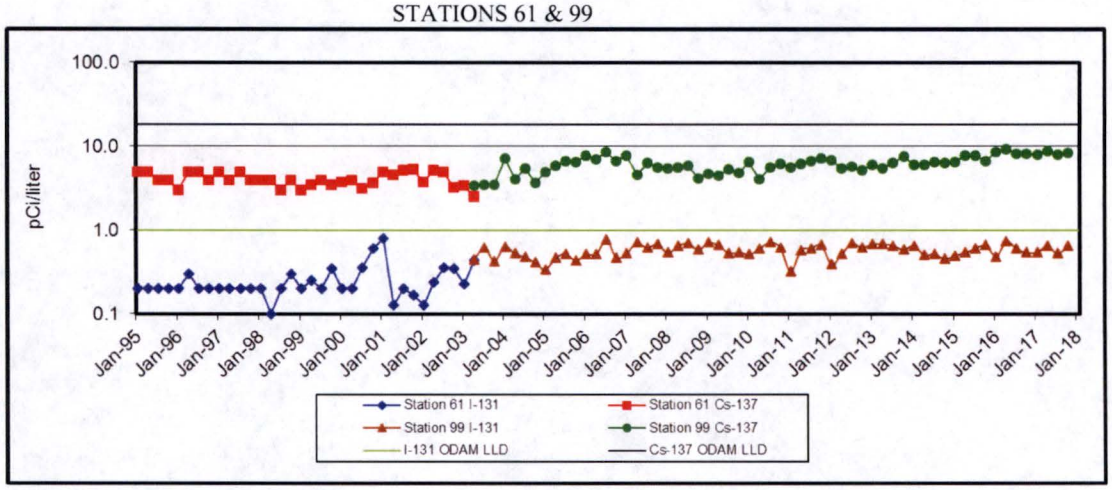
D. *Milk – Nearest Producer*

Milk samples are collected once every 15 days in peak pasture season and once every 31 days the rest of the year from Station 99. The results are presented in Table VII-4 and Trending Graph 4. Twenty five samples were analyzed by gamma ray spectroscopy and for low-level iodine-131 by radiochemical separation. All iodine-131 results were below the required lower limit of detection. Naturally occurring potassium-40 was measured in all samples with an average concentration of 1,301 pCi/L and a range of 1,114 to 1,502 pCi/L. Thorium-228, a naturally occurring radionuclide, was detected in one of the 25 samples and had a concentration of 7.6 pCi/L. All other gamma emitters were below their detection levels. The operation of the Cooper Nuclear Station has no discernable impact on milk samples.

TRENDING GRAPH 4

IODINE-131 AND CESIUM-137 IN MILK – NEAREST PRODUCER

STATIONS 61 & 99



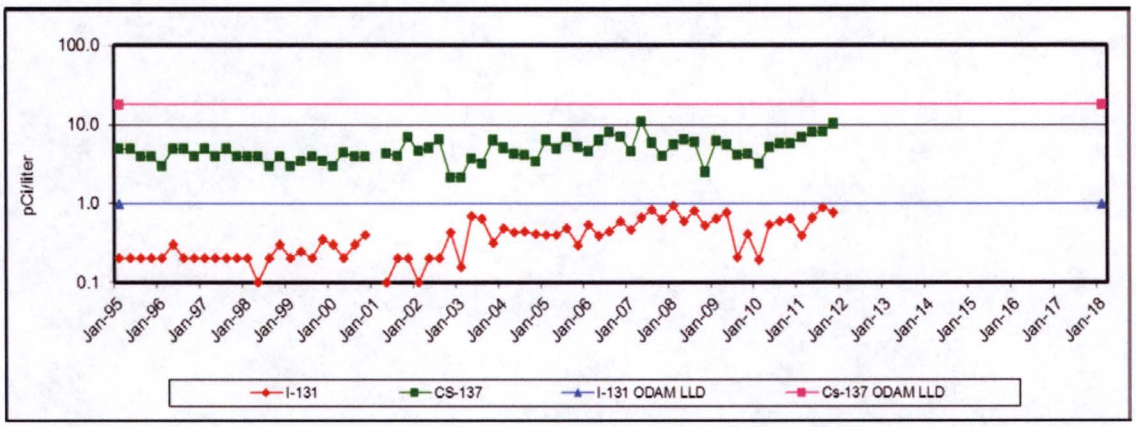
Station 61 went out of business in May of 2003. Station 99 replaced station 61 in May of 2003.
Trending Graph 4 represents minimum detectable concentration (MDC) results. This graph has the ODAM LLD trend line, showing the MDC results as below the ODAM required LLDs. The upward trend indicates shortened detector count time in order to maximize the number of samples counted each day, and is not an indication that the trend will continue to increase above the LLD limit.

E. Milk – Other Producers

Milk – Other Producer location 103 went out of business in 2011. Location 103 will remain as an option for sample collection if conditions change.

TRENDING GRAPH 5

IODINE-131 AND CESIUM-137 IN MILK – OTHER PRODUCERS
QUARTERLY AVERAGE – ALL LOCATIONS



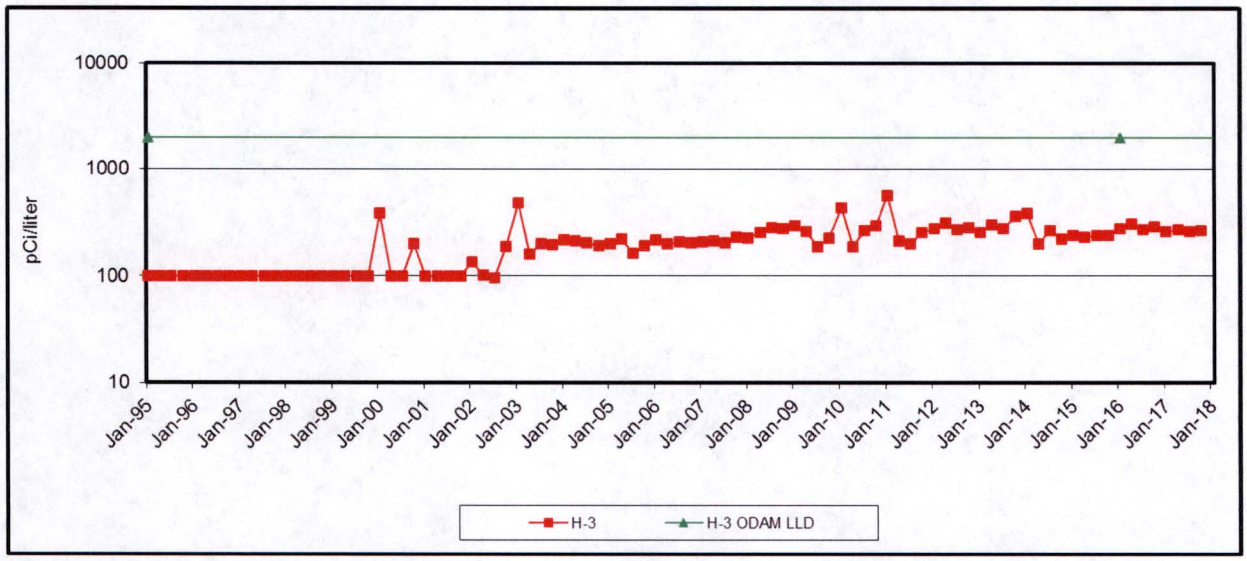
Due to delay in analysis, sample results for I-131 for the first quarter of 2001 were excluded and are not plotted.
Milk station 102 went out of business April 2006. Vegetation samples are taken in lieu of milk.
Trending Graph 5 represents minimum detectable concentration (MDC) results. This graph has the ODAM LLD trend line, showing the MDC results as below the ODAM required LLDs. The upward trend indicates shortened detector count time in order to maximize the number of samples counted each day, and is not an indication that the trend will continue to increase above the LLD limit.

F. Ground Water

Groundwater was collected from two stations quarterly and analyzed for tritium, low level iodine-131 and for gamma emitting radionuclides. Station 11 is located 0.15 miles from the plant and station 47 is 25.8 miles from the plant. The results are presented in Table VII-6 and Trending Graph 6. All tritium and low level iodine results were below the required lower limit of detection. All gamma emitters were below their detection levels.

TRENDING GRAPH 6

TRITIUM IN GROUND WATER
QUARTERLY AVERAGE – ALL LOCATIONS

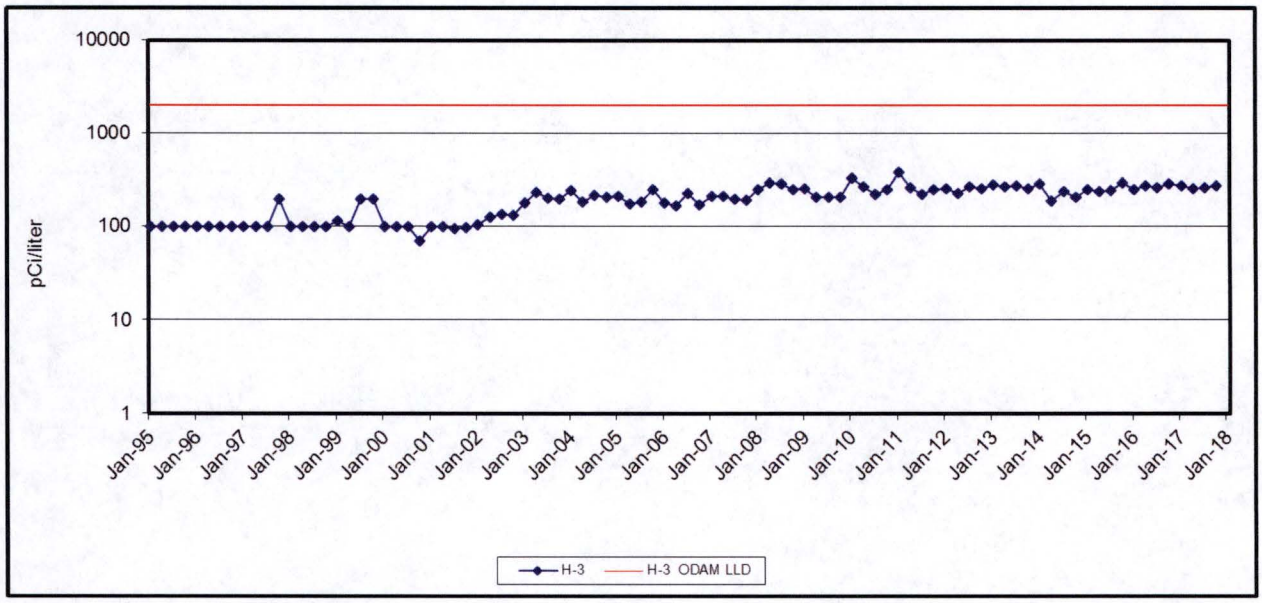


Trending Graph 6 represents minimum detectable concentration (MDC) results. This graph has the ODAM LLD trend line, showing the MDC results as below the ODAM required LLDs. The upward trend indicates shortened detector count time in order to maximize the number of samples counted each day, and is not an indication that the trend will continue to increase above the LLD limit.

G. *River Water*

River water was collected monthly and monitored for gamma emitting radionuclides and tritium. The monthly samples are composited quarterly and analyzed for tritium. The results are presented in Table VII-7 and Trending Graph 7. All tritium results were below the required lower limit of detection. All the gamma emitters were below their detection levels.

TRENDING GRAPH 7
TRITIUM IN RIVER WATER
QUARTERLY AVERAGE – ALL LOCATIONS



Trending Graph 7 represents minimum detectable concentration (MDC) results. This graph has the ODAM LLD trend line, showing the MDC results as below the ODAM required LLDs. The upward trend indicates shortened detector count time in order to maximize the number of samples counted each day, and is not an indication that the trend will continue to increase above the LLD limit.

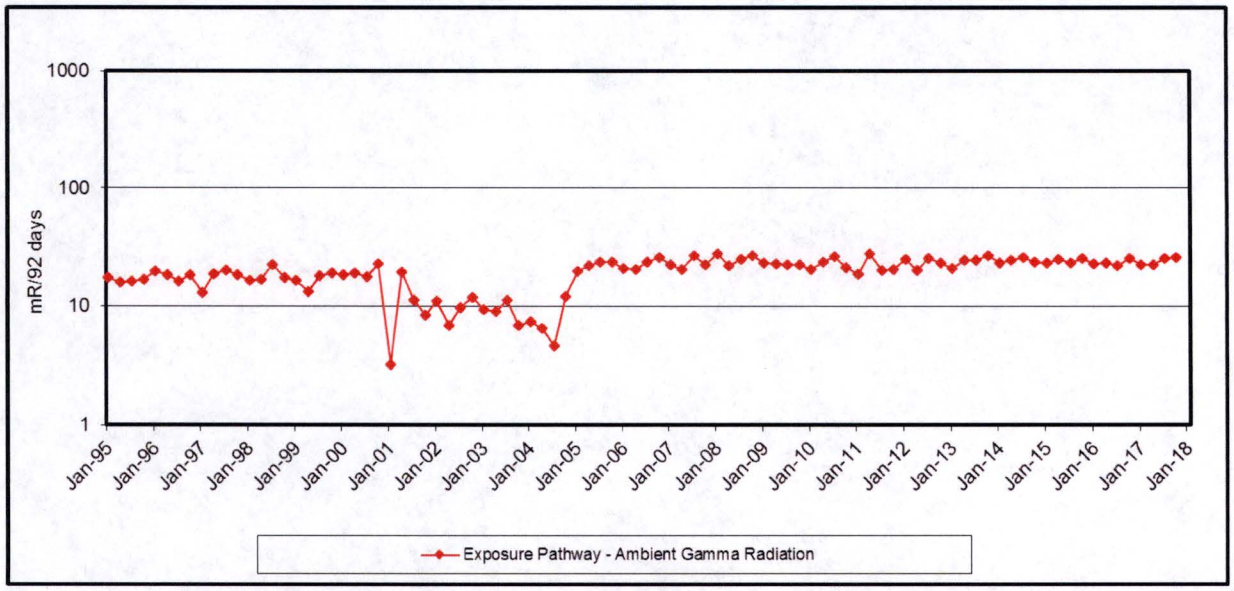
H. Thermoluminescent Dosimeters

Thermoluminescent dosimeters (TLDs) determine environmental radiation doses and the results are presented in Table VII-8 and Trending Graph 8. Ambient radiation was monitored at 32 locations within an 11 mile radius of the Cooper Nuclear Station and collected quarterly. The quarterly average for the indicator locations was 24.1 millirem/quarter and a range from 20.2 to 28.5 millirem/quarter. The control station 44, which is located 10.3 miles, 270 degrees, had an average of 25.9 millirem/quarter and a range from 23.2 to 28.4 millirem/quarter. The highest station was Station 83 with an average of 26.0 millirem/quarter and a range from 24.2 to 27.9 millirem/quarter. The preoperational period of 1971 through 1974 averaged 37.0 millirem/quarter; which is the preoperational four year average. Current year TLD averages deviate from the preoperational averages due to instrument variations from previous vendors.

The data from year to year is in good agreement and indicates no adverse changes in radiation exposure to the population near the Cooper Nuclear Station.

TRENDING GRAPH 8

THERMOLUMINESCENT DOSIMETRY
QUARTERLY AVERAGE – ALL LOCATIONS



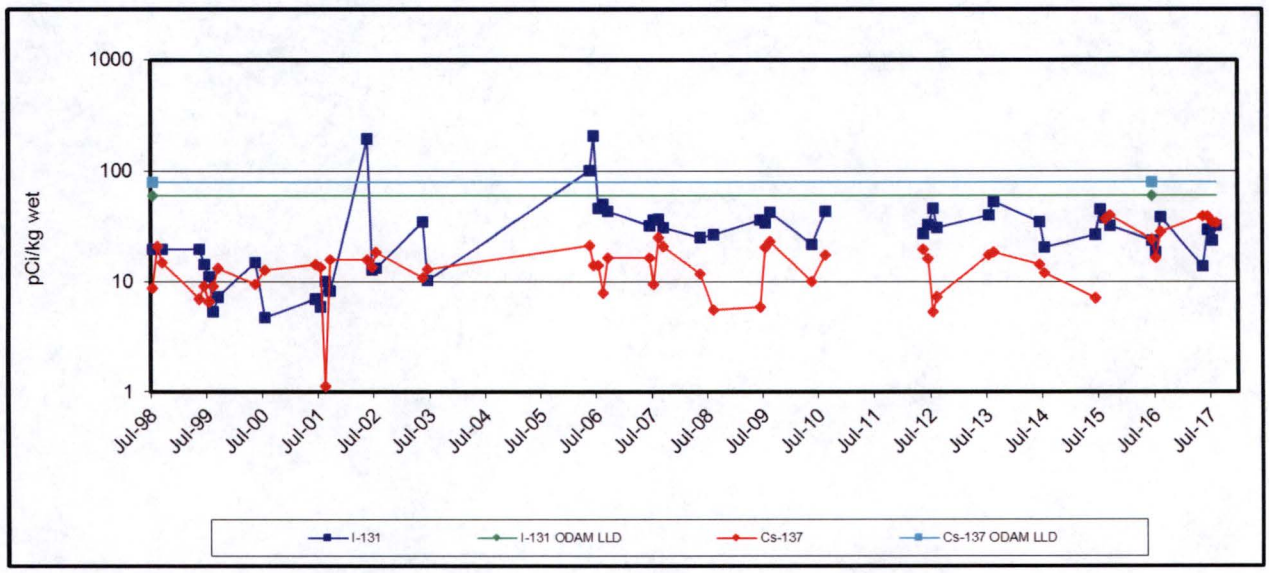
First quarter 2001 TLD data low but still within acceptable limits due to possible dry conditions.

I. Food – Broadleaf Vegetation

Eight broadleaf vegetation samples were collected from two indicator locations and one control location in May, June, July, and August during 2017. The samples were analyzed by gamma ray spectroscopy and for low-level iodine-131 by radiochemical separation. The results are presented in Table VII-9 and Trending Graph 9. Beryllium-7, which is produced continuously in the upper atmosphere by cosmic radiation was measured in all 8 samples analyzed. The average concentration for the indicator locations was 968 pCi/kg (wet weight) with a range of 927 to 1,008 pCi/kg wet. The control location had an average concentration of 680 pCi/kg (wet weight) and a range of 585 to 774 pCi/kg (wet weight). Naturally occurring potassium-40 was measured in all 8 samples analyzed. The concentration for the indicator locations was 4,522 pCi/kg (wet weight) with a range of 3,204 to 6,099 pCi/kg wet. All other gamma emitters were below their detection levels. The operation of the Cooper Nuclear Station has no discernable impact on broadleaf vegetation samples.

TRENDING GRAPH 9

IODINE-131 AND CESIUM-137 IN FOOD – BROADLEAF VEGETATION
ALL LOCATIONS



The low Cs-137 value reported in July 2001 was due to the wrong aliquot being entered for the gamma analysis resulted in an invalid analysis and is not reported

Due to delay in sample receipt, the I-131 had decayed away, resulting in an invalid analysis for May 2002 and is not reported.

Milk samples were collected in lieu of broadleaf vegetation samples in 2004 and 2005.

Due to delay in counting sample, the I-131 had decayed away, resulting in an invalid analysis for June 2006 and is not reported. The I-131 by chemical separation met required I-131 LLD.

Trending Graph 9 represents minimum detectable concentration (MDC) results. This graph has the ODAM LLD trend line, showing the MDC results as below the ODAM required LLDs. The upward trend indicates shortened detector count time in order to maximize the number of samples counted each day, and is not an indication that the trend will continue to increase above the LLD limit.

Broadleaf vegetation samples were not available for collection in 2011 due to Missouri River flooding.

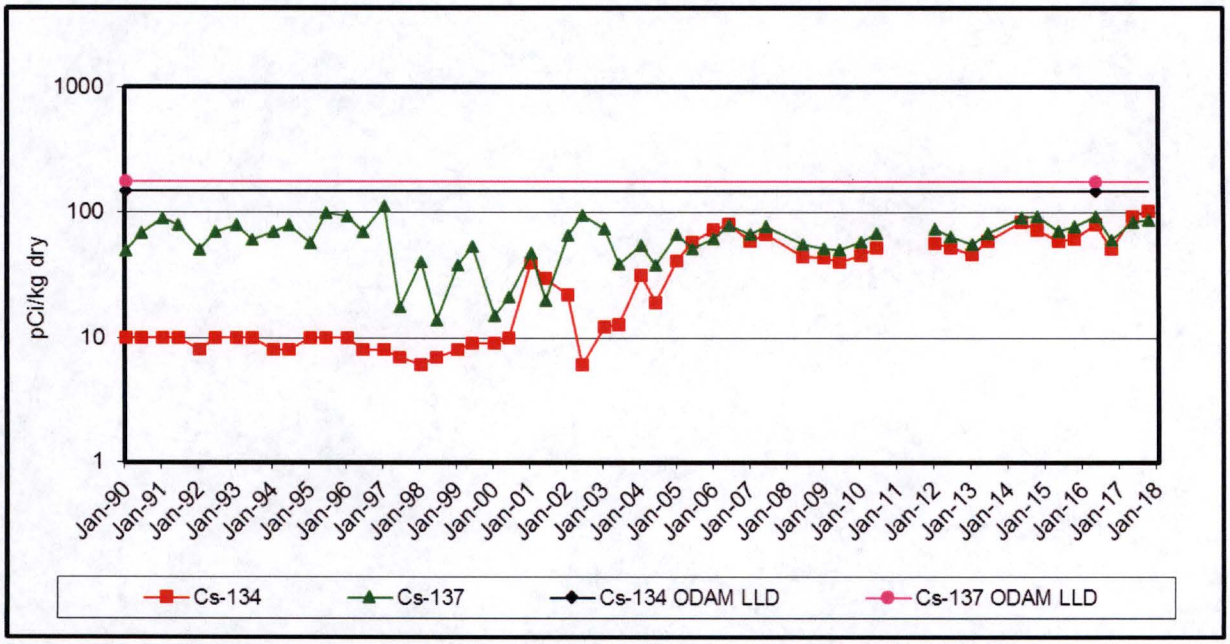
Graph data extends through August 2017 only.

J. Shoreline Sediment

Sediment samples were collected during May and October from indicator location 28 and control location 35 and were analyzed by gamma spectrometry. The results are presented in Table VII-10 and Trending Graph 10. A number of naturally occurring radionuclides were detected in these samples. Naturally occurring potassium-40 was observed in all four samples. The average concentration for the control location was 16,540 pCi/kg (dry weight) and a range of 15,430 to 17,650 pCi/kg (dry weight). The average concentration for the indicator location was 15,495 pCi/kg (dry weight) and a range of 14,050 to 16,940 pCi/kg (dry weight). Radium-226 was observed in one of the control samples with a concentration of 2,006 pCi/kg (dry weight) and both indicator samples with a concentration of 4,123 pCi/kg (dry weight) and a range of 2,310 to 5,936 pCi/kg (dry weight). Thorium-228 was observed in all four samples. The average concentration for the control location was 959 pCi/kg (dry weight) with a range of 836 to 1,082 pCi/kg (dry weight). The average concentration for the indicator location was 1,007 pCi/kg (dry weight) with a range of 977 to 1,037 pCi/kg (dry weight). All other gamma emitters were below their detection limits.

TRENDING GRAPH 10

CESIUM-134 AND CESIUM-137 IN SHORELINE SEDIMENT
STATIONS 28 AND 35



Trending Graph 10 represents minimum detectable concentration (MDC) results. Only one sample was collected in 2008. This graph has the ODAM LLD trend line, showing the MDC results as below the ODAM required LLDs. The upward trend indicates shortened detector count time in order to maximize the number of samples counted each day, and is not an indication that the trend will continue to increase above the LLD limit. Graph data extends through October 2017 only. Shoreline sediment samples were not available for collection due to flooding of the Missouri River in 2011.

K. Errata Data

There was no errata data for 2017.

SECTION V. CONCLUSIONS

V. CONCLUSIONS

The results of the 2017 Radiological Environmental Monitoring Program (REMP) for the Cooper Nuclear Station (CNS) of the Nebraska Public Power District (NPPD) have been presented. The report contains data tables, summaries, and discussions of the data and trending graphs.

Naturally occurring radioactivity and residual traces of fallout were observed in sample media in the expected ranges. They have been discussed individually in the text. Observed radioactivity was at very low concentrations.

The results of the analyses have been presented. Based on the evidence of the Radiological Environmental Monitoring Program, the Nebraska Public Power District, Cooper Nuclear Station has had no discernable radiological impact on the environment and is operating within regulatory limits.

SECTION VI. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY TABLE - 2017

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Cooper Nuclear Station
Location of Facility Nemaha Nebraska
(County/State)

Docket No. 50-298
Reporting Period January 1 2017 to December 31 2017

Medium of Pathway Sampled (Unit of Measurement)	Type & Total No. of Analysis Performed		Lower Limit of Detection(1) (LLD)	All Indicator Locations Mean(2) Range(2)	Location with Highest Annual Mean: Name	Mean(2) Range(2)	Control Location Mean(2) Range(2)	No. of Reportable Occurrences
Air Particulate (pCi/m^3)	GR-B	520	0.01	.028(515/520) (.006/4.07)	Sta. 6 3.0 mi.	.099(52/52) (.006/4.07)	NA(0/0) (NA-NA)	0
	BE-7	40	NA	.125(40/40) (.053/.211)	Sta. 5 3.5 mi.	.137(4/4) (.094/.202)	NA(0/0) (NA-NA)	
	K-40	40	NA	ND(0/40) (ND-ND)	NA	NA(0/0) (NA-NA)	NA(0/0) (NA-NA)	
	CO-60	40	NA	ND(0/40) (ND-ND)	NA	NA(0/0) (NA-NA)	NA(0/0) (NA-NA)	
	TH-228	40	NA	ND(0/40) (ND-ND)	NA	NA(0/0) (NA-NA)	NA(0/0) (NA-NA)	
Air Iodine (pCi/m^3)	I-131	520	0.07	ND(0/520) (ND-ND)	NA	NA(0/0) (NA-NA)	NA(0/0) (NA-NA)	0
Fish (pCi/kg wet)	K-40	7	NA	3098(3/3) (2129/4114)	Sta. 28 1.8 mi.	3098(3/3) (2129/4114)	2816(4/4) (2087/3764)	0
	CO-60	7	130	ND(0/3) (ND-ND)	NA	NA(0/0) (NA-NA)	ND(0/4) (ND-ND)	

(1) Nominal Lower Limit of Detection (LLD), as stated in ODAM.

(2) Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location indicated in brackets().

ND = Non Detectable.

NA = Not Applicable.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Cooper Nuclear Station
Location of Facility Nemaha Nebraska
(County/State)

Docket No. 50-298
Reporting Period January 1 2017 to December 31 2017

Medium of Pathway Sampled (Unit of Measurement)	Type & Total No. of Analysis Performed		Lower Limit of Detection(1) (LLD)	All Indicator Locations Mean(2) Range(2)	Location with Highest Annual Mean Name		Mean(2) Range(2)	Control Location Mean(2) Range(2)	No. of Reportable Occurrences
Fish (cont'd) (pCi/kg wet)	CS-137	7	150	ND(0/3) (ND-ND)	NA		NA(0/0) (NA-NA)	ND(0/4) (ND-ND)	
	TH-228	7	NA	ND(0/3) (ND-ND)	NA		NA(0/0) (NA-NA)	ND(0/4) (ND-ND)	
Milk Nearest (pCi/L)	I-131	25	1	ND(0/25) (ND-ND)	NA		NA(0/0) (NA-NA)	NA(0/0) (NA-NA)	0
	K-40	25	NA	1300 (25/25) (1114/1502)	Sta. 99	10.5 mi.	1300 (25/25) (1114/1502)	NA(0/0) (NA-NA)	
	RA-226	25	NA	ND(0/25) (ND-ND)	NA		NA(0/0) (NA-NA)	NA(0/0) (NA-NA)	
	TH-228	25	NA	7.6(1/25) NA-NA	Sta. 99	10.5 mi.	7.6(1/25) NA-NA	NA(0/0) (NA-NA)	
Water - Ground (pCi/L)	I-131	8	1	ND(0/8) (ND-ND)	NA		NA(0/0) (NA-NA)	NA(0/0) (NA-NA)	0
	H-3	8	2000	ND(0/8) (ND-ND)	NA		NA(0/0) (NA-NA)	NA(0/0) (NA-NA)	

(1) Nominal Lower Limit of Detection (LLD), as stated in ODAM.

(2) Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location indicated in brackets().

ND = Non Detectable.

NA = Not Applicable.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Cooper Nuclear Station
Location of Facility Nemaha Nebraska
(County/State)

Docket No. 50-298
Reporting Period January 1 2017 to December 31 2017

Medium of Pathway Sampled (Unit of Measurement)	Type & Total No. of Analysis Performed		Lower Limit of Detection(1) (LLD)	All Indicator Locations Mean(2) Range(2)	Location with Highest Annual Mean Name	Mean(2) Range(2)	Control Location Mean(2) Range(2)	No. of Reportable Occurrences
Water - Ground (cont'd) (pCi/L)	K-40	8	NA	ND(0/8) (ND-ND)	NA	NA(0/0) (NA-NA)	NA(0/0) (NA-NA)	
	TH-228	8	NA	ND(0/8) (ND-ND)	NA	NA(0/0) (NA-NA)	NA(0/0) (NA-NA)	
River Water (pCi/L)	H-3	32	2000	ND(0/16) (ND-ND)	NA	NA(0/0) (NA-NA)	ND(0/16) (ND-ND)	0
	K-40	24	NA	ND(0/12) (ND-ND)	NA	NA(0/0) (NA-NA)	ND(0/12) (ND-ND)	
	TH-228	24	NA	ND(0/12) (ND-ND)	NA	NA(0/0) (NA-NA)	ND(0/12) (ND-ND)	
Thermoluminescence Dosimeter (mR/Quarter)	Gamma Dose Quarterly	127	NA	24.1(123/123) (20.2/28.5)	Sta. STA-83 4.4 mi.	26.0(4/4) (24.2/27.9)	25.9(4/4) (23.2/28.4)	0
Broadleaf Vegetation (pCi/kg wet)	I-131	8	60	ND(0/6) (ND-ND)	NA	NA(0/0) (NA-NA)	ND(0/2) (ND-ND)	0
	BE-7	8	NA	968.2(3/6) (926.5/1008)	Sta. 96 1.25 mi.	970.3(1/4) NA-NA	679.5(2/2) (585.3/773.6)	

(1) Nominal Lower Limit of Detection (LLD), as stated in ODAM.

(2) Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location indicated in brackets().

ND = Non Detectable.

NA = Not Applicable.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Name of Facility Cooper Nuclear Station
Location of Facility Nemaha Nebraska
(County/State)

Docket No. 50-298
Reporting Period January 1 2017 to December 31 2017

Medium of Pathway Sampled (Unit of Measurement)	Type & Total No. of Analysis Performed		Lower Limit of Detection(1) (LLD)	All Indicator Locations Mean(2) Range(2)	Location with Highest Annual Mean Name		Mean(2) Range(2)	Control Location Mean(2) Range(2)	No. of Reportable Occurrences
Broadleaf Vegetation (cont'd) (pCi/kg wet)	K-40	8	NA	4522(6/6) (3204/6099)	Sta. 35	2.0 mi.	5410(2/2) (4340/6479)	5410(2/2) (4340/6479)	
	RA-226	8	NA	ND(0/6) (ND-ND)	NA		NA(0/0) (NA-NA)	ND(0/2) (ND-ND)	
	TH-228	8	NA	ND(0/6) (ND-ND)	NA		NA(0/0) (NA-NA)	ND(0/2) (ND-ND)	
Shoreline Sediment (pCi/kg dry)	BE-7	4	NA	ND(0/2) (ND-ND)	Sta. 35	2.0 mi.	751.8(1/2) NA-NA	751.8(1/2) NA-NA	0
	K-40	4	NA	15495(2/2) (14050/16940)	Sta. 35	2.0 mi.	16540(2/2) (15430/17650)	16540(2/2) (15430/17650)	
	CS-137	4	180	ND(0/2) (ND-ND)	NA		NA(0/0) (NA-NA)	ND(0/2) (ND-ND)	
	RA-226	4	NA	4123(2/2) (2310/5936)	Sta. 28	1.8 mi.	4123(2/2) (2310/5936)	2006(1/2) NA-NA	
	TH-228	4	NA	1007.2(2/2) (977.4/1037)	Sta. 28	1.8 mi.	1007.2(2/2) (977.4/1037)	958.9(2/2) (835.8/1082)	

(1) Nominal Lower Limit of Detection (LLD), as stated in ODAM.

(2) Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified location indicated in brackets().

ND = Non Detectable.

NA = Not Applicable.

SECTION VII. COMPLETE DATA TABLES

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 1

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	1.00E+04	CU.FT.	2.50E-02 ± 4.71E-03	< 2.E-02
01/10/17	01/17/17	9.99E+03	CU.FT.	3.03E-02 ± 4.91E-03	< 2.E-02
01/17/17	01/24/17	1.02E+04	CU.FT.	2.83E-02 ± 4.63E-03	< 4.E-02
01/24/17	01/31/17	9.97E+03	CU.FT.	2.05E-02 ± 4.07E-03	< 2.E-02
01/31/17	02/07/17	1.01E+04	CU.FT.	2.53E-02 ± 4.52E-03	< 2.E-02
02/07/17	02/14/17	1.00E+04	CU.FT.	2.22E-02 ± 4.68E-03	< 2.E-02
02/14/17	02/21/17	1.01E+04	CU.FT.	1.47E-02 ± 3.65E-03	< 2.E-02
02/21/17	02/28/17	1.00E+04	CU.FT.	1.61E-02 ± 4.04E-03	< 3.E-02
02/28/17	03/07/17	1.01E+04	CU.FT.	2.64E-02 ± 4.55E-03	< 3.E-02
03/07/17	03/14/17	1.01E+04	CU.FT.	1.64E-02 ± 3.99E-03	< 2.E-02
03/14/17	03/21/17	9.97E+03	CU.FT.	2.49E-02 ± 4.40E-03	< 2.E-02
03/21/17	03/28/17	1.01E+04	CU.FT.	1.71E-02 ± 4.08E-03	< 3.E-02
03/28/17	04/04/17	1.01E+04	CU.FT.	2.33E-02 ± 4.38E-03	< 3.E-02
04/04/17	04/11/17	1.04E+04	CU.FT.	1.59E-02 ± 3.41E-03	< 1.E-02
04/11/17	04/18/17	9.75E+03	CU.FT.	1.83E-02 ± 3.95E-03	< 2.E-02
04/18/17	04/25/17	1.00E+04	CU.FT.	1.48E-02 ± 3.79E-03	< 2.E-02
04/25/17	05/02/17	1.01E+04	CU.FT.	8.78E-03 ± 3.18E-03	< 6.E-02
05/02/17	05/09/17	1.00E+04	CU.FT.	1.64E-02 ± 4.02E-03	< 4.E-02
05/09/17	05/17/17	1.15E+04	CU.FT.	1.98E-02 ± 3.69E-03	< 3.E-02
05/17/17	05/23/17	8.58E+03	CU.FT.	9.70E-03 ± 3.57E-03	< 2.E-02
05/23/17	05/30/17	1.01E+04	CU.FT.	1.15E-02 ± 3.86E-03	< 3.E-02
05/30/17	06/06/17	9.98E+03	CU.FT.	2.24E-02 ± 4.40E-03	< 2.E-02
06/06/17	06/13/17	1.01E+04	CU.FT.	1.62E-02 ± 3.87E-03	< 4.E-02
06/13/17	06/20/17	1.01E+04	CU.FT.	1.43E-02 ± 3.81E-03	< 2.E-02
06/20/17	06/27/17	1.02E+04	CU.FT.	1.59E-02 ± 3.83E-03	< 2.E-02
06/27/17	07/03/17	8.55E+03	CU.FT.	1.32E-02 ± 4.13E-03	< 6.E-02
07/03/17	07/11/17	1.06E+04	CU.FT.	1.94E-02 ± 3.82E-03	< 2.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 1

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
07/11/17	07/18/17	5.41E+03	CU.FT.	2.84E-02 ± 7.01E-03	< 4.E-02
07/18/17	07/25/17	9.92E+03	CU.FT.	1.65E-02 ± 3.92E-03	< 3.E-02
07/25/17	08/01/17	1.01E+04	CU.FT.	1.53E-02 ± 3.65E-03	< 3.E-02
08/01/17	08/08/17	1.00E+04	CU.FT.	1.89E-02 ± 4.22E-03	< 2.E-02
08/08/17	08/14/17	8.66E+03	CU.FT.	2.65E-02 ± 4.86E-03	< 2.E-02
08/14/17	08/22/17	1.15E+04	CU.FT.	2.15E-02 ± 4.05E-03	< 2.E-02
08/22/17	08/29/17	1.01E+04	CU.FT.	1.64E-02 ± 3.66E-03	< 2.E-02
08/29/17	09/05/17	9.99E+03	CU.FT.	2.83E-02 ± 4.69E-03	< 2.E-02
09/05/17	09/13/17	1.14E+04	CU.FT.	2.83E-02 ± 4.42E-03	< 2.E-02
09/13/17	09/19/17	8.66E+03	CU.FT.	3.45E-02 ± 5.76E-03	< 3.E-02
09/19/17	09/25/17	8.59E+03	CU.FT.	2.05E-02 ± 4.34E-03	< 3.E-02
09/25/17	10/03/17	1.16E+04	CU.FT.	1.72E-02 ± 3.66E-03	< 3.E-02
10/03/17	10/10/17	1.00E+04	CU.FT.	1.46E-02 ± 3.68E-03	< 2.E-02
10/10/17	10/16/17	8.73E+03	CU.FT.	1.23E-02 ± 3.90E-03	< 2.E-02
10/16/17	10/24/17	1.14E+04	CU.FT.	1.95E-02 ± 4.01E-03	< 2.E-02
10/24/17	10/31/17	1.00E+04	CU.FT.	1.19E-02 ± 3.73E-03	< 6.E-02
10/31/17	11/07/17	1.02E+04	CU.FT.	2.47E-02 ± 4.35E-03	< 6.E-02
11/07/17	11/14/17	1.01E+04	CU.FT.	3.15E-02 ± 4.94E-03	< 2.E-02
11/14/17	11/21/17	1.01E+04	CU.FT.	3.28E-02 ± 4.85E-03	< 2.E-02
11/21/17	11/28/17	1.01E+04	CU.FT.	2.19E-02 ± 4.03E-03	< 3.E-02
11/28/17	12/05/17	1.00E+04	CU.FT.	2.19E-02 ± 4.06E-03	< 2.E-02
12/05/17	12/11/17	8.72E+03	CU.FT.	1.47E-02 ± 3.87E-03	< 3.E-02
12/11/17	12/19/17	1.15E+04	CU.FT.	2.32E-02 ± 4.03E-03	< 2.E-02
12/19/17	12/27/17	1.15E+04	CU.FT.	2.02E-02 ± 3.67E-03	< 2.E-02
12/27/17	01/02/18	3.36E+03	CU.FT.	4.01E-02 ± 1.02E-02	< 5.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 2

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	1.00E+04	CU.FT.	2.44E-02 ± 4.67E-03	< 5.E-02
01/10/17	01/17/17	9.99E+03	CU.FT.	2.35E-02 ± 4.48E-03	< 5.E-02
01/17/17	01/24/17	1.03E+04	CU.FT.	2.71E-02 ± 4.53E-03	< 2.E-02
01/24/17	01/31/17	9.80E+03	CU.FT.	1.78E-02 ± 3.91E-03	< 5.E-02
01/31/17	02/07/17	1.01E+04	CU.FT.	2.46E-02 ± 4.47E-03	< 4.E-02
02/07/17	02/14/17	1.01E+04	CU.FT.	1.29E-02 ± 4.01E-03	< 6.E-02
02/14/17	02/21/17	1.00E+04	CU.FT.	1.71E-02 ± 3.86E-03	< 5.E-02
02/21/17	02/28/17	1.01E+04	CU.FT.	1.27E-02 ± 3.76E-03	< 5.E-02
02/28/17	03/07/17	1.01E+04	CU.FT.	2.25E-02 ± 4.28E-03	< 6.E-02
03/07/17	03/14/17	1.01E+04	CU.FT.	2.01E-02 ± 4.25E-03	< 4.E-02
03/14/17	03/21/17	9.97E+03	CU.FT.	2.52E-02 ± 4.42E-03	< 5.E-02
03/21/17	03/28/17	1.01E+04	CU.FT.	2.28E-02 ± 4.49E-03	< 6.E-02
03/28/17	04/04/17	1.01E+04	CU.FT.	1.43E-02 ± 3.71E-03	< 6.E-02
04/04/17	04/11/17	1.01E+04	CU.FT.	1.48E-02 ± 3.38E-03	< 4.E-02
04/11/17	04/18/17	9.98E+03	CU.FT.	1.95E-02 ± 3.99E-03	< 6.E-02
04/18/17	04/25/17	1.01E+04	CU.FT.	1.14E-02 ± 3.49E-03	< 5.E-02
04/25/17	05/02/17	1.02E+04	CU.FT.	7.54E-03 ± 3.04E-03	< 2.E-02
05/02/17	05/09/17	9.91E+03	CU.FT.	1.91E-02 ± 4.24E-03	< 4.E-02
05/09/17	05/17/17	1.15E+04	CU.FT.	1.39E-02 ± 3.25E-03	< 3.E-02
05/17/17	05/23/17	8.59E+03	CU.FT.	1.35E-02 ± 3.94E-03	< 4.E-02
05/23/17	05/30/17	1.01E+04	CU.FT.	1.10E-02 ± 3.82E-03	< 6.E-02
05/30/17	06/06/17	1.00E+04	CU.FT.	1.81E-02 ± 4.08E-03	< 5.E-02
06/06/17	06/13/17	1.02E+04	CU.FT.	1.62E-02 ± 3.85E-03	< 2.E-02
06/13/17	06/20/17	1.00E+04	CU.FT.	1.26E-02 ± 3.69E-03	< 5.E-02
06/20/17	06/27/17	1.01E+04	CU.FT.	1.44E-02 ± 3.74E-03	< 5.E-02
06/27/17	07/03/17	8.54E+03	CU.FT.	1.82E-02 ± 4.54E-03	< 6.E-02
07/03/17	07/11/17	1.17E+04	CU.FT.	1.77E-02 ± 3.47E-03	< 5.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 2

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)		CHARCOAL FILTER I-131 (PCI/CU.M.)	
07/11/17	07/18/17	9.96E+03	CU.FT.	2.34E-02 ± 4.40E-03		< 5.E-02	
07/18/17	07/25/17	1.01E+04	CU.FT.	1.73E-02 ± 3.93E-03		< 6.E-02	
07/25/17	08/01/17	1.00E+04	CU.FT.	1.88E-02 ± 3.95E-03		< 6.E-02	
08/01/17	08/08/17	1.01E+04	CU.FT.	1.58E-02 ± 3.97E-03		< 6.E-02	
08/08/17	08/14/17	8.59E+03	CU.FT.	1.94E-02 ± 4.35E-03		< 5.E-02	
08/14/17	08/22/17	1.15E+04	CU.FT.	1.55E-02 ± 3.63E-03		< 5.E-02	
08/22/17	08/29/17	1.01E+04	CU.FT.	2.02E-02 ± 3.95E-03		< 5.E-02	
08/29/17	09/05/17	1.00E+04	CU.FT.	3.42E-02 ± 5.05E-03		< 5.E-02	
09/05/17	09/13/17	1.16E+04	CU.FT.	2.63E-02 ± 4.25E-03		< 6.E-02	
09/13/17	09/19/17	8.54E+03	CU.FT.	3.79E-02 ± 6.03E-03		< 6.E-02	
09/19/17	09/25/17	8.60E+03	CU.FT.	1.73E-02 ± 4.08E-03		< 7.E-02	
09/25/17	10/03/17	1.15E+04	CU.FT.	2.46E-02 ± 4.18E-03		< 6.E-02	
10/03/17	10/10/17	1.01E+04	CU.FT.	1.45E-02 ± 3.65E-03		< 4.E-02	
10/10/17	10/16/17	8.68E+03	CU.FT.	1.82E-02 ± 4.40E-03		< 5.E-02	
10/16/17	10/24/17	1.14E+04	CU.FT.	1.99E-02 ± 4.03E-03		< 4.E-02	
10/24/17	10/31/17	1.01E+04	CU.FT.	1.44E-02 ± 3.90E-03		< 6.E-02	
10/31/17	11/07/17	1.02E+04	CU.FT.	2.68E-02 ± 4.48E-03		< 6.E-02	
11/07/17	11/14/17	6.26E+03	CU.FT.	2.79E-02 ± 6.48E-03		< 7.E-02	
11/14/17	11/21/17	1.44E+01	CU.FT.	< 2.E+00	(a)	< 3.E+01	(a)
11/21/17	11/28/17	2.84E+03	CU.FT.	3.41E-02 ± 1.07E-02		< 2.E-01	(a)
11/28/17	12/05/17	2.78E+03	CU.FT.	< 1.E-02		< 2.E-01	(a)
12/05/17	12/11/17	2.86E+03	CU.FT.	< 1.E-02	(a)	< 2.E-01	(a)
12/11/17	12/19/17	1.86E+02	CU.FT.	< 2.E-01	(a)	< 3.E+00	(a)
12/19/17	12/27/17	1.13E+04	CU.FT.	2.06E-02 ± 3.73E-03		< 5.E-02	
12/27/17	01/02/18	8.77E+03	CU.FT.	3.13E-02 ± 5.13E-03		< 6.E-02	

(a) Detection level could not be met due to low volume.

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 3

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	9.85E+03	CU.FT.	2.74E-02 ± 4.91E-03	< 5.E-02
01/10/17	01/17/17	9.98E+03	CU.FT.	2.71E-02 ± 4.71E-03	< 5.E-02
01/17/17	01/24/17	1.01E+04	CU.FT.	3.16E-02 ± 4.86E-03	< 4.E-02
01/24/17	01/31/17	1.00E+04	CU.FT.	1.72E-02 ± 3.81E-03	< 5.E-02
01/31/17	02/07/17	1.01E+04	CU.FT.	2.91E-02 ± 4.76E-03	< 4.E-02
02/07/17	02/14/17	1.01E+04	CU.FT.	2.14E-02 ± 4.59E-03	< 5.E-02
02/14/17	02/21/17	9.91E+03	CU.FT.	1.81E-02 ± 3.97E-03	< 5.E-02
02/21/17	02/28/17	1.02E+04	CU.FT.	1.57E-02 ± 3.95E-03	< 2.E-02
02/28/17	03/07/17	1.01E+04	CU.FT.	2.10E-02 ± 4.17E-03	< 6.E-02
03/07/17	03/14/17	1.00E+04	CU.FT.	1.98E-02 ± 4.27E-03	< 4.E-02
03/14/17	03/21/17	9.73E+03	CU.FT.	2.08E-02 ± 4.18E-03	< 5.E-02
03/21/17	03/28/17	1.03E+04	CU.FT.	1.80E-02 ± 4.09E-03	< 5.E-02
03/28/17	04/04/17	1.02E+04	CU.FT.	3.79E-02 ± 5.25E-03	< 6.E-02
04/04/17	04/11/17	1.02E+04	CU.FT.	1.54E-02 ± 3.41E-03	< 3.E-02
04/11/17	04/18/17	9.74E+03	CU.FT.	1.96E-02 ± 4.05E-03	< 6.E-02
04/18/17	04/25/17	1.02E+04	CU.FT.	1.41E-02 ± 3.68E-03	< 5.E-02
04/25/17	05/02/17	1.01E+04	CU.FT.	1.08E-02 ± 3.36E-03	< 6.E-02
05/02/17	05/09/17	1.00E+04	CU.FT.	1.44E-02 ± 3.85E-03	< 4.E-02
05/09/17	05/17/17	1.15E+04	CU.FT.	2.17E-02 ± 3.82E-03	< 3.E-02
05/17/17	05/23/17	8.61E+03	CU.FT.	7.29E-03 ± 3.30E-03	< 4.E-02
05/23/17	05/30/17	1.01E+04	CU.FT.	8.70E-03 ± 3.62E-03	< 6.E-02
05/30/17	06/06/17	9.92E+03	CU.FT.	1.83E-02 ± 4.11E-03	< 5.E-02
06/06/17	06/13/17	9.92E+03	CU.FT.	1.52E-02 ± 3.84E-03	< 5.E-02
06/13/17	06/20/17	1.03E+04	CU.FT.	1.28E-02 ± 3.63E-03	< 5.E-02
06/20/17	06/27/17	9.91E+03	CU.FT.	1.57E-02 ± 3.90E-03	< 5.E-02
06/27/17	07/03/17	8.77E+03	CU.FT.	1.36E-02 ± 4.08E-03	< 2.E-02
07/03/17	07/11/17	1.14E+04	CU.FT.	2.23E-02 ± 3.85E-03	< 5.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 3

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
07/11/17	07/18/17	1.03E+04	CU.FT.	2.53E-02 ± 4.44E-03	< 5.E-02
07/18/17	07/25/17	9.93E+03	CU.FT.	1.43E-02 ± 3.74E-03	< 6.E-02
07/25/17	08/01/17	1.02E+04	CU.FT.	2.19E-02 ± 4.13E-03	< 6.E-02
08/01/17	08/08/17	1.00E+04	CU.FT.	1.90E-02 ± 4.23E-03	< 6.E-02
08/08/17	08/14/17	8.59E+03	CU.FT.	2.62E-02 ± 4.87E-03	< 5.E-02
08/14/17	08/22/17	1.16E+04	CU.FT.	2.12E-02 ± 4.01E-03	< 5.E-02
08/22/17	08/29/17	1.00E+04	CU.FT.	2.56E-02 ± 4.36E-03	< 5.E-02
08/29/17	09/05/17	9.85E+03	CU.FT.	3.01E-02 ± 4.85E-03	< 5.E-02
09/05/17	09/13/17	1.14E+04	CU.FT.	2.63E-02 ± 4.30E-03	< 6.E-02
09/13/17	09/19/17	8.34E+03	CU.FT.	3.62E-02 ± 6.01E-03	< 6.E-02
09/19/17	09/25/17	8.37E+03	CU.FT.	1.87E-02 ± 4.26E-03	< 7.E-02
09/25/17	10/03/17	1.18E+04	CU.FT.	2.06E-02 ± 3.85E-03	< 6.E-02
10/03/17	10/10/17	1.02E+04	CU.FT.	2.02E-02 ± 4.05E-03	< 4.E-02
10/10/17	10/16/17	8.59E+03	CU.FT.	1.44E-02 ± 4.12E-03	< 5.E-02
10/16/17	10/24/17	1.14E+04	CU.FT.	1.95E-02 ± 4.01E-03	< 4.E-02
10/24/17	10/31/17	1.02E+04	CU.FT.	1.06E-02 ± 3.56E-03	< 3.E-02
10/31/17	11/07/17	1.02E+04	CU.FT.	2.84E-02 ± 4.59E-03	< 6.E-02
11/07/17	11/14/17	9.74E+03	CU.FT.	3.36E-02 ± 5.18E-03	< 4.E-02
11/14/17	11/21/17	1.03E+04	CU.FT.	2.69E-02 ± 4.43E-03	< 4.E-02
11/21/17	11/28/17	1.00E+04	CU.FT.	2.01E-02 ± 3.92E-03	< 6.E-02
11/28/17	12/05/17	9.88E+03	CU.FT.	1.90E-02 ± 3.87E-03	< 5.E-02
12/05/17	12/11/17	8.84E+03	CU.FT.	1.54E-02 ± 3.89E-03	< 6.E-02
12/11/17	12/19/17	1.16E+04	CU.FT.	2.56E-02 ± 4.17E-03	< 5.E-02
12/19/17	12/27/17	1.14E+04	CU.FT.	2.03E-02 ± 3.69E-03	< 5.E-02
12/27/17	01/02/18	8.72E+03	CU.FT.	2.90E-02 ± 4.99E-03	< 6.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 4

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	1.02E+04	CU.FT.	2.68E-02 ± 4.76E-03	< 5.E-02
01/10/17	01/17/17	9.97E+03	CU.FT.	2.60E-02 ± 4.64E-03	< 5.E-02
01/17/17	01/24/17	1.01E+04	CU.FT.	2.72E-02 ± 4.59E-03	< 4.E-02
01/24/17	01/31/17	1.00E+04	CU.FT.	1.86E-02 ± 3.92E-03	< 5.E-02
01/31/17	02/07/17	1.01E+04	CU.FT.	2.50E-02 ± 4.50E-03	< 4.E-02
02/07/17	02/14/17	1.01E+04	CU.FT.	1.60E-02 ± 4.23E-03	< 5.E-02
02/14/17	02/21/17	9.97E+03	CU.FT.	1.56E-02 ± 3.75E-03	< 5.E-02
02/21/17	02/28/17	1.02E+04	CU.FT.	1.25E-02 ± 3.71E-03	< 5.E-02
02/28/17	03/07/17	9.99E+03	CU.FT.	2.05E-02 ± 4.17E-03	< 6.E-02
03/07/17	03/14/17	1.00E+04	CU.FT.	1.55E-02 ± 3.96E-03	< 4.E-02
03/14/17	03/21/17	9.74E+03	CU.FT.	2.37E-02 ± 4.38E-03	< 5.E-02
03/21/17	03/28/17	1.03E+04	CU.FT.	1.86E-02 ± 4.13E-03	< 5.E-02
03/28/17	04/04/17	1.02E+04	CU.FT.	1.47E-02 ± 3.72E-03	< 6.E-02
04/04/17	04/11/17	9.91E+03	CU.FT.	1.61E-02 ± 3.53E-03	< 4.E-02
04/11/17	04/18/17	1.00E+04	CU.FT.	1.76E-02 ± 3.83E-03	< 6.E-02
04/18/17	04/25/17	1.02E+04	CU.FT.	1.25E-02 ± 3.55E-03	< 5.E-02
04/25/17	05/02/17	1.01E+04	CU.FT.	6.44E-03 ± 2.96E-03	< 6.E-02
05/02/17	05/09/17	1.01E+04	CU.FT.	1.86E-02 ± 4.15E-03	< 2.E-02
05/09/17	05/17/17	5.18E+03	CU.FT.	1.43E-02 ± 5.77E-03	< 2.E-02
05/17/17	05/23/17	8.55E+03	CU.FT.	8.26E-03 ± 3.42E-03	< 4.E-02
05/23/17	05/30/17	1.01E+04	CU.FT.	9.32E-03 ± 3.68E-03	< 6.E-02
05/30/17	06/06/17	9.96E+03	CU.FT.	1.82E-02 ± 4.09E-03	< 5.E-02
06/06/17	06/13/17	9.92E+03	CU.FT.	1.52E-02 ± 3.84E-03	< 5.E-02
06/13/17	06/20/17	1.03E+04	CU.FT.	1.23E-02 ± 3.59E-03	< 5.E-02
06/20/17	06/27/17	9.97E+03	CU.FT.	1.64E-02 ± 3.93E-03	< 5.E-02
06/27/17	07/03/17	8.71E+03	CU.FT.	1.94E-02 ± 4.58E-03	< 6.E-02
07/03/17	07/11/17	1.14E+04	CU.FT.	1.85E-02 ± 3.59E-03	< 5.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 4

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
07/11/17	07/18/17	1.03E+04	CU.FT.	2.01E-02 ± 4.08E-03	< 5.E-02
07/18/17	07/25/17	1.00E+04	CU.FT.	1.24E-02 ± 3.57E-03	< 6.E-02
07/25/17	08/01/17	1.01E+04	CU.FT.	2.38E-02 ± 4.28E-03	< 6.E-02
08/01/17	08/08/17	1.01E+04	CU.FT.	1.69E-02 ± 4.05E-03	< 6.E-02
08/08/17	08/14/17	8.61E+03	CU.FT.	2.49E-02 ± 4.77E-03	< 5.E-02
08/14/17	08/22/17	1.15E+04	CU.FT.	1.90E-02 ± 3.88E-03	< 5.E-02
08/22/17	08/29/17	1.00E+04	CU.FT.	2.20E-02 ± 4.11E-03	< 5.E-02
08/29/17	09/05/17	9.93E+03	CU.FT.	3.33E-02 ± 5.02E-03	< 5.E-02
09/05/17	09/13/17	1.14E+04	CU.FT.	3.11E-02 ± 4.58E-03	< 6.E-02
09/13/17	09/19/17	8.88E+03	CU.FT.	3.63E-02 ± 5.78E-03	< 6.E-02
09/19/17	09/25/17	8.65E+03	CU.FT.	1.98E-02 ± 4.27E-03	< 7.E-02
09/25/17	10/03/17	1.14E+04	CU.FT.	2.23E-02 ± 4.06E-03	< 6.E-02
10/03/17	10/10/17	1.02E+04	CU.FT.	1.68E-02 ± 3.80E-03	< 4.E-02
10/10/17	10/16/17	8.59E+03	CU.FT.	1.39E-02 ± 4.08E-03	< 5.E-02
10/16/17	10/24/17	1.15E+04	CU.FT.	1.66E-02 ± 3.78E-03	< 4.E-02
10/24/17	10/31/17	1.01E+04	CU.FT.	9.90E-03 ± 3.53E-03	< 6.E-02
10/31/17	11/07/17	1.02E+04	CU.FT.	2.40E-02 ± 4.30E-03	< 2.E-02
11/07/17	11/14/17	1.00E+04	CU.FT.	3.16E-02 ± 4.98E-03	< 4.E-02
11/14/17	11/21/17	1.00E+04	CU.FT.	2.64E-02 ± 4.47E-03	< 4.E-02
11/21/17	11/28/17	1.01E+04	CU.FT.	2.48E-02 ± 4.24E-03	< 6.E-02
11/28/17	12/05/17	9.97E+03	CU.FT.	1.92E-02 ± 3.86E-03	< 5.E-02
12/05/17	12/11/17	8.72E+03	CU.FT.	1.73E-02 ± 4.09E-03	< 6.E-02
12/11/17	12/19/17	1.16E+04	CU.FT.	2.68E-02 ± 4.24E-03	< 5.E-02
12/19/17	12/27/17	1.14E+04	CU.FT.	2.19E-02 ± 3.80E-03	< 5.E-02
12/27/17	01/02/18	8.72E+03	CU.FT.	3.33E-02 ± 5.28E-03	< 6.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 5

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	1.02E+04	CU.FT.	2.53E-02 ± 4.66E-03	< 5.E-02
01/10/17	01/17/17	9.97E+03	CU.FT.	2.61E-02 ± 4.65E-03	< 5.E-02
01/17/17	01/24/17	1.01E+04	CU.FT.	2.20E-02 ± 4.24E-03	< 4.E-02
01/24/17	01/31/17	9.99E+03	CU.FT.	1.64E-02 ± 3.75E-03	< 5.E-02
01/31/17	02/07/17	1.01E+04	CU.FT.	2.19E-02 ± 4.28E-03	< 4.E-02
02/07/17	02/14/17	1.01E+04	CU.FT.	1.11E-02 ± 3.88E-03	< 5.E-02
02/14/17	02/21/17	9.96E+03	CU.FT.	1.40E-02 ± 3.62E-03	< 5.E-02
02/21/17	02/28/17	1.02E+04	CU.FT.	1.39E-02 ± 3.82E-03	< 5.E-02
02/28/17	03/07/17	1.01E+04	CU.FT.	2.46E-02 ± 4.43E-03	< 6.E-02
03/07/17	03/14/17	1.00E+04	CU.FT.	1.64E-02 ± 4.02E-03	< 4.E-02
03/14/17	03/21/17	9.75E+03	CU.FT.	2.84E-02 ± 4.69E-03	< 5.E-02
03/21/17	03/28/17	1.03E+04	CU.FT.	1.58E-02 ± 3.93E-03	< 5.E-02
03/28/17	04/04/17	1.02E+04	CU.FT.	1.50E-02 ± 3.76E-03	< 6.E-02
04/04/17	04/11/17	9.91E+03	CU.FT.	1.79E-02 ± 3.68E-03	< 4.E-02
04/11/17	04/18/17	1.00E+04	CU.FT.	2.00E-02 ± 4.01E-03	< 6.E-02
04/18/17	04/25/17	1.02E+04	CU.FT.	1.19E-02 ± 3.50E-03	< 5.E-02
04/25/17	05/02/17	1.01E+04	CU.FT.	1.07E-02 ± 3.35E-03	< 6.E-02
05/02/17	05/09/17	1.01E+04	CU.FT.	1.98E-02 ± 4.24E-03	< 2.E-02
05/09/17	05/17/17	5.19E+03	CU.FT.	1.57E-02 ± 5.89E-03	< 6.E-02
05/17/17	05/23/17	8.59E+03	CU.FT.	< 4.E-03 (a)	< 4.E-02
05/23/17	05/30/17	1.01E+04	CU.FT.	1.10E-02 ± 3.82E-03	< 6.E-02
05/30/17	06/06/17	9.96E+03	CU.FT.	2.26E-02 ± 4.42E-03	< 5.E-02
06/06/17	06/13/17	9.92E+03	CU.FT.	1.77E-02 ± 4.04E-03	< 5.E-02
06/13/17	06/20/17	1.03E+04	CU.FT.	1.25E-02 ± 3.61E-03	< 5.E-02
06/20/17	06/27/17	9.97E+03	CU.FT.	1.68E-02 ± 3.96E-03	< 5.E-02
06/27/17	07/03/17	8.71E+03	CU.FT.	1.42E-02 ± 4.15E-03	< 6.E-02
07/03/17	07/11/17	1.14E+04	CU.FT.	1.48E-02 ± 3.30E-03	< 5.E-02

(a) Detection level could not be met due to low volume.

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 5

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
07/11/17	07/18/17	1.03E+04	CU.FT.	1.88E-02 ± 3.98E-03	< 5.E-02
07/18/17	07/25/17	9.92E+03	CU.FT.	1.23E-02 ± 3.58E-03	< 6.E-02
07/25/17	08/01/17	1.01E+04	CU.FT.	1.90E-02 ± 3.94E-03	< 6.E-02
08/01/17	08/08/17	1.00E+04	CU.FT.	1.52E-02 ± 3.95E-03	< 6.E-02
08/08/17	08/14/17	8.70E+03	CU.FT.	2.54E-02 ± 4.77E-03	< 5.E-02
08/14/17	08/22/17	1.15E+04	CU.FT.	1.90E-02 ± 3.88E-03	< 5.E-02
08/22/17	08/29/17	1.00E+04	CU.FT.	2.01E-02 ± 3.97E-03	< 5.E-02
08/29/17	09/05/17	9.93E+03	CU.FT.	3.36E-02 ± 5.04E-03	< 5.E-02
09/05/17	09/13/17	1.14E+04	CU.FT.	2.80E-02 ± 4.40E-03	< 6.E-02
09/13/17	09/19/17	8.84E+03	CU.FT.	3.38E-02 ± 5.65E-03	< 6.E-02
09/19/17	09/25/17	8.68E+03	CU.FT.	2.22E-02 ± 4.44E-03	< 7.E-02
09/25/17	10/03/17	1.15E+04	CU.FT.	2.15E-02 ± 3.98E-03	< 6.E-02
10/03/17	10/10/17	1.02E+04	CU.FT.	1.64E-02 ± 3.77E-03	< 4.E-02
10/10/17	10/16/17	8.59E+03	CU.FT.	1.35E-02 ± 4.05E-03	< 5.E-02
10/16/17	10/24/17	1.15E+04	CU.FT.	1.74E-02 ± 3.84E-03	< 4.E-02
10/24/17	10/31/17	1.01E+04	CU.FT.	1.50E-02 ± 3.95E-03	< 6.E-02
10/31/17	11/07/17	1.02E+04	CU.FT.	2.09E-02 ± 4.08E-03	< 6.E-02
11/07/17	11/14/17	1.00E+04	CU.FT.	3.70E-02 ± 5.29E-03	< 4.E-02
11/14/17	11/21/17	1.00E+04	CU.FT.	2.84E-02 ± 4.60E-03	< 4.E-02
11/21/17	11/28/17	1.01E+04	CU.FT.	2.53E-02 ± 4.27E-03	< 6.E-02
11/28/17	12/05/17	9.97E+03	CU.FT.	2.56E-02 ± 4.33E-03	< 5.E-02
12/05/17	12/11/17	8.72E+03	CU.FT.	1.88E-02 ± 4.22E-03	< 6.E-02
12/11/17	12/19/17	1.16E+04	CU.FT.	2.84E-02 ± 4.34E-03	< 5.E-02
12/19/17	12/27/17	1.14E+04	CU.FT.	1.86E-02 ± 3.57E-03	< 5.E-02
12/27/17	01/02/18	8.72E+03	CU.FT.	3.09E-02 ± 5.12E-03	< 6.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 6

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	1.01E+04	CU.FT.	2.51E-02 ± 4.68E-03	< 2.E-02
01/10/17	01/17/17	9.97E+03	CU.FT.	2.39E-02 ± 4.51E-03	< 2.E-02
01/17/17	01/24/17	1.01E+04	CU.FT.	2.52E-02 ± 4.46E-03	< 4.E-02
01/24/17	01/31/17	9.99E+03	CU.FT.	1.55E-02 ± 3.68E-03	< 2.E-02
01/31/17	02/07/17	1.01E+04	CU.FT.	2.49E-02 ± 4.49E-03	< 4.E-02
02/07/17	02/14/17	1.01E+04	CU.FT.	1.68E-02 ± 4.29E-03	< 2.E-02
02/14/17	02/21/17	9.96E+03	CU.FT.	1.78E-02 ± 3.92E-03	< 5.E-02
02/21/17	02/28/17	1.02E+04	CU.FT.	8.84E-03 ± 3.42E-03	< 5.E-02
02/28/17	03/07/17	1.00E+04	CU.FT.	2.20E-02 ± 4.27E-03	< 6.E-02
03/07/17	03/14/17	1.01E+04	CU.FT.	1.51E-02 ± 3.90E-03	< 4.E-02
03/14/17	03/21/17	9.74E+03	CU.FT.	2.49E-02 ± 4.46E-03	< 6.E-02
03/21/17	03/28/17	1.03E+04	CU.FT.	1.69E-02 ± 4.01E-03	< 2.E-02
03/28/17	04/04/17	1.02E+04	CU.FT.	8.40E-02 ± 7.39E-03	< 3.E-02
04/04/17	04/11/17	9.91E+03	CU.FT.	1.30E-02 ± 3.26E-03	< 4.E-02
04/11/17	04/18/17	1.00E+04	CU.FT.	2.04E-02 ± 4.05E-03	< 2.E-02
04/18/17	04/25/17	1.02E+04	CU.FT.	9.28E-03 ± 3.28E-03	< 3.E-02
04/25/17	05/02/17	1.01E+04	CU.FT.	5.71E-03 ± 2.88E-03	< 5.E-02
05/02/17	05/09/17	1.01E+04	CU.FT.	1.59E-02 ± 3.95E-03	< 4.E-02
05/09/17	05/17/17	5.22E+03	CU.FT.	1.81E-02 ± 6.10E-03	< 2.E-02
05/17/17	05/23/17	1.62E+01	CU.FT.	4.07E+00 ± 1.78E+00 (b)	< 9.E+00 (a)
05/23/17	05/30/17	1.01E+04	CU.FT.	8.08E-03 ± 3.57E-03	< 3.E-02
05/30/17	06/06/17	9.96E+03	CU.FT.	1.85E-02 ± 4.12E-03	< 2.E-02
06/06/17	06/13/17	9.92E+03	CU.FT.	1.61E-02 ± 3.91E-03	< 3.E-02
06/13/17	06/20/17	1.03E+04	CU.FT.	1.20E-02 ± 3.57E-03	< 2.E-02
06/20/17	06/27/17	9.94E+03	CU.FT.	1.21E-02 ± 3.59E-03	< 4.E-02
06/27/17	07/03/17	8.71E+03	CU.FT.	1.85E-02 ± 4.51E-03	< 2.E-02
07/03/17	07/11/17	1.14E+04	CU.FT.	1.78E-02 ± 3.53E-03	< 2.E-02

(a) Detection level could not be met due to low volume.

(b) High value due to low volume

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 6

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
07/11/17	07/18/17	1.03E+04	CU.FT.	2.15E-02 ± 4.17E-03	< 3.E-02
07/18/17	07/25/17	9.92E+03	CU.FT.	1.67E-02 ± 3.93E-03	< 5.E-02
07/25/17	08/01/17	1.02E+04	CU.FT.	1.56E-02 ± 3.65E-03	< 5.E-02
08/01/17	08/08/17	1.01E+04	CU.FT.	1.92E-02 ± 4.33E-03	< 6.E-02
08/08/17	08/14/17	8.67E+03	CU.FT.	2.25E-02 ± 4.57E-03	< 5.E-02
08/14/17	08/22/17	1.15E+04	CU.FT.	1.62E-02 ± 3.68E-03	< 2.E-02
08/22/17	08/29/17	1.00E+04	CU.FT.	2.07E-02 ± 4.01E-03	< 4.E-02
08/29/17	09/05/17	9.94E+03	CU.FT.	3.81E-02 ± 5.30E-03	< 3.E-02
09/05/17	09/13/17	1.14E+04	CU.FT.	3.01E-02 ± 4.52E-03	< 6.E-02
09/13/17	09/19/17	8.84E+03	CU.FT.	3.13E-02 ± 5.49E-03	< 6.E-02
09/19/17	09/25/17	8.69E+03	CU.FT.	2.27E-02 ± 4.48E-03	< 5.E-02
09/25/17	10/03/17	7.35E+03	CU.FT.	3.26E-02 ± 6.16E-03	< 4.E-02
10/03/17	10/10/17	1.02E+04	CU.FT.	2.16E-02 ± 4.15E-03	< 3.E-02
10/10/17	10/16/17	8.59E+03	CU.FT.	1.48E-02 ± 4.15E-03	< 2.E-02
10/16/17	10/24/17	1.15E+04	CU.FT.	1.92E-02 ± 3.96E-03	< 3.E-02
10/24/17	10/31/17	1.01E+04	CU.FT.	1.47E-02 ± 3.93E-03	< 3.E-02
10/31/17	11/07/17	1.02E+04	CU.FT.	2.55E-02 ± 4.40E-03	< 3.E-02
11/07/17	11/14/17	1.00E+04	CU.FT.	2.62E-02 ± 4.65E-03	< 3.E-02
11/14/17	11/21/17	1.00E+04	CU.FT.	2.97E-02 ± 4.69E-03	< 2.E-02
11/21/17	11/28/17	1.01E+04	CU.FT.	2.38E-02 ± 4.17E-03	< 6.E-02
11/28/17	12/05/17	9.97E+03	CU.FT.	2.28E-02 ± 4.30E-03	< 2.E-02
12/05/17	12/11/17	8.72E+03	CU.FT.	1.39E-02 ± 3.79E-03	< 3.E-02
12/11/17	12/19/17	1.16E+04	CU.FT.	2.33E-02 ± 4.01E-03	< 2.E-02
12/19/17	12/27/17	1.14E+04	CU.FT.	1.75E-02 ± 3.49E-03	< 3.E-02
12/27/17	01/02/18	8.72E+03	CU.FT.	2.99E-02 ± 5.05E-03	< 7.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 7

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	9.68E+03	CU.FT.	2.62E-02 ± 4.88E-03	< 5.E-02
01/10/17	01/17/17	9.99E+03	CU.FT.	2.96E-02 ± 4.86E-03	< 4.E-02
01/17/17	01/24/17	1.03E+04	CU.FT.	2.60E-02 ± 4.46E-03	< 2.E-02
01/24/17	01/31/17	9.81E+03	CU.FT.	1.92E-02 ± 4.01E-03	< 5.E-02
01/31/17	02/07/17	1.01E+04	CU.FT.	2.96E-02 ± 4.79E-03	< 4.E-02
02/07/17	02/14/17	1.01E+04	CU.FT.	1.52E-02 ± 4.18E-03	< 4.E-02
02/14/17	02/21/17	1.00E+04	CU.FT.	1.99E-02 ± 4.08E-03	< 5.E-02
02/21/17	02/28/17	1.01E+04	CU.FT.	1.49E-02 ± 3.93E-03	< 6.E-02
02/28/17	03/07/17	1.00E+04	CU.FT.	2.55E-02 ± 4.52E-03	< 6.E-02
03/07/17	03/14/17	1.01E+04	CU.FT.	1.74E-02 ± 4.07E-03	< 5.E-02
03/14/17	03/21/17	9.98E+03	CU.FT.	2.00E-02 ± 4.05E-03	< 6.E-02
03/21/17	03/28/17	1.01E+04	CU.FT.	2.04E-02 ± 4.32E-03	< 5.E-02
03/28/17	04/04/17	1.01E+04	CU.FT.	1.20E-02 ± 3.55E-03	< 6.E-02
04/04/17	04/11/17	1.04E+04	CU.FT.	1.55E-02 ± 3.38E-03	< 2.E-02
04/11/17	04/18/17	9.74E+03	CU.FT.	1.80E-02 ± 3.93E-03	< 5.E-02
04/18/17	04/25/17	1.01E+04	CU.FT.	1.07E-02 ± 3.43E-03	< 6.E-02
04/25/17	05/02/17	1.02E+04	CU.FT.	9.71E-03 ± 3.24E-03	< 5.E-02
05/02/17	05/09/17	9.92E+03	CU.FT.	2.02E-02 ± 4.32E-03	< 5.E-02
05/09/17	05/17/17	1.15E+04	CU.FT.	1.81E-02 ± 3.57E-03	< 3.E-02
05/17/17	05/23/17	8.59E+03	CU.FT.	9.50E-03 ± 3.54E-03	< 4.E-02
05/23/17	05/30/17	1.01E+04	CU.FT.	1.35E-02 ± 3.93E-03	< 7.E-02
05/30/17	06/06/17	1.00E+04	CU.FT.	1.97E-02 ± 4.19E-03	< 5.E-02
06/06/17	06/13/17	1.02E+04	CU.FT.	1.80E-02 ± 3.98E-03	< 3.E-02
06/13/17	06/20/17	1.00E+04	CU.FT.	1.44E-02 ± 3.84E-03	< 5.E-02
06/20/17	06/27/17	1.01E+04	CU.FT.	1.74E-02 ± 3.97E-03	< 4.E-02
06/27/17	07/03/17	8.54E+03	CU.FT.	1.77E-02 ± 4.50E-03	< 6.E-02
07/03/17	07/11/17	1.17E+04	CU.FT.	2.15E-02 ± 3.73E-03	< 4.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 7

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
07/11/17	07/18/17	9.96E+03	CU.FT.	2.74E-02 ± 4.67E-03	< 5.E-02
07/18/17	07/25/17	1.01E+04	CU.FT.	2.10E-02 ± 4.20E-03	< 5.E-02
07/25/17	08/01/17	1.00E+04	CU.FT.	2.12E-02 ± 4.13E-03	< 5.E-02
08/01/17	08/08/17	1.01E+04	CU.FT.	2.11E-02 ± 4.46E-03	< 6.E-02
08/08/17	08/14/17	8.59E+03	CU.FT.	2.20E-02 ± 4.55E-03	< 6.E-02
08/14/17	08/22/17	1.15E+04	CU.FT.	2.42E-02 ± 4.23E-03	< 5.E-02
08/22/17	08/29/17	1.01E+04	CU.FT.	2.30E-02 ± 4.15E-03	< 2.E-02
08/29/17	09/05/17	1.00E+04	CU.FT.	2.43E-02 ± 4.42E-03	< 6.E-02
09/05/17	09/13/17	1.16E+04	CU.FT.	7.90E-03 ± 2.95E-03	< 5.E-02
09/13/17	09/19/17	8.54E+03	CU.FT.	3.11E-02 ± 5.60E-03	< 6.E-02
09/19/17	09/25/17	6.98E+03	CU.FT.	1.75E-02 ± 4.68E-03	< 5.E-02
09/25/17	10/03/17	1.15E+04	CU.FT.	1.64E-02 ± 3.63E-03	< 5.E-02
10/03/17	10/10/17	1.01E+04	CU.FT.	1.64E-02 ± 3.80E-03	< 6.E-02
10/10/17	10/16/17	8.67E+03	CU.FT.	1.22E-02 ± 3.91E-03	< 6.E-02
10/16/17	10/24/17	1.14E+04	CU.FT.	1.89E-02 ± 3.96E-03	< 3.E-02
10/24/17	10/31/17	1.01E+04	CU.FT.	8.51E-03 ± 3.40E-03	< 6.E-02
10/31/17	11/07/17	1.02E+04	CU.FT.	2.46E-02 ± 4.34E-03	< 4.E-02
11/07/17	11/14/17	1.01E+04	CU.FT.	3.62E-02 ± 5.21E-03	< 3.E-02
11/14/17	11/21/17	9.99E+03	CU.FT.	2.68E-02 ± 4.52E-03	< 5.E-02
11/21/17	11/28/17	1.01E+04	CU.FT.	2.41E-02 ± 4.19E-03	< 6.E-02
11/28/17	12/05/17	1.01E+04	CU.FT.	1.58E-02 ± 3.75E-03	< 3.E-02
12/05/17	12/11/17	8.65E+03	CU.FT.	1.09E-02 ± 3.53E-03	< 3.E-02
12/11/17	12/19/17	1.16E+04	CU.FT.	1.81E-02 ± 3.66E-03	< 4.E-02
12/19/17	12/27/17	1.13E+04	CU.FT.	1.89E-02 ± 3.61E-03	< 6.E-02
12/27/17	01/02/18	8.77E+03	CU.FT.	3.04E-02 ± 5.07E-03	< 7.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 8

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	9.92E+03	CU.FT.	2.77E-02 ± 4.90E-03	< 5.E-02
01/10/17	01/17/17	9.79E+03	CU.FT.	3.04E-02 ± 4.97E-03	< 4.E-02
01/17/17	01/24/17	1.03E+04	CU.FT.	2.61E-02 ± 4.47E-03	< 5.E-02
01/24/17	01/31/17	9.86E+03	CU.FT.	2.10E-02 ± 4.14E-03	< 5.E-02
01/31/17	02/07/17	1.01E+04	CU.FT.	2.17E-02 ± 4.27E-03	< 4.E-02
02/07/17	02/14/17	1.01E+04	CU.FT.	1.71E-02 ± 4.31E-03	< 4.E-02
02/14/17	02/21/17	1.01E+04	CU.FT.	1.59E-02 ± 3.74E-03	< 3.E-02
02/21/17	02/28/17	1.00E+04	CU.FT.	1.21E-02 ± 3.74E-03	< 6.E-02
02/28/17	03/07/17	1.01E+04	CU.FT.	2.04E-02 ± 4.13E-03	< 6.E-02
03/07/17	03/14/17	1.00E+04	CU.FT.	1.38E-02 ± 3.82E-03	< 5.E-02
03/14/17	03/21/17	9.98E+03	CU.FT.	2.43E-02 ± 4.36E-03	< 3.E-02
03/21/17	03/28/17	1.01E+04	CU.FT.	1.51E-02 ± 3.92E-03	< 5.E-02
03/28/17	04/04/17	1.03E+04	CU.FT.	6.98E-03 ± 3.05E-03	< 6.E-02
04/04/17	04/11/17	1.02E+04	CU.FT.	1.52E-02 ± 3.39E-03	< 4.E-02
04/11/17	04/18/17	9.69E+03	CU.FT.	1.98E-02 ± 4.08E-03	< 5.E-02
04/18/17	04/25/17	1.01E+04	CU.FT.	1.35E-02 ± 3.66E-03	< 6.E-02
04/25/17	05/02/17	1.02E+04	CU.FT.	7.68E-03 ± 3.05E-03	< 5.E-02
05/02/17	05/09/17	9.92E+03	CU.FT.	1.81E-02 ± 4.17E-03	< 5.E-02
05/09/17	05/17/17	1.15E+04	CU.FT.	1.75E-02 ± 3.53E-03	< 3.E-02
05/17/17	05/23/17	8.59E+03	CU.FT.	6.03E-03 ± 3.16E-03	< 4.E-02
05/23/17	05/30/17	1.01E+04	CU.FT.	8.82E-03 ± 3.54E-03	< 7.E-02
05/30/17	06/06/17	1.00E+04	CU.FT.	1.67E-02 ± 3.97E-03	< 5.E-02
06/06/17	06/13/17	1.03E+04	CU.FT.	1.48E-02 ± 3.71E-03	< 1.E-02
06/13/17	06/20/17	9.93E+03	CU.FT.	1.33E-02 ± 3.77E-03	< 5.E-02
06/20/17	06/27/17	1.01E+04	CU.FT.	1.45E-02 ± 3.75E-03	< 4.E-02
06/27/17	07/03/17	8.59E+03	CU.FT.	1.74E-02 ± 4.46E-03	< 6.E-02
07/03/17	07/11/17	1.18E+04	CU.FT.	1.38E-02 ± 3.15E-03	< 4.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 8

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
07/11/17	07/18/17	1.01E+04	CU.FT.	2.11E-02 ± 4.20E-03	< 5.E-02
07/18/17	07/25/17	9.79E+03	CU.FT.	1.57E-02 ± 3.89E-03	< 5.E-02
07/25/17	08/01/17	1.02E+04	CU.FT.	1.93E-02 ± 3.94E-03	< 5.E-02
08/01/17	08/08/17	1.02E+04	CU.FT.	1.99E-02 ± 4.35E-03	< 2.E-02
08/08/17	08/14/17	8.49E+03	CU.FT.	2.35E-02 ± 4.70E-03	< 6.E-02
08/14/17	08/22/17	1.17E+04	CU.FT.	1.92E-02 ± 3.85E-03	< 5.E-02
08/22/17	08/29/17	9.96E+03	CU.FT.	2.24E-02 ± 4.15E-03	< 4.E-02
08/29/17	09/05/17	9.93E+03	CU.FT.	3.15E-02 ± 4.91E-03	< 6.E-02
09/05/17	09/13/17	1.15E+04	CU.FT.	3.06E-02 ± 4.53E-03	< 6.E-02
09/13/17	09/19/17	8.59E+03	CU.FT.	3.38E-02 ± 5.75E-03	< 6.E-02
09/19/17	09/25/17	8.61E+03	CU.FT.	2.55E-02 ± 4.71E-03	< 5.E-02
09/25/17	10/03/17	1.16E+04	CU.FT.	2.17E-02 ± 3.97E-03	< 5.E-02
10/03/17	10/10/17	1.01E+04	CU.FT.	1.77E-02 ± 3.90E-03	< 6.E-02
10/10/17	10/16/17	8.67E+03	CU.FT.	1.27E-02 ± 3.95E-03	< 6.E-02
10/16/17	10/24/17	1.15E+04	CU.FT.	1.91E-02 ± 3.95E-03	< 3.E-02
10/24/17	10/31/17	8.66E+03	CU.FT.	1.28E-02 ± 4.23E-03	< 7.E-02
10/31/17	11/07/17	1.02E+04	CU.FT.	2.28E-02 ± 4.22E-03	< 4.E-02
11/07/17	11/14/17	1.01E+04	CU.FT.	3.38E-02 ± 5.08E-03	< 3.E-02
11/14/17	11/21/17	1.00E+04	CU.FT.	2.97E-02 ± 4.70E-03	< 5.E-02
11/21/17	11/28/17	1.01E+04	CU.FT.	2.73E-02 ± 4.41E-03	< 6.E-02
11/28/17	12/05/17	1.00E+04	CU.FT.	2.03E-02 ± 4.11E-03	< 3.E-02
12/05/17	12/11/17	8.71E+03	CU.FT.	1.71E-02 ± 4.08E-03	< 3.E-02
12/11/17	12/19/17	1.15E+04	CU.FT.	2.94E-02 ± 4.42E-03	< 4.E-02
12/19/17	12/27/17	1.14E+04	CU.FT.	1.96E-02 ± 3.65E-03	< 6.E-02
12/27/17	01/02/18	8.67E+03	CU.FT.	3.28E-02 ± 5.26E-03	< 7.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 9

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	1.02E+04	CU.FT.	2.93E-02 ± 4.92E-03	< 4.E-02
01/10/17	01/17/17	9.85E+03	CU.FT.	2.48E-02 ± 4.60E-03	< 4.E-02
01/17/17	01/24/17	1.03E+04	CU.FT.	3.24E-02 ± 4.86E-03	< 5.E-02
01/24/17	01/31/17	9.86E+03	CU.FT.	1.66E-02 ± 3.80E-03	< 5.E-02
01/31/17	02/07/17	1.01E+04	CU.FT.	2.29E-02 ± 4.35E-03	< 4.E-02
02/07/17	02/14/17	1.01E+04	CU.FT.	1.35E-02 ± 4.06E-03	< 4.E-02
02/14/17	02/21/17	1.00E+04	CU.FT.	1.65E-02 ± 3.81E-03	< 5.E-02
02/21/17	02/28/17	1.01E+04	CU.FT.	1.26E-02 ± 3.75E-03	< 6.E-02
02/28/17	03/07/17	1.01E+04	CU.FT.	2.01E-02 ± 4.11E-03	< 6.E-02
03/07/17	03/14/17	1.00E+04	CU.FT.	1.51E-02 ± 3.92E-03	< 5.E-02
03/14/17	03/21/17	9.98E+03	CU.FT.	2.30E-02 ± 4.26E-03	< 6.E-02
03/21/17	03/28/17	1.01E+04	CU.FT.	1.76E-02 ± 4.11E-03	< 5.E-02
03/28/17	04/04/17	1.02E+04	CU.FT.	4.13E-02 ± 5.43E-03	< 6.E-02
04/04/17	04/11/17	7.46E+03	CU.FT.	2.22E-02 ± 4.76E-03	< 5.E-02
04/11/17	04/18/17	9.69E+03	CU.FT.	1.49E-02 ± 3.69E-03	< 5.E-02
04/18/17	04/25/17	1.01E+04	CU.FT.	1.33E-02 ± 3.65E-03	< 6.E-02
04/25/17	05/02/17	1.02E+04	CU.FT.	1.03E-02 ± 3.29E-03	< 5.E-02
05/02/17	05/09/17	9.97E+03	CU.FT.	1.72E-02 ± 4.09E-03	< 5.E-02
05/09/17	05/17/17	1.15E+04	CU.FT.	1.74E-02 ± 3.52E-03	< 3.E-02
05/17/17	05/23/17	8.60E+03	CU.FT.	1.04E-02 ± 3.63E-03	< 4.E-02
05/23/17	05/30/17	1.00E+04	CU.FT.	1.08E-02 ± 3.74E-03	< 7.E-02
05/30/17	06/06/17	1.00E+04	CU.FT.	2.02E-02 ± 4.23E-03	< 5.E-02
06/06/17	06/13/17	9.98E+03	CU.FT.	1.81E-02 ± 4.04E-03	< 3.E-02
06/13/17	06/20/17	9.97E+03	CU.FT.	1.09E-02 ± 3.55E-03	< 5.E-02
06/20/17	06/27/17	1.01E+04	CU.FT.	1.28E-02 ± 3.61E-03	< 4.E-02
06/27/17	07/03/17	8.53E+03	CU.FT.	1.50E-02 ± 4.29E-03	< 6.E-02
07/03/17	07/11/17	1.17E+04	CU.FT.	2.14E-02 ± 3.72E-03	< 4.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 9

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
07/11/17	07/18/17	9.75E+03	CU.FT.	2.05E-02 ± 4.25E-03	< 5.E-02
07/18/17	07/25/17	9.79E+03	CU.FT.	1.94E-02 ± 4.17E-03	< 5.E-02
07/25/17	08/01/17	1.02E+04	CU.FT.	2.02E-02 ± 4.00E-03	< 5.E-02
08/01/17	08/08/17	1.01E+04	CU.FT.	1.94E-02 ± 4.27E-03	< 6.E-02
08/08/17	08/14/17	8.54E+03	CU.FT.	2.35E-02 ± 4.69E-03	< 6.E-02
08/14/17	08/22/17	1.09E+04	CU.FT.	2.01E-02 ± 4.10E-03	< 5.E-02
08/22/17	08/29/17	9.99E+03	CU.FT.	1.67E-02 ± 3.71E-03	< 4.E-02
08/29/17	09/05/17	9.93E+03	CU.FT.	3.11E-02 ± 4.88E-03	< 6.E-02
09/05/17	09/13/17	1.15E+04	CU.FT.	2.84E-02 ± 4.40E-03	< 6.E-02
09/13/17	09/19/17	8.64E+03	CU.FT.	3.84E-02 ± 6.01E-03	< 3.E-02
09/19/17	09/25/17	8.55E+03	CU.FT.	2.08E-02 ± 4.37E-03	< 5.E-02
09/25/17	10/03/17	1.17E+04	CU.FT.	2.39E-02 ± 4.09E-03	< 5.E-02
10/03/17	10/10/17	1.00E+04	CU.FT.	1.39E-02 ± 3.62E-03	< 6.E-02
10/10/17	10/16/17	8.65E+03	CU.FT.	1.24E-02 ± 3.93E-03	< 6.E-02
10/16/17	10/24/17	1.13E+04	CU.FT.	2.01E-02 ± 4.07E-03	< 3.E-02
10/24/17	10/31/17	9.67E+03	CU.FT.	8.73E-03 ± 3.54E-03	< 6.E-02
10/31/17	11/07/17	1.01E+04	CU.FT.	2.05E-02 ± 4.08E-03	< 4.E-02
11/07/17	11/14/17	9.99E+03	CU.FT.	3.06E-02 ± 4.93E-03	< 3.E-02
11/14/17	11/21/17	1.01E+04	CU.FT.	2.54E-02 ± 4.39E-03	< 5.E-02
11/21/17	11/28/17	1.01E+04	CU.FT.	2.32E-02 ± 4.13E-03	< 6.E-02
11/28/17	12/05/17	9.97E+03	CU.FT.	1.88E-02 ± 4.01E-03	< 3.E-02
12/05/17	12/11/17	8.79E+03	CU.FT.	1.32E-02 ± 3.72E-03	< 3.E-02
12/11/17	12/19/17	1.15E+04	CU.FT.	2.10E-02 ± 3.88E-03	< 4.E-02
12/19/17	12/27/17	1.14E+04	CU.FT.	1.82E-02 ± 3.54E-03	< 6.E-02
12/27/17	01/02/18	8.67E+03	CU.FT.	3.49E-02 ± 5.40E-03	< 7.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 10

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	9.92E+03	CU.FT.	2.58E-02 ± 4.78E-03	< 5.E-02
01/10/17	01/17/17	1.01E+04	CU.FT.	2.27E-02 ± 4.39E-03	< 4.E-02
01/17/17	01/24/17	1.01E+04	CU.FT.	2.71E-02 ± 4.58E-03	< 5.E-02
01/24/17	01/31/17	9.99E+03	CU.FT.	2.05E-02 ± 4.06E-03	< 5.E-02
01/31/17	02/07/17	1.02E+04	CU.FT.	2.26E-02 ± 4.30E-03	< 1.E-02
02/07/17	02/14/17	1.01E+04	CU.FT.	1.22E-02 ± 3.96E-03	< 4.E-02
02/14/17	02/21/17	9.91E+03	CU.FT.	1.81E-02 ± 3.97E-03	< 5.E-02
02/21/17	02/28/17	1.02E+04	CU.FT.	1.22E-02 ± 3.69E-03	< 5.E-02
02/28/17	03/07/17	1.00E+04	CU.FT.	2.14E-02 ± 4.23E-03	< 6.E-02
03/07/17	03/14/17	1.02E+04	CU.FT.	2.06E-02 ± 4.26E-03	< 2.E-02
03/14/17	03/21/17	9.97E+03	CU.FT.	2.11E-02 ± 4.13E-03	< 6.E-02
03/21/17	03/28/17	1.00E+04	CU.FT.	1.11E-02 ± 3.62E-03	< 5.E-02
03/28/17	04/04/17	1.01E+04	CU.FT.	3.04E-02 ± 4.85E-03	< 6.E-02
04/04/17	04/11/17	1.04E+04	CU.FT.	1.48E-02 ± 3.32E-03	< 4.E-02
04/11/17	04/18/17	9.86E+03	CU.FT.	1.63E-02 ± 3.76E-03	< 5.E-02
04/18/17	04/25/17	9.97E+03	CU.FT.	9.79E-03 ± 3.38E-03	< 6.E-02
04/25/17	05/02/17	1.02E+04	CU.FT.	6.67E-03 ± 2.96E-03	< 3.E-02
05/02/17	05/09/17	9.98E+03	CU.FT.	2.07E-02 ± 4.34E-03	< 5.E-02
05/09/17	05/17/17	1.15E+04	CU.FT.	1.61E-02 ± 3.42E-03	< 3.E-02
05/17/17	05/23/17	8.59E+03	CU.FT.	9.32E-03 ± 3.52E-03	< 4.E-02
05/23/17	05/30/17	1.01E+04	CU.FT.	8.67E-03 ± 3.53E-03	< 7.E-02
05/30/17	06/06/17	1.00E+04	CU.FT.	1.94E-02 ± 4.17E-03	< 5.E-02
06/06/17	06/13/17	1.02E+04	CU.FT.	1.80E-02 ± 3.98E-03	< 3.E-02
06/13/17	06/20/17	1.00E+04	CU.FT.	1.24E-02 ± 3.67E-03	< 5.E-02
06/20/17	06/27/17	1.02E+04	CU.FT.	1.13E-02 ± 3.46E-03	< 4.E-02
06/27/17	07/03/17	8.43E+03	CU.FT.	1.63E-02 ± 4.43E-03	< 7.E-02
07/03/17	07/11/17	1.17E+04	CU.FT.	2.06E-02 ± 3.67E-03	< 4.E-02

VII-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 10

COLL START DATE	COLL STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
07/11/17	07/18/17	9.96E+03	CU.FT.	2.39E-02 ± 4.43E-03	< 5.E-02
07/18/17	07/25/17	1.01E+04	CU.FT.	1.54E-02 ± 3.78E-03	< 5.E-02
07/25/17	08/01/17	1.00E+04	CU.FT.	1.59E-02 ± 3.72E-03	< 5.E-02
08/01/17	08/08/17	1.01E+04	CU.FT.	1.76E-02 ± 4.13E-03	< 6.E-02
08/08/17	08/14/17	8.59E+03	CU.FT.	1.89E-02 ± 4.31E-03	< 6.E-02
08/14/17	08/22/17	1.15E+04	CU.FT.	1.74E-02 ± 3.77E-03	< 5.E-02
08/22/17	08/29/17	1.00E+04	CU.FT.	2.00E-02 ± 3.96E-03	< 4.E-02
08/29/17	09/05/17	1.02E+04	CU.FT.	2.70E-02 ± 4.55E-03	< 6.E-02
09/05/17	09/13/17	1.14E+04	CU.FT.	2.69E-02 ± 4.33E-03	< 6.E-02
09/13/17	09/19/17	8.64E+03	CU.FT.	2.98E-02 ± 5.48E-03	< 6.E-02
09/19/17	09/25/17	8.61E+03	CU.FT.	1.87E-02 ± 4.19E-03	< 5.E-02
09/25/17	10/03/17	1.15E+04	CU.FT.	1.63E-02 ± 3.62E-03	< 5.E-02
10/03/17	10/10/17	1.01E+04	CU.FT.	1.64E-02 ± 3.80E-03	< 6.E-02
10/10/17	10/16/17	8.67E+03	CU.FT.	1.19E-02 ± 3.88E-03	< 6.E-02
10/16/17	10/24/17	1.14E+04	CU.FT.	1.51E-02 ± 3.70E-03	< 3.E-02
10/24/17	10/31/17	1.01E+04	CU.FT.	9.44E-03 ± 3.49E-03	< 6.E-02
10/31/17	11/07/17	1.02E+04	CU.FT.	2.05E-02 ± 4.05E-03	< 4.E-02
11/07/17	11/14/17	1.02E+04	CU.FT.	2.86E-02 ± 4.74E-03	< 3.E-02
11/14/17	11/21/17	9.90E+03	CU.FT.	2.91E-02 ± 4.69E-03	< 5.E-02
11/21/17	11/28/17	1.02E+04	CU.FT.	2.22E-02 ± 4.03E-03	< 3.E-02
11/28/17	12/05/17	1.01E+04	CU.FT.	2.11E-02 ± 4.14E-03	< 3.E-02
12/05/17	12/11/17	8.53E+03	CU.FT.	1.61E-02 ± 4.05E-03	< 3.E-02
12/11/17	12/19/17	1.17E+04	CU.FT.	2.76E-02 ± 4.27E-03	< 4.E-02
12/19/17	12/27/17	1.12E+04	CU.FT.	2.16E-02 ± 3.82E-03	< 6.E-02
12/27/17	01/02/18	8.88E+03	CU.FT.	3.04E-02 ± 5.03E-03	< 3.E-02

VII-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 1

DATE COLLECTED	01/03-04/04/2017	04/04-07/03/2017	07/03-10/03/2017	10/03-01/02/2018
GAMMA SPECTRUM ANALYSIS:				
BE-7	1.51E-01 ± 3.58E-02	1.57E-01 ± 3.93E-02	1.02E-01 ± 3.87E-02	8.93E-02 ± 3.31E-02
K-40	< 5.E-02	< 1.E-02	< 3.E-02	< 5.E-02
MN-54	< 4.E-03	< 3.E-03	< 3.E-03	< 3.E-03
CO-58	< 5.E-03	< 4.E-03	< 3.E-03	< 4.E-03
FE-59	< 1.E-02	< 1.E-02	< 1.E-02	< 1.E-02
CO-60	< 3.E-03	< 2.E-03	< 2.E-03	< 3.E-03
ZN-65	< 9.E-03	< 5.E-03	< 8.E-03	< 7.E-03
ZR-95	< 1.E-02	< 7.E-03	< 7.E-03	< 7.E-03
RU-103	< 8.E-03	< 5.E-03	< 5.E-03	< 5.E-03
RU-106	< 3.E-02	< 2.E-02	< 2.E-02	< 2.E-02
I-131	< 1.E+00	< 3.E-01	< 4.E-01	< 2.E-01
CS-134	< 4.E-03	< 3.E-03	< 3.E-03	< 3.E-03
CS-137	< 3.E-03	< 3.E-03	< 2.E-03	< 2.E-03
BA-140	< 4.E-01	< 2.E-01	< 2.E-01	< 1.E-01
LA-140	< 1.E-01	< 5.E-02	< 7.E-02	< 4.E-02
CE-141	< 2.E-02	< 9.E-03	< 1.E-02	< 8.E-03
CE-144	< 2.E-02	< 1.E-02	< 1.E-02	< 1.E-02
RA-226	< 6.E-02	< 4.E-02	< 4.E-02	< 4.E-02
TH-228	< 5.E-03	< 4.E-03	< 4.E-03	< 3.E-03

VII-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 2

DATE COLLECTED	01/03-04/04/2017	04/04-07/03/2017	07/03-10/03/2017	10/03-01/02/2018
GAMMA SPECTRUM ANALYSIS:				
BE-7	1.24E-01 ± 3.15E-02	1.62E-01 ± 7.21E-02	1.83E-01 ± 6.50E-02	7.08E-02 ± 4.01E-02
K-40	< 3.E-02	< 6.E-02	< 4.E-02	< 6.E-02
MN-54	< 2.E-03	< 4.E-03	< 4.E-03	< 4.E-03
CO-58	< 3.E-03	< 7.E-03	< 8.E-03	< 5.E-03
FE-59	< 1.E-02	< 2.E-02	< 2.E-02	< 2.E-02
CO-60	< 3.E-03	< 4.E-03	< 4.E-03	< 6.E-03
ZN-65	< 5.E-03	< 1.E-02	< 1.E-02	< 1.E-02
ZR-95	< 6.E-03	< 1.E-02	< 1.E-02	< 1.E-02
RU-103	< 5.E-03	< 9.E-03	< 1.E-02	< 9.E-03
RU-106	< 2.E-02	< 4.E-02	< 4.E-02	< 4.E-02
I-131	< 6.E-01	< 6.E-01	< 7.E-01	< 4.E-01
CS-134	< 2.E-03	< 4.E-03	< 5.E-03	< 4.E-03
CS-137	< 2.E-03	< 4.E-03	< 5.E-03	< 4.E-03
BA-140	< 2.E-01	< 3.E-01	< 4.E-01	< 2.E-01
LA-140	< 1.E-01	< 1.E-01	< 1.E-01	< 8.E-02
CE-141	< 8.E-03	< 1.E-02	< 1.E-02	< 1.E-02
CE-144	< 1.E-02	< 1.E-02	< 2.E-02	< 2.E-02
RA-226	< 3.E-02	< 6.E-02	< 7.E-02	< 7.E-02
TH-228	< 3.E-03	< 5.E-03	< 6.E-03	< 6.E-03

VII-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 3

DATE COLLECTED	01/03-04/04/2017	04/04-07/03/2017	07/03-10/03/2017	10/03-01/02/2018
GAMMA SPECTRUM ANALYSIS:				
BE-7	1.24E-01 ± 3.23E-02	1.47E-01 ± 3.99E-02	1.20E-01 ± 4.00E-02	7.85E-02 ± 2.81E-02
K-40	< 3.E-02	< 5.E-02	< 7.E-02	< 4.E-02
MN-54	< 2.E-03	< 2.E-03	< 4.E-03	< 3.E-03
CO-58	< 3.E-03	< 4.E-03	< 6.E-03	< 4.E-03
FE-59	< 1.E-02	< 1.E-02	< 2.E-02	< 1.E-02
CO-60	< 4.E-03	< 4.E-03	< 3.E-03	< 2.E-03
ZN-65	< 6.E-03	< 6.E-03	< 8.E-03	< 7.E-03
ZR-95	< 8.E-03	< 7.E-03	< 1.E-02	< 8.E-03
RU-103	< 7.E-03	< 6.E-03	< 9.E-03	< 6.E-03
RU-106	< 2.E-02	< 3.E-02	< 3.E-02	< 2.E-02
I-131	< 6.E-01	< 4.E-01	< 5.E-01	< 3.E-01
CS-134	< 2.E-03	< 3.E-03	< 4.E-03	< 3.E-03
CS-137	< 2.E-03	< 2.E-03	< 4.E-03	< 3.E-03
BA-140	< 3.E-01	< 2.E-01	< 3.E-01	< 2.E-01
LA-140	< 1.E-01	< 6.E-02	< 1.E-01	< 5.E-02
CE-141	< 9.E-03	< 9.E-03	< 1.E-02	< 1.E-02
CE-144	< 1.E-02	< 1.E-02	< 2.E-02	< 2.E-02
RA-226	< 4.E-02	< 5.E-02	< 5.E-02	< 6.E-02
TH-228	< 4.E-03	< 4.E-03	< 5.E-03	< 4.E-03

VII-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 4

DATE COLLECTED	01/03-04/04/2017	04/04-07/03/2017	07/03-10/03/2017	10/03-01/02/2018
GAMMA SPECTRUM ANALYSIS:				
BE-7	1.25E-01 ± 3.30E-02	1.93E-01 ± 4.13E-02	8.88E-02 ± 3.37E-02	1.15E-01 ± 2.30E-02
K-40	< 4.E-02	< 5.E-02	< 5.E-02	< 3.E-02
MN-54	< 3.E-03	< 2.E-03	< 3.E-03	< 2.E-03
CO-58	< 4.E-03	< 4.E-03	< 4.E-03	< 3.E-03
FE-59	< 1.E-02	< 1.E-02	< 1.E-02	< 8.E-03
CO-60	< 3.E-03	< 3.E-03	< 2.E-03	< 1.E-03
ZN-65	< 6.E-03	< 6.E-03	< 7.E-03	< 5.E-03
ZR-95	< 8.E-03	< 7.E-03	< 6.E-03	< 5.E-03
RU-103	< 6.E-03	< 6.E-03	< 6.E-03	< 4.E-03
RU-106	< 2.E-02	< 2.E-02	< 2.E-02	< 2.E-02
I-131	< 6.E-01	< 3.E-01	< 4.E-01	< 2.E-01
CS-134	< 2.E-03	< 2.E-03	< 2.E-03	< 2.E-03
CS-137	< 2.E-03	< 3.E-03	< 2.E-03	< 1.E-03
BA-140	< 3.E-01	< 2.E-01	< 2.E-01	< 1.E-01
LA-140	< 9.E-02	< 6.E-02	< 5.E-02	< 5.E-02
CE-141	< 9.E-03	< 9.E-03	< 7.E-03	< 6.E-03
CE-144	< 1.E-02	< 1.E-02	< 1.E-02	< 9.E-03
RA-226	< 4.E-02	< 4.E-02	< 4.E-02	< 3.E-02
TH-228	< 3.E-03	< 4.E-03	< 3.E-03	< 3.E-03

VII-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 5

DATE COLLECTED	01/03-04/04/2017	04/04-07/03/2017	07/03-10/03/2017	10/03-01/02/2018
GAMMA SPECTRUM ANALYSIS:				
BE-7	1.16E-01 ± 6.57E-02	2.02E-01 ± 4.11E-02	1.37E-01 ± 3.41E-02	9.41E-02 ± 3.16E-02
K-40	< 4.E-02	< 5.E-02	< 5.E-02	< 4.E-02
MN-54	< 5.E-03	< 3.E-03	< 3.E-03	< 3.E-03
CO-58	< 7.E-03	< 5.E-03	< 4.E-03	< 3.E-03
FE-59	< 2.E-02	< 1.E-02	< 1.E-02	< 9.E-03
CO-60	< 6.E-03	< 2.E-03	< 2.E-03	< 2.E-03
ZN-65	< 1.E-02	< 8.E-03	< 6.E-03	< 7.E-03
ZR-95	< 1.E-02	< 8.E-03	< 8.E-03	< 6.E-03
RU-103	< 1.E-02	< 6.E-03	< 6.E-03	< 4.E-03
RU-106	< 4.E-02	< 3.E-02	< 3.E-02	< 2.E-02
I-131	< 1.E+00	< 5.E-01	< 4.E-01	< 2.E-01
CS-134	< 4.E-03	< 4.E-03	< 3.E-03	< 2.E-03
CS-137	< 3.E-03	< 3.E-03	< 2.E-03	< 2.E-03
BA-140	< 4.E-01	< 2.E-01	< 2.E-01	< 2.E-01
LA-140	< 1.E-01	< 9.E-02	< 9.E-02	< 5.E-02
CE-141	< 1.E-02	< 1.E-02	< 1.E-02	< 7.E-03
CE-144	< 1.E-02	< 1.E-02	< 1.E-02	< 1.E-02
RA-226	< 6.E-02	< 5.E-02	< 4.E-02	< 4.E-02
TH-228	< 5.E-03	< 5.E-03	< 4.E-03	< 3.E-03

VII-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 6

DATE COLLECTED	01/03-04/04/2017	04/04-07/03/2017	07/03-10/03/2017	10/03-01/02/2018
GAMMA SPECTRUM ANALYSIS:				
BE-7	9.43E-02 ± 3.97E-02	1.86E-01 ± 4.49E-02	1.21E-01 ± 3.36E-02	8.15E-02 ± 2.67E-02
K-40	< 2.E-01	< 6.E-02	< 5.E-02	< 5.E-02
MN-54	< 1.E-02	< 5.E-03	< 3.E-03	< 3.E-03
CO-58	< 2.E-02	< 6.E-03	< 5.E-03	< 4.E-03
FE-59	< 8.E-02	< 2.E-02	< 1.E-02	< 8.E-03
CO-60	< 3.E-02	< 4.E-03	< 4.E-03	< 3.E-03
ZN-65	< 4.E-02	< 1.E-02	< 8.E-03	< 7.E-03
ZR-95	< 6.E-02	< 1.E-02	< 9.E-03	< 8.E-03
RU-103	< 4.E-02	< 1.E-02	< 7.E-03	< 5.E-03
RU-106	< 1.E-01	< 3.E-02	< 3.E-02	< 2.E-02
I-131	< 4.E+00	< 5.E-01	< 5.E-01	< 2.E-01
CS-134	< 1.E-02	< 5.E-03	< 3.E-03	< 3.E-03
CS-137	< 1.E-02	< 4.E-03	< 3.E-03	< 2.E-03
BA-140	< 2.E+00	< 3.E-01	< 2.E-01	< 1.E-01
LA-140	< 3.E-01	< 9.E-02	< 8.E-02	< 5.E-02
CE-141	< 4.E-02	< 1.E-02	< 1.E-02	< 8.E-03
CE-144	< 6.E-02	< 2.E-02	< 2.E-02	< 1.E-02
RA-226	< 2.E-01	< 6.E-02	< 6.E-02	< 4.E-02
TH-228	< 2.E-02	< 6.E-03	< 5.E-03	< 4.E-03

VII-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 7

DATE COLLECTED	01/03-04/04/2017	04/04-07/03/2017	07/03-10/03/2017	10/03-01/02/2018
GAMMA SPECTRUM ANALYSIS:				
BE-7	1.60E-01 ± 3.25E-02	1.42E-01 ± 3.23E-02	8.51E-02 ± 3.09E-02	5.29E-02 ± 2.84E-02
K-40	< 6.E-02	< 4.E-02	< 4.E-02	< 3.E-02
MN-54	< 4.E-03	< 3.E-03	< 3.E-03	< 2.E-03
CO-58	< 6.E-03	< 5.E-03	< 4.E-03	< 3.E-03
FE-59	< 2.E-02	< 2.E-02	< 1.E-02	< 6.E-03
CO-60	< 5.E-03	< 3.E-03	< 2.E-03	< 2.E-03
ZN-65	< 1.E-02	< 1.E-02	< 6.E-03	< 5.E-03
ZR-95	< 1.E-02	< 9.E-03	< 7.E-03	< 5.E-03
RU-103	< 9.E-03	< 7.E-03	< 6.E-03	< 4.E-03
RU-106	< 3.E-02	< 3.E-02	< 2.E-02	< 2.E-02
I-131	< 1.E+00	< 4.E-01	< 3.E-01	< 2.E-01
CS-134	< 4.E-03	< 4.E-03	< 2.E-03	< 2.E-03
CS-137	< 3.E-03	< 3.E-03	< 2.E-03	< 2.E-03
BA-140	< 4.E-01	< 2.E-01	< 2.E-01	< 1.E-01
LA-140	< 2.E-01	< 7.E-02	< 5.E-02	< 6.E-02
CE-141	< 2.E-02	< 1.E-02	< 9.E-03	< 6.E-03
CE-144	< 2.E-02	< 2.E-02	< 1.E-02	< 9.E-03
RA-226	< 6.E-02	< 6.E-02	< 4.E-02	< 3.E-02
TH-228	< 5.E-03	< 5.E-03	< 3.E-03	< 3.E-03

VII-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 8

DATE COLLECTED	01/03-04/04/2017	04/04-07/03/2017	07/03-10/03/2017	10/03-01/02/2018
GAMMA SPECTRUM ANALYSIS:				
BE-7	1.39E-01 ± 4.60E-02	1.34E-01 ± 3.63E-02	1.18E-01 ± 4.63E-02	1.23E-01 ± 2.91E-02
K-40	< 5.E-02	< 4.E-02	< 6.E-02	< 3.E-02
MN-54	< 4.E-03	< 2.E-03	< 5.E-03	< 2.E-03
CO-58	< 6.E-03	< 3.E-03	< 5.E-03	< 3.E-03
FE-59	< 2.E-02	< 9.E-03	< 2.E-02	< 8.E-03
CO-60	< 4.E-03	< 3.E-03	< 3.E-03	< 3.E-03
ZN-65	< 8.E-03	< 6.E-03	< 1.E-02	< 6.E-03
ZR-95	< 9.E-03	< 8.E-03	< 1.E-02	< 5.E-03
RU-103	< 8.E-03	< 5.E-03	< 8.E-03	< 3.E-03
RU-106	< 3.E-02	< 2.E-02	< 3.E-02	< 2.E-02
I-131	< 1.E+00	< 3.E-01	< 6.E-01	< 2.E-01
CS-134	< 4.E-03	< 2.E-03	< 3.E-03	< 1.E-03
CS-137	< 3.E-03	< 2.E-03	< 3.E-03	< 2.E-03
BA-140	< 5.E-01	< 2.E-01	< 2.E-01	< 1.E-01
LA-140	< 1.E-01	< 5.E-02	< 1.E-01	< 4.E-02
CE-141	< 1.E-02	< 9.E-03	< 1.E-02	< 7.E-03
CE-144	< 2.E-02	< 1.E-02	< 1.E-02	< 1.E-02
RA-226	< 5.E-02	< 4.E-02	< 5.E-02	< 3.E-02
TH-228	< 5.E-03	< 4.E-03	< 6.E-03	< 3.E-03

VII-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 9

DATE COLLECTED	01/03-04/04/2017	04/04-07/03/2017	07/03-10/03/2017	10/03-01/02/2018
GAMMA SPECTRUM ANALYSIS:				
BE-7	8.50E-02 ± 3.97E-02	2.11E-01 ± 6.36E-02	1.02E-01 ± 3.48E-02	6.96E-02 ± 2.93E-02
K-40	< 2.E-02	< 8.E-02	< 5.E-02	< 4.E-02
MN-54	< 3.E-03	< 3.E-03	< 3.E-03	< 3.E-03
CO-58	< 4.E-03	< 7.E-03	< 3.E-03	< 4.E-03
FE-59	< 1.E-02	< 1.E-02	< 1.E-02	< 1.E-02
CO-60	< 2.E-03	< 4.E-03	< 3.E-03	< 3.E-03
ZN-65	< 7.E-03	< 1.E-02	< 7.E-03	< 6.E-03
ZR-95	< 7.E-03	< 9.E-03	< 8.E-03	< 8.E-03
RU-103	< 5.E-03	< 1.E-02	< 6.E-03	< 5.E-03
RU-106	< 2.E-02	< 4.E-02	< 2.E-02	< 2.E-02
I-131	< 6.E-01	< 5.E-01	< 4.E-01	< 2.E-01
CS-134	< 3.E-03	< 5.E-03	< 3.E-03	< 2.E-03
CS-137	< 2.E-03	< 4.E-03	< 3.E-03	< 3.E-03
BA-140	< 3.E-01	< 3.E-01	< 2.E-01	< 1.E-01
LA-140	< 1.E-01	< 1.E-01	< 6.E-02	< 5.E-02
CE-141	< 9.E-03	< 1.E-02	< 9.E-03	< 8.E-03
CE-144	< 8.E-03	< 1.E-02	< 1.E-02	< 1.E-02
RA-226	< 4.E-02	< 5.E-02	< 4.E-02	< 4.E-02
TH-228	< 3.E-03	< 5.E-03	< 4.E-03	< 4.E-03

VII-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 10

DATE COLLECTED	01/03-04/04/2017	04/04-07/03/2017	07/03-10/03/2017	10/03-01/02/2018
GAMMA SPECTRUM ANALYSIS:				
BE-7	1.33E-01 ± 3.94E-02	1.64E-01 ± 3.54E-02	1.13E-01 ± 4.25E-02	9.36E-02 ± 2.42E-02
K-40	< 4.E-02	< 2.E-02	< 4.E-02	< 3.E-02
MN-54	< 3.E-03	< 2.E-03	< 2.E-03	< 2.E-03
CO-58	< 5.E-03	< 3.E-03	< 4.E-03	< 2.E-03
FE-59	< 1.E-02	< 1.E-02	< 1.E-02	< 8.E-03
CO-60	< 4.E-03	< 3.E-03	< 3.E-03	< 2.E-03
ZN-65	< 7.E-03	< 7.E-03	< 9.E-03	< 5.E-03
ZR-95	< 1.E-02	< 6.E-03	< 7.E-03	< 5.E-03
RU-103	< 8.E-03	< 6.E-03	< 6.E-03	< 4.E-03
RU-106	< 3.E-02	< 2.E-02	< 3.E-02	< 2.E-02
I-131	< 9.E-01	< 3.E-01	< 4.E-01	< 2.E-01
CS-134	< 4.E-03	< 3.E-03	< 3.E-03	< 2.E-03
CS-137	< 3.E-03	< 2.E-03	< 3.E-03	< 2.E-03
BA-140	< 4.E-01	< 2.E-01	< 3.E-01	< 1.E-01
LA-140	< 1.E-01	< 1.E-01	< 7.E-02	< 2.E-02
CE-141	< 1.E-02	< 9.E-03	< 1.E-02	< 6.E-03
CE-144	< 1.E-02	< 1.E-02	< 1.E-02	< 9.E-03
RA-226	< 4.E-02	< 4.E-02	< 5.E-02	< 3.E-02
TH-228	< 4.E-03	< 4.E-03	< 4.E-03	< 3.E-03

VII-3

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

FISH

(PCI/KG WET)

STATION NUMBER 28

DATE COLLECTED	7/25/2017 CATFISH	7/25/2017	9/5/2017 CATFISH	9/5/2017 CARP
GAMMA SPECTRUM ANALYSIS:		(a)		
BE-7	< 3.E+02		< 6.E+02	< 6.E+02
K-40	2.13E+03 ± 7.85E+02		4.11E+03 ± 7.70E+02	3.05E+03 ± 7.61E+02
MN-54	< 4.E+01		< 7.E+01	< 7.E+01
CO-58	< 3.E+01		< 7.E+01	< 7.E+01
FE-59	< 1.E+02		< 2.E+02	< 1.E+02
CO-60	< 5.E+01		< 6.E+01	< 8.E+01
ZN-65	< 7.E+01		< 2.E+02	< 2.E+02
ZR-95	< 9.E+01		< 1.E+02	< 1.E+02
RU-103	< 4.E+01		< 8.E+01	< 8.E+01
RU-106	< 4.E+02		< 6.E+02	< 6.E+02
I-131	< 6.E+01		< 2.E+02	< 2.E+02
CS-134	< 3.E+01		< 7.E+01	< 8.E+01
CS-137	< 5.E+01		< 7.E+01	< 7.E+01
BA-140	< 2.E+02		< 5.E+02	< 5.E+02
CE-141	< 6.E+01		< 1.E+02	< 1.E+02
CE-144	< 2.E+02		< 4.E+02	< 4.E+02
RA-226	< 8.E+02		< 1.E+03	< 1.E+03
TH-228	< 7.E+01		< 1.E+02	< 1.E+02

(a) Fish sample was not avalible

VII-3

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

FISH

(PCI/KG WET)

STATION NUMBER 35

DATE COLLECTED	7/25/2017 CATFISH	7/25/2017 CARP	9/5/2017 CATFISH	9/5/2017 CARP
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 4.E+02	< 6.E+02	< 3.E+02	< 6.E+02
K-40	3.00E+03 ± 9.41E+02	2.09E+03 ± 1.15E+03	2.41E+03 ± 7.73E+02	3.76E+03 ± 1.04E+03
MN-54	< 6.E+01	< 7.E+01	< 5.E+01	< 6.E+01
CO-58	< 6.E+01	< 6.E+01	< 5.E+01	< 7.E+01
FE-59	< 1.E+02	< 1.E+02	< 8.E+01	< 2.E+02
CO-60	< 6.E+01	< 8.E+01	< 5.E+01	< 4.E+01
ZN-65	< 1.E+02	< 2.E+02	< 1.E+02	< 1.E+02
ZR-95	< 8.E+01	< 1.E+02	< 1.E+02	< 1.E+02
RU-103	< 6.E+01	< 6.E+01	< 5.E+01	< 7.E+01
RU-106	< 5.E+02	< 6.E+02	< 3.E+02	< 6.E+02
I-131	< 9.E+01	< 1.E+02	< 1.E+02	< 2.E+02
CS-134	< 7.E+01	< 8.E+01	< 5.E+01	< 7.E+01
CS-137	< 5.E+01	< 6.E+01	< 4.E+01	< 6.E+01
BA-140	< 3.E+02	< 3.E+02	< 3.E+02	< 5.E+02
CE-141	< 8.E+01	< 1.E+02	< 7.E+01	< 9.E+01
CE-144	< 3.E+02	< 4.E+02	< 2.E+02	< 3.E+02
RA-226	< 1.E+03	< 2.E+03	< 8.E+02	< 1.E+03
TH-228	< 9.E+01	< 1.E+02	< 7.E+01	< 1.E+02

VII-4

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

MILK NEAREST PRODUCER

(PCI/LITER)

STATION NUMBER 99

DATE COLLECTED	1/3/2017	2/7/2017	3/7/2017	4/4/2017
RADIOCHEMICAL ANALYSIS:				
I-131	< 5.E-01	< 8.E-01	< 3.E-01	< 3.E-01
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 6.E+01	< 7.E+01	< 5.E+01	< 7.E+01
K-40	1.20E+03 ± 1.53E+02	1.22E+03 ± 1.82E+02	1.32E+03 ± 1.91E+02	1.19E+03 ± 1.75E+02
MN-54	< 7.E+00	< 8.E+00	< 7.E+00	< 8.E+00
CO-58	< 6.E+00	< 9.E+00	< 7.E+00	< 8.E+00
FE-59	< 1.E+01	< 2.E+01	< 2.E+01	< 2.E+01
CO-60	< 7.E+00	< 7.E+00	< 8.E+00	< 1.E+01
ZN-65	< 2.E+01	< 2.E+01	< 2.E+01	< 2.E+01
ZR-95	< 1.E+01	< 1.E+01	< 2.E+01	< 1.E+01
RU-103	< 6.E+00	< 8.E+00	< 6.E+00	< 8.E+00
RU-106	< 7.E+01	< 7.E+01	< 7.E+01	< 8.E+01
I-131	< 9.E+00	< 1.E+01	< 1.E+01	< 1.E+01
CS-134	< 7.E+00	< 8.E+00	< 9.E+00	< 9.E+00
CS-137	< 8.E+00	< 8.E+00	< 8.E+00	< 9.E+00
BA-140	< 3.E+01	< 3.E+01	< 3.E+01	< 4.E+01
LA-140	< 9.E+00	< 7.E+00	< 7.E+00	< 1.E+01
CE-141	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CE-144	< 6.E+01	< 7.E+01	< 5.E+01	< 7.E+01
RA-226	< 2.E+02	< 2.E+02	< 2.E+02	< 2.E+02
TH-228	< 2.E+01	< 2.E+01	< 2.E+01	< 2.E+01

VII-4

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

MILK NEAREST PRODUCER

(PCI/LITER)

STATION NUMBER 99

DATE COLLECTED	5/2/2017	6/6/2017	6/6/2017	6/20/2017
RADIOCHEMICAL ANALYSIS:				
I-131	< 8.E-01	< 1.E+00	< 7.E-01	< 5.E-01
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 5.E+01	< 7.E+01	< 8.E+01	< 6.E+01
K-40	1.15E+03 ± 1.64E+02	1.32E+03 ± 1.86E+02	1.45E+03 ± 2.03E+02	1.45E+03 ± 1.86E+02
MN-54	< 8.E+00	< 9.E+00	< 9.E+00	< 9.E+00
CO-58	< 9.E+00	< 7.E+00	< 1.E+01	< 7.E+00
FE-59	< 2.E+01	< 2.E+01	< 2.E+01	< 2.E+01
CO-60	< 7.E+00	< 1.E+01	< 1.E+01	< 1.E+01
ZN-65	< 2.E+01	< 2.E+01	< 2.E+01	< 2.E+01
ZR-95	< 1.E+01	< 1.E+01	< 2.E+01	< 1.E+01
RU-103	< 8.E+00	< 7.E+00	< 1.E+01	< 7.E+00
RU-106	< 7.E+01	< 7.E+01	< 8.E+01	< 8.E+01
I-131	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CS-134	< 9.E+00	< 7.E+00	< 1.E+01	< 9.E+00
CS-137	< 8.E+00	< 9.E+00	< 1.E+01	< 8.E+00
BA-140	< 3.E+01	< 4.E+01	< 4.E+01	< 3.E+01
LA-140	< 1.E+01	< 8.E+00	< 1.E+01	< 8.E+00
CE-141	< 1.E+01	< 2.E+01	< 1.E+01	< 1.E+01
CE-144	< 4.E+01	< 6.E+01	< 6.E+01	< 4.E+01
RA-226	< 2.E+02	< 2.E+02	< 2.E+02	< 2.E+02
TH-228	< 1.E+01	< 2.E+01	< 2.E+01	< 1.E+01

VII-4

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

MILK NEAREST PRODUCER

(PCI/LITER)

STATION NUMBER 99

DATE COLLECTED	7/3/2017	7/3/2017	7/18/2017	8/1/2017
RADIOCHEMICAL ANALYSIS:				
I-131	< 5.E-01	< 6.E-01	< 6.E-01	< 6.E-01
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 6.E+01	< 6.E+01	< 8.E+01	< 5.E+01
K-40	1.34E+03 ± 1.57E+02	1.23E+03 ± 1.54E+02	1.24E+03 ± 2.07E+02	1.35E+03 ± 1.54E+02
MN-54	< 8.E+00	< 7.E+00	< 9.E+00	< 7.E+00
CO-58	< 8.E+00	< 8.E+00	< 1.E+01	< 6.E+00
FE-59	< 2.E+01	< 2.E+01	< 2.E+01	< 1.E+01
CO-60	< 8.E+00	< 7.E+00	< 1.E+01	< 5.E+00
ZN-65	< 2.E+01	< 2.E+01	< 2.E+01	< 1.E+01
ZR-95	< 1.E+01	< 1.E+01	< 2.E+01	< 1.E+01
RU-103	< 9.E+00	< 8.E+00	< 1.E+01	< 7.E+00
RU-106	< 6.E+01	< 6.E+01	< 1.E+02	< 5.E+01
I-131	< 2.E+01	< 2.E+01	< 1.E+01	< 8.E+00
CS-134	< 8.E+00	< 9.E+00	< 1.E+01	< 7.E+00
CS-137	< 8.E+00	< 7.E+00	< 1.E+01	< 7.E+00
BA-140	< 5.E+01	< 5.E+01	< 4.E+01	< 3.E+01
LA-140	< 1.E+01	< 1.E+01	< 1.E+01	< 7.E+00
CE-141	< 2.E+01	< 1.E+01	< 2.E+01	< 1.E+01
CE-144	< 5.E+01	< 4.E+01	< 7.E+01	< 5.E+01
RA-226	< 2.E+02	< 1.E+02	< 3.E+02	< 2.E+02
TH-228	< 1.E+01	< 1.E+01	< 2.E+01	< 9.E+00

VII-4

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

MILK NEAREST PRODUCER

(PCI/LITER)

STATION NUMBER 99

DATE COLLECTED	8/1/2017	8/15/2017	8/29/2017	9/5/2017
RADIOCHEMICAL ANALYSIS:				
I-131	< 6.E-01	< 5.E-01	< 2.E-01	< 7.E-01
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 8.E+01	< 7.E+01	< 8.E+01	< 3.E+01
K-40	1.50E+03 ± 2.04E+02	1.27E+03 ± 1.89E+02	1.37E+03 ± 2.23E+02	1.39E+03 ± 7.53E+01
MN-54	< 1.E+01	< 9.E+00	< 8.E+00	< 3.E+00
CO-58	< 9.E+00	< 9.E+00	< 1.E+01	< 3.E+00
FE-59	< 2.E+01	< 2.E+01	< 2.E+01	< 8.E+00
CO-60	< 1.E+01	< 1.E+01	< 8.E+00	< 3.E+00
ZN-65	< 2.E+01	< 2.E+01	< 3.E+01	< 7.E+00
ZR-95	< 2.E+01	< 2.E+01	< 1.E+01	< 6.E+00
RU-103	< 1.E+01	< 1.E+01	< 1.E+01	< 4.E+00
RU-106	< 9.E+01	< 8.E+01	< 8.E+01	< 3.E+01
I-131	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CS-134	< 1.E+01	< 1.E+01	< 1.E+01	< 3.E+00
CS-137	< 1.E+01	< 1.E+01	< 9.E+00	< 3.E+00
BA-140	< 4.E+01	< 4.E+01	< 4.E+01	< 2.E+01
LA-140	< 1.E+01	< 1.E+01	< 1.E+01	< 7.E+00
CE-141	< 2.E+01	< 1.E+01	< 1.E+01	< 7.E+00
CE-144	< 6.E+01	< 6.E+01	< 6.E+01	< 3.E+01
RA-226	< 2.E+02	< 2.E+02	< 2.E+02	< 8.E+01
TH-228	< 2.E+01	< 2.E+01	< 2.E+01	7.64E+00 ± 4.91E+00

VII-4

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

MILK NEAREST PRODUCER

(PCI/LITER)

STATION NUMBER 99

DATE COLLECTED	9/5/2017	9/19/2017	9/26/2017	10/3/2017
RADIOCHEMICAL ANALYSIS:				
I-131	< 8.E-01	< 4.E-01	< 4.E-01	< 7.E-01
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 3.E+01	< 8.E+01	< 7.E+01	< 6.E+01
K-40	1.39E+03 ± 9.90E+01	1.22E+03 ± 1.62E+02	1.11E+03 ± 1.69E+02	1.34E+03 ± 1.79E+02
MN-54	< 3.E+00	< 9.E+00	< 7.E+00	< 6.E+00
CO-58	< 3.E+00	< 1.E+01	< 7.E+00	< 6.E+00
FE-59	< 1.E+01	< 2.E+01	< 2.E+01	< 2.E+01
CO-60	< 4.E+00	< 1.E+01	< 8.E+00	< 7.E+00
ZN-65	< 9.E+00	< 2.E+01	< 2.E+01	< 2.E+01
ZR-95	< 7.E+00	< 2.E+01	< 1.E+01	< 1.E+01
RU-103	< 4.E+00	< 1.E+01	< 7.E+00	< 6.E+00
RU-106	< 3.E+01	< 8.E+01	< 7.E+01	< 6.E+01
I-131	< 1.E+01	< 2.E+01	< 1.E+01	< 1.E+01
CS-134	< 4.E+00	< 1.E+01	< 7.E+00	< 5.E+00
CS-137	< 3.E+00	< 1.E+01	< 7.E+00	< 6.E+00
BA-140	< 2.E+01	< 5.E+01	< 3.E+01	< 3.E+01
LA-140	< 8.E+00	< 1.E+01	< 1.E+01	< 1.E+01
CE-141	< 7.E+00	< 2.E+01	< 1.E+01	< 1.E+01
CE-144	< 2.E+01	< 9.E+01	< 4.E+01	< 5.E+01
RA-226	< 8.E+01	< 3.E+02	< 1.E+02	< 2.E+02
TH-228	< 7.E+00	< 2.E+01	< 1.E+01	< 1.E+01

VII-4

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

MILK NEAREST PRODUCER

(PCI/LITER)

STATION NUMBER 99

DATE COLLECTED	10/3/2017	10/10/2017	10/24/2017	11/7/2017
RADIOCHEMICAL ANALYSIS:				
I-131	< 8.E-01	< 7.E-01	< 2.E-01	< 8.E-01
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 7.E+01	< 9.E+01	< 7.E+01	< 8.E+01
K-40	1.34E+03 ± 1.98E+02	1.16E+03 ± 1.59E+02	1.36E+03 ± 1.72E+02	1.30E+03 ± 1.72E+02
MN-54	< 8.E+00	< 1.E+01	< 8.E+00	< 1.E+01
CO-58	< 9.E+00	< 9.E+00	< 7.E+00	< 1.E+01
FE-59	< 1.E+01	< 2.E+01	< 2.E+01	< 2.E+01
CO-60	< 8.E+00	< 1.E+01	< 7.E+00	< 1.E+01
ZN-65	< 2.E+01	< 2.E+01	< 2.E+01	< 2.E+01
ZR-95	< 1.E+01	< 2.E+01	< 1.E+01	< 2.E+01
RU-103	< 9.E+00	< 1.E+01	< 8.E+00	< 1.E+01
RU-106	< 8.E+01	< 9.E+01	< 7.E+01	< 9.E+01
I-131	< 1.E+01	< 1.E+01	< 1.E+01	< 2.E+01
CS-134	< 9.E+00	< 1.E+01	< 9.E+00	< 1.E+01
CS-137	< 7.E+00	< 1.E+01	< 9.E+00	< 1.E+01
BA-140	< 4.E+01	< 4.E+01	< 3.E+01	< 5.E+01
LA-140	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CE-141	< 1.E+01	< 2.E+01	< 1.E+01	< 2.E+01
CE-144	< 5.E+01	< 8.E+01	< 6.E+01	< 8.E+01
RA-226	< 2.E+02	< 3.E+02	< 2.E+02	< 3.E+02
TH-228	< 1.E+01	< 2.E+01	< 2.E+01	< 2.E+01

VII-4

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

MILK NEAREST PRODUCER

(PCI/LITER)

STATION NUMBER 99

DATE COLLECTED	12/5/2017
RADIOCHEMICAL ANALYSIS:	
I-131	< 8.E-01
GAMMA SPECTRUM ANALYSIS:	
BE-7	< 6.E+01
K-40	1.32E+03 ± 1.86E+02
MN-54	< 6.E+00
CO-58	< 9.E+00
FE-59	< 2.E+01
CO-60	< 8.E+00
ZN-65	< 2.E+01
ZR-95	< 1.E+01
RU-103	< 7.E+00
RU-106	< 5.E+01
I-131	< 1.E+01
CS-134	< 7.E+00
CS-137	< 8.E+00
BA-140	< 3.E+01
LA-140	< 7.E+00
CE-141	< 1.E+01
CE-144	< 6.E+01
RA-226	< 2.E+02
TH-228	< 2.E+01

VII-5

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

MILK OTHER PRODUCERS

(PCI/LITER)

STATION NUMBER 103

DATE COLLECTED

MILK - OTHER PRODUCER LOCATON 103 IS NO LONGER AVAILABLE BUT WILL REMAIN AS AN OPTION FOR SAMPLE COLLECTION IF CONDITIONS CHANGE.

RADIOCHEMICAL ANALYSIS:

I-131

GAMMA SPECTRUM ANALYSIS:

BE-7
K-40
MN-54
CO-58
FE-59
CO-60
ZN-65
ZR-95
RU-103
RU-106
I-131
CS-134
CS-137
BA-140
LA-140
CE-141
CE-144
RA-226
TH-228

VII-6

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

WATER - GROUND

(PCI/LITER)

STATION NUMBER 11

DATE COLLECTED	1/10/2017	4/4/2017	7/18/2017	10/18/2017
RADIOCHEMICAL ANALYSIS:				
I-131	< 7.E-01	< 3.E-01	< 5.E-01	< 5.E-01
H-3	< 3.E+02	< 3.E+02	< 3.E+02	< 3.E+02
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 7.E+01	< 6.E+01	< 7.E+01	< 5.E+01
K-40	< 7.E+01	< 1.E+02	< 9.E+01	< 1.E+02
MN-54	< 8.E+00	< 6.E+00	< 8.E+00	< 7.E+00
CO-58	< 9.E+00	< 5.E+00	< 6.E+00	< 6.E+00
FE-59	< 2.E+01	< 1.E+01	< 2.E+01	< 1.E+01
CO-60	< 9.E+00	< 6.E+00	< 8.E+00	< 6.E+00
ZN-65	< 2.E+01	< 1.E+01	< 2.E+01	< 1.E+01
ZR-95	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
RU-103	< 1.E+01	< 5.E+00	< 9.E+00	< 7.E+00
RU-106	< 8.E+01	< 7.E+01	< 6.E+01	< 5.E+01
I-131	< 2.E+01	< 8.E+00	< 9.E+00	< 1.E+01
CS-134	< 9.E+00	< 7.E+00	< 8.E+00	< 7.E+00
CS-137	< 9.E+00	< 8.E+00	< 7.E+00	< 6.E+00
BA-140	< 4.E+01	< 3.E+01	< 3.E+01	< 3.E+01
LA-140	< 1.E+01	< 7.E+00	< 9.E+00	< 1.E+01
CE-141	< 2.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CE-144	< 7.E+01	< 5.E+01	< 6.E+01	< 4.E+01
RA-226	< 3.E+02	< 2.E+02	< 2.E+02	< 1.E+02
TH-228	< 2.E+01	< 1.E+01	< 1.6E+01	< 1.E+01

VII-6

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

WATER - GROUND

(PCI/LITER)

STATION NUMBER 47

DATE COLLECTED	1/10/2017	4/4/2017	7/18/2017	10/18/2017
RADIOCHEMICAL ANALYSIS:				
I-131	< 7.E-01	< 3.E-01	< 5.E-01	< 7.E-01
H-3	< 3.E+02	< 3.E+02	< 3.E+02	< 3.E+02
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 6.E+01	< 7.E+01	< 7.E+01	< 7.E+01
K-40	< 1.E+02	< 2.E+02	< 9.E+01	< 1.E+02
MN-54	< 6.E+00	< 8.E+00	< 8.E+00	< 9.E+00
CO-58	< 6.E+00	< 8.E+00	< 9.E+00	< 7.E+00
FE-59	< 1.E+01	< 1.E+01	< 1.E+01	< 2.E+01
CO-60	< 6.E+00	< 1.E+01	< 9.E+00	< 6.E+00
ZN-65	< 1.E+01	< 2.E+01	< 2.E+01	< 1.E+01
ZR-95	< 1.E+01	< 1.E+01	< 2.E+01	< 1.E+01
RU-103	< 6.E+00	< 9.E+00	< 9.E+00	< 8.E+00
RU-106	< 5.E+01	< 8.E+01	< 9.E+01	< 5.E+01
I-131	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CS-134	< 5.E+00	< 1.E+01	< 1.E+01	< 8.E+00
CS-137	< 6.E+00	< 9.E+00	< 9.E+00	< 8.E+00
BA-140	< 3.E+01	< 3.E+01	< 4.E+01	< 3.E+01
LA-140	< 9.E+00	< 1.E+01	< 1.E+01	< 1.E+01
CE-141	< 1.E+01	< 1.E+01	< 2.E+01	< 2.E+01
CE-144	< 5.E+01	< 6.E+01	< 8.E+01	< 5.E+01
RA-226	< 2.E+02	< 2.E+02	< 2.E+02	< 2.E+02
TH-228	< 1.E+01	< 2.E+01	< 2.E+01	< 2.E+01

VII-7

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

WATER - RIVER

(PCI/LITER)

STATION NUMBER 28

DATE COLLECTED	1/17/2017	2/7/2017	3/7/2017	4/5/2017
RADIOCHEMICAL ANALYSIS:				
H-3	< 3.E+02	< 3.E+02	< 3.E+02	< 3.E+02
H-3 Qtrly			< 3.E+02	
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 4.E+01	< 5.E+01	< 8.E+01	< 5.E+01
K-40	< 5.E+01	< 5.E+01	< 8.E+01	< 2.E+02
MN-54	< 6.E+00	< 6.E+00	< 1.E+01	< 7.E+00
CO-58	< 5.E+00	< 7.E+00	< 9.E+00	< 6.E+00
FE-59	< 1.E+01	< 1.E+01	< 2.E+01	< 1.E+01
CO-60	< 5.E+00	< 7.E+00	< 9.E+00	< 8.E+00
ZN-65	< 1.E+01	< 1.E+01	< 2.E+01	< 1.E+01
ZR-95	< 8.E+00	< 9.E+00	< 1.E+01	< 9.E+00
RU-103	< 6.E+00	< 6.E+00	< 9.E+00	< 7.E+00
RU-106	< 4.E+01	< 6.E+01	< 8.E+01	< 6.E+01
I-131	< 7.E+00	< 7.E+00	< 1.E+01	< 8.E+00
CS-134	< 5.E+00	< 6.E+00	< 1.E+01	< 7.E+00
CS-137	< 6.E+00	< 7.E+00	< 8.E+00	< 8.E+00
BA-140	< 2.E+01	< 2.E+01	< 4.E+01	< 2.E+01
LA-140	< 5.E+00	< 9.E+00	< 1.E+01	< 8.E+00
CE-141	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CE-144	< 4.E+01	< 5.E+01	< 5.E+01	< 5.E+01
RA-226	< 2.E+02	< 1.E+02	< 2.E+02	< 2.E+02
TH-228	< 1.E+01	< 1.E+01	< 2.E+01	< 1.E+01

VII-7

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

WATER - RIVER

(PCI/LITER)

STATION NUMBER 28

DATE COLLECTED	5/3/2017	6/7/2017	7/3/2017	8/1/2017
RADIOCHEMICAL ANALYSIS:				
H-3	< 3.E+02	< 2.E+02	< 3.E+02	< 3.E+02
H-3 Qtrly		< 3.E+02		
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 6.E+01	< 6.E+01	< 5.E+01	< 5.E+01
K-40	< 7.E+01	< 9.E+01	< 1.E+02	< 1.E+02
MN-54	< 6.E+00	< 7.E+00	< 5.E+00	< 5.E+00
CO-58	< 6.E+00	< 7.E+00	< 6.E+00	< 7.E+00
FE-59	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CO-60	< 7.E+00	< 8.E+00	< 6.E+00	< 7.E+00
ZN-65	< 1.E+01	< 1.E+01	< 1.E+01	< 2.E+01
ZR-95	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
RU-103	< 6.E+00	< 7.E+00	< 6.E+00	< 7.E+00
RU-106	< 6.E+01	< 6.E+01	< 5.E+01	< 6.E+01
I-131	< 9.E+00	< 9.E+00	< 8.E+00	< 9.E+00
CS-134	< 8.E+00	< 9.E+00	< 7.E+00	< 7.E+00
CS-137	< 6.E+00	< 8.E+00	< 7.E+00	< 8.E+00
BA-140	< 3.E+01	< 3.E+01	< 2.E+01	< 2.E+01
LA-140	< 1.E+01	< 8.E+00	< 7.E+00	< 8.E+00
CE-141	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CE-144	< 5.E+01	< 5.E+01	< 4.E+01	< 5.E+01
RA-226	< 2.E+02	< 2.E+02	< 1.E+02	< 1.E+02
TH-228	< 1.E+01	< 2.E+01	< 1.E+01	< 1.E+01

VII-7

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

WATER - RIVER

(PCI/LITER)

STATION NUMBER 28

DATE COLLECTED	9/5/2017	10/3/2017	11/7/2017	12/6/2017
RADIOCHEMICAL ANALYSIS:				
H-3	< 3.E+02	< 3.E+02	< 3.E+02	< 3.E+02
H-3 Qtrly	< 3.E+02			< 3.E+02
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 4.E+01	< 7.E+01	< 6.E+01	< 6.E+01
K-40	< 6.E+01	< 1.E+02	< 1.E+02	< 2.E+02
MN-54	< 6.E+00	< 7.E+00	< 6.E+00	< 6.E+00
CO-58	< 7.E+00	< 7.E+00	< 5.E+00	< 7.E+00
FE-59	< 1.E+01	< 2.E+01	< 2.E+01	< 2.E+01
CO-60	< 6.E+00	< 8.E+00	< 6.E+00	< 4.E+00
ZN-65	< 1.E+01	< 1.E+01	< 1.E+01	< 2.E+01
ZR-95	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
RU-103	< 7.E+00	< 8.E+00	< 7.E+00	< 8.E+00
RU-106	< 5.E+01	< 7.E+01	< 6.E+01	< 7.E+01
I-131	< 1.E+01	< 1.E+01	< 1.E+01	< 7.E+00
CS-134	< 6.E+00	< 8.E+00	< 7.E+00	< 9.E+00
CS-137	< 6.E+00	< 7.E+00	< 7.E+00	< 8.E+00
BA-140	< 3.E+01	< 4.E+01	< 3.E+01	< 3.E+01
LA-140	< 1.E+01	< 1.E+01	< 1.E+01	< 6.E+00
CE-141	< 1.E+01	< 1.E+01	< 9.E+00	< 1.E+01
CE-144	< 4.E+01	< 5.E+01	< 3.E+01	< 5.E+01
RA-226	< 2.E+02	< 2.E+02	< 1.E+02	< 2.E+02
TH-228	< 1.E+01	< 1.E+01	< 1.E+01	< 2.E+01

VII-7

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

WATER - RIVER

(PCI/LITER)

STATION NUMBER 35

DATE COLLECTED	1/17/2017	2/7/2017	3/7/2017	4/5/2017
RADIOCHEMICAL ANALYSIS:				
H-3	< 3.E+02	< 3.E+02	< 3.E+02	< 3.E+02
H-3 Qtrly			< 3.E+02	
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 5.E+01	< 7.E+01	< 7.E+01	< 7.E+01
K-40	< 2.E+02	< 6.E+01	< 2.E+02	< 1.E+02
MN-54	< 6.E+00	< 6.E+00	< 8.E+00	< 7.E+00
CO-58	< 7.E+00	< 7.E+00	< 8.E+00	< 7.E+00
FE-59	< 2.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CO-60	< 7.E+00	< 4.E+00	< 8.E+00	< 8.E+00
ZN-65	< 2.E+01	< 1.E+01	< 2.E+01	< 1.E+01
ZR-95	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
RU-103	< 8.E+00	< 7.E+00	< 9.E+00	< 7.E+00
RU-106	< 7.E+01	< 6.E+01	< 7.E+01	< 8.E+01
I-131	< 8.E+00	< 1.E+01	< 1.E+01	< 8.E+00
CS-134	< 6.E+00	< 7.E+00	< 8.E+00	< 8.E+00
CS-137	< 8.E+00	< 6.E+00	< 7.E+00	< 9.E+00
BA-140	< 3.E+01	< 3.E+01	< 3.E+01	< 3.E+01
LA-140	< 1.E+01	< 9.E+00	< 1.E+01	< 1.E+01
CE-141	< 1.E+01	< 1.E+01	< 2.E+01	< 1.E+01
CE-144	< 4.E+01	< 6.E+01	< 7.E+01	< 5.E+01
RA-226	< 2.E+02	< 2.E+02	< 2.E+02	< 2.E+02
TH-228	< 1.E+01	< 2.E+01	< 2.E+01	< 2.E+01

VII-7

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

WATER - RIVER

(PCI/LITER)

STATION NUMBER 35

DATE COLLECTED	5/3/2017	6/7/2017	7/3/2017	8/1/2017
RADIOCHEMICAL ANALYSIS:				
H-3	< 3.E+02	< 2.E+02	< 3.E+02	< 3.E+02
H-3 Qtrly		< 3.E+02		
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 5.E+01	< 7.E+01	< 6.E+01	< 8.E+01
K-40	< 7.E+01	< 1.E+02	< 1.E+02	< 9.E+01
MN-54	< 6.E+00	< 7.E+00	< 6.E+00	< 1.E+01
CO-58	< 7.E+00	< 7.E+00	< 6.E+00	< 9.E+00
FE-59	< 1.E+01	< 2.E+01	< 1.E+01	< 2.E+01
CO-60	< 7.E+00	< 9.E+00	< 8.E+00	< 9.E+00
ZN-65	< 1.E+01	< 2.E+01	< 1.E+01	< 3.E+01
ZR-95	< 1.E+01	< 2.E+01	< 1.E+01	< 1.E+01
RU-103	< 7.E+00	< 8.E+00	< 6.E+00	< 1.E+01
RU-106	< 5.E+01	< 7.E+01	< 6.E+01	< 9.E+01
I-131	< 9.E+00	< 1.E+01	< 9.E+00	< 1.E+01
CS-134	< 6.E+00	< 9.E+00	< 7.E+00	< 1.E+01
CS-137	< 6.E+00	< 8.E+00	< 6.E+00	< 9.E+00
BA-140	< 3.E+01	< 3.E+01	< 3.E+01	< 4.E+01
LA-140	< 7.E+00	< 1.E+01	< 9.E+00	< 1.E+01
CE-141	< 1.E+01	< 1.E+01	< 1.E+01	< 2.E+01
CE-144	< 5.E+01	< 5.E+01	< 4.E+01	< 9.E+01
RA-226	< 2.E+02	< 2.E+02	< 2.E+02	< 3.E+02
TH-228	< 1.E+01	< 2.E+01	< 1.E+01	< 2.E+01

VII-7

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

WATER - RIVER

(PCI/LITER)

STATION NUMBER 35

DATE COLLECTED	9/5/2017	10/3/2017	11/7/2017	12/6/2017
RADIOCHEMICAL ANALYSIS:				
H-3	< 3.E+02	< 3.E+02	< 3.E+02	< 3.E+02
H-3 Qtrly	< 3.E+02			< 3.E+02
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 6.E+01	< 7.E+01	< 5.E+01	< 5.E+01
K-40	< 1.E+02	< 1.E+02	< 6.E+01	< 1.E+02
MN-54	< 7.E+00	< 6.E+00	< 4.E+00	< 9.E+00
CO-58	< 8.E+00	< 7.E+00	< 7.E+00	< 7.E+00
FE-59	< 2.E+01	< 1.E+01	< 1.E+01	< 2.E+01
CO-60	< 1.E+01	< 8.E+00	< 6.E+00	< 7.E+00
ZN-65	< 1.E+01	< 1.E+01	< 1.E+01	< 2.E+01
ZR-95	< 1.E+01	< 1.E+01	< 9.E+00	< 1.E+01
RU-103	< 8.E+00	< 7.E+00	< 7.E+00	< 8.E+00
RU-106	< 8.E+01	< 6.E+01	< 6.E+01	< 7.E+01
I-131	< 2.E+01	< 1.E+01	< 1.E+01	< 9.E+00
CS-134	< 1.E+01	< 7.E+00	< 7.E+00	< 7.E+00
CS-137	< 6.E+00	< 7.E+00	< 6.E+00	< 8.E+00
BA-140	< 3.E+01	< 4.E+01	< 3.E+01	< 3.E+01
LA-140	< 9.E+00	< 1.E+01	< 9.E+00	< 9.E+00
CE-141	< 1.E+01	< 1.E+01	< 1.E+01	< 1.E+01
CE-144	< 5.E+01	< 5.E+01	< 5.E+01	< 6.E+01
RA-226	< 2.E+02	< 2.E+02	< 2.E+02	< 2.E+02
TH-228	< 1.E+01	< 1.E+01	< 1.E+01	< 2.E+01

VII-8

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - THERMOLUMINESCENT DOSIMETRY - TLD

MILLIREM/QUARTER

Sample Nuclide	Station Number	First Quarter 01/01-03/31	Second Quarter 04/01-06/30	Third Quarter 07/01-09/30	Fourth Quarter 10/01-01/01	Quarter Average - 1 S.D.
TLD	1	22.8 ± 0.3	22.4 ± 0.9	25.0 ± 0.3	25.7 ± 0.7	24.0 ± 1.6
	2	22.0 ± 0.5	22.0 ± 0.4	24.8 ± 0.6	25.9 ± 0.9	23.7 ± 2.0
	3	20.9 ± 0.3	20.7 ± 0.1	23.7 ± 0.2	23.9 ± 0.6	22.3 ± 1.7
	4	21.8 ± 0.5	21.2 ± 0.6	24.7 ± 0.4	25.5 ± 0.7	23.3 ± 2.1
	5	20.7 ± 0.5	21.0 ± 0.1	23.2 ± 1.0	24.0 ± 0.2	22.2 ± 1.6
	6	21.4 ± 0.3	20.2 ± 0.8	23.9 ± 1.1	24.5 ± 0.5	22.5 ± 2.0
	7	21.0 ± 0.5	21.9 ± 0.8	24.6 ± 0.3	25.8 ± 0.6	23.3 ± 2.3
	8	22.9 ± 1.0	23.7 ± 0.9	27.1 ± 3.0	27.9 ± 1.2	25.4 ± 2.5
	9	21.6 ± 0.7	21.5 ± 0.9	25.2 ± 0.6	25.1 ± 0.7	23.3 ± 2.1
	10	22.9 ± 0.5	21.2 ± 0.6	24.0 ± 0.7	25.3 ± 0.4	23.4 ± 1.7
	20	22.6 ± 1.0	23.5 ± 0.9	26.0 ± 0.8	26.5 ± 1.2	24.6 ± 1.9
	44	24.4 ± 0.3	23.2 ± 0.4	27.6 ± 0.5	28.4 ± 0.6	25.9 ± 2.5
	56	22.1 ± 0.2	23.5 ± 0.7	24.4 ± 0.4	26.2 ± 0.9	24.0 ± 1.7
	58	22.2 ± 0.8	20.3 ± 0.4	25.2 ± 0.1	25.7 ± 0.2	23.3 ± 2.6
	59	22.7 ± 0.9	24.0 ± 1.0	25.2 ± 0.6	27.0 ± 0.5	24.7 ± 1.8
	66	23.6 ± 0.4	24.4 ± 0.9	27.2 ± 2.0	28.5 ± 0.9	25.9 ± 2.3
	67	23.3 ± 0.4	23.3 ± 0.7	27.5 ± 4.3	26.5 ± 1.1	25.1 ± 2.2
	71	23.3 ± 0.5	24.2 ± 0.3	26.9 ± 4.2	26.5 ± 0.2	25.2 ± 1.7
	79	21.9 ± 1.2	21.9 ± 0.7	24.3 ± 0.2	25.8 ± 0.5	23.5 ± 1.9
	80	22.8 ± 0.3	22.9 ± 0.2	26.1 ± 0.2	26.0 ± 0.6	24.4 ± 1.8
	81	23.7 ± 0.8	24.3 ± 0.7	27.7 ± 3.4	25.4 ± 0.9	25.3 ± 1.7
	82	23.3 ± 0.8	22.7 ± 0.3	27.6 ± 2.4	(a)	24.5 ± 2.7
	83	24.8 ± 0.4	24.2 ± 0.6	26.9 ± 0.4	27.9 ± 0.1	26.0 ± 1.7
	84	24.7 ± 0.4	21.3 ± 0.3	27.2 ± 0.7	27.8 ± 1.0	25.2 ± 3.0
	85	22.2 ± 0.8	22.4 ± 0.4	25.4 ± 1.2	23.8 ± 0.2	23.5 ± 1.5

(a) TLD unable to be analyzed

VII-8

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - THERMOLUMINESCENT DOSIMETRY - TLD

MILLIREM/QUARTER

Sample Nuclide	Station Number	First Quarter 01/01-03/31	Second Quarter 04/01-06/30	Third Quarter 07/01-09/30	Fourth Quarter 10/01-01/01	Quarter Average - 1 S.D.
TLD	86	22.6 ± 1.1	24.0 ± 1.0	25.8 ± 0.6	25.6 ± 0.1	24.5 ± 1.5
	87	23.5 ± 0.4	22.9 ± 0.7	24.8 ± 0.5	27.0 ± 2.6	24.6 ± 1.8
	88	22.0 ± 0.3	22.6 ± 0.7	24.3 ± 0.5	26.5 ± 0.3	23.8 ± 2.0
	89	21.6 ± 0.3	21.7 ± 0.5	24.4 ± 0.5	25.2 ± 0.4	23.2 ± 1.8
	90	22.5 ± 0.1	21.9 ± 0.3	25.0 ± 1.1	25.7 ± 0.3	23.7 ± 1.9
	91	22.1 ± 0.6	21.9 ± 0.7	23.3 ± 0.3	23.8 ± 0.3	22.8 ± 0.9
	94	23.2 ± 0.6	22.6 ± 1.1	24.7 ± 0.4	25.8 ± 0.3	24.1 ± 1.5
Average/Quarter		22.6 ± 1.0	22.5 ± 1.2	25.4 ± 1.4	26.0 ± 1.3	
Range		(20.7-24.8)	(20.2-24.4)	(23.2-27.7)	(23.8-28.5)	
Detection/Total		32/32	32/32	32/32	31/31	

VII-9

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

VEGETATION - TERRESTRIAL, BROADLEAF

(PCI/KG WET)

STATION NUMBER 35

DATE COLLECTED	5/9/2017	6/13/2017	7/11/2017	8/8/2017
RADIOCHEMICAL ANALYSIS:				
I-131	< 1.E+01	< 3.E+01		
GAMMA SPECTRUM ANALYSIS:			(a)	(a)
BE-7	7.74E+02 ± 3.50E+02	5.85E+02 ± 3.25E+02		
K-40	4.34E+03 ± 6.96E+02	6.48E+03 ± 8.26E+02		
MN-54	< 3.E+01	< 3.E+01		
CO-58	< 3.E+01	< 3.E+01		
FE-59	< 6.E+01	< 5.E+01		
CO-60	< 3.E+01	< 3.E+01		
ZN-65	< 7.E+01	< 7.E+01		
ZR-95	< 6.E+01	< 5.E+01		
RU-103	< 3.E+01	< 3.E+01		
RU-106	< 3.E+02	< 2.E+02		
I-131	< 4.E+01	< 4.E+01		
CS-134	< 4.E+01	< 3.E+01		
CS-137	< 3.E+01	< 4.E+01		
BA-140	< 1.E+02	< 1.E+02		
CE-141	< 5.E+01	< 5.E+01		
CE-144	< 2.E+02	< 2.E+02		
RA-226	< 6.E+02	< 6.E+02		
TH-228	< 6.E+01	< 6.E+01		

(a) Broadleaf vegetation was not available

VII-9

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

VEGETATION - TERRESTRIAL, BROADLEAF

(PCI/KG WET)

STATION NUMBER 35

DATE COLLECTED	9/31/2017	10/31/2017
RADIOCHEMICAL ANALYSIS:		
I-131		
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
CE-141		
CE-144		
RA-226		
TH-228		

(a) Broadleaf vegetation was not available

VII-9

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

VEGETATION - TERRESTRIAL, BROADLEAF

(PCI/KG WET)

STATION NUMBER 96

DATE COLLECTED	5/9/2017	6/13/2017	7/11/2017	8/8/2017
RADIOCHEMICAL ANALYSIS:				
I-131	< 2.E+01	< 3.E+01	< 2.E+01	< 3.E+01
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 3.E+02	< 5.E+02	9.70E+02 ± 3.56E+02	< 3.E+02
K-40	4.47E+03 ± 7.52E+02	5.48E+03 ± 8.06E+02	4.54E+03 ± 6.45E+02	6.10E+03 ± 8.67E+02
MN-54	< 3.E+01	< 4.E+01	< 3.E+01	< 3.E+01
CO-58	< 3.E+01	< 4.E+01	< 3.E+01	< 4.E+01
FE-59	< 7.E+01	< 8.E+01	< 7.E+01	< 9.E+01
CO-60	< 4.E+01	< 4.E+01	< 3.E+01	< 3.E+01
ZN-65	< 8.E+01	< 9.E+01	< 8.E+01	< 8.E+01
ZR-95	< 7.E+01	< 8.E+01	< 5.E+01	< 8.E+01
RU-103	< 4.E+01	< 4.E+01	< 3.E+01	< 3.E+01
RU-106	< 3.E+02	< 4.E+02	< 3.E+02	< 4.E+02
I-131	< 3.E+01	< 5.E+01	< 5.E+01	< 5.E+01
CS-134	< 5.E+01	< 4.E+01	< 4.E+01	< 4.E+01
CS-137	< 4.E+01	< 4.E+01	< 3.E+01	< 4.E+01
BA-140	< 1.E+02	< 2.E+02	< 1.E+02	< 1.E+02
CE-141	< 6.E+01	< 6.E+01	< 5.E+01	< 5.E+01
CE-144	< 3.E+02	< 2.E+02	< 2.E+02	< 2.E+02
RA-226	< 9.E+02	< 1.E+03	< 7.E+02	< 8.E+02
TH-228	< 7.E+01	< 8.E+01	< 5.E+01	< 6.E+01

VII-9

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

VEGETATION - TERRESTRIAL, BROADLEAF

(PCI/KG WET)

STATION NUMBER 96

DATE COLLECTED	9/31/2017	10/31/2017
RADIOCHEMICAL ANALYSIS:		
I-131		
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
CE-141		
CE-144		
RA-226		
TH-228		

(a) Broadleaf vegetation was not available

VII-9

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

VEGETATION - TERRESTRIAL, BROADLEAF

(PCI/KG WET)

STATION NUMBER 101

DATE COLLECTED	5/9/2017	6/13/2017	7/11/2017	8/8/2017
RADIOCHEMICAL ANALYSIS:				
I-131			< 3.E+01	< 3.E+01
GAMMA SPECTRUM ANALYSIS:	(a)	(a)		
BE-7			9.27E+02 ± 2.71E+02	1.01E+03 ± 2.98E+02
K-40			3.20E+03 ± 6.89E+02	3.34E+03 ± 6.46E+02
MN-54			< 3.E+01	< 4.E+01
CO-58			< 4.E+01	< 3.E+01
FE-59			< 9.E+01	< 8.E+01
CO-60			< 3.E+01	< 3.E+01
ZN-65			< 6.E+01	< 8.E+01
ZR-95			< 7.E+01	< 6.E+01
RU-103			< 3.E+01	< 3.E+01
RU-106			< 3.E+02	< 2.E+02
I-131			< 6.E+01	< 5.E+01
CS-134			< 3.E+01	< 4.E+01
CS-137			< 4.E+01	< 3.E+01
BA-140			< 1.E+02	< 2.E+02
CE-141			< 5.E+01	< 5.E+01
CE-144			< 2.E+02	< 2.E+02
RA-226			< 8.E+02	< 7.E+02
TH-228			< 6.E+01	< 6.E+01

(a) Broadleaf vegetation was not available

VII-9

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - INGESTION

VEGETATION - TERRESTRIAL, BROADLEAF

(PCI/KG WET)

STATION NUMBER 101

DATE COLLECTED	9/31/2017	10/31/2017
RADIOCHEMICAL ANALYSIS:		
I-131		
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
CE-141		
CE-144		
RA-226		
TH-228		

(a) Broadleaf vegetation was not available

VII-10

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

SHORELINE SEDIMENT

(PCI/KG DRY)

STATION NUMBER 28

DATE COLLECTED	5/3/2017	10/18/2017
GAMMA SPECTRUM ANALYSIS:		
BE-7	< 5.E+02	< 9.E+02
K-40	1.69E+04 ± 1.36E+03	1.41E+04 ± 1.86E+03
MN-54	< 6.E+01	< 9.E+01
CO-58	< 4.E+01	< 9.E+01
FE-59	< 1.E+02	< 2.E+02
CO-60	< 6.E+01	< 1.E+02
ZN-65	< 1.E+02	< 2.E+02
ZR-95	< 8.E+01	< 2.E+02
RU-103	< 5.E+01	< 9.E+01
RU-106	< 5.E+02	< 7.E+02
I-131	< 8.E+01	< 2.E+02
CS-134	< 6.E+01	< 1.E+02
CS-137	< 6.E+01	< 1.E+02
BA-140	< 2.E+02	< 5.E+02
CE-141	< 9.E+01	< 1.E+02
CE-144	< 4.E+02	< 4.E+02
RA-226	2.31E+03 ± 1.02E+03	5.94E+03 ± 2.60E+03
TH-228	9.77E+02 ± 9.47E+01	1.04E+03 ± 1.43E+02

VII-10

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

SHORELINE SEDIMENT

(PCI/KG DRY)

STATION NUMBER 35

DATE COLLECTED	5/3/2017	10/18/2017
GAMMA SPECTRUM ANALYSIS:		
BE-7	< 9.E+02	7.52E+02 ± 6.30E+02
K-40	1.54E+04 ± 2.22E+03	1.77E+04 ± 1.91E+03
MN-54	< 8.E+01	< 7.E+01
CO-58	< 1.E+02	< 5.E+01
FE-59	< 2.E+02	< 2.E+02
CO-60	< 1.E+02	< 6.E+01
ZN-65	< 2.E+02	< 1.E+02
ZR-95	< 2.E+02	< 1.E+02
RU-103	< 9.E+01	< 6.E+01
RU-106	< 9.E+02	< 5.E+02
I-131	< 1.E+02	< 1.E+02
CS-134	< 1.E+02	< 8.E+01
CS-137	< 1.E+02	< 8.E+01
BA-140	< 4.E+02	< 3.E+02
CE-141	< 1.E+02	< 1.E+02
CE-144	< 5.E+02	< 4.E+02
RA-226	< 2.E+03	2.01E+03 ± 1.53E+03
TH-228	8.36E+02 ± 1.73E+02	1.08E+03 ± 1.14E+02

SECTION VIII. REFERENCES

VIII. REFERENCES

1. Nebraska Public Power District, Cooper Nuclear Station Environmental Radiation Monitoring Program, Annual Report, January 1, 1982-December 31, 1982 (prepared by Teledyne Isotopes).

2. Nebraska Public Power District, Cooper Nuclear Station Environmental Radiation Monitoring Program, Annual Report, January 1, 1983-December 31, 1983 (prepared by Teledyne Isotopes).

3. Nebraska Public Power District Cooper Nuclear Station, Environmental Monitoring Program, Annual Report, January 1, 1984 to December 31, 1984. (Prepared by Teledyne Isotopes.)

4. U.S. Department of Energy; EML 440 March 1985; EML-444 April 1989; Environmental Measurements Laboratory, US Department of Energy, New York, New York 10014.

5. U.S. Environmental Protection Agency; Environmental Radiation Data, Report 35, July -- September 1983, Report 39, July -- September 1985; Report 40, October -- December 1984; Report 41, January -- March 1985. Report 42, April -- June 1985; Report 43, July-September 1985, Report 44-45, October-March 1986; Report 46, April-June 1986; Report 47, July-September 1986; Report 48, October-December 1986; Report 49, January-March 1987. Environmental Radiation Facility, Montgomery, Alabama.

6. U.S. Department of Energy; EML 460, October 1, 1986; Environmental Measurements Laboratory, US Department of Energy, New York, New York 10014.

7. U.S. Nuclear Regulatory Commission, 1975, Regulatory Guide 4.8, Environmental Technical Specifications for Nuclear Power Plants.

8. U.S. Regulatory Commission, Branch Technical Position, Radiological Monitoring Acceptable Program (November, 1979, Revision 1).

APPENDIX A
2017 LAND USE CENSUS

ANNUAL CNS LAND USE CENSUS / POTABLE WATER USE

Conducted June 11-13, 2017
0-3 miles

Cooper Nuclear Station (CNS) Offsite Dose Assessment Manual (ODAM) requires an annual land use census. This census identifies the location of the nearest garden that is greater than 500 square feet in area and yields leafy green vegetables, the nearest milk animal, and the location of the nearest resident in each of the 16 meteorological sectors within 3 miles of CNS.

A land use census was performed June 11-13, 2017, in accordance with the CNS ODAM. The nearest residence was found in sector Q, 0.9 miles from CNS, and the nearest garden was found in sector P, 1.7 miles from CNS.

No milk animals were found within 3 miles of CNS and there was no evidence of potable water use from the Missouri River within three miles of CNS.

ANNUAL CNS LAND USE CENSUS

June 11-13, 2017
0-3 Miles

SECTOR	NEAREST RESIDENT Distance	Direction in Degrees	NEAREST GARDEN Distance	Direction in Degrees	NEAREST MILK ANIMAL
A/N	2.9 Miles	5. 0°	NONE	NA	NONE
B/NNE	1.7 Miles	25. 0°	NONE	NA	NONE
C/NE	NONE	NA	NONE	NA	NONE
D/ENE	1.7 Miles	61. 0°	NONE	NA	NONE
E/E	2.2 Miles	95. 0°	NONE	NA	NONE
F/ESE	NONE	NA	2.3 Miles	112. 0°	NONE
G/SE	2.8 Miles	135.0°	NONE	NA	NONE
H/SSE	NONE	NA	NONE	NA	NONE
J/S	NONE	NA	NONE	NA	NONE
K/SSW	3.0 Miles	205.0°	3.0 Miles	205. 0°	NONE
L/SW	1.0 Miles	230.0°	2.2 Miles	232.0°	NONE
M/WSW	2.5 Miles	245.0°	2.5 Miles	245.0°	NONE
N/W	1.0 Miles	270.0°	NONE	NA	NONE
P/WNW	1.7 Miles	290.0°	1.7 Miles	290.0°	NONE
Q/NW	0.9 Miles	307.0°	2.0 Miles	295.0°	NONE
R/NNW	1.9 Miles	330.0°	2.8 Miles	325.0°	NONE

APPENDIX B
SUMMARY OF INTRALABORATORY COMPARISONS

The Teledyne Brown Engineering ICP report is presented in this section

INTERLABORATORY COMPARISION PROGRAM

The purpose of the Interlaboratory Comparison Program (ICP) is to confirm the accuracy of results produced by Teledyne Brown Engineering. Samples of various matrices (i.e. soil, water, vegetation, air filters, and milk) are spiked with known amounts of radioactivity by commercial vendors of this service and by departments within the government. TBE participates in three programs. Two are commercial, Analytics Inc. and Environmental Resource Associates (ERA) and one is a government sponsored program, the Department of Energy's (DOE) Mixed Analyte Performance Evaluation Program (MAPEP). The DOE's Idaho National Engineering Laboratory administers the MAPEP. All three programs are blind performance evaluation studies in which samples with known activities are sent to TBE for analysis. Once analyzed, TBE submits the results to the respective agency for evaluation. The results of these evaluations are published in TBE's quarterly and annual QA reports.

The 2017 Interlaboratory Comparison Program includes all contractually required matrices and analyses we supply to customers.

The National Institute of Standards and Technology (NIST) is the approval authority for laboratory providers participating in Intercomparison Study Programs; however, at this time, there are no approved laboratories for environmental and/or radiochemical isotope analyses.

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
March 2017	E11811	Milk	Sr-89	pCi/L	87	97.7	0.89	A
			Sr-90	pCi/L	12.4	16.2	0.77	W
	E11812	Milk	Ce-141	pCi/L	135	145	0.93	A
			Co-58	pCi/L	153	150	1.02	A
			Co-60	pCi/L	182	183	1.00	A
			Cr-51	pCi/L	258	290	0.89	A
			Cs-134	pCi/L	104	120	0.87	A
			Cs-137	pCi/L	142	140	1.02	A
			Fe-59	pCi/L	135	129	1.05	A
			I-131	pCi/L	92.6	97.9	0.95	A
			Mn-54	pCi/L	173	164	1.05	A
			Zn-65	pCi/L	208	199	1.04	A
	E11813	Charcoal	I-131	pCi	92	93.9	0.98	A
	E11814	AP	Ce-141	pCi	99.9	101	0.99	A
			Co-58	pCi	95.4	104	0.92	A
			Co-60	pCi	140	127	1.10	A
			Cr-51	pCi	211	201	1.05	A
			Cs-134	pCi	82.1	83.2	0.99	A
			Cs-137	pCi	92.8	97.0	0.96	A
			Fe-59	pCi	107	89.3	1.20	A
			Mn-54	pCi	106	114	0.93	A
			Zn-65	pCi	137	138	0.99	A
	E11816	Soil	Ce-141	pCi/g	0.258	0.250	1.03	A
			Co-58	pCi/g	0.241	0.258	0.93	A
			Co-60	pCi/g	0.312	0.315	0.99	A
			Cr-51	pCi/g	0.439	0.500	0.88	A
			Cs-134	pCi/g	0.176	0.207	0.85	A
			Cs-137	pCi/g	0.304	0.317	0.96	A
			Fe-59	pCi/g	0.210	0.222	0.95	A
			Mn-54	pCi/g	0.292	0.283	1.03	A
			Zn-65	pCi/g	0.353	0.344	1.03	A
	E11815	Water	Fe-55	pCi/L	1600	1890	0.85	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
June 2017	E11844	Milk	Sr-89	pCi/L	81.3	92.6	0.88	A
			Sr-90	pCi/L	12.1	13.5	0.90	A
	E11846	Milk	Ce-141	pCi/L	142	151	0.94	A
			Co-58	pCi/L	147	155	0.95	A
			Co-60	pCi/L	185	191	0.97	A
			Cr-51	pCi/L	321	315	1.02	A
			Cs-134	pCi/L	168	188	0.89	A
			Cs-137	pCi/L	148	150	0.99	A
			Fe-59	pCi/L	116	115	1.01	A
			I-131	pCi/L	102	93.6	1.09	A
			Mn-54	pCi/L	168	172	0.98	A
			Zn-65	pCi/L	195	204	0.96	A
	E11847	Charcoal	I-131	pCi	87.9	84.8	1.04	A
	E11845	AP	Sr-89	pCi	70.8	79.1	0.90	A
			Sr-90	pCi	9.10	11.5	0.79	W
	E11848	AP	Ce-141	pCi	112	116	0.96	A
			Co-58	pCi	119	119	1.00	A
			Co-60	pCi	171	146	1.17	A
			Cr-51	pCi	270	241	1.12	A
			Cs-134	pCi	152	144	1.05	A
			Cs-137	pCi	114	115	0.99	A
			Fe-59	pCi	94.1	88.3	1.07	A
			Mn-54	pCi	139	132	1.06	A
			Zn-65	pCi	141	156	0.90	A
	E11849	Water	Fe-55	pCi/L	1840	1890	0.97	A
July 2017	E11901	AP	GR-A	pCi	50.1	44.2	1.13	A
			GR-B	pCi	218	233	0.93	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
September 2017	E11914	Milk	Sr-89	pCi/L	84.3	82.7	1.02	A
			Sr-90	pCi/L	12.6	12.1	1.04	A
	E11915	Milk	Ce-141	pCi/L	93.9	87.0	1.08	A
			Co-58	pCi/L	115	117	0.98	A
			Co-60	pCi/L	265	262	1.01	A
			Cr-51	pCi/L	273	217	1.26	W
			Cs-134	pCi/L	186	201	0.93	A
			Cs-137	pCi/L	175	172	1.02	A
			Fe-59	pCi/L	137	125	1.09	A
			I-131	pCi/L	78.0	71.0	1.10	A
			Mn-54	pCi/L	128	123	1.04	A
			Zn-65	pCi/L	206	184	1.12	A
	E11916	Charcoal	I-131	pCi	71.9	64.4	1.12	A
	E11917	AP	Ce-141	pCi	80.1	86.3	0.93	A
			Co-58	pCi	110	116	0.95	A
			Co-60	pCi	277	260	1.07	A
			Cr-51	pCi	275	215	1.28	W
			Cs-134	pCi	192	199	0.96	A
			Cs-137	pCi	165	170	0.97	A
			Fe-59	pCi	122	124	0.98	A
			Mn-54	pCi	120	122	0.99	A
			Zn-65	pCi	175	183	0.96	A
	E11918	Water	Fe-55	pCi/L	1630	1630	1.00	A
	E11919	Soil	Ce-141	pCi/g	0.136	0.142	0.96	A
			Co-58	pCi/g	0.179	0.191	0.94	A
			Co-60	pCi/g	0.405	0.429	0.94	A
			Cr-51	pCi/g	0.230	0.355	0.65	N [1]
			Cs-134	pCi/g	0.272	0.328	0.83	A
			Cs-137	pCi/g	0.336	0.356	0.94	A
			Fe-59	pCi/g	0.210	0.205	1.02	A
			Mn-54	pCi/g	0.210	0.201	1.05	A
			Zn-65	pCi/g	0.301	0.301	1.00	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) See NCR 17-16

Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
December 2017	E12054	Milk	Sr-89	pCi/L	92.1	92.3	1.00	A
			Sr-90	pCi/L	18.3	16.9	1.09	A
	E12055	Milk	Ce-141	pCi/L	97.8	98.3	0.99	A
			Co-58	pCi/L	92.3	89.9	1.03	A
			Co-60	pCi/L	176	173	1.02	A
			Cr-51	pCi/L	226	242	0.93	A
			Cs-134	pCi/L	118	125	0.95	A
			Cs-137	pCi/L	148	141	1.05	A
			Fe-59	pCi/L	123	113	1.08	A
			I-131	pCi/L	66.0	57.8	1.14	A
			Mn-54	pCi/L	173	161	1.08	A
			Zn-65	pCi/L	233	211	1.10	A
	E12056	Charcoal	I-131	pCi	48.1	47.5	1.01	A
	E12057A	AP	Ce-141	pCi	108	111	0.97	A
			Co-58	pCi	89.5	102	0.88	A
			Co-60	pCi	223	196	1.14	A
			Cr-51	pCi	311	274	1.13	A
			Cs-134	pCi	141	142	1.00	A
			Cs-137	pCi	162	160	1.01	A
			Fe-59	pCi	121	129	0.94	A
			Mn-54	pCi	177	182	0.97	A
			Zn-65	pCi	203	239	0.85	A
	E12058	Water	Fe-55	pCi/L	1970	1740	1.13	A
	E12059	AP	Sr-89	pCi	71.2	87.4	0.81	A
			Sr-90	pCi	12.9	16.0	0.81	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Range	Evaluation [b]
February 2017	17-MaS36	Soil	Ni-63	Bq/kg	-5.512		*(1)*	A
			Sr-90	Bq/kg	571	624	437 - 811	A
	17-MaW36	Water	Am-241	Bq/L	0.693	0.846	0.592 - 1.100	A
			Ni-63	Bq/L	13.4	12.2	8.5 - 15.9	A
			Pu-238	Bq/L	0.7217	0.703	0.492 - 0.914	A
			Pu-239/240	Bq/L	0.9277	0.934	0.654 - 1.214	A
	17-RdF36	AP	U-234/233	Bq/sample	0.0911	0.104	0.073 - 0.135	A
			U-238	Bq/sample	0.0967	0.107	0.075 - 0.139	A
	17-RdV36	Vegetation	Cs-134	Bq/sample	6.44	6.95	4.87 - 9.04	A
			Cs-137	Bq/sample	4.61	4.60	3.22 - 5.98	A
			Co-57	Bq/sample	-0.0229		*(1)*	A
			Co-60	Bq/sample	8.52	8.75	6.13 - 11.38	A
			Mn-54	Bq/sample	3.30	3.28	2.30 - 4.26	A
			Sr-90	Bq/sample	1.30	1.75	1.23 - 2.28	W
			Zn-65	Bq/sample	5.45	5.39	3.77 - 7.01	A
August 2017	17-MaS37	Soil	Ni-63	Bq/kg	1130	1220	854 - 1586	A
			Sr-90	Bq/kg	296	289	202 - 376	A
	17-MaW37	Water	Am-241	Bq/L	0.838	0.892	0.624 - 1.160	A
			Ni-63	Bq/L	-0.096		*(1)*	A
			Pu-238	Bq/L	0.572	0.603	0.422 - 0.784	A
			Pu-239/240	Bq/L	0.863	0.781	0.547 - 1.015	A
	17-RdF37	AP	U-234/233	Bq/sample	0.103	0.084	0.059 - 0.109	W
			U-238	Bq/sample	0.115	0.087	0.061 - 0.113	N [2]
	17-RdV37	Vegetation	Cs-134	Bq/sample	2.34	2.32	1.62 - 3.02	A
			Cs-137	Bq/sample	0.05		*(1)*	A
			Co-57	Bq/sample	3.32	2.8	2.0 - 3.6	A
			Co-60	Bq/sample	2.09	2.07	1.45 - 2.69	A
			Mn-54	Bq/sample	2.90	2.62	1.83 - 3.41	A
			Sr-90	Bq/sample	1.17	1.23	0.86 - 1.60	A
			Zn-65	Bq/sample	6.07	5.37	3.76 - 6.98	A

(a) The MAPEP known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) DOE/MAPEP evaluation:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) False positive test

(2) See NCR 17-15

ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

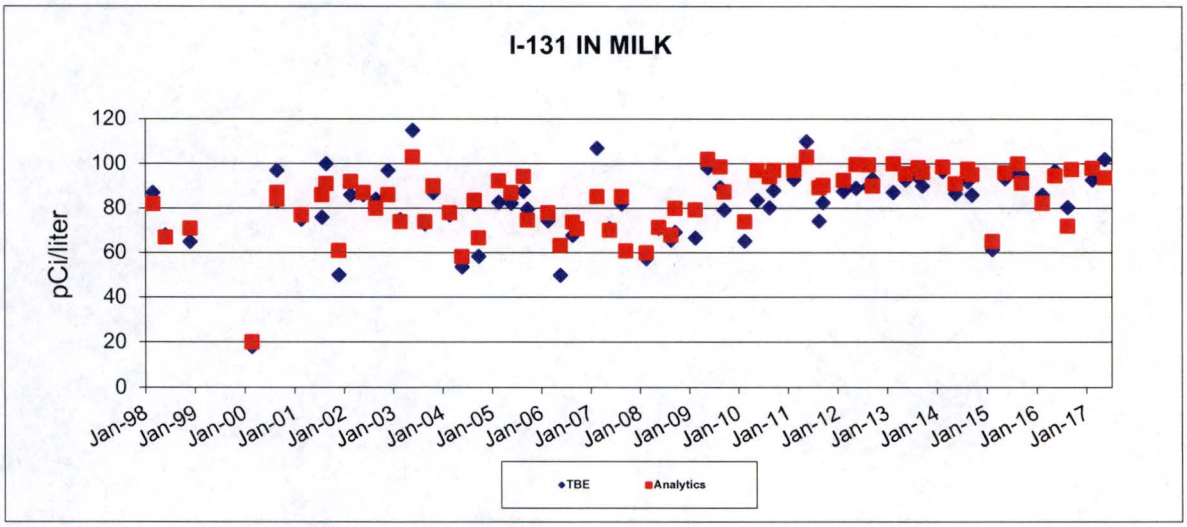
Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Limits	Evaluation [b]
March 2017	MRAD-26	AP	GR-A	pCi/sample	76.3	85.5	28.6 - 133	A
April 2017	RAD-109	Water	Ba-133	pCi/L	49.2	49.7	40.8 - 55.1	A
			Cs-134	pCi/L	83.2	90.1	74.0 - 99.1	A
			Cs-137	pCi/L	202	206	185 - 228	A
			Co-60	pCi/L	51.2	54.7	49.2 - 62.7	A
			Zn-65	pCi/L	39.3	53.8	47.2 - 65.9	N [1]
			GR-A	pCi/L	53.6	75.0	39.5 - 92.3	A
			GR-B	pCi/L	42.7	38.5	25.5 - 46.0	A
			U-Nat	pCi/L	50.1	55.6	45.2 - 61.7	A
			H-3	pCi/L	7080	6850	5920 - 7540	A
			Sr-89	pCi/L	40.7	66.2	53.8 - 74.3	N [1]
			Sr-90	pCi/L	26.9	26.7	19.3 - 31.1	A
			I-131	pCi/L	26.7	29.9	24.9 - 34.9	A
September 2017	MRAD-27	AP	GR-A	pCi/sample	40.9	50.1	16.8 - 77.8	A
		AP	GR-B	pCi/sample	58.0	61.8	39.1 - 90.1	A
October 2017	RAD-111	Water	Ba-133	pCi/L	71.3	73.7	61.7 - 81.1	A
			Cs-134	pCi/L	43.0	53.0	42.8 - 58.3	A
			Cs-137	pCi/L	48.2	52.9	47.6 - 61.1	A
			Co-60	pCi/L	69.0	69.5	62.6 - 78.9	A
			Zn-65	pCi/L	335	348	313 - 406	A
			GR-A	pCi/L	32.5	35.6	18.3 - 45.8	A
			GR-B	pCi/L	24.3	25.6	16.0 - 33.6	A
			U-Nat	pCi/L	36.6	37.0	30.0 - 40.9	A
			H-3	pCi/L	6270	6250	5390 - 6880	A
			I-131	pCi/L	26.4	24.2	20.1 - 28.7	A
November 2017	111317O	Water	Sr-89	pCi/L	57.1	50.0	39.4 - 57.5	A
			Sr-90	pCi/L	27.1	41.8	30.8 - 48.0	N [2]

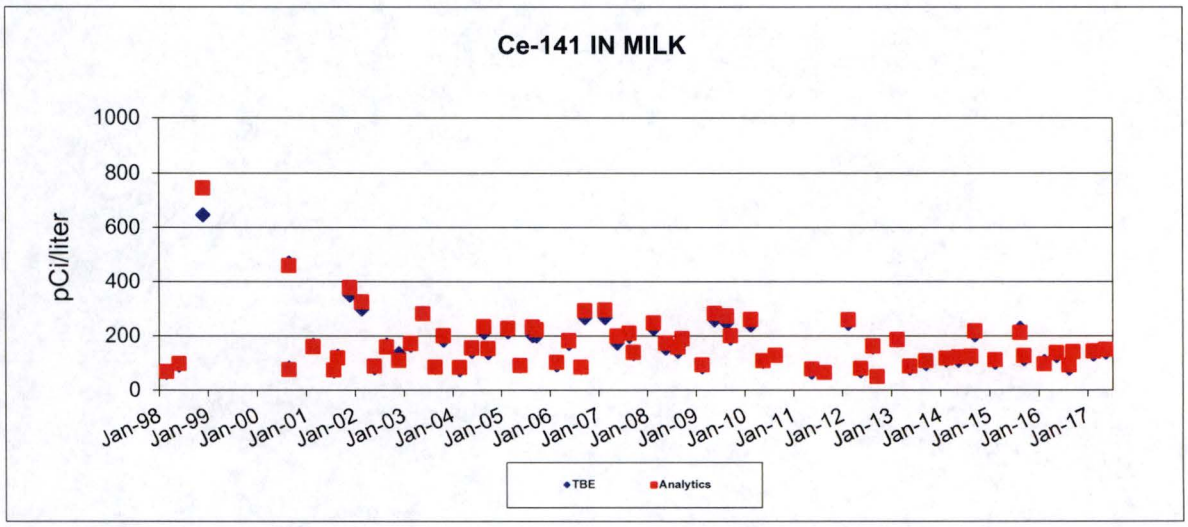
(a) The ERA known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

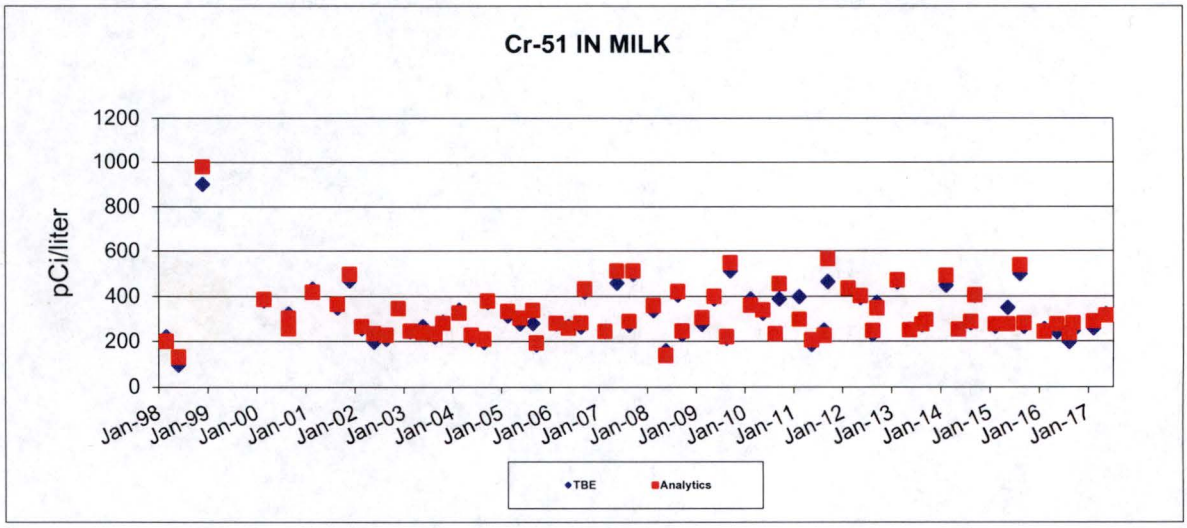
(b) ERA evaluation:
A = Acceptable - Reported value falls within the Acceptance Limits
N = Not Acceptable - Reported value falls outside of the Acceptance Limits

(1) See NCR 17-09
(2) See NCR 17-19

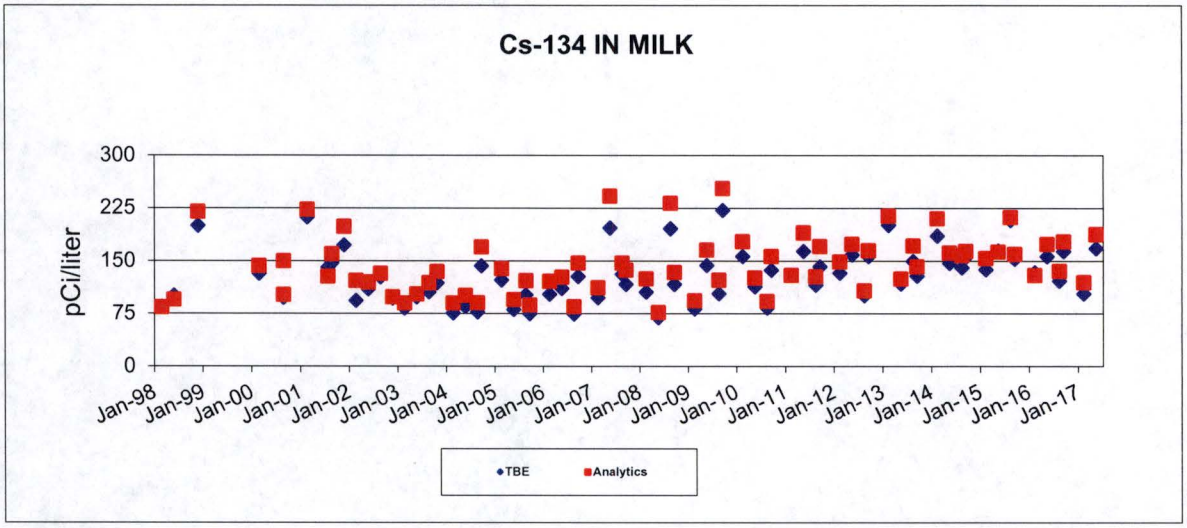
INTERLABORATORY COMPARISON PROGRAM GRAPHS

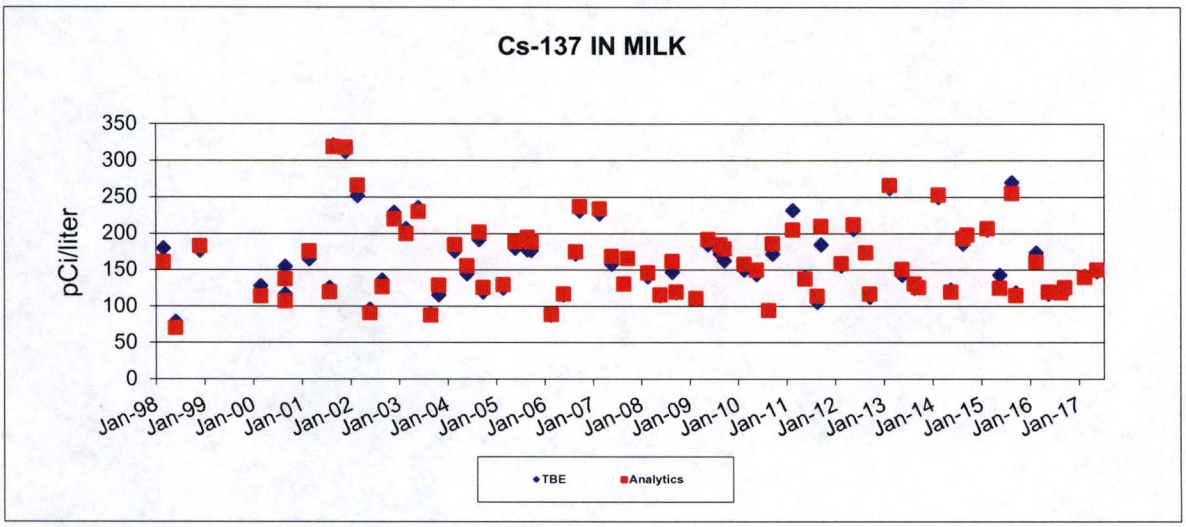


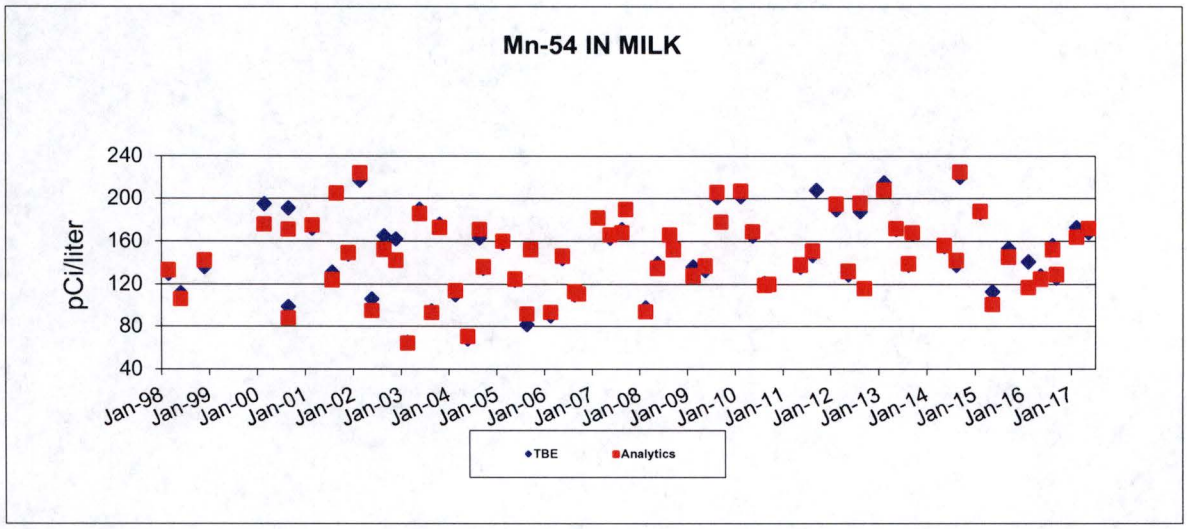




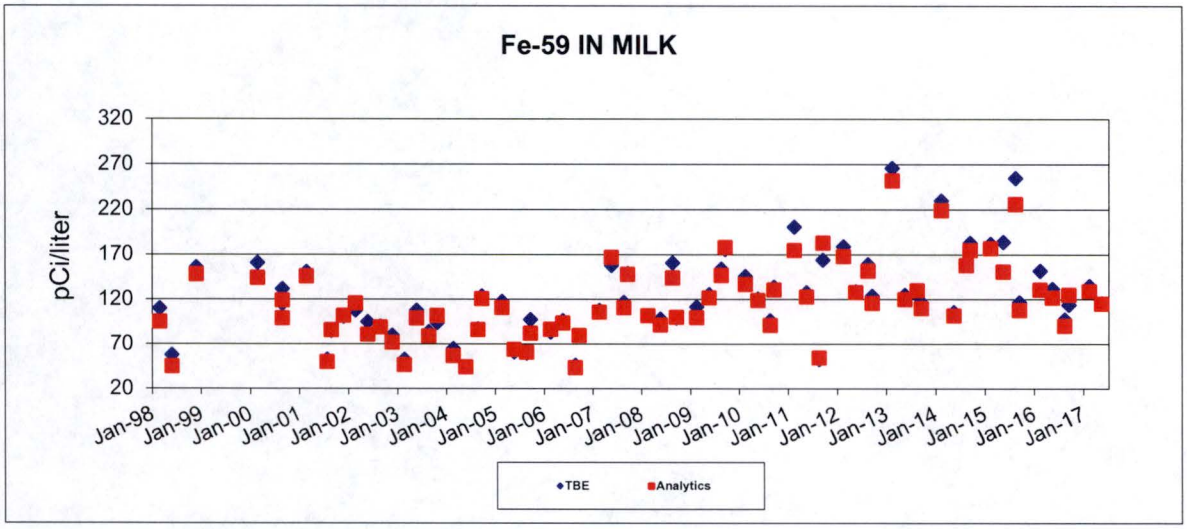
INTERLABORATORY COMPARISON PROGRAM GRAPHS

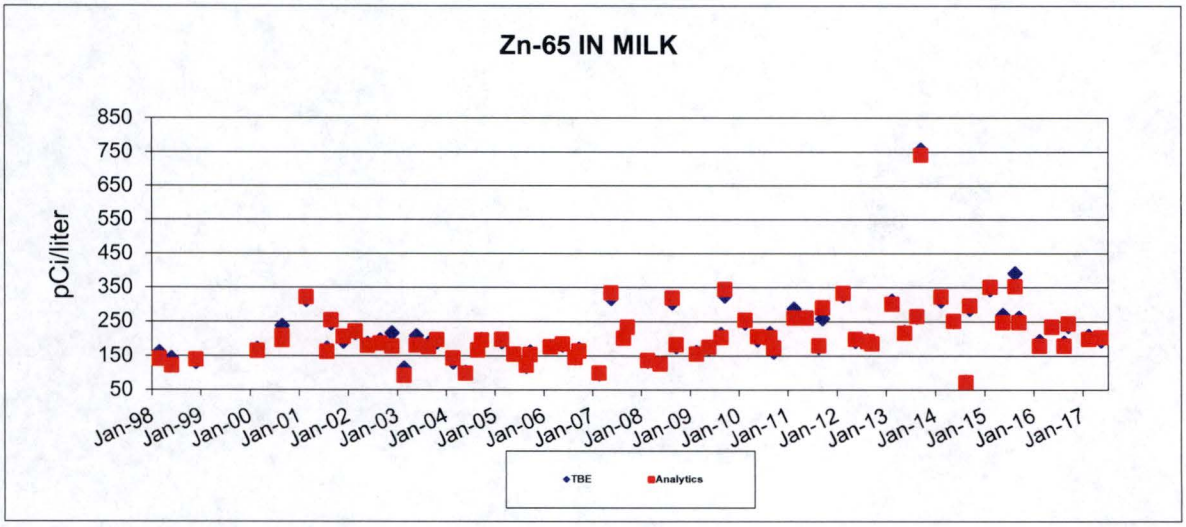


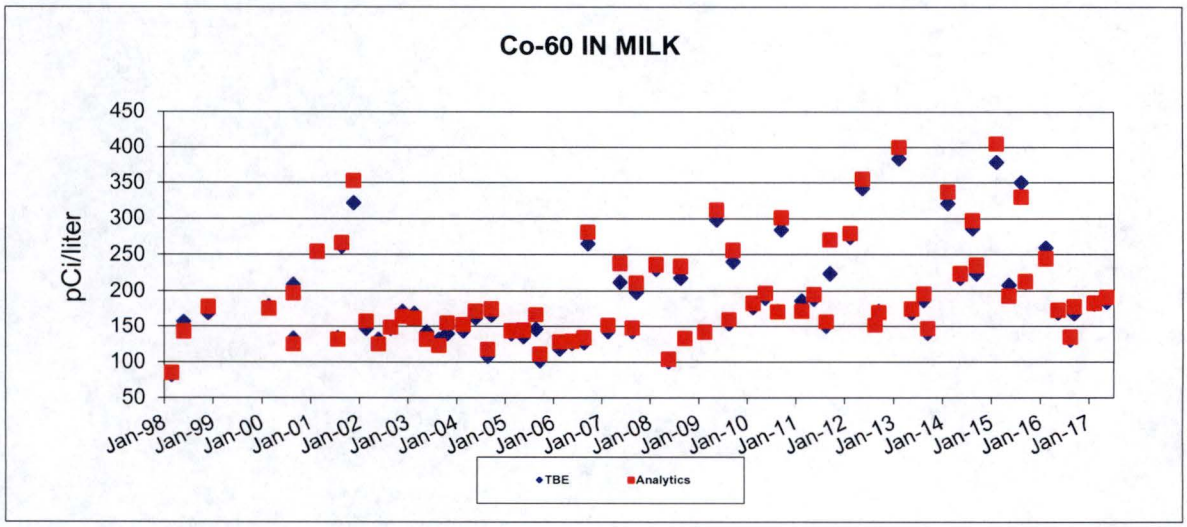




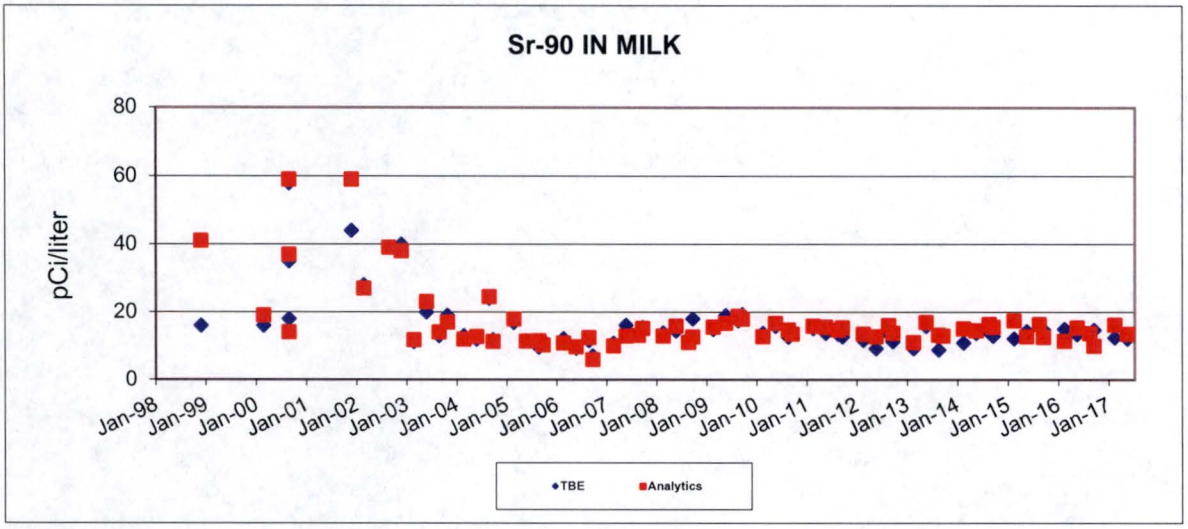
INTERLABORATORY COMPARISON PROGRAM GRAPHS

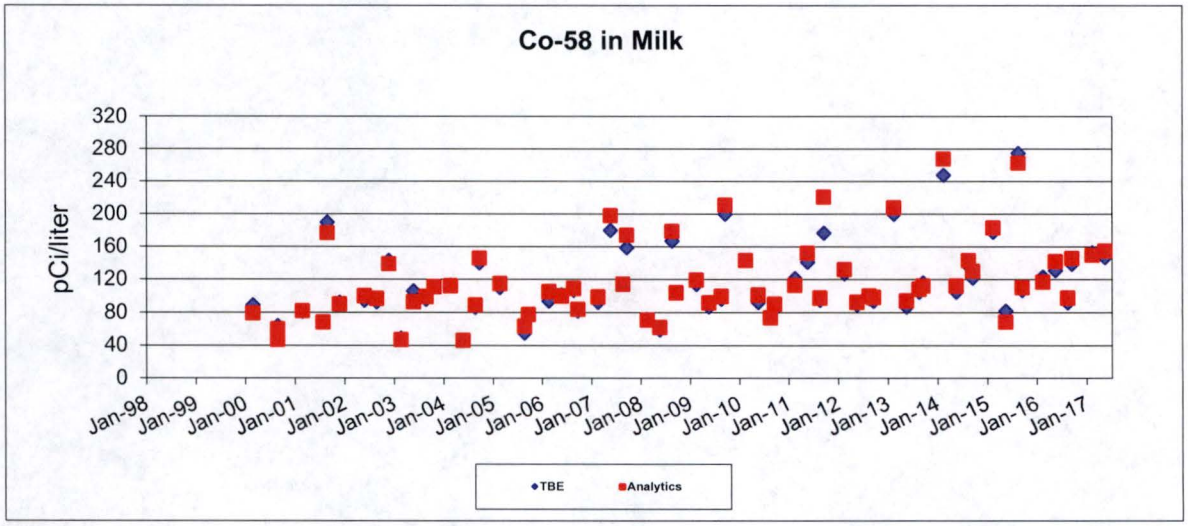


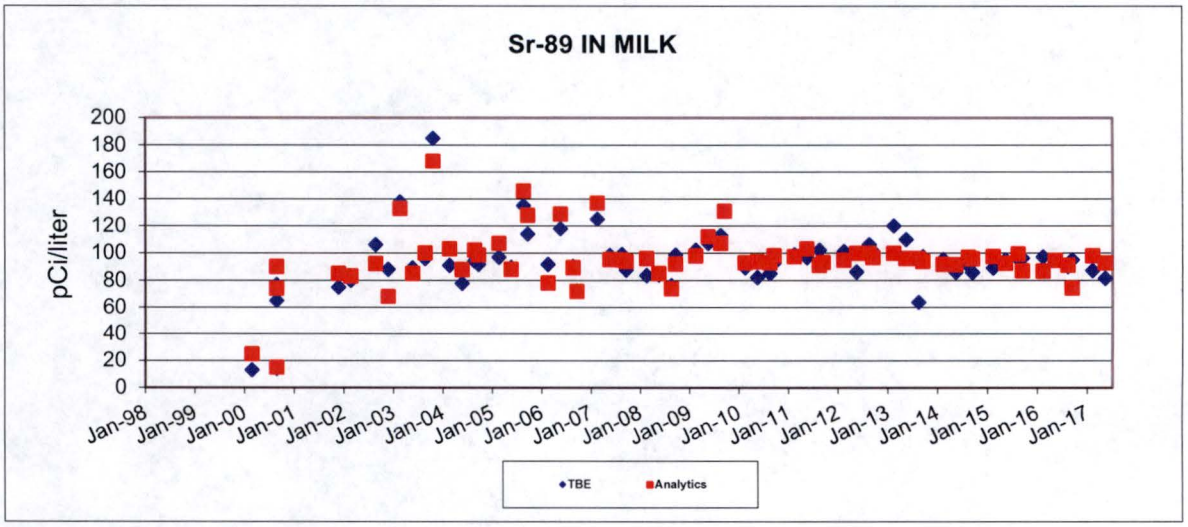




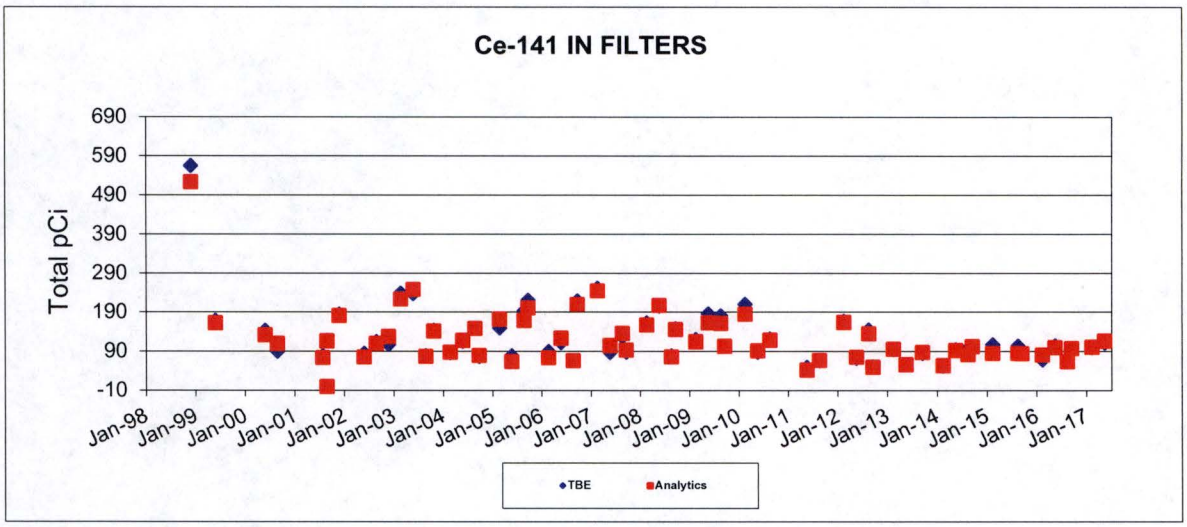
INTERLABORATORY COMPARISON PROGRAM GRAPHS

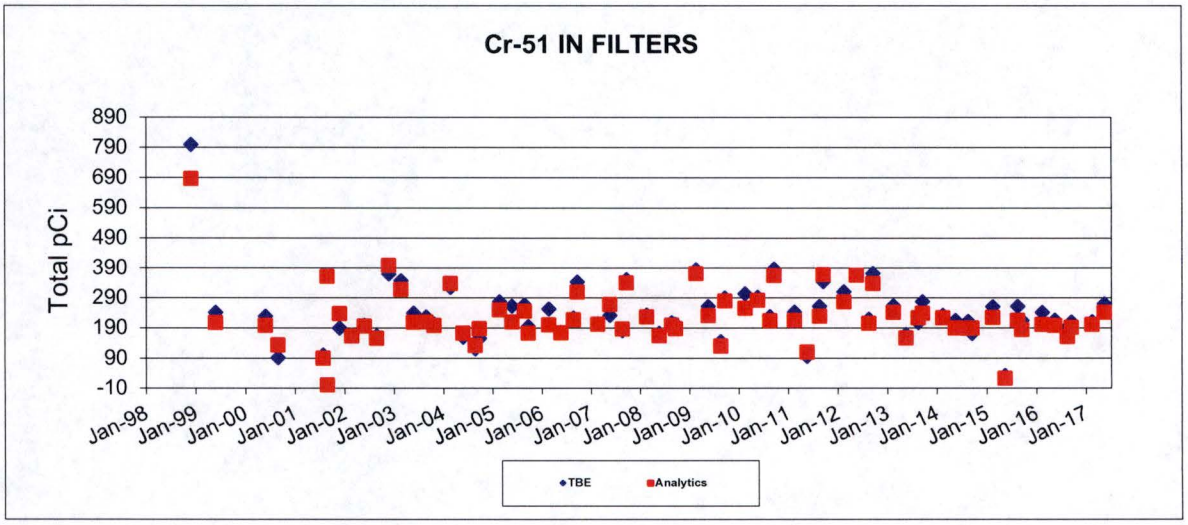


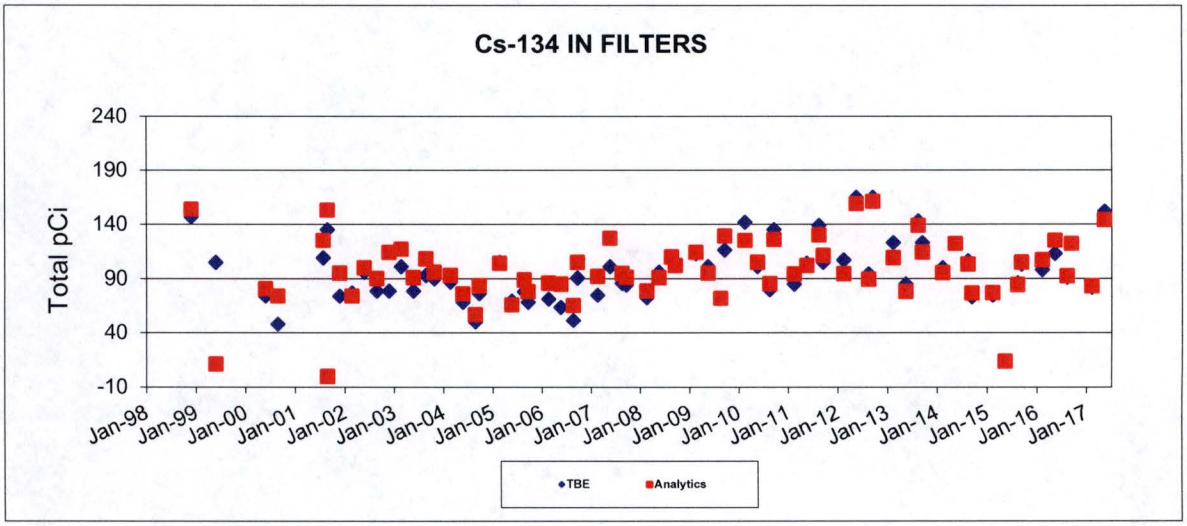




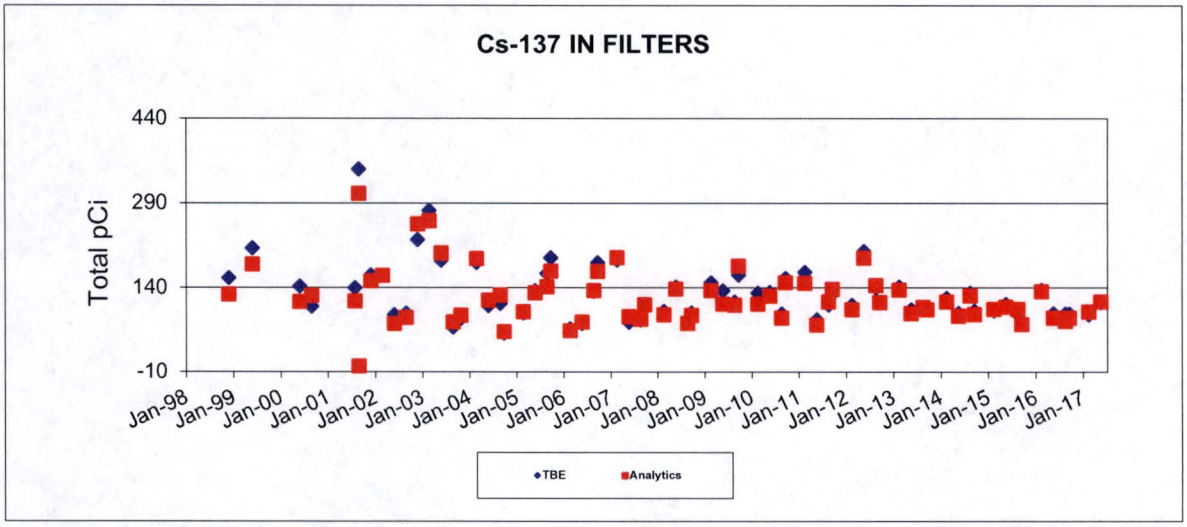
INTERLABORATORY COMPARISON PROGRAM GRAPHS

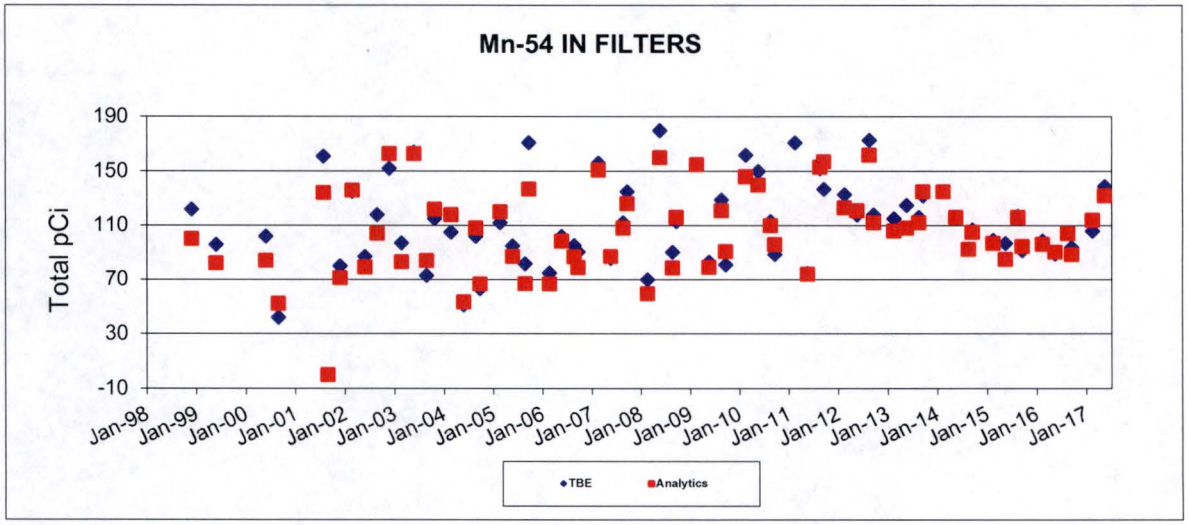


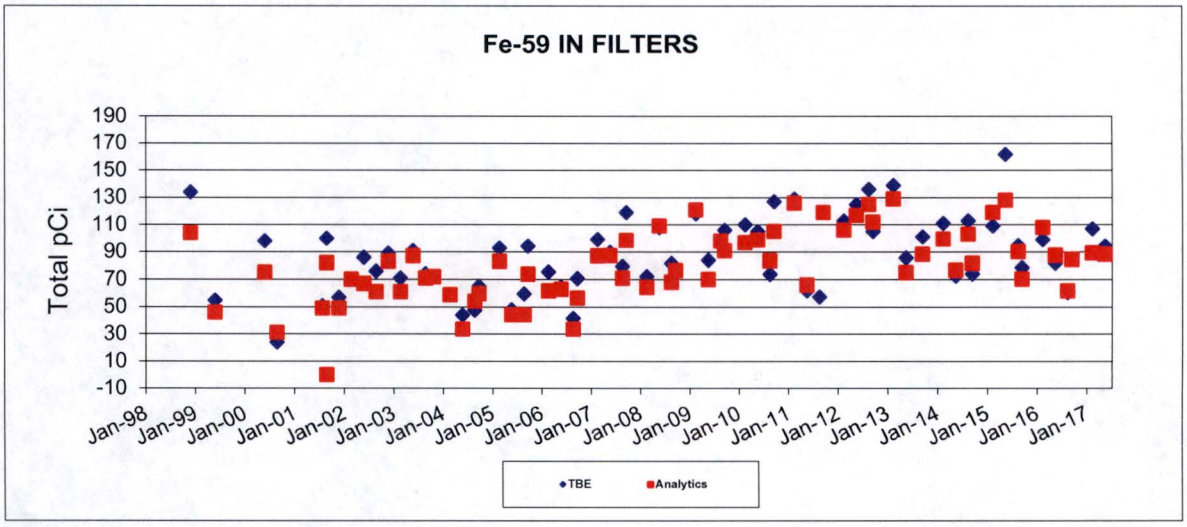




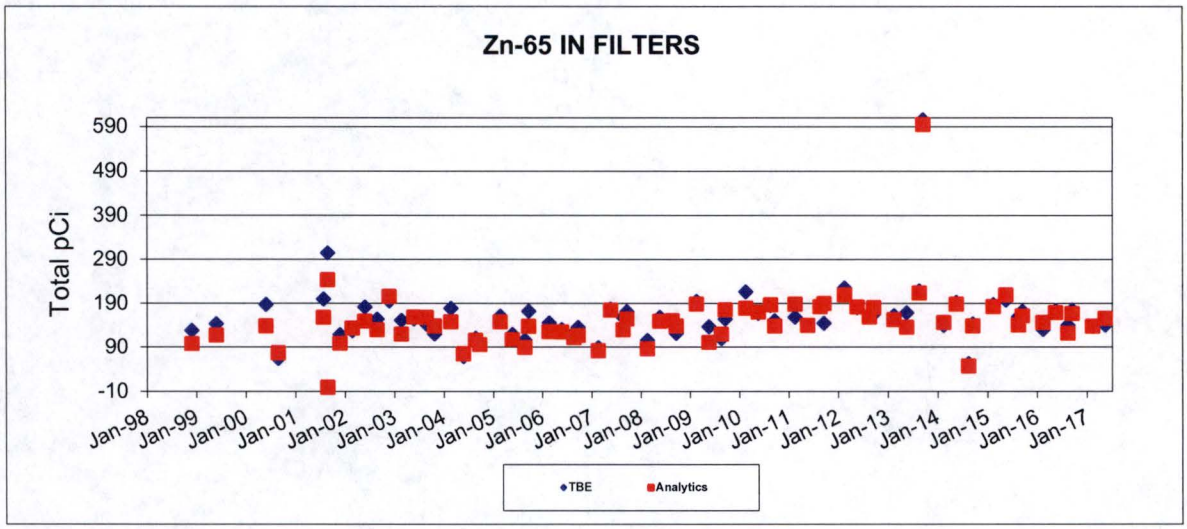
INTERLABORATORY COMPARISON PROGRAM GRAPHS

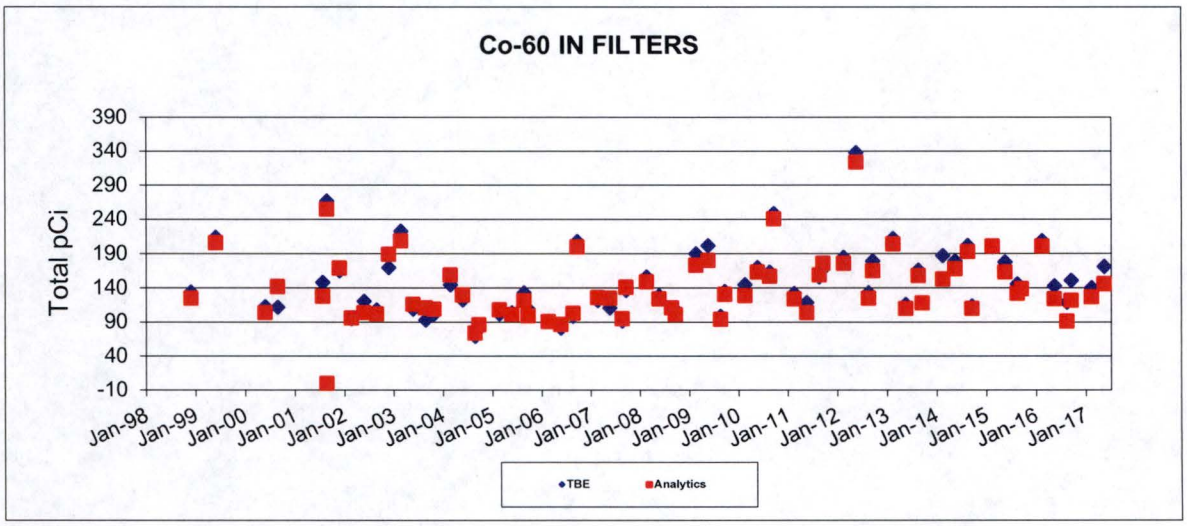


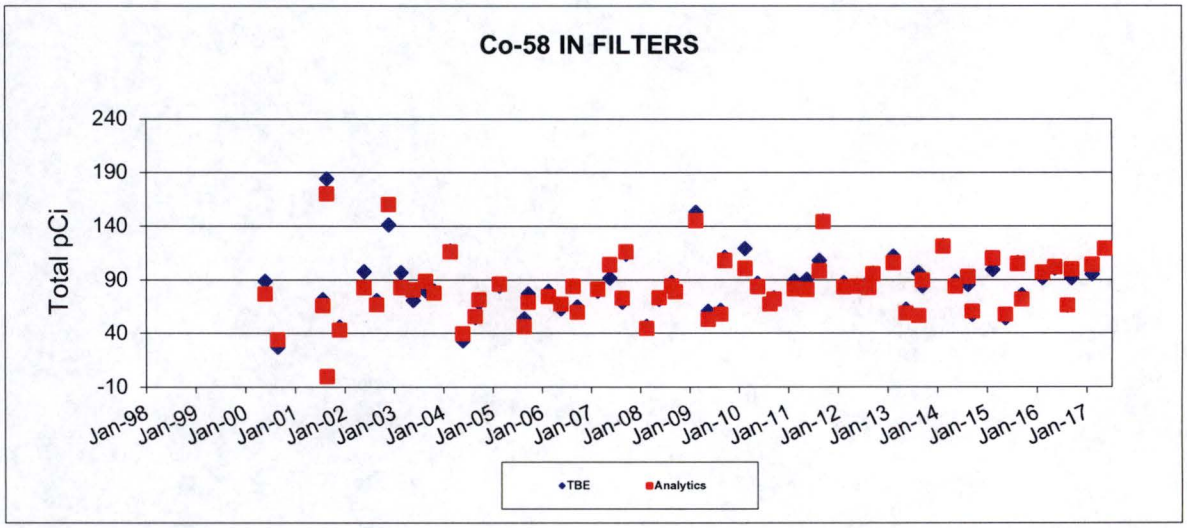


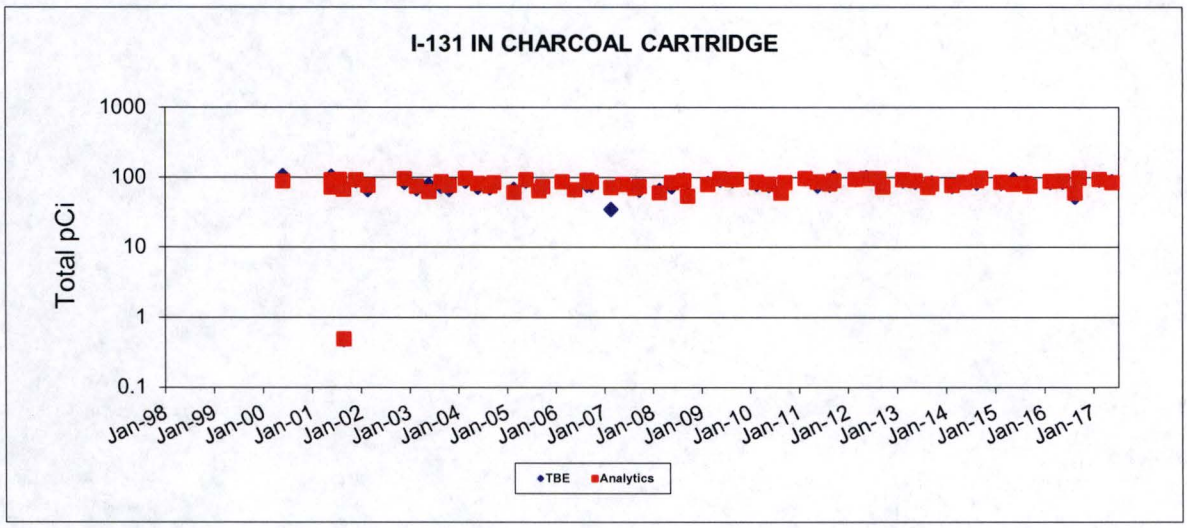


INTERLABORATORY COMPARISON PROGRAM GRAPHS



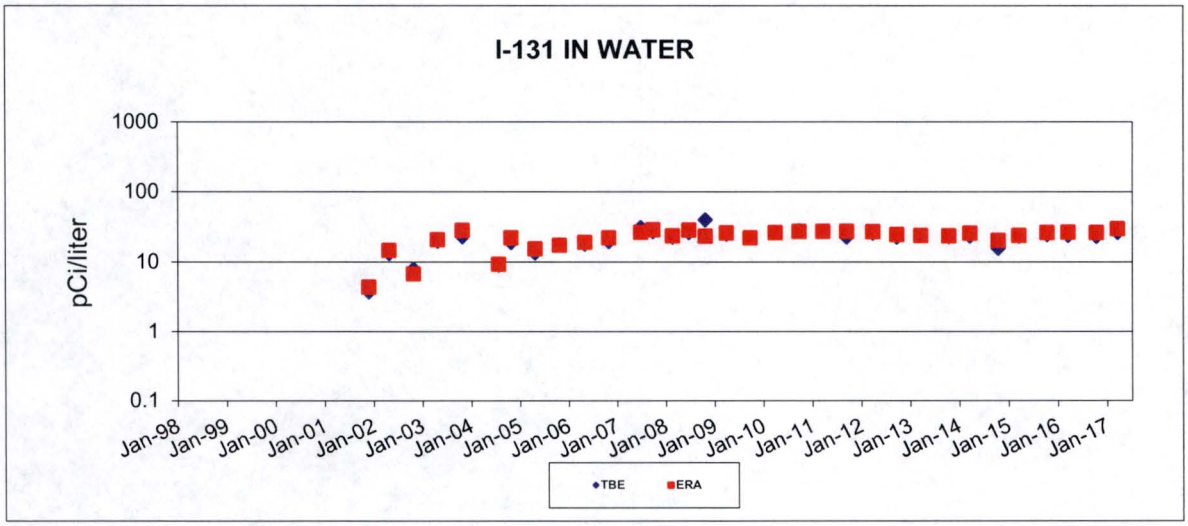


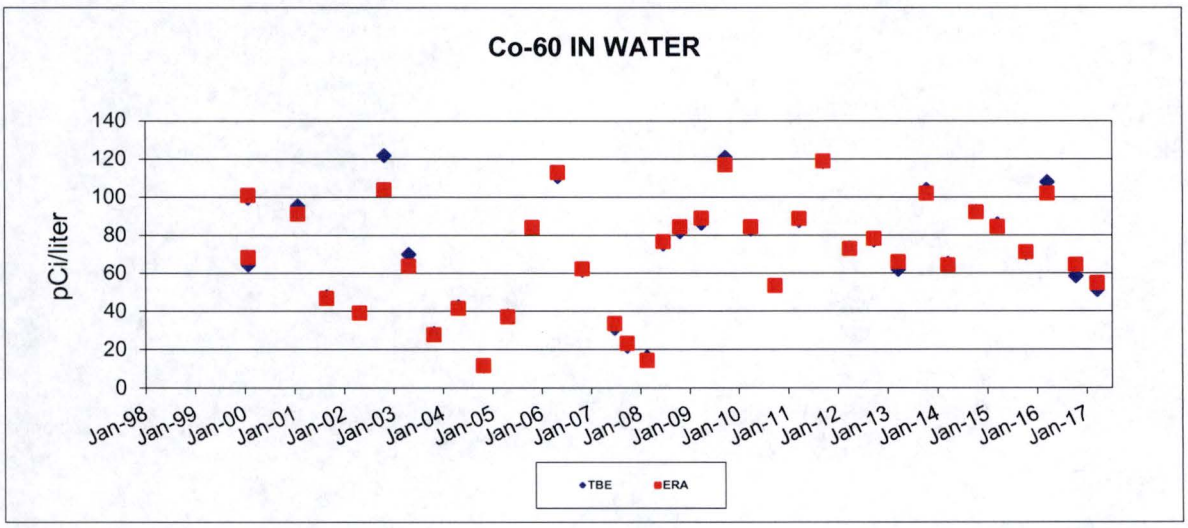


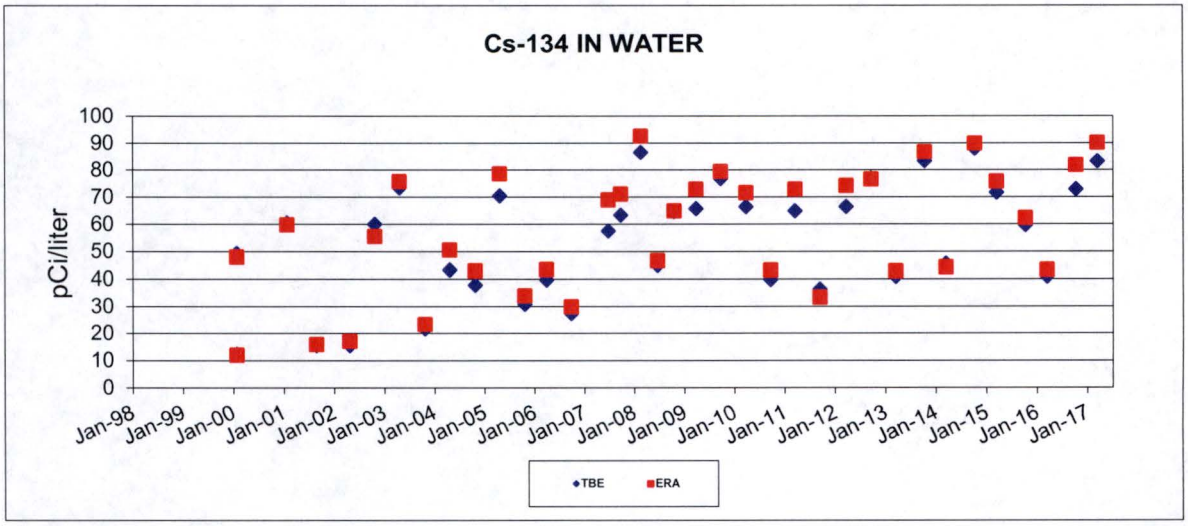


March 2007 - Incorrect side of the cartridge was counted

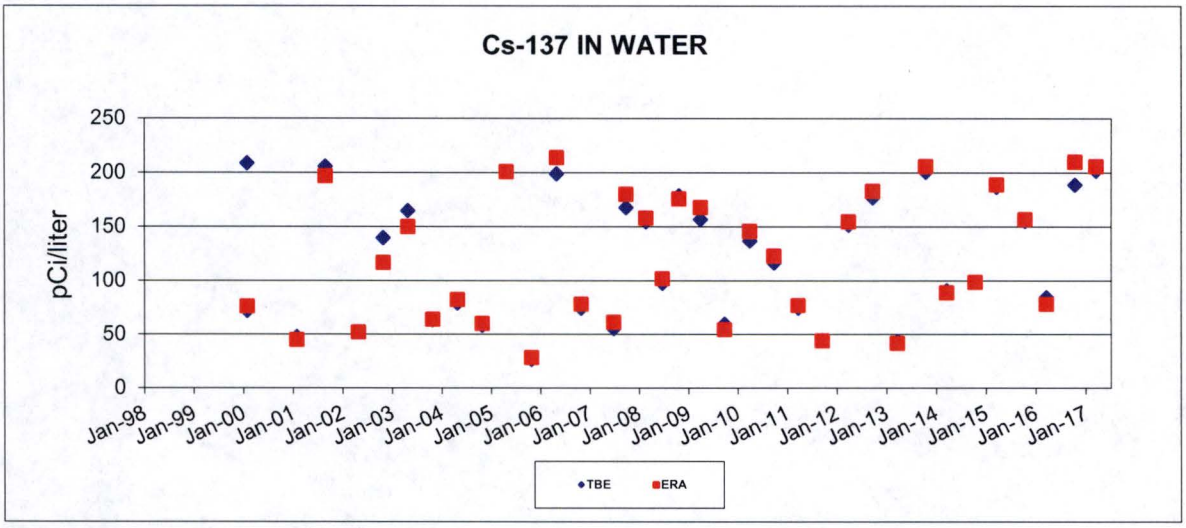
INTERLABORATORY COMPARISON PROGRAM GRAPHS



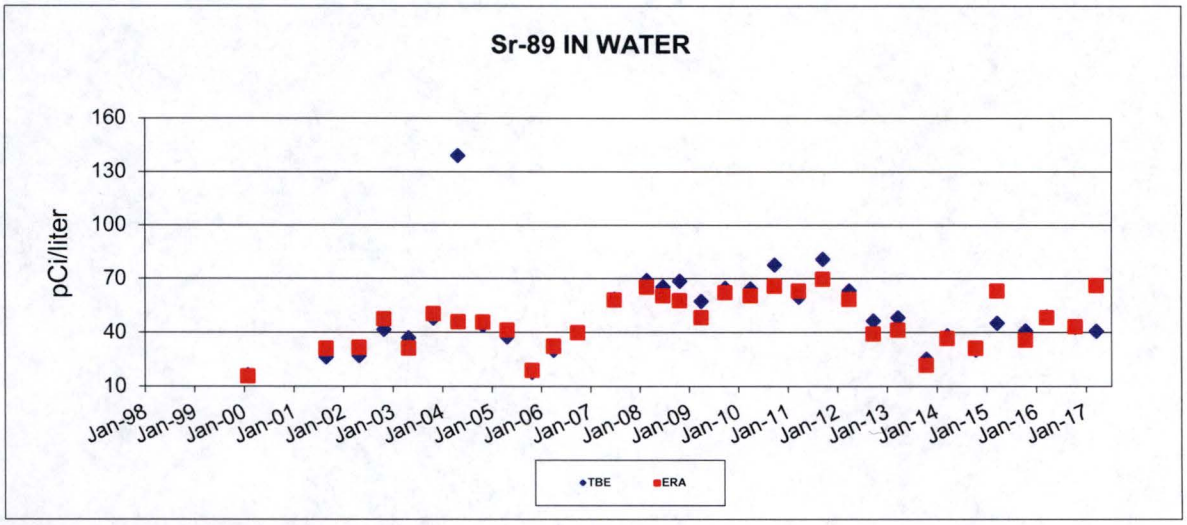




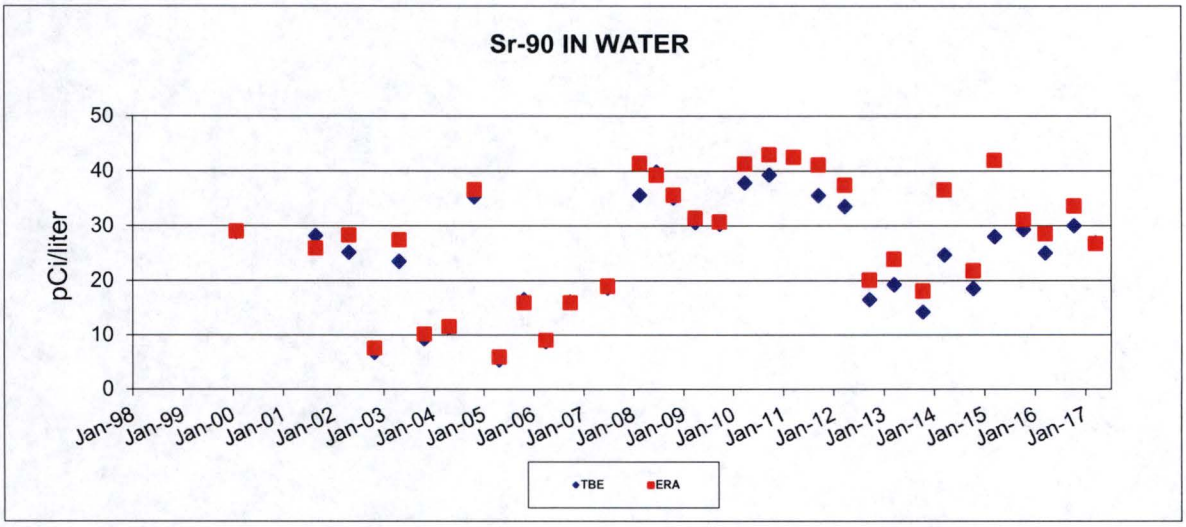
INTERLABORATORY COMPARISON PROGRAM GRAPHS



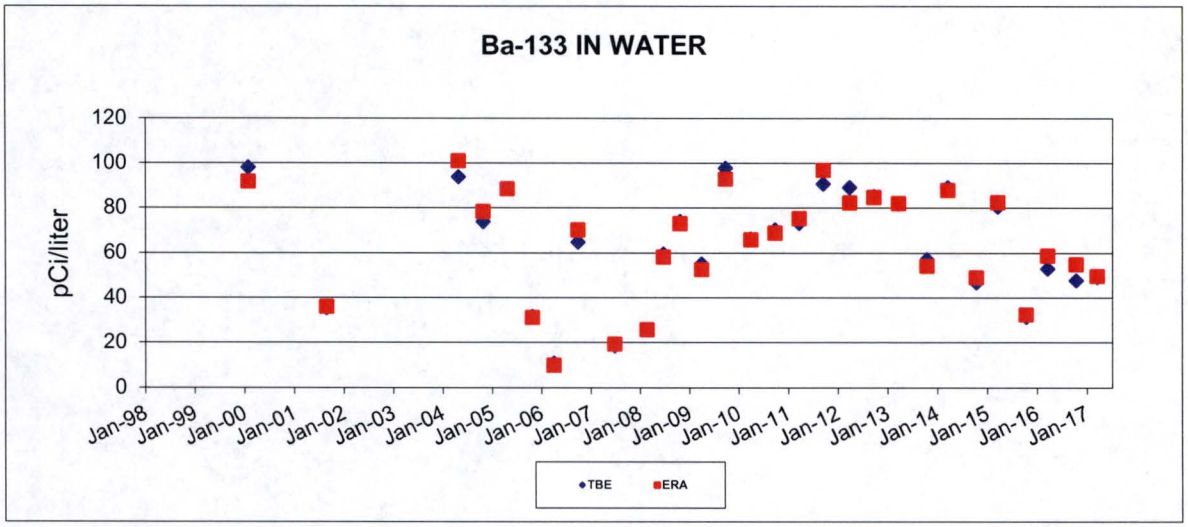
February 2001 - Analyst error or equipment failure.

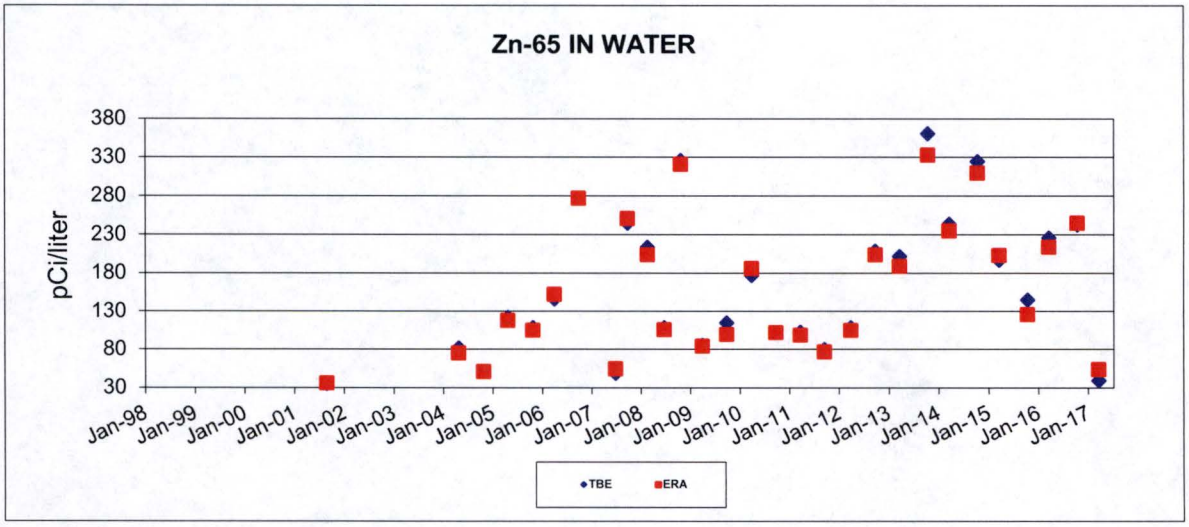


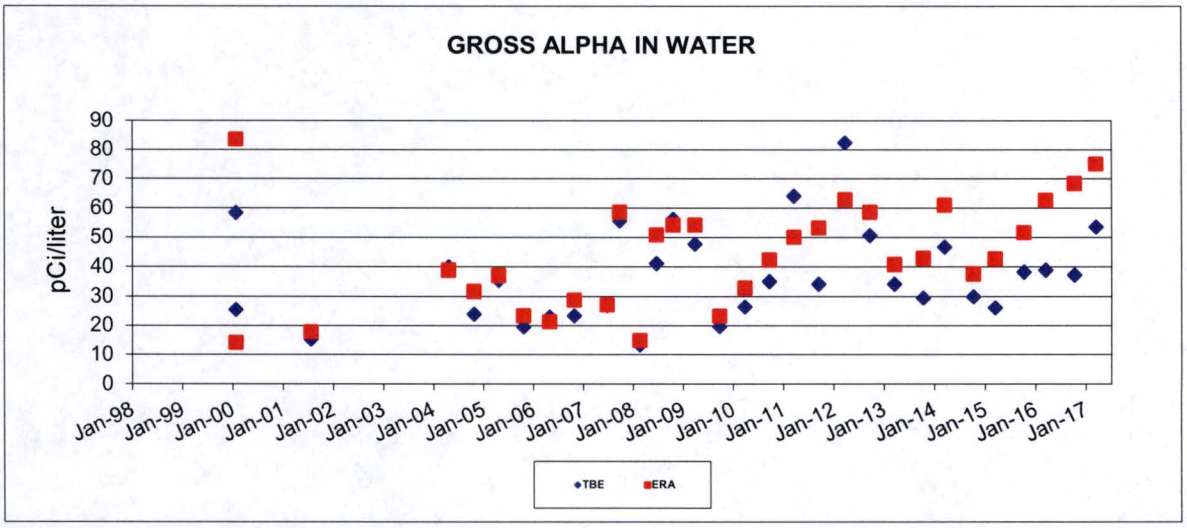
May 2004 - Counted without absorber.



INTERLABORATORY COMPARISON PROGRAM GRAPHS



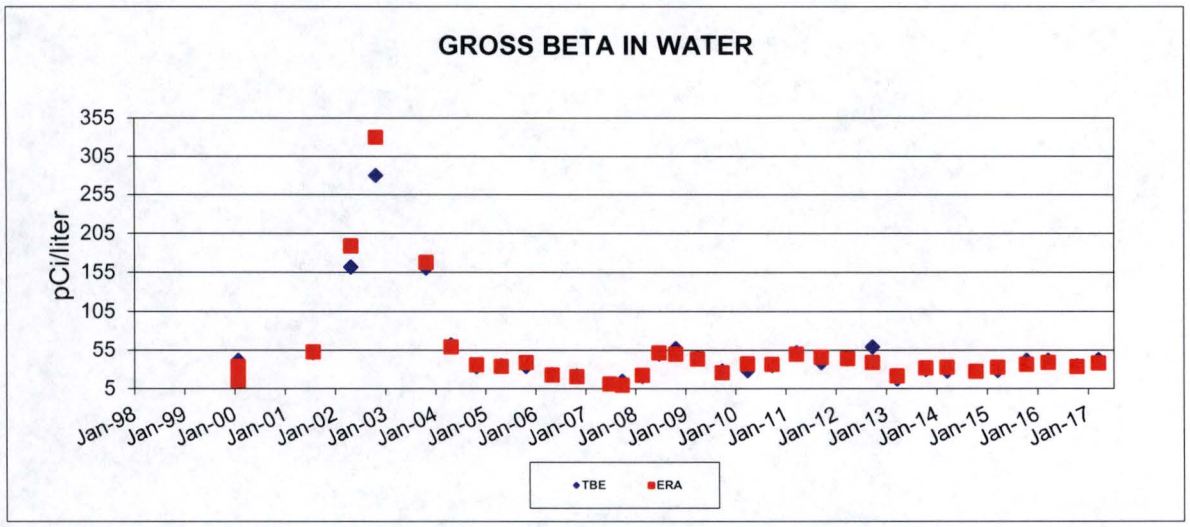


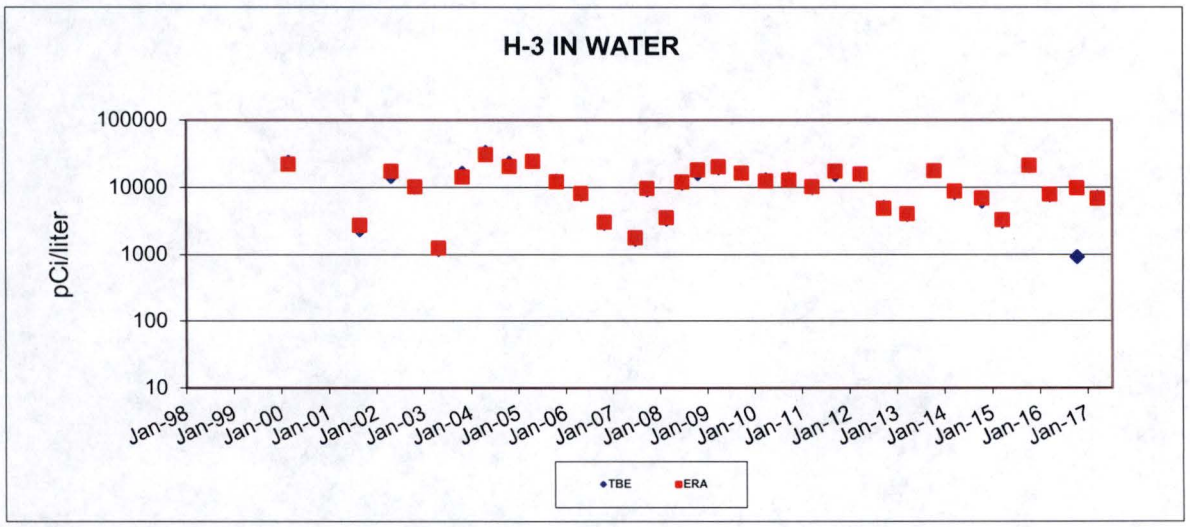


February 2000 - Analyst error or equipment failure.

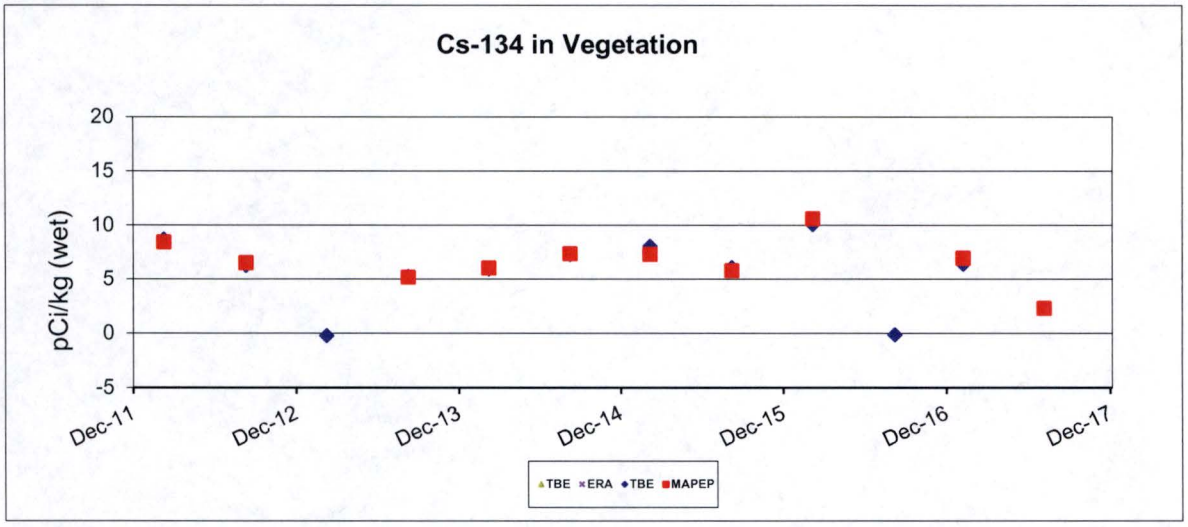
April 2011 - Solids exceeded 100 mg limit.

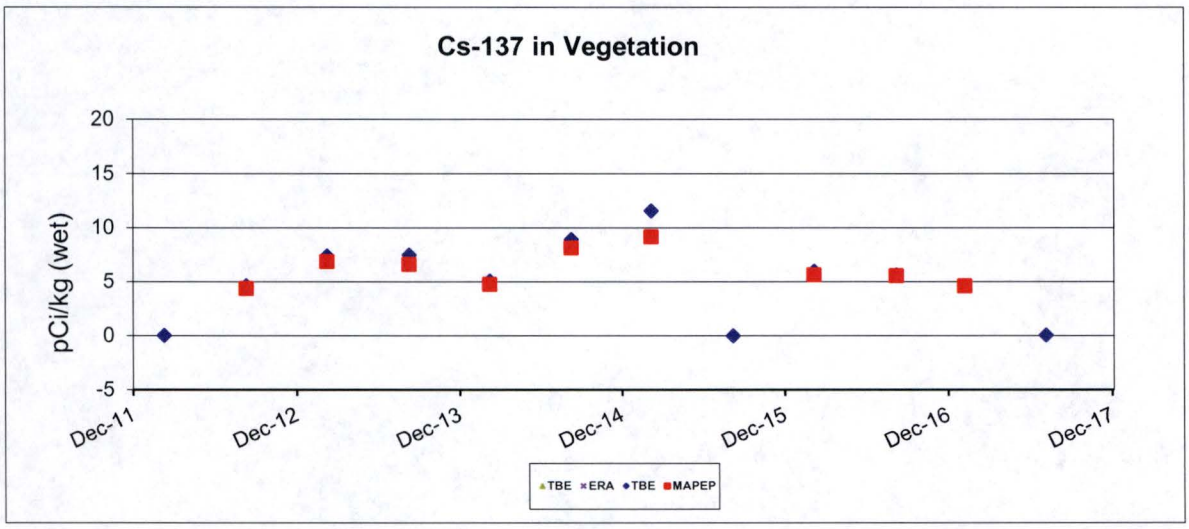
INTERLABORATORY COMPARISON PROGRAM GRAPHS

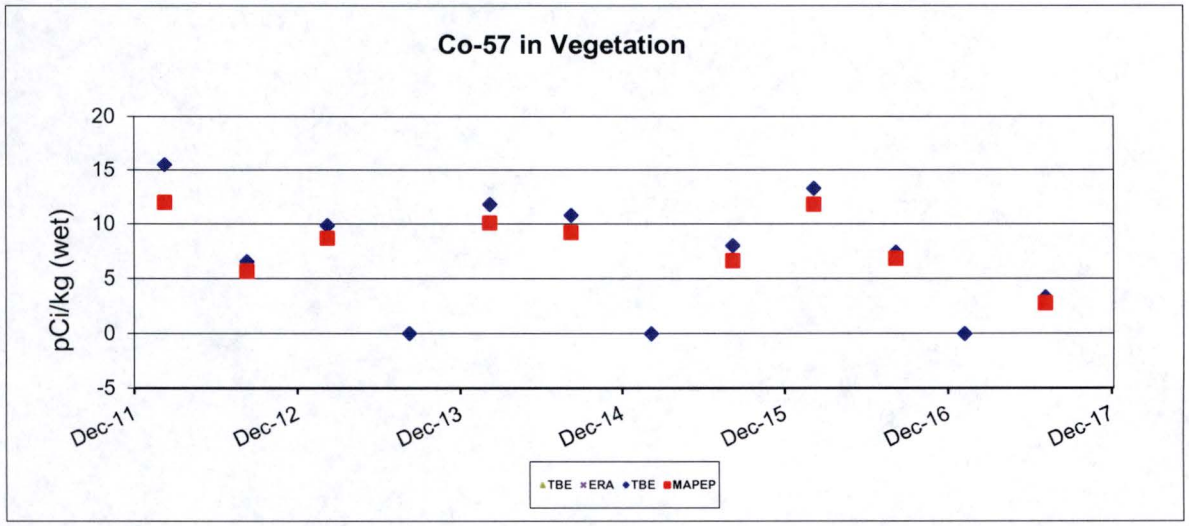




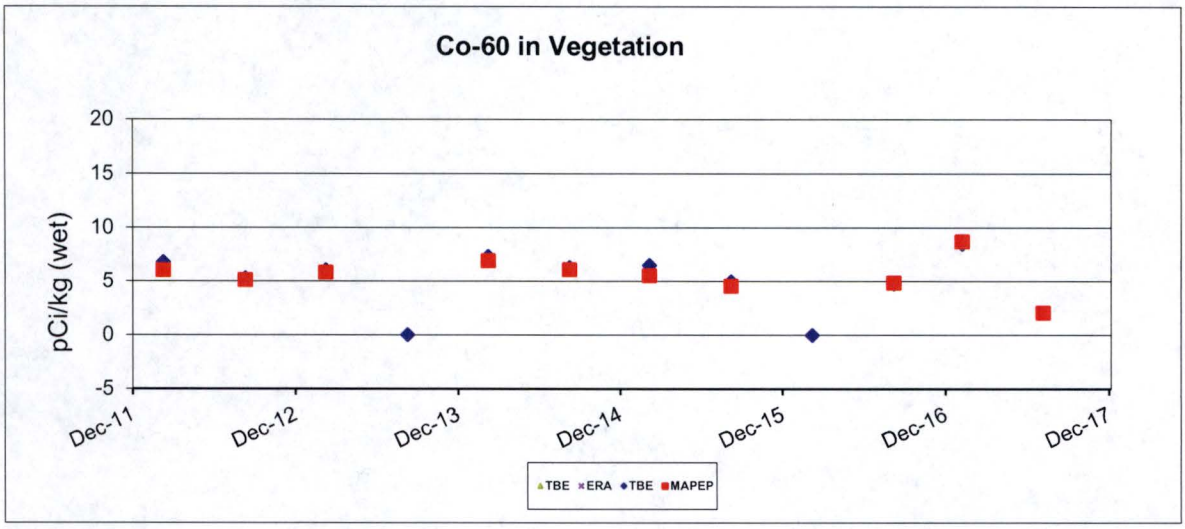
INTERLABORATORY COMPARISON PROGRAM GRAPHS

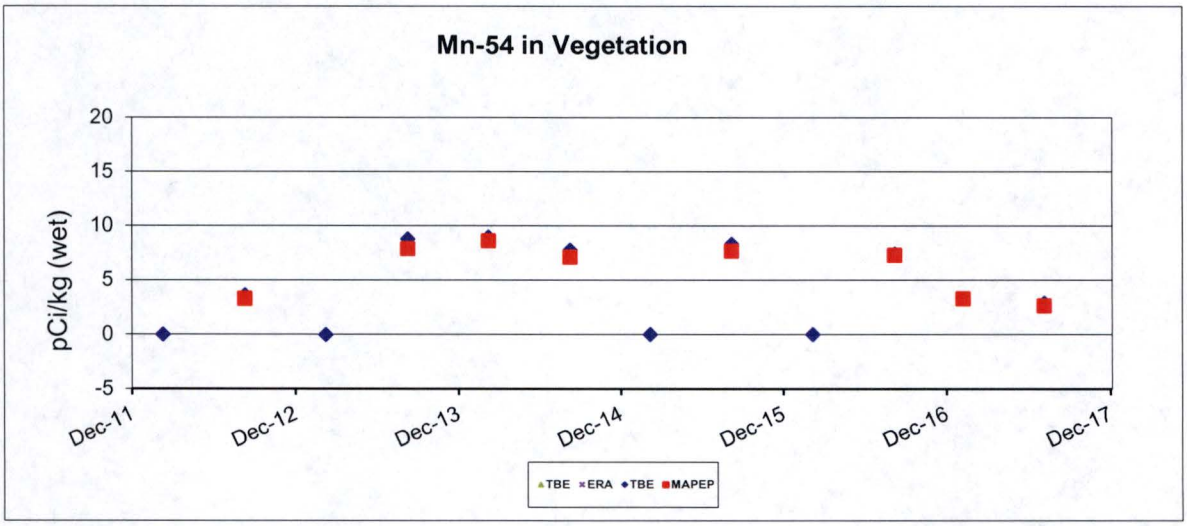


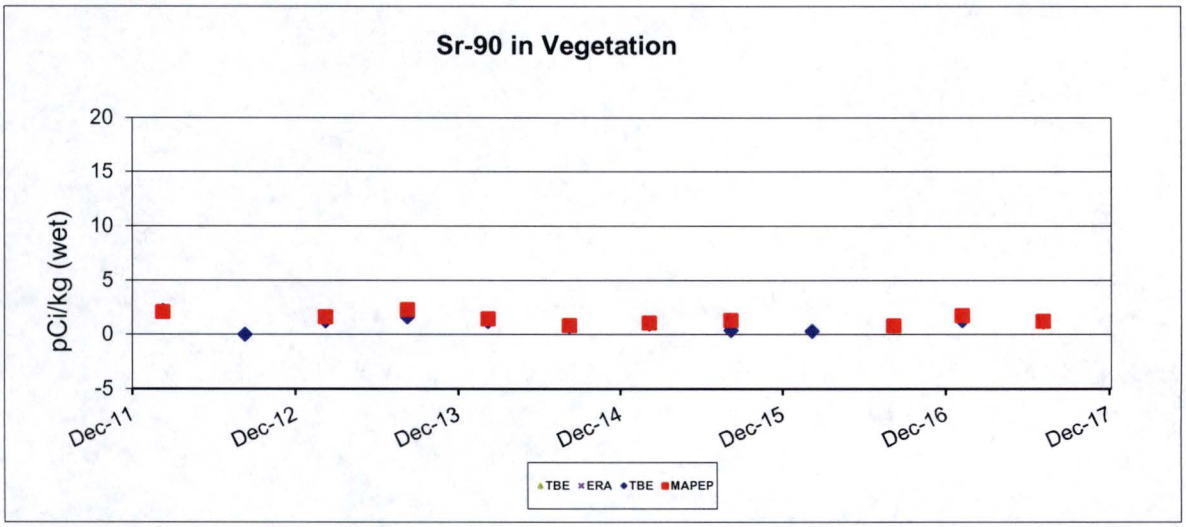


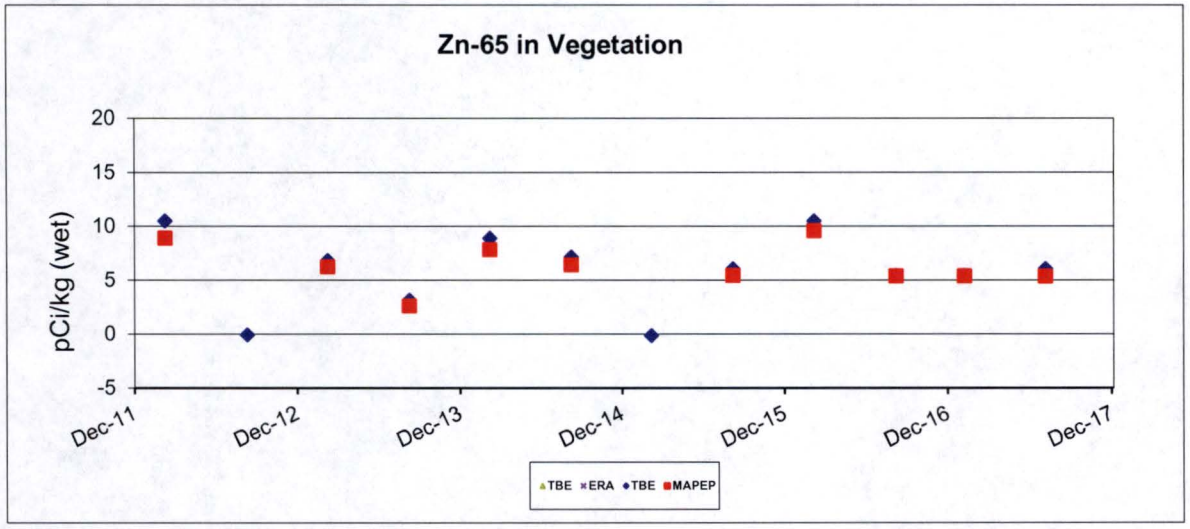


INTERLABORATORY COMPARISON PROGRAM GRAPHS








Zn-65 in Vegetation
pCi/kg (wet)
20
15
10
5
0
-5
Dec-11
Dec-12
Dec-13
Dec-14
Dec-15
Dec-16
Dec-17
TBE
ERA
TBE
MAPEP

APPENDIX C
SYNOPSIS OF ANALYTICAL PROCEDURES

SYNOPSIS OF ANALYTICAL PROCEDURES

Appendix C is a synopsis of the analytical procedures performed during this reporting period on samples collected for the Nebraska Public Power Nuclear Plant's Radiological Environmental Monitoring Program. All analyses have been mutually agreed upon by Nebraska Public Power District and Teledyne Brown Engineering and include those recommended by the USNRC Branch Technical Position, Rev. 1, November 1979.

ANALYSIS TITLE	PAGE
Gross Beta Analysis of Air Particulate Samples	C-3
Air Particulates	C-3
Determination of Gross Beta Activity in Water Samples	C-4
Introduction	C-4
Detection Capabilities	C-4
Analysis of Samples for Tritium (Liquid Scintillation)	C-5
Water	C-5
Analysis of Samples for Iodine-131	C-6
Milk or Water	C-6
Gamma Spectrometry of Samples	C-7
Milk or Water	C-7
Dried Solids other than Soils and Sediment	C-7
Fish	C-7
Soils and Sediments	C-7
Charcoal Cartridges (Air Iodine)	C-7
Airborne Particulates	C-8
Addendum to Gamma Spectrometry Procedure	C-9
Environmental Dosimetry	C-10
Lower Limit of Detection Formulas	C-11

GROSS BETA ANALYSIS OF AIR PARTICULATE SAMPLES

Air Particulates

After a delay of five or more days, allowing for the radon-222 and radon-220 (thoron) daughter products to decay, the filters are counted in a gas-flow proportional counter.

Calculations of the results, the two sigma error and the lower limit of detection (LLD):

RESULT (pCi/m^3) = $((S/T) - (B/t))/(2.22\ V\ E)$

TWO SIGMA ERROR (pCi/m^3) = $2((S/T^2) + (B/t^2))^{1/2}/(2.22\ V\ E)$

LLD (pCi/m^3) = $4.66(B^{1/2})/(2.22\ V\ E\ t)$

where:

S	=	Gross counts of sample including blank
B	=	Counts of blank
E	=	Counting efficiency
T	=	Number of minutes sample was counted
t	=	Number of minutes blank was counted
V	=	Sample aliquot size (cubic meters)

DETERMINATION OF GROSS BETA ACTIVITY IN WATER SAMPLES

Introduction

The procedures described in this section are used to measure the overall radioactivity of water samples without identifying the radioactive species present. No chemical separation techniques are involved.

One liter of the sample is evaporated on a hot plate. A smaller volume may be used if the sample has a significant salt content as measured gravimetrically. If requested by the customer, the sample is filtered through No. 54 filter paper before evaporation, removing particles greater than 30 microns in size.

After evaporating to a small volume in a beaker, the sample is rinsed into a 2-inch diameter stainless steel planchette, which is stamped with a concentric ring pattern to distribute residue evenly. Final evaporation to dryness takes place under heat lamps.

Residue mass is determined by weighing the planchette before and after mounting the sample. The planchette is counted for beta activity on an automatic proportional counter. Results are calculated using empirical self-absorption curves which allow for the change in effective counting efficiency caused by the residue mass.

Detection Capability

Detection capability depends upon the sample volume actually represented on the planchette, the background and the efficiency of the counting instrument, and upon self-absorption of beta particles by the mounted sample. Because the radioactive species are not identified, no decay corrections are made and the reported activity refers to the counting time.

The minimum detectable level (MDL) for water samples is nominally 1.6 picoCuries per liter for gross beta at the 4.66 sigma level (1.0 pCi/L at the 2.83 sigma level), assuming that 1 liter of sample is used and that 0.5 gram of sample residue is mounted on the planchette. These figures are based upon a counting time of 50 minutes and upon representative values of counting efficiency and background of 0.2 and 1.2 cpm, respectively

The MDL becomes significantly lower as the mount weight decreases because of reduced self-absorption. At a zero mount weight, the 4.66 sigma MDL for gross beta is 0.9 pCi/L. These values reflect a beta counting efficiency of 0.38.

ANALYSIS OF SAMPLES FOR TRITIUM

(Liquid Scintillation)

Water

Ten milliliters of water are mixed with 10 ml of a liquid scintillation "cocktail" and then the mixture is counted in an automatic liquid scintillator.

Calculation of the results, the two sigma error and the lower limit detection (LLD) in pCi/L:

RESULT = $(N-B)/(2.22\ V\ E)$

TWO SIGMA ERROR = $2((N + B)/\Delta t)^{1/2} / (2.22\ V\ E)$

LLD = $4.66(B/\Delta t)^{1/2}/(2.22\ V\ E)$

where:

N	=	the gross cpm of the sample
B	=	the background of the detector in cpm
2.22	=	conversion factor changing dpm to pCi
V	=	volume of the sample in ml
E	=	efficiency of the detector
Δt	=	counting time for the sample

ANALYSIS OF SAMPLES FOR IODINE-131

Milk or Water

Two or more liters of sample are first equilibrated with stable iodide carrier. A batch treatment with anion exchange resin is used to remove iodine from the sample. The iodine is then stripped from the resin with sodium hypochlorite solution, is reduced with hydroxylamine hydrochloride and is extracted into carbon tetrachloride as free iodine. It is then back-extracted as iodide into sodium bisulfite solution and is precipitated as palladium iodide. The precipitate is weighed for chemical yield and is mounted on a nylon planchette for low-level beta counting.

Calculations of results, two sigma error and the lower limit of detection (LLD) in pCi/L:

RESULT = $(N/\Delta t - B)/(2.22\ E\ V\ Y\ DF)$

TWO SIGMA ERROR = $2((N/\Delta t + B)/\Delta t)^{1/2}/(2.22\ E\ V\ Y\ DF)$

LLD = $4.66(B/\Delta t)^{1/2}/(2.22\ E\ V\ Y\ DF)$

where:

N	=	total counts from sample (counts)
Δt	=	counting time for sample (min)
B	=	background rate of counter (cpm)
2.22	=	dpm/pCi
V	=	volume or weight of sample analyzed
Y	=	chemical yield of the mount or sample counted
DF	=	decay factor from the collection to the counting date
E	=	efficiency of the counter for I-131, corrected for self absorption effects by the formula
E	=	$E_s(\exp{-0.0061M})/(\exp{-0.0061M_s})$
E_s	=	efficiency of the counter determined from an I-131 standard mount
Ms	=	mass of PdI_2 on the standard mount, mg
M	=	mass of PdI_2 on the sample mount, mg

GAMMA SPECTROMETRY OF SAMPLES

Milk or Water

A 1.0 liter Marinelli beaker is filled with a representative aliquot of the sample. The sample is then counted for approximately 1000 minutes with a shielded high purity germanium (HPGe) detector coupled to a VAX-based data acquisition system, which performs pulse height analysis.

Dried Solids other than Soils and Sediments

A large quantity of the sample is dried at a low temperature, less than 100°C. As much as possible (up to the total sample) is loaded into a tared 1-liter Marinelli and weighed. The sample is then counted for approximately 1000 minutes with a shielded HPGe detector coupled to a VAX-based data acquisition system, which performs pulse height analysis.

Fish

As much as possible (up to the total sample) of the edible portion of the sample is loaded into a tared Marinelli and weighed. The sample is then counted for approximately 1000 minutes with a shielded HPGe detector coupled to a VAX-based data acquisition system, which performs pulse height analysis.

Soils and Sediments

Soils and sediments are dried at a low temperature, less than 100°C. The soil or sediment is loaded fully into a tared, standard 300 cc container and weighed. The sample is then counted for approximately six hours with a shielded HPGe detector coupled to a VAX-based data acquisition system, which performs pulse height and analysis.

Charcoal Cartridges (Air Iodine)

Charcoal cartridges are counted up to five at a time, with one positioned on the face of an HPGe detector and up to four on the side of the HPGe detector. Each HPGe detector is calibrated for both positions. The detection limit for iodine-131 of each charcoal cartridge can be determined (assuming no positive iodine-131) uniquely from the volume of air, which passed through it. In the event iodine-131 is observed in the initial counting of a set, each charcoal cartridge is then counted separately, positioned on the face of the detector.

Air Particulates

The thirteen airborne particulate filters for a quarterly composite for each field station are aligned one in front of another and then counted for at least six hours with a shielded HPGe detector coupled to a VAX-based data acquisition system which performs pulse height analysis.

A VAX software program defines peaks by certain changes in the slope of the spectrum. The program also compares the energy of each peak with a library of peaks for isotope identification and then performs the radioactivity calculation using the appropriate fractional gamma ray abundance, half-life, detector efficiency, and net counts in the peak region.

The calculation of results, two sigma error and the lower limit of detection (LLD) in pCi/volume or pCi/mass:

RESULT = $(S-B)/(2.22\ t\ E\ V\ F\ DF)$

TWO SIGMA ERROR = $2(S+B)^{1/2}/(2.22\ t\ E\ V\ F\ DF)$

LLD = $4.66(B)^{1/2}/(2.22\ t\ E\ V\ F\ DF)$

where:

S	=	Area, in counts, of sample peak and background (region of spectrum of interest)
B	=	Background area, in counts, under sample peak, determined by a linear interpolation of the representative backgrounds on either side of the peak
t	=	length of time in minutes the sample was counted
2.22	=	dpm/pCi
E	=	detector efficiency for energy of interest and geometry of sample
V	=	sample aliquot size (liters, cubic meters, kilograms, or grams)
F	=	fractional gamma abundance (specific for each emitted gamma)
DF	=	decay factor from the mid-collection date to the counting date

ADDENDUM TO GAMMA SPECTROMETRY PROCEDURE

Ba-140 (half-life =~12.8d) decays to LA-140 (half-life ~40 hrs) and the daughter radionuclide, La-140 approaches ~ 90 % of the Ba-140 activity within ~ 6 days. The La-140 photon energy at 1596 keV is used to quantify the Ba-140 activity due to its high photon emission probability yield (96%) producing a higher count rate when present and therefore, a smaller associated counting error.

Zr-95 (half-life = ~65d) decays to Nb-95 (half-life = ~35d). The photon energy of Nb-95 (~765 keV) is used to quantify Zr-95 because of the high photon emission probability yield (~100%) yielding a higher count rate and an associated lower counting error. The daughter radionuclide, Nb-95 approaches the Zr-95 activity after a time period of ~65 days, an estimated time interval occurring between sample exposure, collection and shipping, and analysis.

ENVIRONMENTAL DOSIMETRY

Environmental Dosimetry services are provided by Mirion Technologies. Mirion Technologies uses a thermoluminescent dosimeter (TLD) manufactured by Panasonic, Inc. Panasonic identifies it as an UD-814A1 TLD. The TLD has four elements, numbered 1-4. Elements and their filtration are composed of:

ELEMENT	MATERIAL	FILTRATION
1	$^{n}Li_2{}^{n}B_4O_7$-Cu	Thin plastic
2	$CaSO_4$-Tm	Lead
3	$CaSO_4$-Tm	Lead
4	$CaSO_4$-Tm	Lead

This material has a high light output, negligible thermally induced signal loss (fading) and negligible self-dosing. The energy response curve (as will as other features) satisfies NRC Regulatory Guide 4.13. Transit doses are accounted for by use of separate TLDs.

Prior to being sent to Cooper Nuclear Station, the Mirion badges are exposed to Cs-137, to a known dose and read in the Panasonic UD-710 reader, with reference badges to establish an element response level for each badge. Badges are then re-annealed for assignment and distribution to Cooper Nuclear Station.

Following the field exposure the badges are returned to Mirion Technologies for processing in a Panasonic UD-710 reader. Each element is heated and the measured light emission is recorded. The transit controls are read in the same manner. Total exposure for each badge is the average of Elements 2, 3, and 4.

Transit Controls are calculated using the following equation:

$$\text{TRANSDOSE} = \frac{(E3_1 + E4_1 + E3_2 + E4_2)}{4} - \frac{(E3_{trans} + E4_{trans})}{2}$$

LOWER LIMIT of DETECTION FORMULAS

The LLD formulas in Appendix C are consistent with the LLD discussion in the ODAM. The term s_b in the ODAM equals $\sqrt{B/t}$ by Poisson statistics, where B = blank counts and t = blank counting intervals. The decay factor term $e^{-\lambda\Delta t}$ in the ODAM is the same as the DF terms in Appendix C, but does not appear in certain analyses such as gross beta because decay does not apply. In the tritium analysis, decay is not considered because of the relatively long half-life.

Efficiencies and volumes are consistent between the two documents. Chemical yields appear in Appendix C where applicable but do not apply to other analyses such as tritium and gross beta.

APPENDIX D
DETECTION LIMITS AND REPORTING LEVELS

NEBRASKA PUBLIC POWER - COOPER NUCLEAR STATION
DETECTION LIMITS AND REPORTING LEVELS

Isotope	ODAM LLD	NRC Rept. Level
Water - pCi/liter		
Gross beta	4	N/A
H-3	2000	20000[a] /30000[b]
Mn-54	15	1000
Fe-59	30	400
Co-58	15	1000
Co-60	15	300
Zn-65	30	300
Zr-95	30	400
Nb-95	15	400
I-131	1[c]	2
Cs-134	15	30
Cs-137	18	50
Ba-140	60	200
La-140	15	200
Air Filter - pCi/m^3		
Gross Beta	0.01	N/A
I-131	0.07	0.9
Cs-134	0.05	10
Cs-137	0.06	20
Fish - pCi/kg-wet		
Mn-54	130	30000
Fe-59	260	10000
Co-58	130	30000
Co-60	130	10000
Zn-65	260	20000
Cs-134	130	1000
Cs-137	150	2000
Milk - pCi/liter		
I-131	1	3
Cs-134	15	60
Cs-137	18	70
Ba-140	60	300
La-140	15	300

(a) For drinking water samples
(b) For samples of water not used as a source of drinking water
(c) LLD for drinking water

NEBRASKA PUBLIC POWER - COOPER NUCLEAR STATION
DETECTION LIMITS AND REPORTING LEVELS

Isotope	ODAM LLD	NRC Rept. Level
Vegetation - pCi/kg-wet		
I-131	60	100
Cs-134	60	1000
Cs-137	80	2000
Sediment - pCi/kg-dry		
Cs-134	150	N/A
Cs-137	180	N/A

APPENDIX E
REMP SAMPLING AND ANALYTICAL EXCEPTIONS

EXCEPTIONS

Appendix E contains the exceptions to the 2017 REMP Program. Where possible, causes of the deviation have been corrected to prevent recurrence.

Any deviations from the sampling schedule are documented on the data tables. Data Tables are in Section VII.

REMP SAMPLING ANALYTICAL EXCEPTIONS, 2017

Date of Occurrence	Date of Identification	Sample Requirement	Analyses Impacted	Applicable DLCO 4.1 Condition (A or B)	Cause of Exception	Location Where Replacement Samples were Obtained
1st qtr	3/31/2017	Two Samples from Milk - Other Producers	Gamma Isotopic and I-131	B - Sampling medium was not available.	Stations 102 & 103 are only available milk producers besides Sample 99 (nearest producer) in area. Owners of Stations 102 & 103 weren't actively in production during 2017. There's a possibility that they may resume milk production in the future.	Broadleaf vegetation samples (per ODAM Table D4.1-1 4d) from Stations 35, 96 & 101 were not available during this calendar quarter due to seasonal weather conditions.
2nd qtr	6/30/2017	Two Samples from Milk - Other Producers	Gamma Isotopic and I-131	B - Sampling medium was not available.	Stations 102 & 103 are only available milk producers besides Sample 99 (nearest producer) in area. Owners of Stations 102 & 103 weren't actively in production during 2017. There's a possibility that they may resume milk production in the future.	Broadleaf vegetation samples were obtained (per ODAM Table D4.1-1 4d) from Sample Stations 35 and 96 monthly when available. Suitable broadleaf vegetation was not available at Station 101 during this time period.
3rd qtr	9/30/2017	Two Samples from Milk - Other Producers	Gamma Isotopic and I-131	B - Sampling medium was not available.	Stations 102 & 103 are only available milk producers besides Sample 99 (nearest producer) in area. Owners of Stations 102 & 103 weren't actively in production during 2017. There's a possibility that they may resume milk production in the future.	Broadleaf vegetation samples were obtained (per ODAM Table D4.1-1 4d) from Sample Stations 96 and 101 monthly when available. Suitable broadleaf vegetation was not available at Station 35 during this time period.
4th qtr	12/31/2017	Two Samples from Milk - Other Producers	Gamma Isotopic and I-131	B - Sampling medium was not available.	Stations 102 & 103 are only available milk producers besides Sample 99 (nearest producer) in area. Owners of Stations 102 & 103 weren't actively in production during 2017. There's a possibility that they may resume milk production in the future.	Broadleaf vegetation samples (per ODAM Table D4.1-1 4d) from Stations 35, 96 & 101 were not available during this calendar quarter due to seasonal weather conditions.

APPENDIX F

SUMMARY OF DOSES TO A MEMBER OF THE PUBLIC OFFSITE

LIQUID EFFLUENT DOSE CALCULATIONS

Doses to the maximum individual and 0 to 50 - mile population resulting from the release of radioactive material in liquid effluents from Cooper Nuclear Station were calculated using the latest version of the LADTAP II computer program included as part of NRCDose 2.3.20 (ORNL 2015). The LADTAP II program implements the radiological dose models of Regulatory Guide 1.109 for determining the radiation exposure to man from three principal exposure pathways in the aquatic environment -- potable water, aquatic foods, and recreational water use. Doses to both the maximum individual and 0 to 50 mile population are calculated as a function of age group and pathway for significant body organs, and are presented in Tables 1 - 6.

Assumptions and data sources used for input to the LADTAP II code are described in a separate section of this appendix (see page F-67).

No Liquid Releases 2017

TABLE 1. Doses to Maximum Individual at the Site Boundary, Resulting From Exposure to Radioactivity Discharged in Liquid Effluents, January-June 2017 Cooper Nuclear Station

Period and Pathway	Dose to Individual, mrem							
	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
1st Quarter								
Drinking Water		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Shoreline	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Totals	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**
2nd Quarter								
Eating Fish		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Drinking Water		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Shoreline	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Totals	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**
Totals for 1st & 2nd Quarters	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**

Calculated doses are based on the following periods of exposures: Fishing: April - November; Drinking water and shoreline: January - December

TABLE 2. Doses to Maximum Individual at the Site Boundary, Resulting From Exposure to Radioactivity Discharged in Liquid Effluents, July-December 2017, Cooper Nuclear Station

Period and Pathway	Dose to Individual, mrem							
	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
3rd Quarter								
Eating Fish		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Drinking Water		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Shoreline	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Totals	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**
4th Quarter								
Eating Fish		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Drinking Water		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Shoreline	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Totals	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**
Totals for 3rd & 4th Quarters	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**

Calculated doses are based on the following periods of exposures: Fishing: April - November; Drinking water and shoreline: January - December

TABLE 3. Summary of Doses to Maximum Individual at the Site Boundary, Resulting from Exposure to Radioactivity Discharged in Liquid Effluents, January-December 2017, Cooper Nuclear Station

Period and Pathway	Dose to Individual, mrem							
	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
1st Quarter	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
2nd Quarter	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+001	0.00 E+00	0.00 E+00
3rd Quarter	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
4th Quarter	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Totals for 2017	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**

TABLE 4. Doses to Population Within a 50-Mile Radius, Resulting From Exposure to Radioactivity Discharged in Liquid Effluents, January-June 2017, Cooper Nuclear Station

Period and Pathway	Dose to Population, manrem							
	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
1st Quarter								
Drinking Water		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Shoreline	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Totals	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**
2nd Quarter								
Eating Fish		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Drinking Water		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Shoreline	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Swimming	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Boating	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Totals	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**
Totals for 1st & 2nd Quarters	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**

Calculated doses are based on the following periods of exposures: Fishing and Boating: April - November; Drinking water and shoreline: January - December; Swimming: June - September. Exposure from drinking water is calculated for the city of St. Joseph, Missouri, nearest public water intake from the Missouri River, 84 miles downstream.

TABLE 5. Doses to Population Within a 50-Mile Radius, Resulting From Exposure to Radioactivity Discharged in Liquid Effluents, July-December 2017, Cooper Nuclear Station

Period and Pathway	Dose to Population, manrem							
	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
3rd Quarter								
Eating Fish		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Drinking Water		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Shoreline	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Swimming	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Boating	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Totals	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**
4th Quarter								
Eating Fish		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Drinking Water		0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Shoreline	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Boating	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Totals	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**
Totals for 3rd & 4th Quarters	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**

Calculated doses are based on the following periods of exposures: Fishing and Boating: April - November; Drinking water and shoreline: January - December; Swimming: June - September. Exposure from drinking water is calculated for the city of St. Joseph, Missouri, nearest public water intake from the Missouri River, 84 miles downstream.

TABLE 6. Summary of Doses to Population Within a 50-Mile Radius, Resulting from Exposure to Radioactivity Discharged in Liquid Effluents, January-December 2017 Cooper Nuclear Station

Period and Pathway	Dose to Population, manrem							
	Skin	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
1st Quarter	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
2nd Quarter	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
3rd Quarter	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
4th Quarter	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Totals for 2017	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**	**0.00 E+00**

GASEOUS EFFLUENT DOSE CALCULATIONS (EXCEPT CARBON-14)

Doses to the maximum individual and 0 to 50 mile population resulting from the release of radioactive material in gaseous effluents from the Cooper Nuclear Station were calculated using the latest version of the GASPAR computer code included as part of NRCDose 2.3.20 (ORNL 2015). Four sites were selected for individual dose calculations: the site boundary, the nearest residence, the nearest garden and the nearest cow. GASPAR implements the radiological dose models of Regulatory Guide 1.109 for determining the radiation exposure to man from four principal atmospheric exposure pathways: plume, ground, inhalation, and ingestion. Doses to the maximum individual and the population are calculated as a function of age group and pathway for significant body organs.

Tables 1 through 7 present maximum individual doses. Population doses are given in Tables 8 through 14.

Assumptions and data used for input to the GASPAR code are described in a separate section of this appendix (see page F-67).

TABLE 1. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-MARCH 2017

SPECIAL LOCATION NO. 1A Site Boundary
AT .67 MILES N

ANNUAL BETA AIR DOSE = 1.25E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 2.54E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.72E-06	3.06E-06
GROUND	2.10E-03	2.10E-03	2.10E-03	2.10E-03	2.10E-03	2.10E-03	2.10E-03	2.48E-03
VEGET								
ADULT	3.81E-05	2.76E-04	7.38E-06	2.68E-05	4.75E-06	6.44E-05	9.93E-07	0.00E+00
TEEN	5.56E-05	2.93E-04	1.21E-05	4.16E-05	7.41E-06	8.68E-05	1.86E-06	0.00E+00
CHILD	1.06E-04	1.91E-04	2.86E-05	6.62E-05	1.17E-05	1.66E-04	2.83E-06	0.00E+00
MEAT								
ADULT	9.15E-06	7.24E-05	6.90E-07	5.09E-06	5.96E-07	1.74E-06	8.12E-08	0.00E+00
TEEN	7.08E-06	3.89E-05	5.53E-07	3.97E-06	4.57E-07	1.26E-06	7.68E-08	0.00E+00
CHILD	1.08E-05	1.96E-05	9.82E-07	4.77E-06	5.45E-07	1.90E-06	9.02E-08	0.00E+00
COW MILK								
ADULT	6.78E-06	1.72E-05	5.18E-06	9.01E-06	3.60E-06	4.82E-05	6.87E-07	0.00E+00
TEEN	8.57E-06	2.01E-05	9.22E-06	1.57E-05	6.16E-06	7.62E-05	1.42E-06	0.00E+00
CHILD	1.25E-05	1.33E-05	2.18E-05	2.62E-05	9.87E-06	1.51E-04	2.18E-06	0.00E+00
INFANT	1.75E-05	1.79E-05	3.46E-05	5.04E-05	1.51E-05	3.66E-04	3.95E-06	0.00E+00
GOATMILK								
ADULT	1.24E-05	2.45E-06	1.36E-05	1.88E-05	6.66E-06	5.78E-05	2.06E-06	0.00E+00
TEEN	1.20E-05	2.92E-06	2.46E-05	3.31E-05	1.17E-05	9.14E-05	4.26E-06	0.00E+00
CHILD	9.70E-06	1.98E-06	5.93E-05	5.72E-05	1.95E-05	1.81E-04	6.54E-06	0.00E+00
INFANT	1.01E-05	2.53E-06	9.49E-05	1.12E-04	3.13E-05	4.39E-04	1.18E-05	0.00E+00
INHAL								
ADULT	5.05E-07	7.15E-06	1.43E-07	5.70E-07	1.11E-07	2.81E-06	1.49E-04	0.00E+00
TEEN	6.06E-07	6.51E-06	1.99E-07	7.56E-07	1.49E-07	3.45E-06	2.17E-04	0.00E+00
CHILD	6.28E-07	2.50E-06	2.67E-07	6.78E-07	1.33E-07	3.84E-06	1.76E-04	0.00E+00
INFANT	3.21E-07	8.85E-07	1.63E-07	4.44E-07	7.73E-08	3.51E-06	1.12E-04	0.00E+00

TABLE 1. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-MARCH 2017 (Continued)

SPECIAL LOCATION NO. 2A Site Boundary
AT .60 MILES NNE

ANNUAL BETA AIR DOSE = 7.09E-07 MILLRADS
ANNUAL GAMMA AIR DOSE = 1.44E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.67E-07	9.67E-07	9.67E-07	9.67E-07	9.67E-07	9.67E-07	9.74E-07	1.74E-06
GROUND	1.32E-03	1.32E-03	1.32E-03	1.32E-03	1.32E-03	1.32E-03	1.32E-03	1.55E-03
VEGET								
ADULT	2.38E-05	1.72E-04	4.67E-06	1.68E-05	2.98E-06	4.28E-05	6.22E-07	0.00E+00
TEEN	3.48E-05	1.83E-04	7.62E-06	2.60E-05	4.66E-06	5.77E-05	1.16E-06	0.00E+00
CHILD	6.60E-05	1.20E-04	1.81E-05	4.14E-05	7.35E-06	1.11E-04	1.77E-06	0.00E+00
MEAT								
ADULT	5.72E-06	4.52E-05	4.32E-07	3.18E-06	3.73E-07	1.15E-06	5.08E-08	0.00E+00
TEEN	4.42E-06	2.43E-05	3.47E-07	2.48E-06	2.86E-07	8.36E-07	4.81E-08	0.00E+00
CHILD	6.75E-06	1.23E-05	6.15E-07	2.98E-06	3.41E-07	1.26E-06	5.65E-08	0.00E+00
COW MILK								
ADULT	4.24E-06	1.07E-05	3.24E-06	5.64E-06	2.26E-06	3.20E-05	4.30E-07	0.00E+00
TEEN	5.36E-06	1.26E-05	5.78E-06	9.81E-06	3.87E-06	5.07E-05	8.88E-07	0.00E+00
CHILD	7.83E-06	8.29E-06	1.37E-05	1.64E-05	6.20E-06	1.00E-04	1.36E-06	0.00E+00
INFANT	1.10E-05	1.12E-05	2.17E-05	3.16E-05	9.51E-06	2.43E-04	2.47E-06	0.00E+00
GOATMILK								
ADULT	7.76E-06	1.54E-06	8.52E-06	1.18E-05	4.18E-06	3.84E-05	1.29E-06	0.00E+00
TEEN	7.48E-06	1.83E-06	1.54E-05	2.07E-05	7.37E-06	6.08E-05	2.66E-06	0.00E+00
CHILD	6.08E-06	1.24E-06	3.71E-05	3.58E-05	1.22E-05	1.20E-04	4.09E-06	0.00E+00
INFANT	6.32E-06	1.58E-06	5.95E-05	7.00E-05	1.96E-05	2.92E-04	7.41E-06	0.00E+00
INHAL								
ADULT	3.89E-07	5.50E-06	1.10E-07	4.39E-07	8.53E-08	2.09E-06	1.14E-04	0.00E+00
TEEN	4.66E-07	5.00E-06	1.53E-07	5.81E-07	1.14E-07	2.57E-06	1.67E-04	0.00E+00
CHILD	4.83E-07	1.90E-06	2.05E-07	5.21E-07	1.02E-07	2.85E-06	1.35E-04	0.00E+00
INFANT	2.47E-07	6.66E-07	1.25E-07	3.41E-07	5.91E-08	2.61E-06	8.63E-05	0.00E+00

TABLE 1. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-MARCH 2017 (Continued)

SPECIAL LOCATION NO. 3A Nearest Resident
AT .90 MILES NW

ANNUAL BETA AIR DOSE = 4.39E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 8.94E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	5.99E-06	5.99E-06	5.99E-06	5.99E-06	5.99E-06	5.99E-06	6.03E-06	1.07E-05
GROUND	5.70E-04	5.70E-04	5.70E-04	5.70E-04	5.70E-04	5.70E-04	5.70E-04	6.71E-04
VEGET								
ADULT	1.04E-05	7.47E-05	2.33E-06	7.34E-06	1.38E-06	3.27E-05	2.73E-07	0.00E+00
TEEN	1.51E-05	7.95E-05	3.81E-06	1.14E-05	2.15E-06	4.40E-05	5.11E-07	0.00E+00
CHILD	2.87E-05	5.19E-05	9.06E-06	1.82E-05	3.40E-06	8.44E-05	7.78E-07	0.00E+00
MEAT								
ADULT	2.48E-06	1.96E-05	1.93E-07	1.38E-06	1.64E-07	8.80E-07	2.23E-08	0.00E+00
TEEN	1.92E-06	1.05E-05	1.55E-07	1.08E-06	1.26E-07	6.37E-07	2.11E-08	0.00E+00
CHILD	2.93E-06	5.32E-06	2.75E-07	1.30E-06	1.51E-07	9.62E-07	2.48E-08	0.00E+00
COW MILK								
ADULT	1.87E-06	4.67E-06	1.46E-06	2.50E-06	1.04E-06	2.45E-05	1.89E-07	0.00E+00
TEEN	2.37E-06	5.47E-06	2.60E-06	4.35E-06	1.79E-06	3.88E-05	3.90E-07	0.00E+00
CHILD	3.46E-06	3.61E-06	6.15E-06	7.27E-06	2.88E-06	7.67E-05	5.99E-07	0.00E+00
INFANT	4.88E-06	4.87E-06	9.83E-06	1.41E-05	4.45E-06	1.86E-04	1.08E-06	0.00E+00
GOATMILK								
ADULT	3.43E-06	6.82E-07	3.79E-06	5.20E-06	1.90E-06	2.94E-05	5.66E-07	0.00E+00
TEEN	3.32E-06	8.16E-07	6.87E-06	9.16E-06	3.36E-06	4.65E-05	1.17E-06	0.00E+00
CHILD	2.74E-06	5.56E-07	1.65E-05	1.58E-05	5.56E-06	9.20E-05	1.80E-06	0.00E+00
INFANT	2.90E-06	7.05E-07	2.66E-05	3.10E-05	8.97E-06	2.24E-04	3.25E-06	0.00E+00
INHAL								
ADULT	1.10E-07	1.56E-06	3.26E-08	1.25E-07	2.69E-08	9.51E-07	3.21E-05	0.00E+00
TEEN	1.32E-07	1.46E-06	4.54E-08	1.66E-07	3.61E-08	1.18E-06	4.68E-05	0.00E+00
CHILD	1.37E-07	8.51E-07	6.10E-08	1.49E-07	3.24E-08	1.34E-06	3.79E-05	0.00E+00
INFANT	7.03E-08	4.61E-07	3.76E-08	9.83E-08	1.91E-08	1.22E-06	2.42E-05	0.00E+00

TABLE 1. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-MARCH 2017 (Continued)

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 3.18E-07 MILLRADS
ANNUAL GAMMA AIR DOSE = 7.32E-07 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.88E-07	4.88E-07	4.88E-07	4.88E-07	4.88E-07	4.88E-07	4.90E-07	8.36E-07
GROUND	2.90E-05	2.90E-05	2.90E-05	2.90E-05	2.90E-05	2.90E-05	2.90E-05	3.41E-05
VEGET								
ADULT	5.31E-07	3.80E-06	1.41E-07	3.78E-07	7.62E-08	2.70E-06	1.41E-08	0.00E+00
TEEN	7.73E-07	4.04E-06	2.30E-07	5.87E-07	1.19E-07	3.64E-06	2.65E-08	0.00E+00
CHILD	1.47E-06	2.64E-06	5.51E-07	9.36E-07	1.88E-07	6.97E-06	4.03E-08	0.00E+00
MEAT								
ADULT	1.26E-07	9.96E-07	1.02E-08	7.05E-08	8.56E-09	7.26E-08	1.15E-09	0.00E+00
TEEN	9.75E-08	5.35E-07	8.19E-09	5.49E-08	6.58E-09	5.26E-08	1.09E-09	0.00E+00
CHILD	1.49E-07	2.70E-07	1.46E-08	6.62E-08	7.88E-09	7.94E-08	1.28E-09	0.00E+00
COW MILK								
ADULT	9.75E-08	2.38E-07	7.77E-08	1.31E-07	5.77E-08	2.02E-06	9.77E-09	0.00E+00
TEEN	1.24E-07	2.79E-07	1.39E-07	2.28E-07	9.94E-08	3.20E-06	2.02E-08	0.00E+00
CHILD	1.81E-07	1.84E-07	3.29E-07	3.81E-07	1.60E-07	6.34E-06	3.10E-08	0.00E+00
INFANT	2.57E-07	2.48E-07	5.30E-07	7.42E-07	2.50E-07	1.54E-05	5.61E-08	0.00E+00
GOATMILK								
ADULT	1.79E-07	3.58E-08	2.00E-07	2.72E-07	1.03E-07	2.43E-06	2.93E-08	0.00E+00
TEEN	1.75E-07	4.31E-08	3.62E-07	4.79E-07	1.82E-07	3.85E-06	6.05E-08	0.00E+00
CHILD	1.46E-07	2.96E-08	8.72E-07	8.29E-07	3.02E-07	7.61E-06	9.31E-08	0.00E+00
INFANT	1.59E-07	3.71E-08	1.41E-06	1.63E-06	4.89E-07	1.85E-05	1.68E-07	0.00E+00
INHAL								
ADULT	1.27E-08	1.85E-07	4.45E-09	1.48E-08	4.37E-09	2.97E-07	3.59E-06	0.00E+00
TEEN	1.52E-08	1.84E-07	6.21E-09	1.97E-08	5.92E-09	3.72E-07	5.24E-06	0.00E+00
CHILD	1.58E-08	1.88E-07	8.37E-09	1.78E-08	5.38E-09	4.29E-07	4.25E-06	0.00E+00
INFANT	8.24E-09	1.30E-07	5.37E-09	1.21E-08	3.30E-09	3.93E-07	2.72E-06	0.00E+00

TABLE 1. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-MARCH 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 2.80 MILES NNW

ANNUAL BETA AIR DOSE = 2.90E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 5.91E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.96E-06	3.96E-06	3.96E-06	3.96E-06	3.96E-06	3.96E-06	3.99E-06	7.11E-06
GROUND	4.83E-05	4.83E-05	4.83E-05	4.83E-05	4.83E-05	4.83E-05	4.83E-05	5.68E-05
VEGET								
ADULT	8.84E-07	6.33E-06	2.28E-07	6.28E-07	1.25E-07	4.18E-06	2.35E-08	0.00E+00
TEEN	1.29E-06	6.73E-06	3.73E-07	9.76E-07	1.95E-07	5.64E-06	4.40E-08	0.00E+00
CHILD	2.44E-06	4.40E-06	8.90E-07	1.56E-06	3.08E-07	1.08E-05	6.69E-08	0.00E+00
MEAT								
ADULT	2.10E-07	1.66E-06	1.69E-08	1.17E-07	1.42E-08	1.13E-07	1.92E-09	0.00E+00
TEEN	1.62E-07	8.92E-07	1.36E-08	9.15E-08	1.09E-08	8.15E-08	1.81E-09	0.00E+00
CHILD	2.48E-07	4.50E-07	2.41E-08	1.10E-07	1.31E-08	1.23E-07	2.13E-09	0.00E+00
COW MILK								
ADULT	1.62E-07	3.96E-07	1.28E-07	2.17E-07	9.48E-08	3.14E-06	1.62E-08	0.00E+00
TEEN	2.05E-07	4.65E-07	2.29E-07	3.78E-07	1.63E-07	4.97E-06	3.35E-08	0.00E+00
CHILD	3.00E-07	3.07E-07	5.43E-07	6.32E-07	2.62E-07	9.83E-06	5.15E-08	0.00E+00
INFANT	4.25E-07	4.13E-07	8.74E-07	1.23E-06	4.09E-07	2.39E-05	9.32E-08	0.00E+00
GOATMILK								
ADULT	2.97E-07	5.94E-08	3.31E-07	4.50E-07	1.70E-07	3.77E-06	4.87E-08	0.00E+00
TEEN	2.89E-07	7.13E-08	5.99E-07	7.94E-07	3.00E-07	5.96E-06	1.01E-07	0.00E+00
CHILD	2.42E-07	4.89E-08	1.44E-06	1.37E-06	4.97E-07	1.18E-05	1.55E-07	0.00E+00
INFANT	2.62E-07	6.14E-08	2.33E-06	2.70E-06	8.05E-07	2.87E-05	2.80E-07	0.00E+00
INHAL								
ADULT	1.91E-08	2.76E-07	6.42E-09	2.22E-08	6.08E-09	3.47E-07	5.42E-06	0.00E+00
TEEN	2.29E-08	2.76E-07	8.97E-09	2.95E-08	8.22E-09	4.34E-07	7.92E-06	0.00E+00
CHILD	2.39E-08	3.05E-07	1.21E-08	2.66E-08	7.45E-09	4.99E-07	6.42E-06	0.00E+00
INFANT	1.24E-08	2.17E-07	7.70E-09	1.80E-08	4.54E-09	4.57E-07	4.11E-06	0.00E+00

TABLE 2. DOSES TO MAXIMUM INDIVIDUAL (MREM), APRIL-JUNE 2017

SPECIAL LOCATION NO. 1A Site Boundary
AT .67 MILES N

ANNUAL BETA AIR DOSE = 3.41E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 6.94E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.64E-06	4.64E-06	4.64E-06	4.64E-06	4.64E-06	4.64E-06	4.68E-06	8.35E-06
GROUND	1.39E-03	1.39E-03	1.39E-03	1.39E-03	1.39E-03	1.39E-03	1.39E-03	1.63E-03
VEGET								
ADULT	2.77E-05	1.77E-04	9.05E-06	2.05E-05	4.40E-06	1.50E-04	1.16E-06	0.00E+00
TEEN	3.85E-05	1.88E-04	1.49E-05	3.20E-05	6.97E-06	2.02E-04	2.17E-06	0.00E+00
CHILD	7.01E-05	1.23E-04	3.56E-05	5.23E-05	1.14E-05	3.86E-04	3.30E-06	0.00E+00
MEAT								
ADULT	6.11E-06	4.73E-05	6.36E-07	3.38E-06	3.14E-07	4.02E-06	9.45E-08	0.00E+00
TEEN	4.64E-06	2.55E-05	5.28E-07	2.65E-06	2.54E-07	2.91E-06	8.94E-08	0.00E+00
CHILD	6.98E-06	1.29E-05	9.72E-07	3.24E-06	3.21E-07	4.40E-06	1.05E-07	0.00E+00
COW MILK								
ADULT	6.07E-06	1.06E-05	5.50E-06	8.03E-06	3.03E-06	1.12E-04	8.00E-07	0.00E+00
TEEN	6.82E-06	1.25E-05	9.96E-06	1.41E-05	5.36E-06	1.78E-04	1.65E-06	0.00E+00
CHILD	8.14E-06	8.28E-06	2.40E-05	2.43E-05	8.90E-06	3.52E-04	2.54E-06	0.00E+00
INFANT	1.12E-05	7.43E-06	3.89E-05	4.81E-05	1.45E-05	8.55E-04	4.60E-06	0.00E+00
GOATMILK								
ADULT	1.43E-05	1.79E-06	1.60E-05	2.18E-05	7.94E-06	1.35E-04	2.40E-06	0.00E+00
TEEN	1.37E-05	2.18E-06	2.89E-05	3.84E-05	1.40E-05	2.13E-04	4.96E-06	0.00E+00
CHILD	1.09E-05	1.52E-06	6.97E-05	6.65E-05	2.33E-05	4.22E-04	7.62E-06	0.00E+00
INFANT	1.12E-05	1.41E-06	1.12E-04	1.30E-04	3.78E-05	1.03E-03	1.38E-05	0.00E+00
INHAL								
ADULT	2.21E-07	2.62E-06	9.86E-08	2.43E-07	7.22E-08	4.51E-06	5.43E-05	0.00E+00
TEEN	2.49E-07	2.41E-06	1.38E-07	3.25E-07	9.89E-08	5.65E-06	7.94E-05	0.00E+00
CHILD	2.43E-07	1.10E-06	1.87E-07	3.01E-07	9.20E-08	6.53E-06	6.43E-05	0.00E+00
INFANT	1.25E-07	4.86E-07	1.17E-07	2.11E-07	5.78E-08	5.98E-06	4.10E-05	0.00E+00

TABLE 2. DOSES TO MAXIMUM INDIVIDUAL (MREM), APRIL-JUNE 2017 (Continued)

SPECIAL LOCATION NO. 2A Site Boundary
AT .81 MILES SSE

ANNUAL BETA AIR DOSE = 2.83E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 5.76E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.85E-06	3.85E-06	3.85E-06	3.85E-06	3.85E-06	3.85E-06	3.88E-06	6.93E-06
GROUND	6.76E-04	6.76E-04	6.76E-04	6.76E-04	6.76E-04	6.76E-04	6.76E-04	7.95E-04
VEGET								
ADULT	1.35E-05	8.62E-05	4.42E-06	9.97E-06	2.15E-06	7.39E-05	5.64E-07	0.00E+00
TEEN	1.88E-05	9.18E-05	7.26E-06	1.56E-05	3.41E-06	9.95E-05	1.06E-06	0.00E+00
CHILD	3.42E-05	6.00E-05	1.74E-05	2.55E-05	5.55E-06	1.91E-04	1.61E-06	0.00E+00
MEAT								
ADULT	2.98E-06	2.31E-05	3.10E-07	1.65E-06	1.53E-07	1.99E-06	4.61E-08	0.00E+00
TEEN	2.26E-06	1.24E-05	2.57E-07	1.29E-06	1.24E-07	1.44E-06	4.36E-08	0.00E+00
CHILD	3.41E-06	6.27E-06	4.74E-07	1.58E-06	1.57E-07	2.17E-06	5.12E-08	0.00E+00
COW MILK								
ADULT	2.96E-06	5.17E-06	2.68E-06	3.92E-06	1.48E-06	5.55E-05	3.90E-07	0.00E+00
TEEN	3.32E-06	6.09E-06	4.86E-06	6.89E-06	2.62E-06	8.78E-05	8.06E-07	0.00E+00
CHILD	3.97E-06	4.04E-06	1.17E-05	1.19E-05	4.35E-06	1.74E-04	1.24E-06	0.00E+00
INFANT	5.47E-06	3.62E-06	1.90E-05	2.35E-05	7.10E-06	4.22E-04	2.24E-06	0.00E+00
GOATMILK								
ADULT	6.98E-06	8.75E-07	7.78E-06	1.06E-05	3.87E-06	6.66E-05	1.17E-06	0.00E+00
TEEN	6.69E-06	1.06E-06	1.41E-05	1.87E-05	6.86E-06	1.05E-04	2.42E-06	0.00E+00
CHILD	5.30E-06	7.42E-07	3.40E-05	3.24E-05	1.14E-05	2.09E-04	3.72E-06	0.00E+00
INFANT	5.49E-06	6.87E-07	5.47E-05	6.36E-05	1.84E-05	5.07E-04	6.72E-06	0.00E+00
INHAL								
ADULT	2.17E-07	2.56E-06	9.73E-08	2.39E-07	7.31E-08	4.67E-06	5.32E-05	0.00E+00
TEEN	2.44E-07	2.35E-06	1.36E-07	3.20E-07	1.00E-07	5.87E-06	7.77E-05	0.00E+00
CHILD	2.38E-07	1.05E-06	1.85E-07	2.97E-07	9.31E-08	6.81E-06	6.30E-05	0.00E+00
INFANT	1.23E-07	4.46E-07	1.16E-07	2.08E-07	5.86E-08	6.24E-06	4.02E-05	0.00E+00

TABLE 2. DOSES TO MAXIMUM INDIVIDUAL (MREM), APRIL-JUNE 2017 (Continued)

SPECIAL LOCATION NO. 3A Nearest Resident
AT .90 MILES NW

ANNUAL BETA AIR DOSE = 3.07E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 6.24E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.18E-06	4.18E-06	4.18E-06	4.18E-06	4.18E-06	4.18E-06	4.21E-06	7.52E-06
GROUND	1.53E-04	1.53E-04	1.53E-04	1.53E-04	1.53E-04	1.53E-04	1.53E-04	1.79E-04
VEGET								
ADULT	3.06E-06	1.95E-05	1.14E-06	2.27E-06	5.23E-07	2.37E-05	1.27E-07	0.00E+00
TEEN	4.26E-06	2.08E-05	1.87E-06	3.56E-06	8.27E-07	3.19E-05	2.38E-07	0.00E+00
CHILD	7.77E-06	1.36E-05	4.47E-06	5.81E-06	1.35E-06	6.11E-05	3.63E-07	0.00E+00
MEAT								
ADULT	6.74E-07	5.21E-06	7.19E-08	3.74E-07	3.63E-08	6.36E-07	1.04E-08	0.00E+00
TEEN	5.12E-07	2.80E-06	5.97E-08	2.93E-07	2.93E-08	4.61E-07	9.84E-09	0.00E+00
CHILD	7.70E-07	1.42E-06	1.10E-07	3.58E-07	3.70E-08	6.96E-07	1.16E-08	0.00E+00
COW MILK								
ADULT	6.80E-07	1.18E-06	6.23E-07	9.04E-07	3.65E-07	1.78E-05	8.80E-08	0.00E+00
TEEN	7.69E-07	1.39E-06	1.13E-06	1.59E-06	6.46E-07	2.81E-05	1.82E-07	0.00E+00
CHILD	9.32E-07	9.20E-07	2.72E-06	2.74E-06	1.07E-06	5.57E-05	2.80E-07	0.00E+00
INFANT	1.30E-06	8.39E-07	4.44E-06	5.44E-06	1.76E-06	1.35E-04	5.06E-07	0.00E+00
GOATMILK								
ADULT	1.59E-06	2.05E-07	1.78E-06	2.41E-06	9.08E-07	2.13E-05	2.64E-07	0.00E+00
TEEN	1.53E-06	2.51E-07	3.23E-06	4.26E-06	1.61E-06	3.38E-05	5.46E-07	0.00E+00
CHILD	1.23E-06	1.76E-07	7.79E-06	7.38E-06	2.67E-06	6.69E-05	8.38E-07	0.00E+00
INFANT	1.31E-06	1.65E-07	1.26E-05	1.45E-05	4.33E-06	1.63E-04	1.52E-06	0.00E+00
INHAL								
ADULT	3.16E-08	3.75E-07	1.49E-08	3.55E-08	1.23E-08	8.59E-07	7.55E-06	0.00E+00
TEEN	3.58E-08	3.65E-07	2.09E-08	4.77E-08	1.68E-08	1.08E-06	1.10E-05	0.00E+00
CHILD	3.51E-08	3.23E-07	2.83E-08	4.43E-08	1.57E-08	1.26E-06	8.95E-06	0.00E+00
INFANT	1.84E-08	2.14E-07	1.81E-08	3.16E-08	9.94E-09	1.15E-06	5.72E-06	0.00E+00

TABLE 2. DOSES TO MAXIMUM INDIVIDUAL (MREM), APRIL-JUNE 2017 (Continued)

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 4.09E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 8.33E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	5.57E-06	5.57E-06	5.57E-06	5.57E-06	5.57E-06	5.57E-06	5.61E-06	1.00E-05
GROUND	1.67E-05	1.67E-05	1.67E-05	1.67E-05	1.67E-05	1.67E-05	1.67E-05	1.96E-05
VEGET								
ADULT	3.37E-07	2.13E-06	1.51E-07	2.53E-07	6.43E-08	3.91E-06	1.39E-08	0.00E+00
TEEN	4.70E-07	2.27E-06	2.47E-07	3.95E-07	1.01E-07	5.26E-06	2.60E-08	0.00E+00
CHILD	8.57E-07	1.49E-06	5.95E-07	6.45E-07	1.64E-07	1.01E-05	3.96E-08	0.00E+00
MEAT								
ADULT	7.37E-08	5.69E-07	8.21E-09	4.11E-08	4.28E-09	1.05E-07	1.13E-09	0.00E+00
TEEN	5.60E-08	3.06E-07	6.81E-09	3.22E-08	3.44E-09	7.60E-08	1.07E-09	0.00E+00
CHILD	8.42E-08	1.55E-07	1.25E-08	3.94E-08	4.34E-09	1.15E-07	1.26E-09	0.00E+00
COW MILK								
ADULT	7.63E-08	1.30E-07	7.15E-08	1.03E-07	4.57E-08	2.94E-06	9.61E-09	0.00E+00
TEEN	8.75E-08	1.53E-07	1.30E-07	1.80E-07	8.08E-08	4.65E-06	1.99E-08	0.00E+00
CHILD	1.09E-07	1.02E-07	3.12E-07	3.10E-07	1.34E-07	9.20E-06	3.05E-08	0.00E+00
INFANT	1.54E-07	9.56E-08	5.15E-07	6.20E-07	2.21E-07	2.24E-05	5.52E-08	0.00E+00
GOATMILK								
ADULT	1.75E-07	2.39E-08	1.99E-07	2.67E-07	1.06E-07	3.52E-06	2.88E-08	0.00E+00
TEEN	1.71E-07	2.94E-08	3.62E-07	4.71E-07	1.87E-07	5.58E-06	5.95E-08	0.00E+00
CHILD	1.41E-07	2.08E-08	8.72E-07	8.17E-07	3.10E-07	1.10E-05	9.15E-08	0.00E+00
INFANT	1.56E-07	1.99E-08	1.42E-06	1.61E-06	5.06E-07	2.68E-05	1.65E-07	0.00E+00
INHAL								
ADULT	5.91E-09	7.28E-08	3.80E-09	7.65E-09	4.60E-09	4.23E-07	1.14E-06	0.00E+00
TEEN	6.96E-09	9.76E-08	5.33E-09	1.04E-08	6.32E-09	5.33E-07	1.67E-06	0.00E+00
CHILD	7.15E-09	2.89E-07	7.23E-09	9.80E-09	5.93E-09	6.22E-07	1.36E-06	0.00E+00
INFANT	4.11E-09	2.40E-07	5.01E-09	7.68E-09	3.85E-09	5.70E-07	8.79E-07	0.00E+00

TABLE 2. DOSES TO MAXIMUM INDIVIDUAL (MREM), APRIL-JUNE 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 2.30 MILES ESE

ANNUAL BETA AIR DOSE = 2.64E-08 MILLRADS
ANNUAL GAMMA AIR DOSE = 4.96E-08 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.29E-08	3.29E-08	3.29E-08	3.29E-08	3.29E-08	3.29E-08	3.31E-08	5.94E-08
GROUND	2.08E-05	2.08E-05	2.08E-05	2.08E-05	2.08E-05	2.08E-05	2.08E-05	2.45E-05
VEGET								
ADULT	4.18E-07	2.66E-06	1.64E-07	3.12E-07	7.38E-08	3.67E-06	1.74E-08	0.00E+00
TEEN	5.83E-07	2.83E-06	2.70E-07	4.88E-07	1.16E-07	4.94E-06	3.25E-08	0.00E+00
CHILD	1.06E-06	1.85E-06	6.47E-07	7.96E-07	1.89E-07	9.47E-06	4.95E-08	0.00E+00
MEAT								
ADULT	9.19E-08	7.11E-07	9.94E-09	5.11E-08	5.06E-09	9.86E-08	1.42E-09	0.00E+00
TEEN	6.99E-08	3.82E-07	8.24E-09	4.01E-08	4.08E-09	7.14E-08	1.34E-09	0.00E+00
CHILD	1.05E-07	1.93E-07	1.52E-08	4.90E-08	5.15E-09	1.08E-07	1.58E-09	0.00E+00
COW MILK								
ADULT	9.34E-08	1.61E-07	8.62E-08	1.25E-07	5.17E-08	2.75E-06	1.20E-08	0.00E+00
TEEN	1.06E-07	1.90E-07	1.56E-07	2.19E-07	9.15E-08	4.36E-06	2.48E-08	0.00E+00
CHILD	1.29E-07	1.26E-07	3.76E-07	3.77E-07	1.52E-07	8.63E-06	3.81E-08	0.00E+00
INFANT	1.81E-07	1.16E-07	6.16E-07	7.50E-07	2.49E-07	2.10E-05	6.90E-08	0.00E+00
GOATMILK								
ADULT	2.17E-07	2.85E-08	2.45E-07	3.30E-07	1.26E-07	3.30E-06	3.60E-08	0.00E+00
TEEN	2.10E-07	3.48E-08	4.44E-07	5.83E-07	2.23E-07	5.23E-06	7.44E-08	0.00E+00
CHILD	1.70E-07	2.45E-08	1.07E-06	1.01E-06	3.70E-07	1.04E-05	1.14E-07	0.00E+00
INFANT	1.83E-07	2.31E-08	1.73E-06	1.99E-06	6.02E-07	2.52E-05	2.07E-07	0.00E+00
INHAL								
ADULT	9.93E-09	1.18E-07	4.63E-09	1.10E-08	3.75E-09	2.79E-07	2.41E-06	0.00E+00
TEEN	1.12E-08	1.10E-07	6.50E-09	1.48E-08	5.14E-09	3.50E-07	3.52E-06	0.00E+00
CHILD	1.09E-08	5.67E-08	8.80E-09	1.37E-08	4.79E-09	4.07E-07	2.85E-06	0.00E+00
INFANT	5.66E-09	2.74E-08	5.59E-09	9.72E-09	3.03E-09	3.73E-07	1.82E-06	0.00E+00

TABLE 3. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-JUNE 2017

SPECIAL LOCATION NO. 1A Site Boundary
AT .67 MILES N

ANNUAL BETA AIR DOSE = 4.75E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 9.67E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	6.47E-06	6.47E-06	6.47E-06	6.47E-06	6.47E-06	6.47E-06	6.52E-06	1.16E-05
GROUND	3.92E-03	3.92E-03	3.92E-03	3.92E-03	3.92E-03	3.92E-03	3.92E-03	4.61E-03
VEGET								
ADULT	7.30E-05	5.09E-04	1.73E-05	5.22E-05	9.91E-06	2.13E-04	2.26E-06	0.00E+00
TEEN	1.05E-04	5.41E-04	2.83E-05	8.13E-05	1.56E-05	2.87E-04	4.23E-06	0.00E+00
CHILD	1.97E-04	3.54E-04	6.73E-05	1.30E-04	2.48E-05	5.50E-04	6.44E-06	0.00E+00
MEAT								
ADULT	1.71E-05	1.34E-04	1.43E-06	9.49E-06	1.05E-06	5.73E-06	1.84E-07	0.00E+00
TEEN	1.32E-05	7.23E-05	1.16E-06	7.41E-06	8.14E-07	4.15E-06	1.75E-07	0.00E+00
CHILD	2.00E-05	3.65E-05	2.10E-06	8.97E-06	9.86E-07	6.26E-06	2.05E-07	0.00E+00
COW MILK								
ADULT	1.39E-05	3.14E-05	1.13E-05	1.85E-05	7.27E-06	1.60E-04	1.56E-06	0.00E+00
TEEN	1.69E-05	3.68E-05	2.04E-05	3.23E-05	1.26E-05	2.53E-04	3.23E-06	0.00E+00
CHILD	2.32E-05	2.43E-05	4.85E-05	5.45E-05	2.04E-05	5.00E-04	4.96E-06	0.00E+00
INFANT	3.24E-05	2.98E-05	7.77E-05	1.06E-04	3.20E-05	1.21E-03	8.97E-06	0.00E+00
GOATMILK								
ADULT	2.81E-05	4.71E-06	3.10E-05	4.26E-05	1.53E-05	1.92E-04	4.68E-06	0.00E+00
TEEN	2.70E-05	5.66E-06	5.62E-05	7.51E-05	2.70E-05	3.03E-04	9.68E-06	0.00E+00
CHILD	2.17E-05	3.87E-06	1.35E-04	1.30E-04	4.48E-05	6.00E-04	1.49E-05	0.00E+00
INFANT	2.25E-05	4.51E-06	2.17E-04	2.54E-04	7.24E-05	1.46E-03	2.69E-05	0.00E+00
INHAL								
ADULT	7.41E-07	9.92E-06	2.48E-07	8.29E-07	1.89E-07	7.59E-06	2.06E-04	0.00E+00
TEEN	8.70E-07	9.06E-06	3.47E-07	1.10E-06	2.56E-07	9.47E-06	3.01E-04	0.00E+00
CHILD	8.86E-07	3.66E-06	4.67E-07	9.99E-07	2.32E-07	1.08E-05	2.44E-04	0.00E+00
INFANT	4.54E-07	1.40E-06	2.88E-07	6.69E-07	1.40E-07	9.91E-06	1.56E-04	0.00E+00

TABLE 3. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-JUNE 2017 (Continued)

SPECIAL LOCATION NO. 2A Site Boundary
AT .65 MILES SE

ANNUAL BETA AIR DOSE = 1.29E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 2.62E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.76E-06	1.76E-06	1.76E-06	1.76E-06	1.76E-06	1.76E-06	1.77E-06	3.16E-06
GROUND	3.06E-03	3.06E-03	3.06E-03	3.06E-03	3.06E-03	3.06E-03	3.06E-03	3.60E-03
VEGET								
ADULT	5.69E-05	3.97E-04	1.25E-05	4.05E-05	7.47E-06	1.19E-04	1.76E-06	0.00E+00
TEEN	8.19E-05	4.23E-04	2.05E-05	6.32E-05	1.17E-05	1.61E-04	3.29E-06	0.00E+00
CHILD	1.53E-04	2.76E-04	4.88E-05	1.01E-04	1.87E-05	3.08E-04	5.01E-06	0.00E+00
MEAT								
ADULT	1.33E-05	1.05E-04	1.11E-06	7.40E-06	8.08E-07	3.21E-06	1.44E-07	0.00E+00
TEEN	1.03E-05	5.64E-05	8.97E-07	5.78E-06	6.28E-07	2.33E-06	1.36E-07	0.00E+00
CHILD	1.56E-05	2.85E-05	1.61E-06	6.99E-06	7.60E-07	3.51E-06	1.60E-07	0.00E+00
COW MILK								
ADULT	1.08E-05	2.45E-05	8.72E-06	1.43E-05	5.47E-06	8.93E-05	1.22E-06	0.00E+00
TEEN	1.31E-05	2.87E-05	1.56E-05	2.49E-05	9.46E-06	1.41E-04	2.51E-06	0.00E+00
CHILD	1.79E-05	1.89E-05	3.72E-05	4.21E-05	1.53E-05	2.79E-04	3.86E-06	0.00E+00
INFANT	2.49E-05	2.32E-05	5.94E-05	8.17E-05	2.39E-05	6.79E-04	6.98E-06	0.00E+00
GOATMILK								
ADULT	2.18E-05	3.63E-06	2.40E-05	3.30E-05	1.17E-05	1.07E-04	3.65E-06	0.00E+00
TEEN	2.09E-05	4.35E-06	4.35E-05	5.82E-05	2.07E-05	1.70E-04	7.53E-06	0.00E+00
CHILD	1.67E-05	2.96E-06	1.05E-04	1.01E-04	3.42E-05	3.35E-04	1.16E-05	0.00E+00
INFANT	1.71E-05	3.46E-06	1.68E-04	1.97E-04	5.52E-05	8.15E-04	2.10E-05	0.00E+00
INHAL								
ADULT	5.83E-07	7.81E-06	1.94E-07	6.51E-07	1.46E-07	5.74E-06	1.63E-04	0.00E+00
TEEN	6.85E-07	7.11E-06	2.71E-07	8.66E-07	1.98E-07	7.15E-06	2.38E-04	0.00E+00
CHILD	6.97E-07	2.72E-06	3.65E-07	7.85E-07	1.79E-07	8.13E-06	1.92E-04	0.00E+00
INFANT	3.57E-07	9.53E-07	2.25E-07	5.25E-07	1.07E-07	7.44E-06	1.23E-04	0.00E+00

TABLE 3. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-JUNE 2017 (Continued)

SPECIAL LOCATION NO. 3A Nearest Resident
AT .90 MILES NW

ANNUAL BETA AIR DOSE = 7.46E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 1.52E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.02E-05	1.02E-05	1.02E-05	1.02E-05	1.02E-05	1.02E-05	1.02E-05	1.83E-05
GROUND	6.73E-04	6.73E-04	6.73E-04	6.73E-04	6.73E-04	6.73E-04	6.73E-04	7.92E-04
VEGET								
ADULT	1.26E-05	8.76E-05	3.37E-06	9.05E-06	1.81E-06	5.59E-05	3.91E-07	0.00E+00
TEEN	1.81E-05	9.32E-05	5.52E-06	1.41E-05	2.84E-06	7.54E-05	7.32E-07	0.00E+00
CHILD	3.40E-05	6.09E-05	1.32E-05	2.26E-05	4.54E-06	1.44E-04	1.11E-06	0.00E+00
MEAT								
ADULT	2.94E-06	2.31E-05	2.53E-07	1.64E-06	1.84E-07	1.50E-06	3.19E-08	0.00E+00
TEEN	2.26E-06	1.24E-05	2.06E-07	1.28E-06	1.43E-07	1.09E-06	3.02E-08	0.00E+00
CHILD	3.44E-06	6.27E-06	3.70E-07	1.55E-06	1.74E-07	1.65E-06	3.55E-08	0.00E+00
COW MILK								
ADULT	2.43E-06	5.42E-06	2.01E-06	3.25E-06	1.34E-06	4.20E-05	2.70E-07	0.00E+00
TEEN	2.97E-06	6.36E-06	3.61E-06	5.67E-06	2.32E-06	6.64E-05	5.58E-07	0.00E+00
CHILD	4.09E-06	4.20E-06	8.60E-06	9.57E-06	3.76E-06	1.31E-04	8.58E-07	0.00E+00
INFANT	5.74E-06	5.16E-06	1.39E-05	1.87E-05	5.94E-06	3.20E-04	1.55E-06	0.00E+00
GOATMILK								
ADULT	4.89E-06	8.32E-07	5.44E-06	7.42E-06	2.74E-06	5.04E-05	8.10E-07	0.00E+00
TEEN	4.73E-06	1.00E-06	9.86E-06	1.31E-05	4.84E-06	7.97E-05	1.67E-06	0.00E+00
CHILD	3.85E-06	6.90E-07	2.37E-05	2.26E-05	8.03E-06	1.58E-04	2.57E-06	0.00E+00
INFANT	4.08E-06	8.01E-07	3.82E-05	4.44E-05	1.30E-05	3.83E-04	4.66E-06	0.00E+00
INHAL								
ADULT	1.33E-07	1.79E-06	4.69E-08	1.51E-07	3.85E-08	1.92E-06	3.66E-05	0.00E+00
TEEN	1.57E-07	1.69E-06	6.55E-08	2.01E-07	5.22E-08	2.40E-06	5.34E-05	0.00E+00
CHILD	1.60E-07	1.12E-06	8.83E-08	1.82E-07	4.76E-08	2.77E-06	4.33E-05	0.00E+00
INFANT	8.25E-08	6.55E-07	5.53E-08	1.23E-07	2.90E-08	2.53E-06	2.76E-05	0.00E+00

TABLE 3. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-JUNE 2017 (Continued)

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 6.78E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 1.38E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.25E-06	9.25E-06	9.25E-06	9.25E-06	9.25E-06	9.25E-06	9.32E-06	1.66E-05
GROUND	4.96E-05	4.96E-05	4.96E-05	4.96E-05	4.96E-05	4.96E-05	4.96E-05	5.83E-05
VEGET								
ADULT	9.37E-07	6.46E-06	3.01E-07	6.78E-07	1.48E-07	6.66E-06	2.91E-08	0.00E+00
TEEN	1.35E-06	6.88E-06	4.94E-07	1.06E-06	2.32E-07	8.97E-06	5.45E-08	0.00E+00
CHILD	2.52E-06	4.49E-06	1.18E-06	1.70E-06	3.70E-07	1.72E-05	8.30E-08	0.00E+00
MEAT								
ADULT	2.17E-07	1.70E-06	1.95E-08	1.21E-07	1.41E-08	1.79E-07	2.38E-09	0.00E+00
TEEN	1.67E-07	9.15E-07	1.58E-08	9.47E-08	1.10E-08	1.30E-07	2.25E-09	0.00E+00
CHILD	2.54E-07	4.62E-07	2.85E-08	1.15E-07	1.34E-08	1.96E-07	2.64E-09	0.00E+00
COW MILK								
ADULT	1.84E-07	4.02E-07	1.56E-07	2.48E-07	1.10E-07	5.00E-06	2.01E-08	0.00E+00
TEEN	2.26E-07	4.72E-07	2.80E-07	4.33E-07	1.91E-07	7.92E-06	4.16E-08	0.00E+00
CHILD	3.14E-07	3.12E-07	6.68E-07	7.31E-07	3.10E-07	1.57E-05	6.39E-08	0.00E+00
INFANT	4.45E-07	3.85E-07	1.09E-06	1.44E-06	4.94E-07	3.81E-05	1.16E-07	0.00E+00
GOATMILK								
ADULT	3.68E-07	6.42E-08	4.14E-07	5.60E-07	2.16E-07	6.00E-06	6.04E-08	0.00E+00
TEEN	3.59E-07	7.78E-08	7.51E-07	9.87E-07	3.82E-07	9.50E-06	1.25E-07	0.00E+00
CHILD	3.00E-07	5.40E-08	1.81E-06	1.71E-06	6.34E-07	1.88E-05	1.92E-07	0.00E+00
INFANT	3.28E-07	6.24E-08	2.93E-06	3.36E-06	1.03E-06	4.57E-05	3.47E-07	0.00E+00
INHAL								
ADULT	1.81E-08	2.50E-07	8.30E-09	2.19E-08	9.06E-09	7.26E-07	4.52E-06	0.00E+00
TEEN	2.15E-08	2.83E-07	1.16E-08	2.94E-08	1.24E-08	9.14E-07	6.61E-06	0.00E+00
CHILD	2.22E-08	5.54E-07	1.57E-08	2.70E-08	1.15E-08	1.06E-06	5.36E-06	0.00E+00
INFANT	1.20E-08	4.40E-07	1.05E-08	1.95E-08	7.26E-09	9.73E-07	3.44E-06	0.00E+00

TABLE 3. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-JUNE 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 2.30 MILES ESE

ANNUAL BETA AIR DOSE = 1.83E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 3.73E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.50E-06	2.50E-06	2.50E-06	2.50E-06	2.50E-06	2.50E-06	2.52E-06	4.49E-06
GROUND	7.96E-05	7.96E-05	7.96E-05	7.96E-05	7.96E-05	7.96E-05	7.96E-05	9.36E-05
VEGET								
ADULT	1.49E-06	1.04E-05	4.18E-07	1.07E-06	2.20E-07	7.52E-06	4.63E-08	0.00E+00
TEEN	2.15E-06	1.10E-05	6.84E-07	1.67E-06	3.44E-07	1.01E-05	8.67E-08	0.00E+00
CHILD	4.02E-06	7.20E-06	1.63E-06	2.68E-06	5.50E-07	1.94E-05	1.32E-07	0.00E+00
MEAT								
ADULT	3.48E-07	2.73E-06	3.02E-08	1.94E-07	2.20E-08	2.02E-07	3.78E-09	0.00E+00
TEEN	2.68E-07	1.47E-06	2.45E-08	1.51E-07	1.71E-08	1.47E-07	3.58E-09	0.00E+00
CHILD	4.06E-07	7.41E-07	4.42E-08	1.83E-07	2.07E-08	2.21E-07	4.20E-09	0.00E+00
COW MILK								
ADULT	2.90E-07	6.41E-07	2.40E-07	3.87E-07	1.62E-07	5.65E-06	3.20E-08	0.00E+00
TEEN	3.53E-07	7.53E-07	4.32E-07	6.75E-07	2.81E-07	8.94E-06	6.61E-08	0.00E+00
CHILD	4.88E-07	4.98E-07	1.03E-06	1.14E-06	4.56E-07	1.77E-05	1.02E-07	0.00E+00
INFANT	6.87E-07	6.12E-07	1.66E-06	2.23E-06	7.22E-07	4.30E-05	1.84E-07	0.00E+00
GOATMILK								
ADULT	5.81E-07	9.94E-08	6.48E-07	8.82E-07	3.29E-07	6.78E-06	9.60E-08	0.00E+00
TEEN	5.62E-07	1.20E-07	1.17E-06	1.55E-06	5.82E-07	1.07E-05	1.98E-07	0.00E+00
CHILD	4.61E-07	8.26E-08	2.83E-06	2.69E-06	9.64E-07	2.12E-05	3.05E-07	0.00E+00
INFANT	4.92E-07	9.59E-08	4.56E-06	5.28E-06	1.56E-06	5.16E-05	5.52E-07	0.00E+00
INHAL								
ADULT	2.52E-08	3.39E-07	9.01E-09	2.86E-08	7.61E-09	4.07E-07	6.87E-06	0.00E+00
TEEN	2.96E-08	3.23E-07	1.26E-08	3.81E-08	1.03E-08	5.10E-07	1.00E-05	0.00E+00
CHILD	3.02E-08	2.41E-07	1.70E-08	3.46E-08	9.42E-09	5.87E-07	8.13E-06	0.00E+00
INFANT	1.57E-08	1.49E-07	1.07E-08	2.35E-08	5.77E-09	5.37E-07	5.20E-06	0.00E+00

TABLE 4. DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-SEPTEMBER 2017

SPECIAL LOCATION NO. 1A Site Boundary
AT .67 MILES N

ANNUAL BETA AIR DOSE = 2.16E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 4.39E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.94E-06	2.94E-06	2.94E-06	2.94E-06	2.94E-06	2.94E-06	2.96E-06	5.28E-06
GROUND	1.34E-03	1.34E-03	1.34E-03	1.34E-03	1.34E-03	1.34E-03	1.34E-03	1.57E-03
VEGET								
ADULT	2.54E-05	1.70E-04	6.60E-06	1.75E-05	3.00E-06	2.54E-05	9.41E-07	0.00E+00
TEEN	3.60E-05	1.81E-04	1.08E-05	2.75E-05	4.78E-06	3.36E-05	1.76E-06	0.00E+00
CHILD	6.64E-05	1.18E-04	2.59E-05	4.46E-05	7.84E-06	6.42E-05	2.68E-06	0.00E+00
MEAT								
ADULT	5.82E-06	4.58E-05	5.04E-07	3.12E-06	2.35E-07	6.48E-07	7.69E-08	0.00E+00
TEEN	4.45E-06	2.46E-05	4.18E-07	2.44E-06	1.90E-07	4.69E-07	7.27E-08	0.00E+00
CHILD	6.73E-06	1.24E-05	7.71E-07	2.98E-06	2.41E-07	7.08E-07	8.55E-08	0.00E+00
COW MILK								
ADULT	4.99E-06	1.01E-05	4.29E-06	6.37E-06	2.08E-06	2.06E-05	6.51E-07	0.00E+00
TEEN	5.64E-06	1.19E-05	7.77E-06	1.12E-05	3.69E-06	3.28E-05	1.34E-06	0.00E+00
CHILD	6.85E-06	7.91E-06	1.87E-05	1.93E-05	6.12E-06	6.66E-05	2.07E-06	0.00E+00
INFANT	9.41E-06	6.95E-06	3.00E-05	3.78E-05	9.89E-06	1.62E-04	3.74E-06	0.00E+00
GOATMILK								
ADULT	1.15E-05	1.58E-06	1.27E-05	1.74E-05	6.02E-06	2.47E-05	1.95E-06	0.00E+00
TEEN	1.09E-05	1.91E-06	2.31E-05	3.08E-05	1.07E-05	3.94E-05	4.03E-06	0.00E+00
CHILD	8.45E-06	1.32E-06	5.57E-05	5.33E-05	1.77E-05	7.99E-05	6.20E-06	0.00E+00
INFANT	8.40E-06	1.19E-06	8.91E-05	1.04E-04	2.85E-05	1.94E-04	1.12E-05	0.00E+00
INHAL								
ADULT	4.15E-07	5.23E-06	1.74E-07	4.51E-07	1.53E-07	7.03E-06	1.09E-04	0.00E+00
TEEN	4.77E-07	4.77E-06	2.44E-07	6.05E-07	2.11E-07	9.53E-06	1.59E-04	0.00E+00
CHILD	4.77E-07	1.84E-06	3.31E-07	5.61E-07	1.97E-07	1.25E-05	1.29E-04	0.00E+00
INFANT	2.47E-07	6.51E-07	2.11E-07	3.97E-07	1.26E-07	1.16E-05	8.22E-05	0.00E+00

TABLE 4. DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-SEPTEMBER 2017 (Continued)

SPECIAL LOCATION NO. 2A Site Boundary
AT .65 MILES SE

ANNUAL BETA AIR DOSE = 2.69E-07 MILLRADS
ANNUAL GAMMA AIR DOSE = 5.48E-07 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.67E-07	3.67E-07	3.67E-07	3.67E-07	3.67E-07	3.67E-07	3.70E-07	6.60E-07
GROUND	6.31E-04	6.31E-04	6.31E-04	6.31E-04	6.31E-04	6.31E-04	6.31E-04	7.42E-04
VEGET								
ADULT	1.20E-05	8.02E-05	2.94E-06	8.24E-06	1.37E-06	4.18E-06	4.43E-07	0.00E+00
TEEN	1.69E-05	8.54E-05	4.84E-06	1.29E-05	2.19E-06	5.31E-06	8.30E-07	0.00E+00
CHILD	3.13E-05	5.58E-05	1.15E-05	2.09E-05	3.59E-06	1.01E-05	1.26E-06	0.00E+00
MEAT								
ADULT	2.74E-06	2.16E-05	2.35E-07	1.47E-06	1.09E-07	9.44E-08	3.62E-08	0.00E+00
TEEN	2.10E-06	1.16E-05	1.95E-07	1.15E-06	8.87E-08	6.83E-08	3.42E-08	0.00E+00
CHILD	3.17E-06	5.87E-06	3.60E-07	1.40E-06	1.12E-07	1.03E-07	4.02E-08	0.00E+00
COW MILK								
ADULT	2.34E-06	4.77E-06	2.00E-06	2.98E-06	9.50E-07	3.89E-06	3.06E-07	0.00E+00
TEEN	2.64E-06	5.62E-06	3.62E-06	5.24E-06	1.68E-06	6.30E-06	6.33E-07	0.00E+00
CHILD	3.19E-06	3.72E-06	8.72E-06	9.01E-06	2.79E-06	1.33E-05	9.72E-07	0.00E+00
INFANT	4.37E-06	3.27E-06	1.40E-05	1.77E-05	4.50E-06	3.23E-05	1.76E-06	0.00E+00
GOATMILK								
ADULT	5.41E-06	7.36E-07	5.97E-06	8.19E-06	2.80E-06	4.67E-06	9.18E-07	0.00E+00
TEEN	5.13E-06	8.87E-07	1.08E-05	1.44E-05	4.95E-06	7.56E-06	1.90E-06	0.00E+00
CHILD	3.94E-06	6.12E-07	2.61E-05	2.50E-05	8.21E-06	1.59E-05	2.92E-06	0.00E+00
INFANT	3.88E-06	5.54E-07	4.17E-05	4.89E-05	1.32E-05	3.87E-05	5.28E-06	0.00E+00
INHAL								
ADULT	3.93E-07	4.93E-06	1.66E-07	4.29E-07	1.51E-07	7.19E-06	1.03E-04	0.00E+00
TEEN	4.52E-07	4.50E-06	2.33E-07	5.76E-07	2.08E-07	9.75E-06	1.50E-04	0.00E+00
CHILD	4.52E-07	1.68E-06	3.16E-07	5.34E-07	1.95E-07	1.28E-05	1.22E-04	0.00E+00
INFANT	2.34E-07	5.64E-07	2.02E-07	3.80E-07	1.25E-07	1.19E-05	7.75E-05	0.00E+00

TABLE 4. DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-SEPTEMBER 2017 (Continued)

SPECIAL LOCATION NO. 3A Nearest Resident
AT .90 MILES NW

ANNUAL BETA AIR DOSE = 1.40E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 2.85E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.91E-05	1.91E-05	1.91E-05	1.91E-05	1.91E-05	1.91E-05	1.92E-05	3.43E-05
GROUND	3.44E-04	3.44E-04	3.44E-04	3.44E-04	3.44E-04	3.44E-04	3.44E-04	4.05E-04
VEGET								
ADULT	6.62E-06	4.39E-05	2.30E-06	4.62E-06	9.30E-07	3.48E-05	2.45E-07	0.00E+00
TEEN	9.36E-06	4.67E-05	3.78E-06	7.23E-06	1.47E-06	4.67E-05	4.59E-07	0.00E+00
CHILD	1.73E-05	3.06E-05	9.07E-06	1.18E-05	2.40E-06	8.95E-05	6.98E-07	0.00E+00
MEAT								
ADULT	1.50E-06	1.18E-05	1.38E-07	8.07E-07	6.51E-08	9.25E-07	2.00E-08	0.00E+00
TEEN	1.15E-06	6.34E-06	1.15E-07	6.32E-07	5.28E-08	6.70E-07	1.89E-08	0.00E+00
CHILD	1.73E-06	3.20E-06	2.11E-07	7.71E-07	6.70E-08	1.01E-06	2.23E-08	0.00E+00
COW MILK								
ADULT	1.33E-06	2.63E-06	1.19E-06	1.72E-06	6.57E-07	2.66E-05	1.69E-07	0.00E+00
TEEN	1.52E-06	3.10E-06	2.15E-06	3.03E-06	1.16E-06	4.23E-05	3.50E-07	0.00E+00
CHILD	1.89E-06	2.06E-06	5.19E-06	5.21E-06	1.93E-06	8.42E-05	5.38E-07	0.00E+00
INFANT	2.65E-06	1.81E-06	8.45E-06	1.03E-05	3.16E-06	2.05E-04	9.74E-07	0.00E+00
GOATMILK								
ADULT	3.04E-06	4.39E-07	3.43E-06	4.62E-06	1.70E-06	3.20E-05	5.08E-07	0.00E+00
TEEN	2.93E-06	5.35E-07	6.21E-06	8.15E-06	3.02E-06	5.07E-05	1.05E-06	0.00E+00
CHILD	2.34E-06	3.74E-07	1.50E-05	1.41E-05	5.01E-06	1.01E-04	1.61E-06	0.00E+00
INFANT	2.46E-06	3.43E-07	2.41E-05	2.77E-05	8.12E-06	2.45E-04	2.92E-06	0.00E+00
INHAL								
ADULT	7.17E-08	9.03E-07	3.27E-08	8.02E-08	3.24E-08	1.92E-06	1.82E-05	0.00E+00
TEEN	8.27E-08	8.76E-07	4.59E-08	1.08E-07	4.47E-08	2.54E-06	2.67E-05	0.00E+00
CHILD	8.32E-08	7.60E-07	6.22E-08	1.00E-07	4.18E-08	3.23E-06	2.16E-05	0.00E+00
INFANT	4.37E-08	5.00E-07	4.05E-08	7.25E-08	2.69E-08	2.98E-06	1.38E-05	0.00E+00

TABLE 4. DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-SEPTEMBER 2017 (Continued)

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 1.08E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 2.19E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.47E-05	1.47E-05	1.47E-05	1.47E-05	1.47E-05	1.47E-05	1.48E-05	2.64E-05
GROUND	2.68E-05	2.68E-05	2.68E-05	2.68E-05	2.68E-05	2.68E-05	2.68E-05	3.15E-05
VEGET								
ADULT	5.19E-07	3.42E-06	2.04E-07	3.64E-07	7.89E-08	3.89E-06	1.92E-08	0.00E+00
TEEN	7.33E-07	3.64E-06	3.35E-07	5.70E-07	1.24E-07	5.22E-06	3.59E-08	0.00E+00
CHILD	1.35E-06	2.38E-06	8.06E-07	9.27E-07	2.03E-07	1.00E-05	5.47E-08	0.00E+00
MEAT								
ADULT	1.17E-07	9.16E-07	1.11E-08	6.30E-08	5.26E-09	1.04E-07	1.57E-09	0.00E+00
TEEN	8.93E-08	4.93E-07	9.21E-09	4.93E-08	4.27E-09	7.50E-08	1.48E-09	0.00E+00
CHILD	1.35E-07	2.49E-07	1.70E-08	6.01E-08	5.41E-09	1.13E-07	1.74E-09	0.00E+00
COW MILK								
ADULT	1.06E-07	2.06E-07	9.58E-08	1.38E-07	5.61E-08	2.96E-06	1.33E-08	0.00E+00
TEEN	1.22E-07	2.43E-07	1.74E-07	2.42E-07	9.95E-08	4.70E-06	2.74E-08	0.00E+00
CHILD	1.52E-07	1.61E-07	4.19E-07	4.17E-07	1.65E-07	9.34E-06	4.21E-08	0.00E+00
INFANT	2.16E-07	1.42E-07	6.88E-07	8.30E-07	2.72E-07	2.27E-05	7.62E-08	0.00E+00
GOATMILK								
ADULT	2.40E-07	3.55E-08	2.73E-07	3.65E-07	1.39E-07	3.56E-06	3.98E-08	0.00E+00
TEEN	2.32E-07	4.34E-08	4.94E-07	6.44E-07	2.46E-07	5.64E-06	8.22E-08	0.00E+00
CHILD	1.89E-07	3.06E-08	1.19E-06	1.12E-06	4.09E-07	1.12E-05	1.26E-07	0.00E+00
INFANT	2.04E-07	2.82E-08	1.93E-06	2.20E-06	6.65E-07	2.72E-05	2.29E-07	0.00E+00
INHAL								
ADULT	8.93E-09	1.14E-07	5.74E-09	1.14E-08	7.58E-09	6.67E-07	1.95E-06	0.00E+00
TEEN	1.05E-08	1.44E-07	8.07E-09	1.54E-08	1.05E-08	8.59E-07	2.85E-06	0.00E+00
CHILD	1.09E-08	3.88E-07	1.10E-08	1.46E-08	9.82E-09	1.04E-06	2.31E-06	0.00E+00
INFANT	6.10E-09	3.19E-07	7.63E-09	1.14E-08	6.41E-09	9.56E-07	1.49E-06	0.00E+00

TABLE 4. DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-SEPTEMBER 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 1.70 MILES WNW

ANNUAL BETA AIR DOSE = 2.10E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 4.28E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.86E-05	2.86E-05	2.86E-05	2.86E-05	2.86E-05	2.86E-05	2.88E-05	5.15E-05
GROUND	5.74E-05	5.74E-05	5.74E-05	5.74E-05	5.74E-05	5.74E-05	5.74E-05	6.75E-05
VEGET								
ADULT	1.11E-06	7.32E-06	4.51E-07	7.83E-07	1.73E-07	9.03E-06	4.12E-08	0.00E+00
TEEN	1.57E-06	7.80E-06	7.42E-07	1.23E-06	2.73E-07	1.21E-05	7.72E-08	0.00E+00
CHILD	2.90E-06	5.11E-06	1.79E-06	1.99E-06	4.45E-07	2.32E-05	1.17E-07	0.00E+00
MEAT								
ADULT	2.50E-07	1.96E-06	2.39E-08	1.35E-07	1.14E-08	2.41E-07	3.36E-09	0.00E+00
TEEN	1.91E-07	1.06E-06	1.99E-08	1.06E-07	9.23E-09	1.74E-07	3.18E-09	0.00E+00
CHILD	2.89E-07	5.33E-07	3.67E-08	1.29E-07	1.17E-08	2.63E-07	3.74E-09	0.00E+00
COW MILK								
ADULT	2.28E-07	4.41E-07	2.07E-07	2.97E-07	1.23E-07	6.87E-06	2.85E-08	0.00E+00
TEEN	2.63E-07	5.21E-07	3.76E-07	5.23E-07	2.18E-07	1.09E-05	5.88E-08	0.00E+00
CHILD	3.29E-07	3.46E-07	9.07E-07	8.99E-07	3.63E-07	2.17E-05	9.05E-08	0.00E+00
INFANT	4.69E-07	3.05E-07	1.49E-06	1.79E-06	5.98E-07	5.26E-05	1.64E-07	0.00E+00
GOATMILK								
ADULT	5.17E-07	7.69E-08	5.88E-07	7.86E-07	3.02E-07	8.25E-06	8.54E-08	0.00E+00
TEEN	5.01E-07	9.42E-08	1.07E-06	1.39E-06	5.35E-07	1.31E-05	1.77E-07	0.00E+00
CHILD	4.10E-07	6.65E-08	2.57E-06	2.40E-06	8.88E-07	2.60E-05	2.71E-07	0.00E+00
INFANT	4.44E-07	6.13E-08	4.16E-06	4.73E-06	1.44E-06	6.32E-05	4.91E-07	0.00E+00
INHAL								
ADULT	1.75E-08	2.24E-07	1.11E-08	2.22E-08	1.47E-08	1.29E-06	3.83E-06	0.00E+00
TEEN	2.06E-08	2.80E-07	1.57E-08	3.01E-08	2.02E-08	1.66E-06	5.61E-06	0.00E+00
CHILD	2.12E-08	7.39E-07	2.13E-08	2.84E-08	1.90E-08	2.01E-06	4.55E-06	0.00E+00
INFANT	1.19E-08	6.07E-07	1.48E-08	2.21E-08	1.24E-08	1.84E-06	2.94E-06	0.00E+00

TABLE 5. DOSES TO MAXIMUM INDIVIDUAL (MREM), OCTOBER-DECEMBER 2017

SPECIAL LOCATION NO. 1A Site Boundary
AT .67 MILES N

ANNUAL BETA AIR DOSE = 2.99E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 5.87E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.96E-06	7.16E-06
GROUND	2.29E-03	2.29E-03	2.29E-03	2.29E-03	2.29E-03	2.29E-03	2.29E-03	2.69E-03
VEGET								
ADULT	3.50E-05	2.95E-04	1.27E-06	1.72E-05	1.86E-06	3.15E-04	2.57E-09	0.00E+00
TEEN	5.48E-05	3.14E-04	2.02E-06	2.63E-05	2.80E-06	4.24E-04	4.82E-09	0.00E+00
CHILD	1.10E-04	2.05E-04	4.85E-06	4.06E-05	4.45E-06	8.12E-04	7.33E-09	0.00E+00
MEAT								
ADULT	9.28E-06	7.90E-05	2.53E-08	4.24E-06	4.76E-08	8.44E-06	2.10E-10	0.00E+00
TEEN	7.36E-06	4.25E-05	2.11E-08	3.29E-06	3.87E-08	6.11E-06	1.98E-10	0.00E+00
CHILD	1.14E-05	2.15E-05	3.92E-08	3.91E-06	4.88E-08	9.22E-06	2.33E-10	0.00E+00
COW MILK								
ADULT	2.45E-06	1.75E-05	5.56E-07	1.69E-06	1.29E-06	2.38E-04	1.77E-09	0.00E+00
TEEN	4.21E-06	2.06E-05	1.01E-06	2.92E-06	2.30E-06	3.77E-04	3.66E-09	0.00E+00
CHILD	8.42E-06	1.36E-05	2.45E-06	4.80E-06	3.83E-06	7.49E-04	5.63E-09	0.00E+00
INFANT	1.41E-05	1.20E-05	5.08E-06	1.07E-05	6.66E-06	1.82E-03	1.02E-08	0.00E+00
GOATMILK								
ADULT	7.77E-07	2.35E-06	7.12E-07	1.06E-06	1.56E-06	2.86E-04	5.31E-09	0.00E+00
TEEN	1.29E-06	2.81E-06	1.29E-06	1.86E-06	2.78E-06	4.53E-04	1.10E-08	0.00E+00
CHILD	2.44E-06	1.91E-06	3.14E-06	3.22E-06	4.61E-06	8.98E-04	1.69E-08	0.00E+00
INFANT	4.37E-06	1.71E-06	6.44E-06	7.68E-06	8.02E-06	2.18E-03	3.05E-08	0.00E+00
INHAL								
ADULT	4.99E-07	8.34E-06	1.03E-07	5.17E-07	2.87E-07	3.65E-05	1.73E-04	0.00E+00
TEEN	6.68E-07	7.61E-06	1.46E-07	6.90E-07	3.96E-07	4.66E-05	2.53E-04	0.00E+00
CHILD	7.60E-07	2.91E-06	1.98E-07	6.25E-07	3.71E-07	5.56E-05	2.05E-04	0.00E+00
INFANT	4.16E-07	1.01E-06	1.57E-07	4.53E-07	2.44E-07	5.10E-05	1.31E-04	0.00E+00

TABLE 5. DOSES TO MAXIMUM INDIVIDUAL (MREM), OCTOBER-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 2A Site Boundary
AT .60 MILES NNE

ANNUAL BETA AIR DOSE = 2.63E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 5.18E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.47E-06	3.47E-06	3.47E-06	3.47E-06	3.47E-06	3.47E-06	3.50E-06	6.32E-06
GROUND	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.99E-03
VEGET								
ADULT	2.59E-05	2.18E-04	9.66E-07	1.27E-05	1.38E-06	2.34E-04	2.01E-09	0.00E+00
TEEN	4.05E-05	2.32E-04	1.54E-06	1.94E-05	2.08E-06	3.15E-04	3.76E-09	0.00E+00
CHILD	8.14E-05	1.51E-04	3.69E-06	3.00E-05	3.30E-06	6.03E-04	5.72E-09	0.00E+00
MEAT								
ADULT	6.86E-06	5.83E-05	1.90E-08	3.13E-06	3.54E-08	6.26E-06	1.64E-10	0.00E+00
TEEN	5.43E-06	3.14E-05	1.59E-08	2.43E-06	2.88E-08	4.53E-06	1.55E-10	0.00E+00
CHILD	8.44E-06	1.58E-05	2.95E-08	2.89E-06	3.62E-08	6.85E-06	1.82E-10	0.00E+00
COW MILK								
ADULT	1.81E-06	1.29E-05	4.14E-07	1.25E-06	9.58E-07	1.77E-04	1.38E-09	0.00E+00
TEEN	3.11E-06	1.52E-05	7.53E-07	2.16E-06	1.71E-06	2.80E-04	2.86E-09	0.00E+00
CHILD	6.23E-06	1.01E-05	1.83E-06	3.55E-06	2.84E-06	5.56E-04	4.40E-09	0.00E+00
INFANT	1.04E-05	8.85E-06	3.78E-06	7.95E-06	4.94E-06	1.35E-03	7.95E-09	0.00E+00
GOATMILK								
ADULT	5.77E-07	1.73E-06	5.32E-07	7.85E-07	1.16E-06	2.12E-04	4.15E-09	0.00E+00
TEEN	9.57E-07	2.07E-06	9.66E-07	1.39E-06	2.06E-06	3.36E-04	8.58E-09	0.00E+00
CHILD	1.81E-06	1.41E-06	2.35E-06	2.39E-06	3.43E-06	6.67E-04	1.32E-08	0.00E+00
INFANT	3.24E-06	1.26E-06	4.80E-06	5.71E-06	5.96E-06	1.62E-03	2.39E-08	0.00E+00
INHAL								
ADULT	3.68E-07	6.14E-06	7.77E-08	3.84E-07	2.15E-07	2.74E-05	1.27E-04	0.00E+00
TEEN	4.93E-07	5.61E-06	1.09E-07	5.11E-07	2.97E-07	3.50E-05	1.86E-04	0.00E+00
CHILD	5.62E-07	2.16E-06	1.49E-07	4.63E-07	2.78E-07	4.17E-05	1.51E-04	0.00E+00
INFANT	3.07E-07	7.59E-07	1.18E-07	3.37E-07	1.83E-07	3.83E-05	9.63E-05	0.00E+00

TABLE 5. DOSES TO MAXIMUM INDIVIDUAL (MREM), OCTOBER-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 3A Nearest Resident
AT .90 MILES NW

ANNUAL BETA AIR DOSE = 1.49E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 2.94E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.97E-05	1.97E-05	1.97E-05	1.97E-05	1.97E-05	1.97E-05	1.98E-05	3.58E-05
GROUND	5.28E-04	5.28E-04	5.28E-04	5.28E-04	5.28E-04	5.28E-04	5.28E-04	6.22E-04
VEGET								
ADULT	8.17E-06	6.81E-05	9.76E-07	4.07E-06	5.85E-07	1.01E-04	3.29E-09	0.00E+00
TEEN	1.28E-05	7.26E-05	1.59E-06	6.24E-06	8.84E-07	1.36E-04	6.17E-09	0.00E+00
CHILD	2.56E-05	4.75E-05	3.86E-06	9.66E-06	1.41E-06	2.60E-04	9.39E-09	0.00E+00
MEAT								
ADULT	2.15E-06	1.82E-05	1.51E-08	9.83E-07	1.56E-08	2.70E-06	2.69E-10	0.00E+00
TEEN	1.70E-06	9.81E-06	1.26E-08	7.63E-07	1.27E-08	1.96E-06	2.54E-10	0.00E+00
CHILD	2.64E-06	4.95E-06	2.36E-08	9.07E-07	1.60E-08	2.95E-06	2.99E-10	0.00E+00
COW MILK								
ADULT	6.15E-07	4.06E-06	2.15E-07	4.73E-07	4.18E-07	7.62E-05	2.27E-09	0.00E+00
TEEN	1.05E-06	4.78E-06	3.91E-07	8.22E-07	7.45E-07	1.21E-04	4.69E-09	0.00E+00
CHILD	2.07E-06	3.17E-06	9.50E-07	1.36E-06	1.24E-06	2.40E-04	7.21E-09	0.00E+00
INFANT	3.49E-06	2.79E-06	1.92E-06	3.08E-06	2.15E-06	5.82E-04	1.30E-08	0.00E+00
GOATMILK								
ADULT	2.58E-07	5.76E-07	3.14E-07	3.73E-07	5.13E-07	9.15E-05	6.81E-09	0.00E+00
TEEN	4.06E-07	6.94E-07	5.72E-07	6.60E-07	9.15E-07	1.45E-04	1.41E-08	0.00E+00
CHILD	7.30E-07	4.79E-07	1.39E-06	1.14E-06	1.52E-06	2.87E-04	2.16E-08	0.00E+00
INFANT	1.31E-06	4.33E-07	2.75E-06	2.67E-06	2.64E-06	6.98E-04	3.91E-08	0.00E+00
INHAL								
ADULT	8.11E-08	1.34E-06	2.00E-08	8.67E-08	5.18E-08	6.41E-06	2.73E-05	0.00E+00
TEEN	1.09E-07	1.27E-06	2.81E-08	1.16E-07	7.15E-08	8.18E-06	4.00E-05	0.00E+00
CHILD	1.24E-07	8.67E-07	3.82E-08	1.05E-07	6.70E-08	9.75E-06	3.24E-05	0.00E+00
INFANT	6.83E-08	5.13E-07	3.02E-08	7.77E-08	4.41E-08	8.95E-06	2.07E-05	0.00E+00

TABLE 5. DOSES TO MAXIMUM INDIVIDUAL (MREM), OCTOBER-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 7.64E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 1.50E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.83E-05
GROUND	2.22E-05	2.22E-05	2.22E-05	2.22E-05	2.22E-05	2.22E-05	2.22E-05	2.61E-05
VEGET								
ADULT	3.46E-07	2.87E-06	6.28E-08	1.75E-07	2.95E-08	5.11E-06	2.25E-10	0.00E+00
TEEN	5.40E-07	3.05E-06	1.03E-07	2.67E-07	4.46E-08	6.88E-06	4.21E-10	0.00E+00
CHILD	1.08E-06	2.00E-06	2.50E-07	4.15E-07	7.12E-08	1.32E-05	6.41E-10	0.00E+00
MEAT								
ADULT	9.02E-08	7.66E-07	9.27E-10	4.14E-08	7.99E-10	1.37E-07	1.83E-11	0.00E+00
TEEN	7.15E-08	4.12E-07	7.76E-10	3.22E-08	6.51E-10	9.92E-08	1.74E-11	0.00E+00
CHILD	1.11E-07	2.08E-07	1.45E-09	3.82E-08	8.23E-10	1.50E-07	2.04E-11	0.00E+00
COW MILK								
ADULT	2.74E-08	1.71E-07	1.17E-08	2.25E-08	2.13E-08	3.86E-06	1.55E-10	0.00E+00
TEEN	4.62E-08	2.02E-07	2.14E-08	3.91E-08	3.79E-08	6.12E-06	3.20E-10	0.00E+00
CHILD	9.09E-08	1.34E-07	5.20E-08	6.53E-08	6.31E-08	1.21E-05	4.92E-10	0.00E+00
INFANT	1.54E-07	1.18E-07	1.05E-07	1.48E-07	1.10E-07	2.95E-05	8.91E-10	0.00E+00
GOATMILK								
ADULT	1.33E-08	2.52E-08	1.79E-08	1.97E-08	2.63E-08	4.64E-06	4.65E-10	0.00E+00
TEEN	2.04E-08	3.06E-08	3.27E-08	3.49E-08	4.70E-08	7.34E-06	9.61E-10	0.00E+00
CHILD	3.59E-08	2.13E-08	7.97E-08	6.05E-08	7.81E-08	1.46E-05	1.48E-09	0.00E+00
INFANT	6.41E-08	1.93E-08	1.56E-07	1.41E-07	1.35E-07	3.54E-05	2.67E-09	0.00E+00
INHAL								
ADULT	8.86E-09	1.42E-07	3.42E-09	1.05E-08	7.68E-09	8.89E-07	2.68E-06	0.00E+00
TEEN	1.18E-08	1.53E-07	4.82E-09	1.40E-08	1.06E-08	1.13E-06	3.92E-06	0.00E+00
CHILD	1.35E-08	2.54E-07	6.57E-09	1.30E-08	9.94E-09	1.35E-06	3.18E-06	0.00E+00
INFANT	7.72E-09	1.97E-07	5.13E-09	1.01E-08	6.55E-09	1.24E-06	2.04E-06	0.00E+00

TABLE 5. DOSES TO MAXIMUM INDIVIDUAL (MREM), OCTOBER-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 1.70 MILES WNW

ANNUAL BETA AIR DOSE = 1.23E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 2.42E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.62E-05	1.62E-05	1.62E-05	1.62E-05	1.62E-05	1.62E-05	1.63E-05	2.95E-05
GROUND	5.29E-05	5.29E-05	5.29E-05	5.29E-05	5.29E-05	5.29E-05	5.29E-05	6.22E-05
VEGET								
ADULT	8.25E-07	6.83E-06	1.65E-07	4.18E-07	7.37E-08	1.28E-05	5.94E-10	0.00E+00
TEEN	1.29E-06	7.28E-06	2.70E-07	6.41E-07	1.11E-07	1.72E-05	1.11E-09	0.00E+00
CHILD	2.58E-06	4.76E-06	6.54E-07	9.94E-07	1.78E-07	3.30E-05	1.69E-09	0.00E+00
MEAT								
ADULT	2.15E-07	1.82E-06	2.41E-09	9.87E-08	2.01E-09	3.43E-07	4.85E-11	0.00E+00
TEEN	1.70E-07	9.81E-07	2.02E-09	7.66E-08	1.63E-09	2.48E-07	4.59E-11	0.00E+00
CHILD	2.64E-07	4.95E-07	3.78E-09	9.12E-08	2.07E-09	3.75E-07	5.39E-11	0.00E+00
COW MILK								
ADULT	6.63E-08	4.08E-07	2.99E-08	5.54E-08	5.34E-08	9.68E-06	4.10E-10	0.00E+00
TEEN	1.12E-07	4.82E-07	5.44E-08	9.65E-08	9.52E-08	1.53E-05	8.47E-10	0.00E+00
CHILD	2.19E-07	3.20E-07	1.32E-07	1.61E-07	1.58E-07	3.04E-05	1.30E-09	0.00E+00
INFANT	3.71E-07	2.82E-07	2.66E-07	3.67E-07	2.75E-07	7.39E-05	2.35E-09	0.00E+00
GOATMILK								
ADULT	3.35E-08	6.09E-08	4.60E-08	4.99E-08	6.62E-08	1.16E-05	1.23E-09	0.00E+00
TEEN	5.11E-08	7.39E-08	8.39E-08	8.83E-08	1.18E-07	1.84E-05	2.54E-09	0.00E+00
CHILD	8.94E-08	5.15E-08	2.04E-07	1.53E-07	1.96E-07	3.65E-05	3.90E-09	0.00E+00
INFANT	1.59E-07	4.69E-08	3.99E-07	3.55E-07	3.40E-07	8.87E-05	7.06E-09	0.00E+00
INHAL								
ADULT	1.55E-08	2.50E-07	5.62E-09	1.80E-08	1.28E-08	1.49E-06	4.78E-06	0.00E+00
TEEN	2.07E-08	2.64E-07	7.92E-09	2.42E-08	1.77E-08	1.90E-06	6.99E-06	0.00E+00
CHILD	2.37E-08	3.99E-07	1.08E-08	2.23E-08	1.66E-08	2.27E-06	5.67E-06	0.00E+00
INFANT	1.34E-08	3.05E-07	8.43E-09	1.72E-08	1.09E-08	2.08E-06	3.63E-06	0.00E+00

TABLE 6. DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-DECEMBER 2017

SPECIAL LOCATION NO. 1A Site Boundary
AT .67 MILES N

ANNUAL BETA AIR DOSE = 5.24E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 1.04E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	7.00E-06	7.00E-06	7.00E-06	7.00E-06	7.00E-06	7.00E-06	7.05E-06	1.27E-05
GROUND	3.69E-03	3.69E-03	3.69E-03	3.69E-03	3.69E-03	3.69E-03	3.69E-03	4.35E-03
VEGET								
ADULT	6.14E-05	4.73E-04	7.71E-06	3.50E-05	4.85E-06	3.53E-04	9.17E-07	0.00E+00
TEEN	9.23E-05	5.04E-04	1.26E-05	5.42E-05	7.57E-06	4.75E-04	1.72E-06	0.00E+00
CHILD	1.80E-04	3.30E-04	3.01E-05	8.58E-05	1.23E-05	9.09E-04	2.61E-06	0.00E+00
MEAT								
ADULT	1.54E-05	1.27E-04	5.16E-07	7.47E-06	2.78E-07	9.42E-06	7.49E-08	0.00E+00
TEEN	1.20E-05	6.84E-05	4.28E-07	5.82E-06	2.25E-07	6.82E-06	7.09E-08	0.00E+00
CHILD	1.85E-05	3.45E-05	7.89E-07	6.98E-06	2.85E-07	1.03E-05	8.33E-08	0.00E+00
COW MILK								
ADULT	7.41E-06	2.81E-05	4.74E-06	7.95E-06	3.37E-06	2.69E-04	6.34E-07	0.00E+00
TEEN	9.88E-06	3.31E-05	8.60E-06	1.39E-05	5.98E-06	4.26E-04	1.31E-06	0.00E+00
CHILD	1.55E-05	2.19E-05	2.07E-05	2.37E-05	9.94E-06	8.46E-04	2.01E-06	0.00E+00
INFANT	2.39E-05	1.93E-05	3.45E-05	4.80E-05	1.66E-05	2.06E-03	3.64E-06	0.00E+00
GOATMILK								
ADULT	1.20E-05	3.99E-06	1.31E-05	1.81E-05	7.47E-06	3.22E-04	1.90E-06	0.00E+00
TEEN	1.20E-05	4.79E-06	2.38E-05	3.18E-05	1.32E-05	5.11E-04	3.93E-06	0.00E+00
CHILD	1.07E-05	3.28E-06	5.74E-05	5.51E-05	2.20E-05	1.02E-03	6.04E-06	0.00E+00
INFANT	1.27E-05	2.95E-06	9.32E-05	1.09E-04	3.61E-05	2.47E-03	1.09E-05	0.00E+00
INHAL								
ADULT	9.44E-07	1.41E-05	2.81E-07	1.00E-06	4.68E-07	4.75E-05	2.94E-04	0.00E+00
TEEN	1.19E-06	1.29E-05	3.94E-07	1.34E-06	6.45E-07	6.12E-05	4.29E-04	0.00E+00
CHILD	1.29E-06	4.96E-06	5.35E-07	1.22E-06	6.04E-07	7.41E-05	3.48E-04	0.00E+00
INFANT	6.94E-07	1.73E-06	3.76E-07	8.80E-07	3.94E-07	6.81E-05	2.22E-04	0.00E+00

TABLE 6. DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 2A Site Boundary
AT .60 MILES NNE

ANNUAL BETA AIR DOSE = 2.55E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 5.08E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.40E-06	3.40E-06	3.40E-06	3.40E-06	3.40E-06	3.40E-06	3.43E-06	6.16E-06
GROUND	2.34E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03	2.34E-03	2.75E-03
VEGET								
ADULT	3.88E-05	2.99E-04	4.71E-06	2.21E-05	3.03E-06	2.16E-04	5.79E-07	0.00E+00
TEEN	5.84E-05	3.19E-04	7.70E-06	3.42E-05	4.72E-06	2.90E-04	1.08E-06	0.00E+00
CHILD	1.14E-04	2.08E-04	1.84E-05	5.42E-05	7.65E-06	5.56E-04	1.65E-06	0.00E+00
MEAT								
ADULT	9.72E-06	8.04E-05	3.24E-07	4.72E-06	1.75E-07	5.76E-06	4.73E-08	0.00E+00
TEEN	7.60E-06	4.32E-05	2.69E-07	3.68E-06	1.41E-07	4.17E-06	4.48E-08	0.00E+00
CHILD	1.17E-05	2.18E-05	4.95E-07	4.41E-06	1.79E-07	6.30E-06	5.26E-08	0.00E+00
COW MILK								
ADULT	4.67E-06	1.78E-05	2.98E-06	5.01E-06	2.10E-06	1.64E-04	4.00E-07	0.00E+00
TEEN	6.23E-06	2.09E-05	5.40E-06	8.77E-06	3.73E-06	2.60E-04	8.27E-07	0.00E+00
CHILD	9.74E-06	1.39E-05	1.30E-05	1.49E-05	6.19E-06	5.17E-04	1.27E-06	0.00E+00
INFANT	1.50E-05	1.22E-05	2.16E-05	3.02E-05	1.03E-05	1.26E-03	2.30E-06	0.00E+00
GOATMILK								
ADULT	7.57E-06	2.51E-06	8.26E-06	1.14E-05	4.69E-06	1.97E-04	1.20E-06	0.00E+00
TEEN	7.55E-06	3.01E-06	1.50E-05	2.01E-05	8.30E-06	3.12E-04	2.48E-06	0.00E+00
CHILD	6.75E-06	2.06E-06	3.61E-05	3.48E-05	1.38E-05	6.21E-04	3.81E-06	0.00E+00
INFANT	7.97E-06	1.86E-06	5.86E-05	6.88E-05	2.26E-05	1.51E-03	6.90E-06	0.00E+00
INHAL								
ADULT	7.65E-07	1.15E-05	2.28E-07	8.12E-07	3.81E-07	3.88E-05	2.38E-04	0.00E+00
TEEN	9.64E-07	1.04E-05	3.20E-07	1.09E-06	5.26E-07	4.99E-05	3.48E-04	0.00E+00
CHILD	1.05E-06	3.96E-06	4.34E-07	9.93E-07	4.92E-07	6.05E-05	2.82E-04	0.00E+00
INFANT	5.62E-07	1.36E-06	3.05E-07	7.14E-07	3.21E-07	5.56E-05	1.80E-04	0.00E+00

TABLE 6. DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 3A Nearest Resident
AT .90 MILES NW

ANNUAL BETA AIR DOSE = 2.98E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 5.93E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.97E-05	3.97E-05	3.97E-05	3.97E-05	3.97E-05	3.97E-05	4.00E-05	7.19E-05
GROUND	9.24E-04	9.24E-04	9.24E-04	9.24E-04	9.24E-04	9.24E-04	9.24E-04	1.09E-03
VEGET								
ADULT	1.55E-05	1.19E-04	3.25E-06	8.98E-06	1.53E-06	1.46E-04	2.35E-07	0.00E+00
TEEN	2.33E-05	1.26E-04	5.33E-06	1.39E-05	2.38E-06	1.96E-04	4.40E-07	0.00E+00
CHILD	4.54E-05	8.27E-05	1.28E-05	2.20E-05	3.85E-06	3.75E-04	6.70E-07	0.00E+00
MEAT								
ADULT	3.85E-06	3.18E-05	1.47E-07	1.88E-06	7.90E-08	3.89E-06	1.92E-08	0.00E+00
TEEN	3.01E-06	1.71E-05	1.22E-07	1.46E-06	6.40E-08	2.82E-06	1.82E-08	0.00E+00
CHILD	4.63E-06	8.64E-06	2.26E-07	1.76E-06	8.12E-08	4.26E-06	2.13E-08	0.00E+00
COW MILK								
ADULT	1.95E-06	7.08E-06	1.36E-06	2.16E-06	1.09E-06	1.11E-04	1.62E-07	0.00E+00
TEEN	2.62E-06	8.35E-06	2.47E-06	3.79E-06	1.93E-06	1.75E-04	3.36E-07	0.00E+00
CHILD	4.12E-06	5.54E-06	5.96E-06	6.46E-06	3.21E-06	3.48E-04	5.16E-07	0.00E+00
INFANT	6.45E-06	4.88E-06	1.01E-05	1.32E-05	5.40E-06	8.45E-04	9.34E-07	0.00E+00
GOATMILK								
ADULT	3.16E-06	1.07E-06	3.58E-06	4.78E-06	2.18E-06	1.33E-04	4.87E-07	0.00E+00
TEEN	3.22E-06	1.29E-06	6.50E-06	8.44E-06	3.87E-06	2.10E-04	1.01E-06	0.00E+00
CHILD	3.03E-06	8.95E-07	1.57E-05	1.46E-05	6.43E-06	4.17E-04	1.55E-06	0.00E+00
INFANT	3.79E-06	8.13E-07	2.59E-05	2.92E-05	1.06E-05	1.01E-03	2.80E-06	0.00E+00
INHAL								
ADULT	1.58E-07	2.35E-06	5.29E-08	1.72E-07	8.94E-08	9.11E-06	4.76E-05	0.00E+00
TEEN	1.99E-07	2.24E-06	7.43E-08	2.30E-07	1.23E-07	1.17E-05	6.96E-05	0.00E+00
CHILD	2.16E-07	1.67E-06	1.01E-07	2.12E-07	1.16E-07	1.42E-05	5.64E-05	0.00E+00
INFANT	1.18E-07	1.03E-06	7.18E-08	1.55E-07	7.56E-08	1.30E-05	3.60E-05	0.00E+00

TABLE 6. DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 1.98E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 3.95E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	2.65E-05	2.65E-05	2.65E-05	2.65E-05	2.65E-05	2.65E-05	2.67E-05	4.79E-05
GROUND	5.44E-05	5.44E-05	5.44E-05	5.44E-05	5.44E-05	5.44E-05	5.44E-05	6.39E-05
VEGET								
ADULT	9.19E-07	6.99E-06	2.43E-07	5.37E-07	1.03E-07	1.08E-05	1.41E-08	0.00E+00
TEEN	1.38E-06	7.45E-06	3.99E-07	8.31E-07	1.59E-07	1.45E-05	2.63E-08	0.00E+00
CHILD	2.69E-06	4.87E-06	9.63E-07	1.32E-06	2.57E-07	2.78E-05	4.01E-08	0.00E+00
MEAT								
ADULT	2.27E-07	1.87E-06	9.36E-09	1.11E-07	5.01E-09	2.89E-07	1.15E-09	0.00E+00
TEEN	1.77E-07	1.01E-06	7.79E-09	8.62E-08	4.07E-09	2.09E-07	1.09E-09	0.00E+00
CHILD	2.73E-07	5.08E-07	1.44E-08	1.04E-07	5.16E-09	3.15E-07	1.28E-09	0.00E+00
COW MILK								
ADULT	1.19E-07	4.19E-07	8.67E-08	1.34E-07	7.33E-08	8.16E-06	9.72E-09	0.00E+00
TEEN	1.60E-07	4.94E-07	1.57E-07	2.35E-07	1.30E-07	1.29E-05	2.01E-08	0.00E+00
CHILD	2.53E-07	3.28E-07	3.81E-07	4.00E-07	2.17E-07	2.57E-05	3.09E-08	0.00E+00
INFANT	3.97E-07	2.89E-07	6.54E-07	8.26E-07	3.66E-07	6.24E-05	5.58E-08	0.00E+00
GOATMILK								
ADULT	1.93E-07	6.52E-08	2.23E-07	2.92E-07	1.41E-07	9.79E-06	2.91E-08	0.00E+00
TEEN	1.98E-07	7.94E-08	4.04E-07	5.15E-07	2.49E-07	1.55E-05	6.02E-08	0.00E+00
CHILD	1.92E-07	5.54E-08	9.76E-07	8.92E-07	4.14E-07	3.08E-05	9.26E-08	0.00E+00
INFANT	2.46E-07	5.06E-08	1.62E-06	1.79E-06	6.87E-07	7.48E-05	1.67E-07	0.00E+00
INHAL								
ADULT	1.89E-08	2.77E-07	9.44E-09	2.31E-08	1.62E-08	1.66E-06	5.01E-06	0.00E+00
TEEN	2.40E-08	3.19E-07	1.33E-08	3.12E-08	2.23E-08	2.12E-06	7.33E-06	0.00E+00
CHILD	2.64E-08	6.76E-07	1.81E-08	2.91E-08	2.09E-08	2.54E-06	5.95E-06	0.00E+00
INFANT	1.50E-08	5.43E-07	1.33E-08	2.27E-08	1.37E-08	2.34E-06	3.82E-06	0.00E+00

TABLE 6. DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 1.70 MILES WNW

ANNUAL BETA AIR DOSE = 3.68E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 7.34E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.92E-05	4.92E-05	4.92E-05	4.92E-05	4.92E-05	4.92E-05	4.95E-05	8.90E-05
GROUND	1.25E-04	1.25E-04	1.25E-04	1.25E-04	1.25E-04	1.25E-04	1.25E-04	1.47E-04
VEGET								
ADULT	2.12E-06	1.61E-05	5.71E-07	1.24E-06	2.39E-07	2.54E-05	3.24E-08	0.00E+00
TEEN	3.18E-06	1.71E-05	9.38E-07	1.92E-06	3.70E-07	3.42E-05	6.07E-08	0.00E+00
CHILD	6.18E-06	1.12E-05	2.26E-06	3.04E-06	5.99E-07	6.55E-05	9.23E-08	0.00E+00
MEAT								
ADULT	5.21E-07	4.30E-06	2.17E-08	2.55E-07	1.16E-08	6.80E-07	2.64E-09	0.00E+00
TEEN	4.08E-07	2.31E-06	1.80E-08	1.98E-07	9.43E-09	4.92E-07	2.50E-09	0.00E+00
CHILD	6.27E-07	1.17E-06	3.34E-08	2.38E-07	1.20E-08	7.43E-07	2.94E-09	0.00E+00
COW MILK								
ADULT	2.74E-07	9.64E-07	2.01E-07	3.09E-07	1.71E-07	1.93E-05	2.24E-08	0.00E+00
TEEN	3.70E-07	1.14E-06	3.65E-07	5.43E-07	3.05E-07	3.05E-05	4.63E-08	0.00E+00
CHILD	5.84E-07	7.55E-07	8.83E-07	9.26E-07	5.07E-07	6.06E-05	7.11E-08	0.00E+00
INFANT	9.19E-07	6.66E-07	1.52E-06	1.91E-06	8.55E-07	1.47E-04	1.29E-07	0.00E+00
GOATMILK								
ADULT	4.44E-07	1.51E-07	5.15E-07	6.74E-07	3.27E-07	2.31E-05	6.71E-08	0.00E+00
TEEN	4.58E-07	1.84E-07	9.35E-07	1.19E-06	5.80E-07	3.66E-05	1.39E-07	0.00E+00
CHILD	4.45E-07	1.28E-07	2.26E-06	2.06E-06	9.63E-07	7.27E-05	2.13E-07	0.00E+00
INFANT	5.73E-07	1.17E-07	3.75E-06	4.13E-06	1.60E-06	1.77E-04	3.86E-07	0.00E+00
INHAL								
ADULT	3.53E-08	5.17E-07	1.77E-08	4.33E-08	3.04E-08	3.11E-06	9.36E-06	0.00E+00
TEEN	4.49E-08	5.96E-07	2.49E-08	5.84E-08	4.20E-08	3.98E-06	1.37E-05	0.00E+00
CHILD	4.93E-08	1.26E-06	3.38E-08	5.45E-08	3.94E-08	4.77E-06	1.11E-05	0.00E+00
INFANT	2.80E-08	1.01E-06	2.48E-08	4.25E-08	2.59E-08	4.38E-06	7.14E-06	0.00E+00

TABLE 7. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-DECEMBER 2017

SPECIAL LOCATION NO. 1A Site Boundary
AT .67 MILES N

ANNUAL BETA AIR DOSE = 1.11E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 2.23E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.49E-05	1.49E-05	1.49E-05	1.49E-05	1.49E-05	1.49E-05	1.51E-05	2.70E-05
GROUND	7.62E-03	7.62E-03	7.62E-03	7.62E-03	7.62E-03	7.62E-03	7.62E-03	8.97E-03
VEGET								
ADULT	1.35E-04	9.84E-04	2.52E-05	8.77E-05	1.49E-05	5.54E-04	3.21E-06	0.00E+00
TEEN	1.98E-04	1.05E-03	4.13E-05	1.36E-04	2.33E-05	7.45E-04	6.02E-06	0.00E+00
CHILD	3.78E-04	6.84E-04	9.85E-05	2.17E-04	3.74E-05	1.43E-03	9.16E-06	0.00E+00
MEAT								
ADULT	3.25E-05	2.62E-04	1.98E-06	1.70E-05	1.35E-06	1.48E-05	2.62E-07	0.00E+00
TEEN	2.52E-05	1.41E-04	1.61E-06	1.33E-05	1.06E-06	1.07E-05	2.48E-07	0.00E+00
CHILD	3.86E-05	7.11E-05	2.92E-06	1.60E-05	1.29E-06	1.62E-05	2.92E-07	0.00E+00
COW MILK								
ADULT	2.15E-05	5.97E-05	1.63E-05	2.67E-05	1.07E-05	4.18E-04	2.22E-06	0.00E+00
TEEN	2.70E-05	7.01E-05	2.93E-05	4.67E-05	1.87E-05	6.62E-04	4.59E-06	0.00E+00
CHILD	3.89E-05	4.64E-05	7.00E-05	7.90E-05	3.05E-05	1.31E-03	7.06E-06	0.00E+00
INFANT	5.65E-05	4.94E-05	1.13E-04	1.55E-04	4.88E-05	3.19E-03	1.28E-05	0.00E+00
GOATMILK								
ADULT	4.05E-05	8.71E-06	4.46E-05	6.13E-05	2.30E-05	5.02E-04	6.66E-06	0.00E+00
TEEN	3.94E-05	1.05E-05	8.09E-05	1.08E-04	4.06E-05	7.95E-04	1.38E-05	0.00E+00
CHILD	3.27E-05	7.15E-06	1.95E-04	1.87E-04	6.73E-05	1.58E-03	2.12E-05	0.00E+00
INFANT	3.55E-05	7.49E-06	3.14E-04	3.68E-04	1.09E-04	3.83E-03	3.83E-05	0.00E+00
INHAL								
ADULT	1.75E-06	2.48E-05	5.48E-07	1.90E-06	6.03E-07	4.62E-05	5.16E-04	0.00E+00
TEEN	2.12E-06	2.26E-05	7.68E-07	2.54E-06	8.24E-07	5.89E-05	7.53E-04	0.00E+00
CHILD	2.23E-06	8.84E-06	1.04E-06	2.31E-06	7.62E-07	7.03E-05	6.10E-04	0.00E+00
INFANT	1.17E-06	3.20E-06	6.74E-07	1.59E-06	4.81E-07	6.45E-05	3.89E-04	0.00E+00

TABLE 7. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 2A Site Boundary
AT .60 MILES NNE

ANNUAL BETA AIR DOSE = 7.13E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 1.43E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	9.59E-06	9.59E-06	9.59E-06	9.59E-06	9.59E-06	9.59E-06	9.66E-06	1.73E-05
GROUND	4.62E-03	4.62E-03	4.62E-03	4.62E-03	4.62E-03	4.62E-03	4.62E-03	5.44E-03
VEGET								
ADULT	8.17E-05	5.97E-04	1.55E-05	5.32E-05	9.08E-06	3.49E-04	1.95E-06	0.00E+00
TEEN	1.20E-04	6.35E-04	2.54E-05	8.27E-05	1.42E-05	4.69E-04	3.65E-06	0.00E+00
CHILD	2.29E-04	4.15E-04	6.05E-05	1.32E-04	2.28E-05	8.99E-04	5.55E-06	0.00E+00
MEAT								
ADULT	1.97E-05	1.59E-04	1.20E-06	1.03E-05	8.18E-07	9.33E-06	1.59E-07	0.00E+00
TEEN	1.53E-05	8.54E-05	9.81E-07	8.05E-06	6.41E-07	6.76E-06	1.51E-07	0.00E+00
CHILD	2.34E-05	4.31E-05	1.78E-06	9.71E-06	7.84E-07	1.02E-05	1.77E-07	0.00E+00
COW MILK								
ADULT	1.31E-05	3.62E-05	9.89E-06	1.62E-05	6.55E-06	2.64E-04	1.35E-06	0.00E+00
TEEN	1.64E-05	4.25E-05	1.78E-05	2.84E-05	1.14E-05	4.18E-04	2.78E-06	0.00E+00
CHILD	2.36E-05	2.81E-05	4.26E-05	4.80E-05	1.87E-05	8.29E-04	4.28E-06	0.00E+00
INFANT	3.44E-05	3.00E-05	6.89E-05	9.45E-05	2.99E-05	2.01E-03	7.74E-06	0.00E+00
GOATMILK								
ADULT	2.46E-05	5.30E-06	2.71E-05	3.72E-05	1.40E-05	3.16E-04	4.04E-06	0.00E+00
TEEN	2.39E-05	6.36E-06	4.92E-05	6.56E-05	2.47E-05	5.01E-04	8.35E-06	0.00E+00
CHILD	1.99E-05	4.36E-06	1.18E-04	1.14E-04	4.10E-05	9.95E-04	1.28E-05	0.00E+00
INFANT	2.16E-05	4.56E-06	1.91E-04	2.23E-04	6.66E-05	2.42E-03	2.32E-05	0.00E+00
INHAL								
ADULT	1.43E-06	2.01E-05	4.52E-07	1.56E-06	5.11E-07	3.93E-05	4.18E-04	0.00E+00
TEEN	1.73E-06	1.83E-05	6.32E-07	2.07E-06	6.99E-07	5.02E-05	6.11E-04	0.00E+00
CHILD	1.81E-06	7.10E-06	8.55E-07	1.89E-06	6.46E-07	6.02E-05	4.95E-04	0.00E+00
INFANT	9.50E-07	2.53E-06	5.57E-07	1.30E-06	4.09E-07	5.53E-05	3.16E-04	0.00E+00

TABLE 7. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 3A Nearest Resident
AT .90 MILES NW

ANNUAL BETA AIR DOSE = 3.36E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 6.74E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.51E-05	4.51E-05	4.51E-05	4.51E-05	4.51E-05	4.51E-05	4.55E-05	8.15E-05
GROUND	1.62E-03	1.62E-03	1.62E-03	1.62E-03	1.62E-03	1.62E-03	1.62E-03	1.90E-03
VEGET								
ADULT	2.88E-05	2.09E-04	7.05E-06	1.89E-05	3.60E-06	1.96E-04	6.91E-07	0.00E+00
TEEN	4.23E-05	2.23E-04	1.16E-05	2.94E-05	5.62E-06	2.64E-04	1.29E-06	0.00E+00
CHILD	8.07E-05	1.46E-04	2.77E-05	4.70E-05	9.02E-06	5.06E-04	1.97E-06	0.00E+00
MEAT								
ADULT	6.91E-06	5.56E-05	4.44E-07	3.63E-06	3.01E-07	5.26E-06	5.64E-08	0.00E+00
TEEN	5.36E-06	2.99E-05	3.63E-07	2.83E-06	2.36E-07	3.81E-06	5.34E-08	0.00E+00
CHILD	8.19E-06	1.51E-05	6.59E-07	3.41E-06	2.89E-07	5.75E-06	6.27E-08	0.00E+00
COW MILK								
ADULT	4.71E-06	1.27E-05	3.69E-06	5.92E-06	2.62E-06	1.48E-04	4.78E-07	0.00E+00
TEEN	5.95E-06	1.50E-05	6.65E-06	1.04E-05	4.58E-06	2.35E-04	9.87E-07	0.00E+00
CHILD	8.63E-06	9.92E-06	1.59E-05	1.75E-05	7.50E-06	4.66E-04	1.52E-06	0.00E+00
INFANT	1.27E-05	1.06E-05	2.61E-05	3.48E-05	1.21E-05	1.13E-03	2.74E-06	0.00E+00
GOATMILK								
ADULT	8.83E-06	1.94E-06	9.89E-06	1.34E-05	5.31E-06	1.78E-04	1.43E-06	0.00E+00
TEEN	8.68E-06	2.35E-06	1.79E-05	2.36E-05	9.40E-06	2.82E-04	2.96E-06	0.00E+00
CHILD	7.43E-06	1.62E-06	4.32E-05	4.09E-05	1.56E-05	5.59E-04	4.55E-06	0.00E+00
INFANT	8.36E-06	1.70E-06	7.01E-05	8.07E-05	2.54E-05	1.36E-03	8.23E-06	0.00E+00
INHAL								
ADULT	2.92E-07	4.12E-06	1.01E-07	3.25E-07	1.21E-07	9.91E-06	8.37E-05	0.00E+00
TEEN	3.55E-07	3.91E-06	1.41E-07	4.34E-07	1.66E-07	1.27E-05	1.22E-04	0.00E+00
CHILD	3.73E-07	2.81E-06	1.91E-07	3.97E-07	1.54E-07	1.51E-05	9.92E-05	0.00E+00
INFANT	1.97E-07	1.71E-06	1.27E-07	2.78E-07	9.79E-08	1.39E-05	6.33E-05	0.00E+00

TABLE 7. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 2.52E-05 MILLRADS
ANNUAL GAMMA AIR DOSE = 5.05E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.38E-05	3.38E-05	3.38E-05	3.38E-05	3.38E-05	3.38E-05	3.41E-05	6.11E-05
GROUND	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.24E-04
VEGET								
ADULT	1.89E-06	1.36E-05	5.62E-07	1.25E-06	2.61E-07	1.75E-05	4.54E-08	0.00E+00
TEEN	2.77E-06	1.45E-05	9.22E-07	1.94E-06	4.06E-07	2.35E-05	8.51E-08	0.00E+00
CHILD	5.28E-06	9.48E-06	2.22E-06	3.11E-06	6.52E-07	4.51E-05	1.30E-07	0.00E+00
MEAT								
ADULT	4.50E-07	3.61E-06	3.04E-08	2.37E-07	2.05E-08	4.69E-07	3.71E-09	0.00E+00
TEEN	3.49E-07	1.94E-06	2.49E-08	1.85E-07	1.61E-08	3.40E-07	3.51E-09	0.00E+00
CHILD	5.33E-07	9.82E-07	4.52E-08	2.23E-07	1.97E-08	5.13E-07	4.13E-09	0.00E+00
COW MILK								
ADULT	3.15E-07	8.32E-07	2.54E-07	4.00E-07	1.91E-07	1.32E-05	3.14E-08	0.00E+00
TEEN	4.00E-07	9.80E-07	4.59E-07	7.00E-07	3.34E-07	2.09E-05	6.49E-08	0.00E+00
CHILD	5.83E-07	6.49E-07	1.10E-06	1.19E-06	5.48E-07	4.14E-05	9.98E-08	0.00E+00
INFANT	8.64E-07	6.96E-07	1.82E-06	2.37E-06	8.92E-07	1.01E-04	1.81E-07	0.00E+00
GOATMILK								
ADULT	5.89E-07	1.32E-07	6.68E-07	8.94E-07	3.71E-07	1.58E-05	9.42E-08	0.00E+00
TEEN	5.83E-07	1.60E-07	1.21E-06	1.58E-06	6.58E-07	2.51E-05	1.95E-07	0.00E+00
CHILD	5.12E-07	1.11E-07	2.92E-06	2.73E-06	1.09E-06	4.97E-05	2.99E-07	0.00E+00
INFANT	5.94E-07	1.16E-07	4.77E-06	5.41E-06	1.79E-06	1.21E-04	5.42E-07	0.00E+00
INHAL								
ADULT	3.68E-08	5.23E-07	1.77E-08	4.50E-08	2.48E-08	2.33E-06	9.42E-06	0.00E+00
TEEN	4.52E-08	6.01E-07	2.49E-08	6.04E-08	3.41E-08	2.96E-06	1.38E-05	0.00E+00
CHILD	4.81E-08	1.24E-06	3.38E-08	5.60E-08	3.18E-08	3.51E-06	1.12E-05	0.00E+00
INFANT	2.67E-08	9.92E-07	2.37E-08	4.20E-08	2.06E-08	3.22E-06	7.18E-06	0.00E+00

TABLE 7. DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 2.30 MILES ESE

ANNUAL BETA AIR DOSE = 5.25E-06 MILLRADS
ANNUAL GAMMA AIR DOSE = 1.05E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	7.05E-06	7.05E-06	7.05E-06	7.05E-06	7.05E-06	7.05E-06	7.10E-06	1.27E-05
GROUND	1.39E-04	1.39E-04	1.39E-04	1.39E-04	1.39E-04	1.39E-04	1.39E-04	1.63E-04
VEGET								
ADULT	2.47E-06	1.79E-05	5.91E-07	1.62E-06	3.05E-07	1.62E-05	5.91E-08	0.00E+00
TEEN	3.62E-06	1.91E-05	9.68E-07	2.52E-06	4.76E-07	2.18E-05	1.11E-07	0.00E+00
CHILD	6.91E-06	1.25E-05	2.32E-06	4.02E-06	7.64E-07	4.17E-05	1.69E-07	0.00E+00
MEAT								
ADULT	5.92E-07	4.76E-06	3.79E-08	3.11E-07	2.57E-08	4.33E-07	4.83E-09	0.00E+00
TEEN	4.59E-07	2.56E-06	3.10E-08	2.43E-07	2.01E-08	3.14E-07	4.57E-09	0.00E+00
CHILD	7.02E-07	1.29E-06	5.61E-08	2.93E-07	2.47E-08	4.74E-07	5.37E-09	0.00E+00
COW MILK								
ADULT	4.03E-07	1.09E-06	3.14E-07	5.06E-07	2.22E-07	1.22E-05	4.09E-08	0.00E+00
TEEN	5.08E-07	1.28E-06	5.66E-07	8.84E-07	3.87E-07	1.93E-05	8.45E-08	0.00E+00
CHILD	7.36E-07	8.49E-07	1.35E-06	1.50E-06	6.34E-07	3.84E-05	1.30E-07	0.00E+00
INFANT	1.08E-06	9.08E-07	2.22E-06	2.97E-06	1.02E-06	9.32E-05	2.35E-07	0.00E+00
GOATMILK								
ADULT	7.55E-07	1.66E-07	8.44E-07	1.15E-06	4.51E-07	1.47E-05	1.23E-07	0.00E+00
TEEN	7.41E-07	2.00E-07	1.53E-06	2.02E-06	7.99E-07	2.32E-05	2.53E-07	0.00E+00
CHILD	6.32E-07	1.38E-07	3.69E-06	3.50E-06	1.33E-06	4.60E-05	3.89E-07	0.00E+00
INFANT	7.10E-07	1.44E-07	5.98E-06	6.89E-06	2.16E-06	1.12E-04	7.05E-07	0.00E+00
INHAL								
ADULT	5.12E-08	7.22E-07	1.76E-08	5.70E-08	2.11E-08	1.74E-06	1.47E-05	0.00E+00
TEEN	6.23E-08	6.83E-07	2.47E-08	7.62E-08	2.89E-08	2.22E-06	2.15E-05	0.00E+00
CHILD	6.55E-08	4.66E-07	3.33E-08	6.95E-08	2.68E-08	2.65E-06	1.74E-05	0.00E+00
INFANT	3.46E-08	2.76E-07	2.21E-08	4.87E-08	1.71E-08	2.43E-06	1.11E-05	0.00E+00

TABLE 8. DOSES TO POPULATION WITHIN 50 MILES, JANUARY-MARCH 2017

ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (PERSON-REM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.69E-06	1.69E-06	1.69E-06	1.69E-06	1.69E-06	1.69E-06	1.70E-06	3.33E-06
	1.39%	1.17%	1.43%	1.40%	1.45%	1.10%	1.24%	2.42%
GROUND	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.14E-04	1.34E-04
	93.37%	78.47%	96.17%	94.02%	97.27%	73.81%	82.63%	97.58%
INHAL	7.80E-08	1.00E-06	3.34E-08	9.29E-08	3.20E-08	2.72E-06	2.19E-05	0.00E+00
	.06%	.69%	.03%	.08%	.03%	1.77%	15.92%	.00%
VEGET	3.95E-06	1.93E-05	1.13E-06	2.69E-06	4.51E-07	4.62E-07	1.15E-07	0.00E+00
	3.24%	13.33%	.96%	2.22%	.39%	.30%	.08%	.00%
COW MILK	1.31E-06	2.50E-06	1.58E-06	2.21E-06	9.48E-07	3.48E-05	1.77E-07	0.00E+00
	1.07%	1.72%	1.34%	1.82%	.81%	22.55%	.13%	.00%
MEAT	1.05E-06	6.68E-06	9.14E-08	5.63E-07	6.89E-08	7.34E-07	9.80E-09	0.00E+00
	.86%	4.61%	.08%	.46%	.06%	.48%	.01%	.00%
TOTAL	1.22E-04	1.45E-04	1.18E-04	1.21E-04	1.17E-04	1.54E-04	1.38E-04	1.37E-04

TABLE 9. DOSES TO POPULATION WITHIN 50 MILES, APRIL-JUNE 2017

ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (PERSON-REM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.47E-06	1.47E-06	1.47E-06	1.47E-06	1.47E-06	1.47E-06	1.48E-06	3.04E-06
	2.73%	2.34%	2.77%	2.73%	2.83%	1.63%	2.48%	4.94%
GROUND	4.97E-05	4.97E-05	4.97E-05	4.97E-05	4.97E-05	4.97E-05	4.97E-05	5.84E-05
	92.18%	79.24%	93.63%	92.24%	95.60%	55.09%	83.13%	95.06%
INHAL	3.74E-08	4.77E-07	2.68E-08	4.76E-08	2.83E-08	3.20E-06	8.40E-06	0.00E+00
	.07%	.76%	.05%	.09%	.05%	3.55%	14.05%	.00%
VEGET	1.65E-06	7.49E-06	8.14E-07	1.23E-06	2.30E-07	4.59E-07	7.61E-08	0.00E+00
	3.06%	11.95%	1.53%	2.28%	.44%	.51%	.13%	.00%
COW MILK	6.38E-07	9.44E-07	1.02E-06	1.21E-06	5.30E-07	3.46E-05	1.18E-07	0.00E+00
	1.18%	1.51%	1.92%	2.24%	1.02%	38.40%	.20%	.00%
MEAT	4.19E-07	2.63E-06	5.20E-08	2.28E-07	2.52E-08	7.36E-07	6.54E-09	0.00E+00
	.78%	4.19%	.10%	.42%	.05%	.82%	.01%	.00%
TOTAL	5.39E-05	6.27E-05	5.30E-05	5.38E-05	5.19E-05	9.01E-05	5.97E-05	6.15E-05

TABLE 10. DOSES TO POPULATION WITHIN 50 MILES, JANUARY-JUNE 2017

ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (PERSON-REM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.13E-06	3.13E-06	3.13E-06	3.13E-06	3.13E-06	3.13E-06	3.15E-06	6.28E-06
	1.74%	1.48%	1.79%	1.75%	1.81%	1.26%	1.57%	3.10%
GROUND	1.67E-04	1.67E-04	1.67E-04	1.67E-04	1.67E-04	1.67E-04	1.67E-04	1.96E-04
	93.16%	79.08%	95.49%	93.61%	96.85%	67.44%	83.12%	96.90%
INHAL	1.15E-07	1.48E-06	6.03E-08	1.40E-07	6.03E-08	5.92E-06	3.03E-05	0.00E+00
	.06%	.70%	.03%	.08%	.03%	2.39%	15.06%	.00%
VEGET	5.60E-06	2.68E-05	1.95E-06	3.92E-06	6.82E-07	9.18E-07	1.91E-07	0.00E+00
	3.13%	12.70%	1.11%	2.20%	.40%	.37%	.10%	.00%
COW MILK	1.95E-06	3.44E-06	2.61E-06	3.41E-06	1.48E-06	6.92E-05	2.95E-07	0.00E+00
	1.09%	1.63%	1.49%	1.91%	.86%	27.94%	.15%	.00%
MEAT	1.47E-06	9.31E-06	1.44E-07	7.90E-07	9.41E-08	1.47E-06	1.64E-08	0.00E+00
	.82%	4.41%	.08%	.44%	.05%	.59%	.01%	.00%
TOTAL	1.79E-04	2.11E-04	1.75E-04	1.78E-04	1.72E-04	2.48E-04	2.01E-04	2.03E-04

TABLE 11. DOSES TO POPULATION WITHIN 50 MILES, JULY-SEPTEMBER 2017

ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (PERSON-REM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.36E-06	6.92E-06
	5.00%	4.35%	5.08%	5.02%	5.17%	3.60%	4.25%	8.88%
GROUND	6.04E-05	6.04E-05	6.04E-05	6.04E-05	6.04E-05	6.04E-05	6.04E-05	7.10E-05
	90.65%	78.84%	92.19%	90.98%	93.72%	65.29%	76.48%	91.12%
INHAL	6.21E-08	7.31E-07	4.14E-08	7.70E-08	4.58E-08	4.59E-06	1.50E-05	0.00E+00
	.09%	.95%	.06%	.12%	.07%	4.96%	19.02%	.00%
VEGET	1.77E-06	8.22E-06	7.59E-07	1.24E-06	2.11E-07	3.22E-07	7.28E-08	0.00E+00
	2.66%	10.74%	1.16%	1.86%	.33%	.35%	.09%	.00%
COW MILK	6.07E-07	1.02E-06	9.34E-07	1.11E-06	4.41E-07	2.33E-05	1.12E-07	0.00E+00
	.91%	1.33%	1.43%	1.67%	.68%	25.24%	.14%	.00%
MEAT	4.56E-07	2.90E-06	4.81E-08	2.38E-07	2.09E-08	5.12E-07	6.24E-09	0.00E+00
	.69%	3.79%	.07%	.36%	.03%	.55%	.01%	.00%
TOTAL	6.66E-05	7.66E-05	6.55E-05	6.63E-05	6.44E-05	9.24E-05	7.89E-05	7.79E-05

TABLE 12. DOSES TO POPULATION WITHIN 50 MILES, OCTOBER-DECEMBER 2017

ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (PERSON-REM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.10E-06	3.10E-06	3.10E-06	3.10E-06	3.10E-06	3.10E-06	3.13E-06	6.57E-06
	3.17%	2.65%	3.29%	3.24%	3.30%	1.91%	2.76%	5.82%
GROUND	9.05E-05	9.05E-05	9.05E-05	9.05E-05	9.05E-05	9.05E-05	9.05E-05	1.06E-04
	92.57%	77.29%	96.07%	94.70%	96.28%	55.82%	79.92%	94.18%
INHAL	6.56E-08	9.02E-07	2.68E-08	7.19E-08	5.54E-08	7.64E-06	1.96E-05	0.00E+00
	.07%	.77%	.03%	.08%	.06%	4.72%	17.31%	.00%
VEGET	2.82E-06	1.53E-05	3.39E-07	1.19E-06	2.22E-08	7.47E-07	2.40E-09	0.00E+00
	2.88%	13.09%	.36%	1.25%	.02%	.46%	.00%	.00%
COW MILK	4.90E-07	1.88E-06	2.30E-07	3.60E-07	3.17E-07	5.89E-05	3.16E-09	0.00E+00
	.50%	1.61%	.24%	.38%	.34%	36.33%	.00%	.00%
MEAT	7.96E-07	5.39E-06	9.81E-09	3.45E-07	7.23E-09	1.23E-06	1.87E-10	0.00E+00
	.81%	4.60%	.01%	.36%	.01%	.76%	.00%	.00%
TOTAL	9.77E-05	1.17E-04	9.42E-05	9.55E-05	9.39E-05	1.62E-04	1.13E-04	1.13E-04

TABLE 13. DOSES TO POPULATION WITHIN 50 MILES, JULY-DECEMBER 2017

ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (PERSON-REM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	6.11E-06	6.11E-06	6.11E-06	6.11E-06	6.11E-06	6.11E-06	6.17E-06	1.29E-05
	3.62%	3.08%	3.72%	3.67%	3.75%	2.35%	3.10%	6.58%
GROUND	1.56E-04	1.56E-04	1.56E-04	1.56E-04	1.56E-04	1.56E-04	1.56E-04	1.83E-04
	92.19%	78.53%	94.82%	93.54%	95.56%	59.92%	78.32%	93.42%
INHAL	1.33E-07	1.72E-06	6.81E-08	1.53E-07	1.06E-07	1.32E-05	3.67E-05	0.00E+00
	.08%	.87%	.04%	.09%	.07%	5.08%	18.48%	.00%
VEGET	4.59E-06	2.35E-05	1.10E-06	2.43E-06	2.33E-07	1.07E-06	7.52E-08	0.00E+00
	2.72%	11.88%	.67%	1.46%	.14%	.41%	.04%	.00%
COW MILK	1.10E-06	2.90E-06	1.16E-06	1.47E-06	7.57E-07	8.20E-05	1.16E-07	0.00E+00
	.65%	1.46%	.71%	.88%	.46%	31.56%	.06%	.00%
MEAT	1.25E-06	8.28E-06	5.79E-08	5.83E-07	2.81E-08	1.74E-06	6.42E-09	0.00E+00
	.74%	4.18%	.04%	.35%	.02%	.67%	.00%	.00%
TOTAL	1.69E-04	1.98E-04	1.64E-04	1.66E-04	1.63E-04	2.60E-04	1.99E-04	1.96E-04

TABLE 14. DOSES TO POPULATION WITHIN 50 MILES, JANUARY-DECEMBER 2017

ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (PERSON-REM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	8.90E-06	8.90E-06	8.90E-06	8.90E-06	8.90E-06	8.90E-06	8.98E-06	1.85E-05
	2.56%	2.17%	2.62%	2.58%	2.65%	1.75%	2.24%	4.63%
GROUND	3.23E-04	3.23E-04	3.23E-04	3.23E-04	3.23E-04	3.23E-04	3.23E-04	3.80E-04
	92.79%	78.90%	95.27%	93.68%	96.32%	63.69%	80.67%	95.37%
INHAL	2.52E-07	3.23E-06	1.31E-07	3.00E-07	1.64E-07	1.86E-05	6.78E-05	0.00E+00
	.07%	.79%	.04%	.09%	.05%	3.66%	16.91%	.00%
VEGET	1.02E-05	5.04E-05	3.04E-06	6.35E-06	9.14E-07	1.99E-06	2.66E-07	0.00E+00
	2.93%	12.30%	.90%	1.84%	.27%	.39%	.07%	.00%
COW MILK	3.04E-06	6.35E-06	3.77E-06	4.88E-06	2.23E-06	1.52E-04	4.10E-07	0.00E+00
	.87%	1.55%	1.11%	1.41%	.67%	29.87%	.10%	.00%
MEAT	2.72E-06	1.76E-05	2.01E-07	1.37E-06	1.22E-07	3.22E-06	2.28E-08	0.00E+00
	.78%	4.29%	.06%	.40%	.04%	.63%	.01%	.00%
TOTAL	3.48E-04	4.10E-04	3.39E-04	3.45E-04	3.36E-04	5.07E-04	4.01E-04	3.99E-04

CARBON-14 GASEOUS EFFLUENT DOSE CALCULATIONS

Doses to the maximum individual resulting from the release of Carbon-14 in gaseous effluents from the Cooper Nuclear Station (CNS) were calculated using the latest version of the GASPAR computer code included as part of NRCDose 2.3.20 (ORNL 2015). Four pathways were selected for individual dose calculations: the nearest site boundary for inhalation, nearest garden for vegetation ingestion, nearest animal for meat ingestion, and the nearest milk animal (cow). Based on the 2017 Land Use Census, there are no meat or milk animals identified within 5 miles of CNS. However, CNS maintains a virtual cow receptor at 3.5 miles north-northwest of the plant and conservatively includes this receptor in dose calculations.

Use of a normalized Carbon-14 source term and scaling factors based on the annual thermal gigawatts (GW_T) power generation were utilized to determine the quantity of Carbon-14 in the CNS gaseous effluent discharge for 2017. Specifically, the Boiling Water Reactor proxy production rate of 5.1 curies Carbon-14 per GW_T generation using the methodology described in EPRI, 2010 was the basis for the CNS total calculated emissions of 12.2 curies of Carbon-14 in 2017.

GASPAR implements the radiological dose models of Regulatory Guide 1.109 for determining the radiation exposure to man from four principal atmospheric exposure pathways: plume, ground, inhalation, and ingestion. Doses to the maximum individual are calculated as a function of age group and pathway for significant body organs.

Tables 15 through 21 present maximum individual doses. Note that the inhalation pathway was calculated at the closest site boundary receptor and was negligible for Carbon-14 and is not included in the tables. In addition, the doses presented were conservatively calculated based on the annual site X/Qs. These X/Qs result in doses approximately 20% higher than those calculated with the X/Qs based on growing season meteorology.

Additional assumptions and data used for input to the GASPAR code are described in a separate section of this appendix (see page F-67).

TABLE 15. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-MARCH 2017

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	6.27E-03	6.27E-03	3.13E-02	6.27E-03	6.27E-03	6.27E-03	6.27E-03	6.27E-03
TEEN	1.05E-02	1.05E-02	5.24E-02	1.05E-02	1.05E-02	1.05E-02	1.05E-02	1.05E-02
CHILD	2.55E-02	2.55E-02	1.28E-01	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02
MEAT								
ADULT	2.50E-03	2.50E-03	1.25E-02	2.50E-03	2.50E-03	2.50E-03	2.50E-03	2.50E-03
TEEN	2.11E-03	2.11E-03	1.06E-02	2.11E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03
CHILD	3.97E-03	3.97E-03	1.99E-02	3.97E-03	3.97E-03	3.97E-03	3.97E-03	3.97E-03
COW MILK								
ADULT	2.73E-03	2.73E-03	1.36E-02	2.73E-03	2.73E-03	2.73E-03	2.73E-03	2.73E-03
TEEN	5.03E-03	5.03E-03	2.52E-02	5.03E-03	5.03E-03	5.03E-03	5.03E-03	5.03E-03
CHILD	1.24E-02	1.24E-02	6.19E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02
INFANT	2.59E-02	2.59E-02	1.21E-01	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02
GOATMILK								
ADULT	2.73E-03	2.73E-03	1.36E-02	2.73E-03	2.73E-03	2.73E-03	2.73E-03	2.73E-03
TEEN	5.03E-03	5.03E-03	2.52E-02	5.03E-03	5.03E-03	5.03E-03	5.03E-03	5.03E-03
CHILD	1.24E-02	1.24E-02	6.19E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02
INFANT	2.59E-02	2.59E-02	1.21E-01	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02

TABLE 15. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-MARCH 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 2.80 MILES NNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	9.48E-03	9.48E-03	4.74E-02	9.48E-03	9.48E-03	9.48E-03	9.48E-03	9.48E-03
TEEN	1.59E-02	1.59E-02	7.93E-02	1.59E-02	1.59E-02	1.59E-02	1.59E-02	1.59E-02
CHILD	3.86E-02	3.86E-02	1.93E-01	3.86E-02	3.86E-02	3.86E-02	3.86E-02	3.86E-02
MEAT								
ADULT	3.78E-03	3.78E-03	1.89E-02	3.78E-03	3.78E-03	3.78E-03	3.78E-03	3.78E-03
TEEN	3.20E-03	3.20E-03	1.60E-02	3.20E-03	3.20E-03	3.20E-03	3.20E-03	3.20E-03
CHILD	6.01E-03	6.01E-03	3.00E-02	6.01E-03	6.01E-03	6.01E-03	6.01E-03	6.01E-03
COW MILK								
ADULT	4.13E-03	4.13E-03	2.06E-02	4.13E-03	4.13E-03	4.13E-03	4.13E-03	4.13E-03
TEEN	7.61E-03	7.61E-03	3.81E-02	7.61E-03	7.61E-03	7.61E-03	7.61E-03	7.61E-03
CHILD	1.87E-02	1.87E-02	9.36E-02	1.87E-02	1.87E-02	1.87E-02	1.87E-02	1.87E-02
INFANT	3.91E-02	3.91E-02	1.83E-01	3.91E-02	3.91E-02	3.91E-02	3.91E-02	3.91E-02
GOATMILK								
ADULT	4.13E-03	4.13E-03	2.06E-02	4.13E-03	4.13E-03	4.13E-03	4.13E-03	4.13E-03
TEEN	7.61E-03	7.61E-03	3.81E-02	7.61E-03	7.61E-03	7.61E-03	7.61E-03	7.61E-03
CHILD	1.87E-02	1.87E-02	9.36E-02	1.87E-02	1.87E-02	1.87E-02	1.87E-02	1.87E-02
INFANT	3.91E-02	3.91E-02	1.83E-01	3.91E-02	3.91E-02	3.91E-02	3.91E-02	3.91E-02

TABLE 16. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), APRIL-JUNE 2017

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	5.19E-03	5.19E-03	2.60E-02	5.19E-03	5.19E-03	5.19E-03	5.19E-03	5.19E-03
TEEN	8.69E-03	8.69E-03	4.34E-02	8.69E-03	8.69E-03	8.69E-03	8.69E-03	8.69E-03
CHILD	2.11E-02	2.11E-02	1.06E-01	2.11E-02	2.11E-02	2.11E-02	2.11E-02	2.11E-02
MEAT								
ADULT	2.07E-03	2.07E-03	1.04E-02	2.07E-03	2.07E-03	2.07E-03	2.07E-03	2.07E-03
TEEN	1.75E-03	1.75E-03	8.75E-03	1.75E-03	1.75E-03	1.75E-03	1.75E-03	1.75E-03
CHILD	3.29E-03	3.29E-03	1.65E-02	3.29E-03	3.29E-03	3.29E-03	3.29E-03	3.29E-03
COW MILK								
ADULT	2.26E-03	2.26E-03	1.13E-02	2.26E-03	2.26E-03	2.26E-03	2.26E-03	2.26E-03
TEEN	4.17E-03	4.17E-03	2.09E-02	4.17E-03	4.17E-03	4.17E-03	4.17E-03	4.17E-03
CHILD	1.03E-02	1.03E-02	5.13E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02
INFANT	2.14E-02	2.14E-02	1.00E-01	2.14E-02	2.14E-02	2.14E-02	2.14E-02	2.14E-02
GOATMILK								
ADULT	2.26E-03	2.26E-03	1.13E-02	2.26E-03	2.26E-03	2.26E-03	2.26E-03	2.26E-03
TEEN	4.17E-03	4.17E-03	2.09E-02	4.17E-03	4.17E-03	4.17E-03	4.17E-03	4.17E-03
CHILD	1.03E-02	1.03E-02	5.13E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02
INFANT	2.14E-02	2.14E-02	1.00E-01	2.14E-02	2.14E-02	2.14E-02	2.14E-02	2.14E-02

TABLE 16. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), APRIL-JUNE 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 2.30 MILES ESE

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	1.07E-02	1.07E-02	5.36E-02	1.07E-02	1.07E-02	1.07E-02	1.07E-02	1.07E-02
TEEN	1.79E-02	1.79E-02	8.96E-02	1.79E-02	1.79E-02	1.79E-02	1.79E-02	1.79E-02
CHILD	4.36E-02	4.36E-02	2.18E-01	4.36E-02	4.36E-02	4.36E-02	4.36E-02	4.36E-02
MEAT								
ADULT	4.27E-03	4.27E-03	2.14E-02	4.27E-03	4.27E-03	4.27E-03	4.27E-03	4.27E-03
TEEN	3.61E-03	3.61E-03	1.81E-02	3.61E-03	3.61E-03	3.61E-03	3.61E-03	3.61E-03
CHILD	6.79E-03	6.79E-03	3.39E-02	6.79E-03	6.79E-03	6.79E-03	6.79E-03	6.79E-03
COW MILK								
ADULT	4.66E-03	4.66E-03	2.33E-02	4.66E-03	4.66E-03	4.66E-03	4.66E-03	4.66E-03
TEEN	8.60E-03	8.60E-03	4.30E-02	8.60E-03	8.60E-03	8.60E-03	8.60E-03	8.60E-03
CHILD	2.12E-02	2.12E-02	1.06E-01	2.12E-02	2.12E-02	2.12E-02	2.12E-02	2.12E-02
INFANT	4.42E-02	4.42E-02	2.07E-01	4.42E-02	4.42E-02	4.42E-02	4.42E-02	4.42E-02
GOATMILK								
ADULT	4.66E-03	4.66E-03	2.33E-02	4.66E-03	4.66E-03	4.66E-03	4.66E-03	4.66E-03
TEEN	8.60E-03	8.60E-03	4.30E-02	8.60E-03	8.60E-03	8.60E-03	8.60E-03	8.60E-03
CHILD	2.12E-02	2.12E-02	1.06E-01	2.12E-02	2.12E-02	2.12E-02	2.12E-02	2.12E-02
INFANT	4.42E-02	4.42E-02	2.07E-01	4.42E-02	4.42E-02	4.42E-02	4.42E-02	4.42E-02

TABLE 17. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-JUNE 2017

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	1.16E-02	1.16E-02	5.81E-02	1.16E-02	1.16E-02	1.16E-02	1.16E-02	1.16E-02
TEEN	1.94E-02	1.94E-02	9.72E-02	1.94E-02	1.94E-02	1.94E-02	1.94E-02	1.94E-02
CHILD	4.73E-02	4.73E-02	2.37E-01	4.73E-02	4.73E-02	4.73E-02	4.73E-02	4.73E-02
MEAT								
ADULT	4.64E-03	4.64E-03	2.32E-02	4.64E-03	4.64E-03	4.64E-03	4.64E-03	4.64E-03
TEEN	3.92E-03	3.92E-03	1.96E-02	3.92E-03	3.92E-03	3.92E-03	3.92E-03	3.92E-03
CHILD	7.37E-03	7.37E-03	3.68E-02	7.37E-03	7.37E-03	7.37E-03	7.37E-03	7.37E-03
COW MILK								
ADULT	5.06E-03	5.06E-03	2.53E-02	5.06E-03	5.06E-03	5.06E-03	5.06E-03	5.06E-03
TEEN	9.34E-03	9.34E-03	4.67E-02	9.34E-03	9.34E-03	9.34E-03	9.34E-03	9.34E-03
CHILD	2.30E-02	2.30E-02	1.15E-01	2.30E-02	2.30E-02	2.30E-02	2.30E-02	2.30E-02
INFANT	4.80E-02	4.80E-02	2.25E-01	4.80E-02	4.80E-02	4.80E-02	4.80E-02	4.80E-02
GOATMILK								
ADULT	5.06E-03	5.06E-03	2.53E-02	5.06E-03	5.06E-03	5.06E-03	5.06E-03	5.06E-03
TEEN	9.34E-03	9.34E-03	4.67E-02	9.34E-03	9.34E-03	9.34E-03	9.34E-03	9.34E-03
CHILD	2.30E-02	2.30E-02	1.15E-01	2.30E-02	2.30E-02	2.30E-02	2.30E-02	2.30E-02
INFANT	4.80E-02	4.80E-02	2.25E-01	4.80E-02	4.80E-02	4.80E-02	4.80E-02	4.80E-02

TABLE 17. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-JUNE 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 2.30 MILES ESE

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	1.74E-02	1.74E-02	8.72E-02	1.74E-02	1.74E-02	1.74E-02	1.74E-02	1.74E-02
TEEN	2.92E-02	2.92E-02	1.46E-01	2.92E-02	2.92E-02	2.92E-02	2.92E-02	2.92E-02
CHILD	7.10E-02	7.10E-02	3.55E-01	7.10E-02	7.10E-02	7.10E-02	7.10E-02	7.10E-02
MEAT								
ADULT	6.96E-03	6.96E-03	3.48E-02	6.96E-03	6.96E-03	6.96E-03	6.96E-03	6.96E-03
TEEN	5.88E-03	5.88E-03	2.94E-02	5.88E-03	5.88E-03	5.88E-03	5.88E-03	5.88E-03
CHILD	1.11E-02	1.11E-02	5.53E-02	1.11E-02	1.11E-02	1.11E-02	1.11E-02	1.11E-02
COW MILK								
ADULT	7.59E-03	7.59E-03	3.80E-02	7.59E-03	7.59E-03	7.59E-03	7.59E-03	7.59E-03
TEEN	1.40E-02	1.40E-02	7.00E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02
CHILD	3.44E-02	3.44E-02	1.72E-01	3.44E-02	3.44E-02	3.44E-02	3.44E-02	3.44E-02
INFANT	7.20E-02	7.20E-02	3.37E-01	7.20E-02	7.20E-02	7.20E-02	7.20E-02	7.20E-02
GOATMILK								
ADULT	7.59E-03	7.59E-03	3.80E-02	7.59E-03	7.59E-03	7.59E-03	7.59E-03	7.59E-03
TEEN	1.40E-02	1.40E-02	7.00E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02
CHILD	3.44E-02	3.44E-02	1.72E-01	3.44E-02	3.44E-02	3.44E-02	3.44E-02	3.44E-02
INFANT	7.20E-02	7.20E-02	3.37E-01	7.20E-02	7.20E-02	7.20E-02	7.20E-02	7.20E-02

TABLE 18. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-SEPTEMBER 2017

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	8.22E-03	8.22E-03	4.11E-02	8.22E-03	8.22E-03	8.22E-03	8.22E-03	8.22E-03
TEEN	1.37E-02	1.37E-02	6.87E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02
CHILD	3.35E-02	3.35E-02	1.67E-01	3.35E-02	3.35E-02	3.35E-02	3.35E-02	3.35E-02
MEAT								
ADULT	3.28E-03	3.28E-03	1.64E-02	3.28E-03	3.28E-03	3.28E-03	3.28E-03	3.28E-03
TEEN	2.77E-03	2.77E-03	1.39E-02	2.77E-03	2.77E-03	2.77E-03	2.77E-03	2.77E-03
CHILD	5.21E-03	5.21E-03	2.61E-02	5.21E-03	5.21E-03	5.21E-03	5.21E-03	5.21E-03
COW MILK								
ADULT	3.58E-03	3.58E-03	1.79E-02	3.58E-03	3.58E-03	3.58E-03	3.58E-03	3.58E-03
TEEN	6.60E-03	6.60E-03	3.30E-02	6.60E-03	6.60E-03	6.60E-03	6.60E-03	6.60E-03
CHILD	1.62E-02	1.62E-02	8.12E-02	1.62E-02	1.62E-02	1.62E-02	1.62E-02	1.62E-02
INFANT	3.39E-02	3.39E-02	1.59E-01	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02
GOATMILK								
ADULT	3.58E-03	3.58E-03	1.79E-02	3.58E-03	3.58E-03	3.58E-03	3.58E-03	3.58E-03
TEEN	6.60E-03	6.60E-03	3.30E-02	6.60E-03	6.60E-03	6.60E-03	6.60E-03	6.60E-03
CHILD	1.62E-02	1.62E-02	8.12E-02	1.62E-02	1.62E-02	1.62E-02	1.62E-02	1.62E-02
INFANT	3.39E-02	3.39E-02	1.59E-01	3.39E-02	3.39E-02	3.39E-02	3.39E-02	3.39E-02

TABLE 18. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-SEPTEMBER 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 1.70 MILES WNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	1.51E-02	1.51E-02	7.56E-02	1.51E-02	1.51E-02	1.51E-02	1.51E-02	1.51E-02
TEEN	2.53E-02	2.53E-02	1.26E-01	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02
CHILD	6.16E-02	6.16E-02	3.08E-01	6.16E-02	6.16E-02	6.16E-02	6.16E-02	6.16E-02
MEAT								
ADULT	6.04E-03	6.04E-03	3.02E-02	6.04E-03	6.04E-03	6.04E-03	6.04E-03	6.04E-03
TEEN	5.10E-03	5.10E-03	2.55E-02	5.10E-03	5.10E-03	5.10E-03	5.10E-03	5.10E-03
CHILD	9.59E-03	9.59E-03	4.79E-02	9.59E-03	9.59E-03	9.59E-03	9.59E-03	9.59E-03
COW MILK								
ADULT	6.59E-03	6.59E-03	3.29E-02	6.59E-03	6.59E-03	6.59E-03	6.59E-03	6.59E-03
TEEN	1.21E-02	1.21E-02	6.07E-02	1.21E-02	1.21E-02	1.21E-02	1.21E-02	1.21E-02
CHILD	2.99E-02	2.99E-02	1.49E-01	2.99E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02
INFANT	6.25E-02	6.25E-02	2.93E-01	6.25E-02	6.25E-02	6.25E-02	6.25E-02	6.25E-02
GOATMILK								
ADULT	6.59E-03	6.59E-03	3.29E-02	6.59E-03	6.59E-03	6.59E-03	6.59E-03	6.59E-03
TEEN	1.21E-02	1.21E-02	6.07E-02	1.21E-02	1.21E-02	1.21E-02	1.21E-02	1.21E-02
CHILD	2.99E-02	2.99E-02	1.49E-01	2.99E-02	2.99E-02	2.99E-02	2.99E-02	2.99E-02
INFANT	6.25E-02	6.25E-02	2.93E-01	6.25E-02	6.25E-02	6.25E-02	6.25E-02	6.25E-02

TABLE 19. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), OCTOBER-DECEMBER 2017

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	6.25E-03	6.25E-03	3.12E-02	6.25E-03	6.25E-03	6.25E-03	6.25E-03	6.25E-03
TEEN	1.04E-02	1.04E-02	5.22E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02
CHILD	2.54E-02	2.54E-02	1.27E-01	2.54E-02	2.54E-02	2.54E-02	2.54E-02	2.54E-02
MEAT								
ADULT	2.49E-03	2.49E-03	1.25E-02	2.49E-03	2.49E-03	2.49E-03	2.49E-03	2.49E-03
TEEN	2.11E-03	2.11E-03	1.05E-02	2.11E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03
CHILD	3.96E-03	3.96E-03	1.98E-02	3.96E-03	3.96E-03	3.96E-03	3.96E-03	3.96E-03
COW MILK								
ADULT	2.72E-03	2.72E-03	1.36E-02	2.72E-03	2.72E-03	2.72E-03	2.72E-03	2.72E-03
TEEN	5.02E-03	5.02E-03	2.51E-02	5.02E-03	5.02E-03	5.02E-03	5.02E-03	5.02E-03
CHILD	1.23E-02	1.23E-02	6.17E-02	1.23E-02	1.23E-02	1.23E-02	1.23E-02	1.23E-02
INFANT	2.58E-02	2.58E-02	1.21E-01	2.58E-02	2.58E-02	2.58E-02	2.58E-02	2.58E-02
GOATMILK								
ADULT	2.72E-03	2.72E-03	1.36E-02	2.72E-03	2.72E-03	2.72E-03	2.72E-03	2.72E-03
TEEN	5.02E-03	5.02E-03	2.51E-02	5.02E-03	5.02E-03	5.02E-03	5.02E-03	5.02E-03
CHILD	1.23E-02	1.23E-02	6.17E-02	1.23E-02	1.23E-02	1.23E-02	1.23E-02	1.23E-02
INFANT	2.58E-02	2.58E-02	1.21E-01	2.58E-02	2.58E-02	2.58E-02	2.58E-02	2.58E-02

TABLE 19. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), OCTOBER-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 1.70 MILES WNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	1.04E-02	1.04E-02	5.18E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02
TEEN	1.73E-02	1.73E-02	8.66E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02
CHILD	4.22E-02	4.22E-02	2.11E-01	4.22E-02	4.22E-02	4.22E-02	4.22E-02	4.22E-02
MEAT								
ADULT	4.13E-03	4.13E-03	2.07E-02	4.13E-03	4.13E-03	4.13E-03	4.13E-03	4.13E-03
TEEN	3.49E-03	3.49E-03	1.75E-02	3.49E-03	3.49E-03	3.49E-03	3.49E-03	3.49E-03
CHILD	6.57E-03	6.57E-03	3.28E-02	6.57E-03	6.57E-03	6.57E-03	6.57E-03	6.57E-03
COW MILK								
ADULT	4.51E-03	4.51E-03	2.25E-02	4.51E-03	4.51E-03	4.51E-03	4.51E-03	4.51E-03
TEEN	8.32E-03	8.32E-03	4.16E-02	8.32E-03	8.32E-03	8.32E-03	8.32E-03	8.32E-03
CHILD	2.05E-02	2.05E-02	1.02E-01	2.05E-02	2.05E-02	2.05E-02	2.05E-02	2.05E-02
INFANT	4.28E-02	4.28E-02	2.00E-01	4.28E-02	4.28E-02	4.28E-02	4.28E-02	4.28E-02
GOATMILK								
ADULT	4.51E-03	4.51E-03	2.25E-02	4.51E-03	4.51E-03	4.51E-03	4.51E-03	4.51E-03
TEEN	8.32E-03	8.32E-03	4.16E-02	8.32E-03	8.32E-03	8.32E-03	8.32E-03	8.32E-03
CHILD	2.05E-02	2.05E-02	1.02E-01	2.05E-02	2.05E-02	2.05E-02	2.05E-02	2.05E-02
INFANT	4.28E-02	4.28E-02	2.00E-01	4.28E-02	4.28E-02	4.28E-02	4.28E-02	4.28E-02

TABLE 20. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-DECEMBER 2017

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	1.48E-02	1.48E-02	7.39E-02	1.48E-02	1.48E-02	1.48E-02	1.48E-02	1.48E-02
TEEN	2.47E-02	2.47E-02	1.24E-01	2.47E-02	2.47E-02	2.47E-02	2.47E-02	2.47E-02
CHILD	6.01E-02	6.01E-02	3.01E-01	6.01E-02	6.01E-02	6.01E-02	6.01E-02	6.01E-02
MEAT								
ADULT	5.90E-03	5.90E-03	2.95E-02	5.90E-03	5.90E-03	5.90E-03	5.90E-03	5.90E-03
TEEN	4.98E-03	4.98E-03	2.49E-02	4.98E-03	4.98E-03	4.98E-03	4.98E-03	4.98E-03
CHILD	9.36E-03	9.36E-03	4.68E-02	9.36E-03	9.36E-03	9.36E-03	9.36E-03	9.36E-03
COW MILK								
ADULT	6.43E-03	6.43E-03	3.22E-02	6.43E-03	6.43E-03	6.43E-03	6.43E-03	6.43E-03
TEEN	1.19E-02	1.19E-02	5.93E-02	1.19E-02	1.19E-02	1.19E-02	1.19E-02	1.19E-02
CHILD	2.92E-02	2.92E-02	1.46E-01	2.92E-02	2.92E-02	2.92E-02	2.92E-02	2.92E-02
INFANT	6.10E-02	6.10E-02	2.86E-01	6.10E-02	6.10E-02	6.10E-02	6.10E-02	6.10E-02
GOATMILK								
ADULT	6.43E-03	6.43E-03	3.22E-02	6.43E-03	6.43E-03	6.43E-03	6.43E-03	6.43E-03
TEEN	1.19E-02	1.19E-02	5.93E-02	1.19E-02	1.19E-02	1.19E-02	1.19E-02	1.19E-02
CHILD	2.92E-02	2.92E-02	1.46E-01	2.92E-02	2.92E-02	2.92E-02	2.92E-02	2.92E-02
INFANT	6.10E-02	6.10E-02	2.86E-01	6.10E-02	6.10E-02	6.10E-02	6.10E-02	6.10E-02

TABLE 20. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), JULY-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 1.70 MILES WNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	2.59E-02	2.59E-02	1.30E-01	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.59E-02
TEEN	4.34E-02	4.34E-02	2.17E-01	4.34E-02	4.34E-02	4.34E-02	4.34E-02	4.34E-02
CHILD	1.06E-01	1.06E-01	5.28E-01	1.06E-01	1.06E-01	1.06E-01	1.06E-01	1.06E-01
MEAT								
ADULT	1.04E-02	1.04E-02	5.18E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02
TEEN	8.74E-03	8.74E-03	4.37E-02	8.74E-03	8.74E-03	8.74E-03	8.74E-03	8.74E-03
CHILD	1.64E-02	1.64E-02	8.22E-02	1.64E-02	1.64E-02	1.64E-02	1.64E-02	1.64E-02
COW MILK								
ADULT	1.13E-02	1.13E-02	5.65E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02
TEEN	2.08E-02	2.08E-02	1.04E-01	2.08E-02	2.08E-02	2.08E-02	2.08E-02	2.08E-02
CHILD	5.12E-02	5.12E-02	2.56E-01	5.12E-02	5.12E-02	5.12E-02	5.12E-02	5.12E-02
INFANT	1.07E-01	1.07E-01	5.02E-01	1.07E-01	1.07E-01	1.07E-01	1.07E-01	1.07E-01
GOATMILK								
ADULT	1.13E-02	1.13E-02	5.65E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02
TEEN	2.08E-02	2.08E-02	1.04E-01	2.08E-02	2.08E-02	2.08E-02	2.08E-02	2.08E-02
CHILD	5.12E-02	5.12E-02	2.56E-01	5.12E-02	5.12E-02	5.12E-02	5.12E-02	5.12E-02
INFANT	1.07E-01	1.07E-01	5.02E-01	1.07E-01	1.07E-01	1.07E-01	1.07E-01	1.07E-01

TABLE 21. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-DECEMBER 2017

SPECIAL LOCATION NO. 4A Nearest Cow
AT 3.50 MILES NNW

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	2.61E-02	2.61E-02	1.30E-01	2.61E-02	2.61E-02	2.61E-02	2.61E-02	2.61E-02
TEEN	4.36E-02	4.36E-02	2.18E-01	4.36E-02	4.36E-02	4.36E-02	4.36E-02	4.36E-02
CHILD	1.06E-01	1.06E-01	5.30E-01	1.06E-01	1.06E-01	1.06E-01	1.06E-01	1.06E-01
MEAT								
ADULT	1.04E-02	1.04E-02	5.20E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02
TEEN	8.78E-03	8.78E-03	4.39E-02	8.78E-03	8.78E-03	8.78E-03	8.78E-03	8.78E-03
CHILD	1.65E-02	1.65E-02	8.26E-02	1.65E-02	1.65E-02	1.65E-02	1.65E-02	1.65E-02
COW MILK								
ADULT	1.13E-02	1.13E-02	5.67E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02
TEEN	2.09E-02	2.09E-02	1.05E-01	2.09E-02	2.09E-02	2.09E-02	2.09E-02	2.09E-02
CHILD	5.14E-02	5.14E-02	2.57E-01	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02
INFANT	1.08E-01	1.08E-01	5.04E-01	1.08E-01	1.08E-01	1.08E-01	1.08E-01	1.08E-01
GOATMILK								
ADULT	1.13E-02	1.13E-02	5.67E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02	1.13E-02
TEEN	2.09E-02	2.09E-02	1.05E-01	2.09E-02	2.09E-02	2.09E-02	2.09E-02	2.09E-02
CHILD	5.14E-02	5.14E-02	2.57E-01	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02
INFANT	1.08E-01	1.08E-01	5.04E-01	1.08E-01	1.08E-01	1.08E-01	1.08E-01	1.08E-01

TABLE 21. CARBON-14 DOSES TO MAXIMUM INDIVIDUAL (MREM), JANUARY-DECEMBER 2017 (Continued)

SPECIAL LOCATION NO. 5A Nearest Garden
AT 2.30 MILES ESE

ANNUAL BETA AIR DOSE = 0.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GROUND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VEGET								
ADULT	3.97E-02	3.97E-02	1.99E-01	3.97E-02	3.97E-02	3.97E-02	3.97E-02	3.97E-02
TEEN	6.64E-02	6.64E-02	3.32E-01	6.64E-02	6.64E-02	6.64E-02	6.64E-02	6.64E-02
CHILD	1.62E-01	1.62E-01	8.09E-01	1.62E-01	1.62E-01	1.62E-01	1.62E-01	1.62E-01
MEAT								
ADULT	1.59E-02	1.59E-02	7.93E-02	1.59E-02	1.59E-02	1.59E-02	1.59E-02	1.59E-02
TEEN	1.34E-02	1.34E-02	6.70E-02	1.34E-02	1.34E-02	1.34E-02	1.34E-02	1.34E-02
CHILD	2.52E-02	2.52E-02	1.26E-01	2.52E-02	2.52E-02	2.52E-02	2.52E-02	2.52E-02
COW MILK								
ADULT	1.73E-02	1.73E-02	8.65E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02
TEEN	3.19E-02	3.19E-02	1.60E-01	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02
CHILD	7.84E-02	7.84E-02	3.92E-01	7.84E-02	7.84E-02	7.84E-02	7.84E-02	7.84E-02
INFANT	1.64E-01	1.64E-01	7.68E-01	1.64E-01	1.64E-01	1.64E-01	1.64E-01	1.64E-01
GOATMILK								
ADULT	1.73E-02	1.73E-02	8.65E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02
TEEN	3.19E-02	3.19E-02	1.60E-01	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02
CHILD	7.84E-02	7.84E-02	3.92E-01	7.84E-02	7.84E-02	7.84E-02	7.84E-02	7.84E-02
INFANT	1.64E-01	1.64E-01	7.68E-01	1.64E-01	1.64E-01	1.64E-01	1.64E-01	1.64E-01

DOSE CALCULATION MODELS

To evaluate the radiological consequences of the routine release of liquid and gaseous effluents from the Cooper Nuclear Station, the latest versions of two computer codes were used: LADTAP II for liquid doses and GASPAR for gaseous doses included as part of NRCDose 2.3.20 (ORNL 2015). Both of these computer codes implement the dose calculational methodologies of U.S. NRC Regulatory Guide 1.109, Revision 1.

Source terms for each quarter are combined with station-specific demographic data and either hydrological dilution factors, for liquid dose calculations, or atmospheric diffusion estimates, for gaseous dose calculations.

For liquid dose calculations, the hydrological dilution factors used for input to LADTAP II, as well as other input parameters, are listed in Table 22. Other inputs not specifically listed in this table are taken from Regulatory Guide 1.109, Revision 1. Semiannual doses are obtained by summing the contributions from the appropriate quarters.

For gaseous dose calculations, atmospheric diffusion estimates are obtained from the reduction and processing of onsite meteorological data, as described in Appendix B. Source terms for the semiannual period are obtained by summing source terms for the appropriate quarters. Additional input to GASPAR includes the following station-supplied data:

- 0 to 50 mile population distribution
- 0 to 50 mile meat, milk, and vegetable distributions
- Absolute humidity at Cooper Nuclear Station (14.61 g/m^3)
- The fraction of the year that the vegetables are grown (0.5)
- The fraction of the daily feed intake derived from pasture for milk and meat animals (0.5)

Other values used for input to GASPAR are default values from Regulatory Guide 1.109, Rev. 1.

TABLE 22. Values of Parameters Used to Make Dose Estimates Resulting From Liquid Discharges at Cooper Nuclear Station January-December 2017

Parameter	Values Assigned	
	Individual	Population
Cooling flow rate (cfs) * (Average daily value)	Q1 NR	NR
	Q2 NR	NR
	Q3 NR	NR
	Q4 NR	NR
Dilution factor*	Q1 NR	NR
	Q2 NR	NR
	Q3 NR	NR
	Q4 NR	NR
Holding time:		
Fish	24 hr ***	168 hr ***
Drinking water	12 hr ***	22.4 hr **
Shoreline exposure	0 hr ***	22.4 hr **
Swimming	0 hr ***	22.4 hr **
Boating	0 hr ***	22.4 hr **

* Q1, Q2, Q3, and Q4 represent first, second, third and fourth quarter station data for 2017, respectively.

** Based on an average Missouri River water flow of 5.5 ft/sec, 84 miles down the river.

*** Values from Regulatory Guide 1.109, Revision 1.

NR- No release

REFERENCES

Electric Power Research Institute, Technical Report 1021106, "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents", December 2010.

Oak Ridge National Laboratory, NRCDose 2.3.20, "Code System for Evaluating Routine Radioactive Effluents from Nuclear Power Plants with Windows Interface", February 2015.

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants", Revision 1, 1974.

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.23 (Safety Guide 23), "Onsite Meteorological Programs", Revision 0, 1972.

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors", Revision 1, 1977.

U.S. Nuclear Regulatory Commission, NUREG/CR-2919, "XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations", 1982.

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors", Revision 0, 1976.

U.S. Nuclear Regulatory Commission, NUREG-0597, "User's Guide to GASPAR Code", December 1980.

U.S. Nuclear Regulatory Commission, NUREG/CR-1276, "User's Manual for LADTAP II: A Computer Code for Calculating Radiation Exposure to Man From Routine Release of Nuclear Reactor Liquid Effluents", 1980.

U.S. Nuclear Regulatory Commission, Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I", Revision 1, 1977.

APPENDIX G
REMP SAMPLE STATION DESCRIPTIONS

REMP SAMPLE STATION DESCRIPTIONS

The following pages contain descriptions of the CNS REMP Sample Stations that were active or were used for part or all of 2017.

REMP SAMPLE STATION DESCRIPTIONS
SAMPLE TYPES AND SAMPLE LOCATIONS

Sample Station (a)	Sample Description – Type and Location
No. 1	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: Outside the northwest edge of fence, east of the gate to the LLRW storage pad on the CNS site, NW ¼, S32, T5N, R16E, Nemaha County, Nebraska. Lon. 095.38.634 W – Lat. 40.21.523 N
No. 2	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: North side of county road to the south portion of CNS site, SW ¼, S32, T5N, R16E, Nemaha County, Nebraska. Lon. 095.38.954 W – Lat. 40.21.126 N
No. 3	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: Located on the north side of the Brownville State Recreation Park access road near water gauging station, SE ¼, S18, T5N, R16E, Nemaha County, Nebraska. Lon. 095.39.108 W – Lat. 40.23.777 N
No. 4	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: Located ½ mile south of Phelps City, Missouri, on west side of highway "U", NE ¼, S2, T64N, R42W, Atchison County, Missouri. Lon. 095.35.792 W – Lat. 40.23.797 N
No. 5	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: Located ¼ mile south and ¼ mile east of Langdon, Missouri, on north side of road, west of railroad tracks, SW ¼, T64N, R41W, Atchison County, Missouri. Lon. 095.34.434 W – Lat. 40.21.151 N

NOTES:
(a) Sample station numbers missing from the sequence are for inactive or discontinued sampling locations.

Sample Station (a)	Sample Description – Type and Location
No. 6	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: One mile west of the end of Missouri State Highway "U", SW corner of the intersection, NW ¼, S34, T64N, R42W, Atchison County, Missouri. Lon. 095.37.620 W – Lat. 40.19.459 N
No 7	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: 300 yards east of Highway 67 on north side of road, SW ¼, S6, T4N, R16E, Nemaha, Nebraska. Lon. 095.40.207 W – Lat. 40.20.287 N
No. 8	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: ½ mile north, ¾ mile west and ¾ mile north of Nemaha, on west side of road adjacent to transmission line, NE ¼, S35, T5N, R15E, Nemaha County, Nebraska. Lon. 095.41.220 W – Lat. 40.21.570 N
No. 9	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: Four miles north of Highway 136, on Highway 67. Then 1 mile east of Highway 67 and ½ mile north on west side of road, SW ¼, S26, T6N, R15E, Nemaha County, Nebraska. Lon. 095.41.810 W – Lat. 40.27.259 N
No. 10	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: One mile north of Barada, Nebraska, in SW corner of intersection, NE ¼, S14, T3N, R16E, Richardson County, Nebraska. Lon. 095.34.723 W – Lat. 40.13.970 N

NOTES:
(a) Sample station numbers missing from the sequence are for inactive or discontinued sampling locations.

Sample Station (a)	Sample Description – Type and Location
No. 11	Type: (1) Water – Ground Location: Plant well water supply header at well pits, NW ¼, S32, T5N, R16E, Nemaha County, Nebraska. Lon. 095.53.866 W – Lat. 40.18.970 N
No.20	Type: (1) Environmental Thermoluminescent Dosimetry Location: On NNW boundary of NPPD property, east side of county road, SE, S30, T5N, R16E, Nemaha County, Nebraska. Lon. 095.39.226 W – Lat. 40.22.260 N
No.28	Type: (1) Water – River, (2) Fish (3) Sediment from Shoreline Location: Samples (1), (3), and (4) are taken from the Missouri River or its shore downstream near River Mile 530, Sample (2) is taken from the Missouri River ½ to 3 miles downstream of the plant site. Lon. 095.37.301 W – Lat. 40.20.336 N
No. 35	Type: (1) Fish (2) Water – River (Alternate Site) (3) Food Products – Broadleaf Vegetation (4) Sediment from Shoreline Location: Sample (1) will be taken from the Missouri River about 1 to 3 miles above the CNS intake structure. During periods when unsafe conditions warrant, Station 35 may be used as an alternate to Station 12 (upstream collection site) for sample type (2). Sample (3) is taken about ¼ mile south of the Brownville State Recreation Area in Sector A. Lon. 095.39.046 W – Lat. 40.23.737 N

NOTES:
(a) Sample station numbers missing from the sequence are for inactive or discontinued sampling locations.

Sample Station (a)	Sample Description – Type and Location
No. 44	Type: (1) Environmental Thermoluminescent Dosimetry Location: ¼ mile south of Auburn Country Club on Highway 75, then ½ mile east of Highway 75 at fence line north of county road, SE1/4, S27, T5N, R14E, Nemaha County, Nebraska. Lon. 095.49.759 W – Lat. 40.21.840 N
No. 47	Type: (1) Water – Ground Location: At Falls City Municipal water supply well. Lon. 095.25.537 W – Lat. 40.01.939 N
No. 56	Type: (1) Environmental Thermoluminescent Dosimetry Location: 1 ¼ miles SW of Langdon, Missouri, on Highway "U", on the right side of the highway, NW ¼, S23, T64N, R42W, Atchison County, Missouri. Lon. 095.36.383 W – Lat. 40.21.157 N
No. 58	Type: (1) Environmental Thermoluminescent Dosimetry Location: Three miles south of Brownville, Nebraska, on county road, at the SE corner of the intersection with the farm road leading to Sample Station No. 2, SE1/4, S31, T5N, R16E, Nemaha County, Nebraska. Lon. 095.39.338 W – Lat. 40.21.126 N

NOTES:
(a) Sample station numbers missing from the sequence are for inactive or discontinued sampling locations.

Sample Station (a)	Sample Description – Type and Location
No. 59	Type: (1) Environmental Thermoluminescent Dosimetry Location: One mile SSE of the CNS Elevated Release Point, in the vicinity of the levee at the south boundary of NPPD property, SE ¼, S32, T5N, R16E, Nemaha County, Nebraska. Lon. 095.38.223 W – Lat. 40.20.986 N
No. 66	Type: (1) Environmental Thermoluminescent Dosimetry Location: Two miles south of Nemaha, Nebraska, on Highway 67 east side of road, NW1/4, S19, T4N, R16E, Nemaha County, Nebraska. Lon. 095.40.307 W – Lat. 40.18.277 N
No. 67	Type: (1) Environmental Thermoluminescent Dosimetry Location: 2 miles west of Brownville, Nebraska, on Highway 136, then north 1 ½ miles on county road and east ½ mile, on north side of road, NE1/4, S11, T5N, R15E, Nemaha County, Nebraska. Lon. 095.41.520 W – Lat. 40.24.898 N
No. 71	Type: (1) Environmental Thermoluminescent Dosimetry Location: Two miles east of Phelps City, Missouri, on Highway 36, then south 1 ½ miles on county road and west ¼ mile, SE1/4, S6, T64N, R41W, Atchison County, Missouri. Lon. 095.34.727 W – Lat. 40.21.664 N
No. 79	Type: (1) Environmental Thermoluminescent Dosimetry Location: 1 7/8 miles south of Brownville, NE, on east side of paved road, NPPD property, SE1/4, S30, T5N, R16E, Nemaha County, Nebraska. Lon. 095.39.238 W – Lat. 40.22.006 N

NOTES:
(a) Sample station numbers missing from the sequence are for inactive or discontinued sampling locations.

Sample Station (a)	Sample Description – Type and Location
No. 80	Type: (1) Environmental Thermoluminescent Dosimetry Location: 2 1/8 miles south of Brownville, on east side of paved road, NPPD property, NE1/4, S31, T5N, R16E, Nemaha County, Nebraska. Lon. 095.39.259 W – Lat. 40.21.834 N
No. 81	Type: (1) Environmental Thermoluminescent Dosimetry Location: 2 3/8 miles south of Brownville, Nebraska, in the NE corner of the intersection of the paved county road and CNS access road, NPPD property, NE1/4, S31, T5N, R16E, Nemaha County, Nebraska. Lon. 095.39.291 W – Lat. 40.21.582 N
No. 82	Type: (1) Environmental Thermoluminescent Dosimetry Location: 7/8 mile south of CNS in a field, on NPPD property, SW1/4, S32, T5N, R16E, Nemaha County, Nebraska. Lon. 095.38.395 W – Lat. 40.20.961 N
No. 83	Type: (1) Environmental Thermoluminescent Dosimetry Location: 2 ¼ miles south of Nemaha, Nebraska, on Highway 67, then east 1 mile to the junction of the driveway and county road (east side of drive), NE1/4, S19, T4N, R16E, Nemaha County, Nebraska. Lon. 095.39.411 W – Lat. 40.18.119 N
No. 84	Type: (1) Environmental Thermoluminescent Dosimetry Location: 2 ½ miles west of Brownville, NE, south side of Highway 136 west of Locust Grove School, NW1/4, S22, T5N, R15E, Nemaha County, Nebraska. Lon. 095.42.993 W – Lat. 40.23.564 N

NOTES:
(a) Sample station numbers missing from the sequence are for inactive or discontinued sampling locations.

Sample Station (a)	Sample Description – Type and Location
No. 85	Type: (1) Environmental Thermoluminescent Dosimetry Location: One mile east of Brownville, Nebraska, on Highway 136, then north ¼ mile on the east side of the county road, NE1/4, S33, T65N, R42W, Atchison County, Missouri. Lon. 095.38.309 W – Lat. 40.24.508 N
No. 86	Type: (1) Environmental Thermoluminescent Dosimetry Location: One mile west of Phelps City, Missouri, on Highway 136, then north 1 ½ miles on Highway "D" on west side, SE1/4, S22, T65N, R42W, Atchison County, Missouri. Lon. 095.36.938 W – Lat. 40.25.563 N
No. 87	Type: (1) Environmental Thermoluminescent Dosimetry Location: One mile west of Phelps City, Missouri, on Highway 136, then south ½ mile on county road and ¾ mile west on county road to the end of the road, NW1/4, S3, T64N, R42W, Atchison County, Missouri. Lon. 095.37.806 W – Lat. 40.23.818 N
No. 88	Type: (1) Environmental Thermoluminescent Dosimetry Location: One mile west of Phelps City, Missouri, on Highway 136, then south 2 miles at the end of the county road, NW1/4, S11, T64N, R42W, Atchison County, Missouri. Lon. 095.37.771 W – Lat. 40.24.762 N
No. 89	Type: (1) Environmental Thermoluminescent Dosimetry Location: 2 ½ miles south of Phelps City, Missouri, on Highway "U", then ½ mile west in the SE corner of the county road intersection, NE1/4, S14, T64N, R42W, Atchison County, Missouri. Lon. 095.36.361 W – Lat. 40.21.962 N

NOTES:
(a) Sample station numbers missing from the sequence are for inactive or discontinued sampling locations.

Sample Station (a)	Sample Description – Type and Location
No. 90	Type: (1) Environmental Thermoluminescent Dosimetry Location: 1 ½ miles west and ¾ mile south of Langdon, Missouri, on Highway "U", then ¼ mile west, SW1/4, S23, T64N, R42W, Atchison County, Missouri. Lon. 095.35.808 W – Lat. 40.19.472 N
No. 91	Type: (1) Environmental Thermoluminescent Dosimetry Location: ½ mile west of Rockport, Missouri, on the south side of the intersection of U.S. Highway 136 and U.S. Highway 275, at the south side of the water tower, NW1/4, S28, T65N, R41W, Atchison County, Missouri. Lon. 095.32.217 W – Lat. 40.25.181 N
No. 94	Type: (1) Environmental Thermoluminescent Dosimetry Location: ¼ mile of Langdon, Missouri, on the west side of the road, NE1/4, S24, T64N, R42W, Atchison County, Missouri. Lon. 095.34.673 W – Lat. 40.20.931 N
No. 96	Type: (1) Food products – Broadleaf Vegetation Location: Approximately 1 mile south of Brownville, Nebraska, along the paved road, in the road ditch in Sector R, SW1/4, S19, T5N, R16E, Nemaha County, Nebraska. Lon. 095.39.318 W – Lat. 40.23.144 N
No. 99	Type: (1) Milk (Nearest and Other Producer) Location: 1 ¼ mile south of Shubert, Nebraska, on the west side of Highway 67, NE1/4, S24, T3N, R15E, Richardson County, Nebraska. Lon. 095.40.368 W – Lat. 40.12.850 N

NOTES:
(a) Sample station numbers missing from the sequence are for inactive or discontinued sampling locations.

Sample Station (a)	Sample Description – Type and Location
No. 101	Type: (1) Food Products – Broadleaf Vegetation
	Location: 5 ½ miles east and ½ mile north of Rock Port, Missouri, near the junction of Highway 136 and Highway 59, in Sector D, encompasses portions of several sections, Athison County, Missouri. Lon. 095.23.822 W – Lat. 40.25.222 N
No. 103	Type: (1) Milk (Other Producer)
	Location: Four miles south and 3 miles west of Auburn, Nebraska, NE ¼, S13, T4N, R13E, Nemaha County, Nebraska. Lon. 095.53.865 W – Lat. 40.18.971 N

NOTES:
(a) Sample station numbers missing from the sequence are for inactive or discontinued sampling locations.

APPENDIX H
ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM (ARGPP) REPORT

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

Radiological Groundwater Protection Program

2017 Annual Report

January 1, 2017 to December 31, 2017

Prepared by
Teledyne Brown Engineering
2508 Quality Lane
Knoxville, TN 37931-3133

Table of Contents

I. Summary 4

II. Characteristics of Tritium (H-3) 6

III. Introduction 8
- A. Objectives of the RGPP 10
- B. Implementation of the Objectives 10
- C. Program Description 10

IV. Program Description 12
- A. Sample Analysis 13
- B. Data Interpretation 13

V. Results and Discussion 15
- A. Groundwater Results 16

Appendices

Appendix A: Location Designation of the Annual Radiological Groundwater Protection Program Report (ARGPPR)

Tables

Table A-1: Radiological Groundwater Protection Program - Sampling Locations, Nebraska Public Power District, Cooper Nuclear Station, 2017

Map

Map A-1: Routine Well Water Sample Locations for the Radiological Groundwater Protection Program, Nebraska Public Power District, Cooper Nuclear Station, 2017

Appendix B: Data Tables of the Annual Radiological Groundwater Protection Program Report (ARGPPR)

Table B-1: Exposure Pathway – Water - Ground, 2017

SECTION I. SUMMARY

I. SUMMARY

In 2008, the Cooper Nuclear Station (CNS) of the Nebraska Public Power District (NPPD) instituted a comprehensive program to evaluate the impact of station operations on groundwater in the vicinity of CNS. This report covers groundwater samples, collected outside of the Licensee required Off-Site Dose Assessment Manual (ODAM) requirements, both on and off station property in 2017. During that time period, analyses were performed on 70 samples from 23 locations.

In assessing all the data gathered for this report, it was concluded that the operation of CNS had no adverse radiological impact on the environment, and there are no known active releases into the groundwater or surface water at Nebraska Public Power District.

Tritium was not detected in any of the groundwater samples at concentrations greater than the United States Environmental Protection Agency (USEPA) drinking water standard (and the Nuclear Regulatory Commission [NRC] reporting limit) of 20,000 pCi/L. The tritium concentrations ranged from 278 ± 183 pCi/L to 2,640 ± 334 pCi/L.

Gamma-emitting radionuclides associated with licensed plant operations were not detected at concentrations greater than their respective Lower Limits of Detection (LLDs) as specified in NUREG-1302 in any of the groundwater samples. In the case of tritium, CNS specified that the independent laboratory achieve a lower limit of detection 10 times lower than that required by the United States Environmental Protection Agency (USEPA) regulation.

SECTION II. CHARACTERISTICS OF TRITIUM (H-3)

II. CHARACTERISTICS OF TRITIUM (H-3)

Tritium (chemical symbol H-3) is a radioactive isotope of hydrogen. The most common form of tritium is tritium oxide, which is also called "tritiated water." The chemical properties of tritium are essentially those of ordinary hydrogen.

Tritiated water functions the same as ordinary water in both the environment and the body. Tritium can be taken into the body by drinking water, breathing air, eating food, or absorption through skin. Once tritium enters the body, it disperses quickly and is uniformly distributed throughout the body. Tritium is excreted primarily through urine with a clearance rate characterized by an effective biological half-life of about 14 days. Within one month or so after ingestion, essentially all tritium is cleared. Organically bound tritium (tritium that is incorporated in organic compounds) can remain in the body for a longer period.

Tritium is produced naturally in the upper atmosphere when cosmic rays strike air molecules. Tritium is also produced during nuclear weapons explosions, as a by-product in reactors producing electricity, and in special production reactors, where the isotopes lithium-6 and/or boron-10 are activated to produce tritium. Like normal water, tritiated water is colorless and odorless. Tritiated water behaves chemically and physically like non-tritiated water in the subsurface, and therefore tritiated water will travel at the same velocity as the average groundwater velocity.

Tritium has a half-life of approximately 12.3 years. It decays spontaneously to helium-3 (3He). This radioactive decay releases a beta particle (low-energy electron). The radioactive decay of tritium is the source of the health risk from exposure to tritium. Tritium is one of the least dangerous radionuclides because it emits very weak beta radiation and leaves the body relatively quickly. Since tritium is almost always found as water, it goes directly into soft tissues and organs. The associated dose to these tissues is generally uniform and is dependent on the water content of the specific tissue.

SECTION III. INTRODUCTION

III. INTRODUCTION

Cooper Nuclear Station is located in Nemaha County in the southeast corner of Nebraska on the Missouri River. A portion of the site extends into Missouri. The reactor is an 830-megawatt (net electrical) boiling water reactor. Initial criticality was attained on February 21, 1974.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) on samples collected in 2017.

III. INTRODUCTION (cont)

A. Objectives of the Radiological Groundwater Protection Program (RGPP)

The long-term objectives of the RGPP are as follows:

1. Identify suitable locations to monitor and evaluate potential impacts from station operations before significant radiological impact to the environment and potential drinking water sources.

2. Understand the local hydrogeologic regime in the vicinity of the station and maintain up-to-date knowledge of flow patterns on the surface and shallow subsurface.

3. Perform routine water sampling and radiological analysis of water from selected locations.

4. Report new leaks, spills, or other detections with potential radiological significance to stakeholders in a timely manner.

5. Regularly assess analytical results to identify adverse trends.

6. Take necessary corrective actions to protect groundwater resources.

B. Implementation of the Objectives

The objectives identified have been implemented at CNS as discussed below:

1. Cooper Nuclear Station will continue to perform routine sampling and radiological analysis of water from selected locations.

2. Cooper Nuclear Station has implemented procedures to identify and report new leaks, spills, or other detections with potential radiological significance in a timely manner.

3. Cooper Nuclear Station staff assesses analytical results on an ongoing basis to identify adverse trends.

C. Program Description

1. Sample Collection

Sample locations can be found in Appendix A, Table A-1 and Map A-1.

Groundwater

Samples of water are collected, managed, transported and analyzed in

III. INTRODUCTION (cont)

accordance with approved procedures following regulatory methods. Sample locations, sample collection frequencies and analytical frequencies are controlled in accordance with approved station procedures. Contractor and/or station personnel are trained in the collection, preservation management, and shipment of samples, as well as in documentation of sampling events. Analytical laboratories are subject to internal quality assurance programs, inter-laboratory cross-check programs, as well as nuclear industry audits. Station personnel review and evaluate all analytical data deliverables after initial review by the contractor.

Analytical data results are reviewed by station personnel for adverse trends or changes to hydrogeologic conditions.

SECTION IV. PROGRAM DESCRIPTION

IV. Program Description

A. Sample Analysis

This section describes the general analytical methodologies used by TBE to analyze the environmental samples for radioactivity for the CNS RGPP in 2017.

In order to achieve the stated objectives, the current program analyzes each sample for tritium. If a sample indicates tritium above TBE's lower limit of detection (LLD), then the sample is analyzed for gamma emitters (Be-7, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Zr-95, Ru-103, Ru-106, I-131, Cs-134, Cs-137, Ba-140, Ce-141, Ce-144, Ra-226 and Th-228). If the sample indicates gamma emitters (other than those that are naturally occurring) above TBE's LLD, then the sample is analyzed for Hard to Detects (HTDs – Gross Alpha, Fe-55, Ni-63, Sr-90, Sr-91).

Note: Statistically positive results include their respective uncertainties. Results reported below TBE's LLD for a given radio nuclide are preceded with "L.T." (= "Less Than").

B. Data Interpretation

The radiological data collected prior to CNS becoming operational were used as a baseline with which these operational data were compared. For the purpose of this report, CNS was considered operational at initial criticality. Several factors were important in the interpretation of the data:

1. Lower Limit of Detection and Minimum Detectable Concentration

The lower limit of detection (LLD) is specified by federal regulation as a minimum sensitivity value that must be achieved routinely by the analytical parameter.

2. Laboratory Measurements Uncertainty

The estimated uncertainty in measurement of tritium in environmental samples is frequently on the order of 50% of the measurement value.

Statistically, the exact value of a measurement is expressed as a range with a stated level of confidence. The convention is to report results with a 95% level of confidence. The uncertainty comes from calibration standards, sample volume or weight measurements, sampling uncertainty and other factors. CNS reports the uncertainty of a measurement created by statistical process (counting error). Each result has two values calculated. CNS reports the result with plus or minus (±) the estimated sample standard deviation.

IV. Program Description (cont)

Analytical uncertainties are reported at the 95% confidence level in this report for reporting consistency with the REMP.

Gamma spectroscopy results for each type of sample were grouped as follows:

For groundwater 19 nuclides, Be-7, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Zr-95, Ru-103, Ru-106, I-131, Cs-134, Cs-137, Ba-140, La-140 Ce-141, Ce-144, Ra-226 and Th-228 were reported.

SECTION V. RESULTS AND DISCUSSION

V. Results and Discussion

A. Groundwater Results

Tritium

Samples from 23 locations were analyzed for tritium activity (Table B-1, Appendix B). Tritium was detected at six locations. Tritium values ranged from 278 to 2,640 pCi/L. All values were below the United States Environmental Protection Agency (USEPA) drinking water standard (and the Nuclear Regulatory Commission [NRC] reporting limit) of 20,000 pCi/liter.

Gamma Emitters

No gamma emitting nuclides were detected (Table B-1, Appendix B).

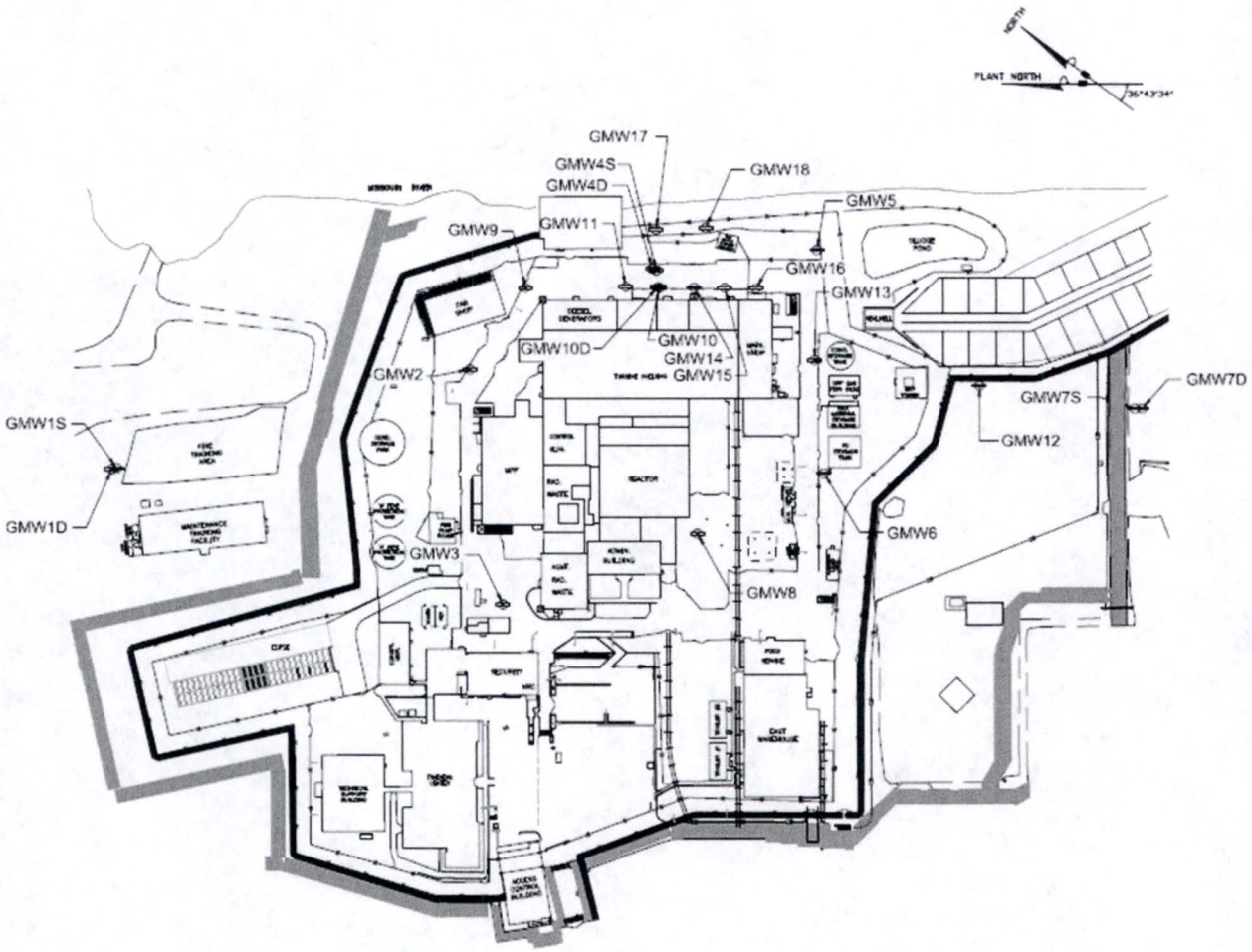
APPENDIX A

LOCATION DESIGNATION OF THE ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

TABLE A-1: Radiological Groundwater Protection Program - Sampling Locations, Nebraska Public Power District, Cooper Nuclear Station, 2017

Site	Type
Ground High Capacity Non-Potable Well-1A	Ground Water
Ground High Capacity Non-Potable Well-1B	Ground Water
Ground Monitoring Well-1D	Ground Water
Ground Monitoring Well-1S	Ground Water
Ground Monitoring Well-2	Ground Water
Ground Monitoring Well-3	Ground Water
Ground Monitoring Well-4D	Ground Water
Ground Monitoring Well-4S	Ground Water
Ground Monitoring Well-5	Ground Water
Ground Monitoring Well-6	Ground Water
Ground Monitoring Well-7D	Ground Water
Ground Monitoring Well-7S	Ground Water
Ground Monitoring Well-8	Ground Water
Ground Monitoring Well-10	Ground Water
Ground Monitoring Well-10D	Ground Water
Ground Monitoring Well-11	Ground Water
Ground Monitoring Well-12	Ground Water
Ground Monitoring Well-13	Ground Water
Ground Monitoring Well-14	Ground Water
Ground Monitoring Well-15	Ground Water
Ground Monitoring Well-16	Ground Water
Ground Monitoring Well-17	Ground Water
Ground Monitoring Well-18	Ground Water

MAP A-1



Routine Well Water Sample Locations for the Radiological Groundwater Protection Program, Nebraska Public Power District, Cooper Nuclear Station, 2017

APPENDIX B

DATA TABLES OF THE ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER RIVER WELL 1A

DATE COLLECTED	2/1/2017	5/2/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
LA-140		
CE-141		
CE-144		
RA-226		
TH-228		
H-3	< 3.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER RIVER WELL 1B

DATE COLLECTED

GAMMA SPECTRUM ANALYSIS:

BE-7
K-40
MN-54
CO-58
FE-59
CO-60
ZN-65
ZR-95
RU-103
RU-106
I-131
CS-134
CS-137
BA-140
LA-140
CE-141
CE-144
RA-226
TH-228

No Samples collected at this locaton in 2017

H-3

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 1D

DATE COLLECTED	6/15/2017	11/29/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
LA-140		
CE-141		
CE-144		
RA-226		
TH-228		
H-3	< 3.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 1S

DATE COLLECTED	6/15/2017	11/29/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
LA-140		
CE-141		
CE-144		
RA-226		
TH-228		
H-3	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 2

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	11/28/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)	(a)	(a)
BE-7				
K-40				
MN-54				
CO-58				
FE-59				
CO-60				
ZN-65				
ZR-95				
RU-103				
RU-106				
I-131				
CS-134				
CS-137				
BA-140				
LA-140				
CE-141				
CE-144				
RA-226				
TH-228				
H-3	< 3.E+02	< 2.E+02	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 3

DATE COLLECTED	6/13/2017	11/28/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
LA-140		
CE-141		
CE-144		
RA-226		
TH-228		
H-3	< 3.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 4D

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	11/28/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)	(a)	(a)
BE-7				
K-40				
MN-54				
CO-58				
FE-59				
CO-60				
ZN-65				
ZR-95				
RU-103				
RU-106				
I-131				
CS-134				
CS-137				
BA-140				
LA-140				
CE-141				
CE-144				
RA-226				
TH-228				
H-3	< 3.E+02	< 2.E+02	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 4S

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	12/14/2017
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 1.E+01	< 2.E+01	< 2.E+01	< 1.E+01
K-40	< 6.E+00	< 2.E+01	< 3.E+01	< 2.E+01
MN-54	< 7.E-01	< 1.E+00	< 1.E+00	< 7.E-01
CO-58	< 1.E+00	< 2.E+00	< 2.E+00	< 1.E+00
FE-59	< 3.E+00	< 5.E+00	< 4.E+00	< 3.E+00
CO-60	< 7.E-01	< 1.E+00	< 1.E+00	< 9.E-01
ZN-65	< 1.E+00	< 3.E+00	< 2.E+00	< 1.E+00
ZR-95	< 2.E+00	< 3.E+00	< 3.E+00	< 2.E+00
RU-103	< 2.E+00	< 2.E+00	< 2.E+00	< 2.E+00
RU-106	< 6.E+00	< 1.E+01	< 1.E+01	< 7.E+00
I-131	< 2.E+02	< 5.E+01	< 8.E+01	< 1.E+02
CS-134	< 6.E-01	< 1.E+00	< 1.E+00	< 8.E-01
CS-137	< 7.E-01	< 1.E+00	< 1.E+00	< 9.E-01
BA-140	< 8.E+01	< 4.E+01	< 5.E+01	< 6.E+01
LA-140	< 2.E+01	< 1.E+01	< 1.E+01	< 2.E+01
CE-141	< 4.E+00	< 5.E+00	< 5.E+00	< 4.E+00
CE-144	< 5.E+00	< 1.E+01	< 9.E+00	< 5.E+00
RA-226	< 1.E+01	< 4.E+01	< 2.E+01	< 2.E+01
TH-228	< 1.E+00	< 3.E+00	< 3.E+00	< 2.E+00
H-3	3.48E+02 ± 1.82E+02	3.96E+02 ± 1.83E+02	5.88E+02 ± 1.78E+02	5.05E+02 ± 1.91E+02

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 5

DATE COLLECTED	06/13/17	09/28/17
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
LA-140		
CE-141		
CE-144		
RA-226		
TH-228		
H-3	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 6

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	12/14/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)	(a)	(a)
BE-7				
K-40				
MN-54				
CO-58				
FE-59				
CO-60				
ZN-65				
ZR-95				
RU-103				
RU-106				
I-131				
CS-134				
CS-137				
BA-140				
LA-140				
CE-141				
CE-144				
RA-226				
TH-228				
H-3	< 3.E+02	< 2.E+02	< 3.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 7D

DATE COLLECTED	6/15/2017	11/29/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
LA-140		
CE-141		
CE-144		
RA-226		
TH-228		
H-3	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 7S

DATE COLLECTED	6/15/2017	11/29/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
LA-140		
CE-141		
CE-144		
RA-226		
TH-228		
H-3	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 8

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	12/14/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)	(a)	(a)
BE-7				
K-40				
MN-54				
CO-58				
FE-59				
CO-60				
ZN-65				
ZR-95				
RU-103				
RU-106				
I-131				
CS-134				
CS-137				
BA-140				
LA-140				
CE-141				
CE-144				
RA-226				
TH-228				
H-3	< 3.E+02	< 2.E+02	< 3.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 9

DATE COLLECTED	11/28/2017
GAMMA SPECTRUM ANALYSIS:	(a)
BE-7	
K-40	
MN-54	
CO-58	
FE-59	
CO-60	
ZN-65	
ZR-95	
RU-103	
RU-106	
I-131	
CS-134	
CS-137	
BA-140	
LA-140	
CE-141	
CE-144	
RA-226	
TH-228	
H-3	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 10

DATE COLLECTED 9/28/2017

GAMMA SPECTRUM ANALYSIS:

BE-7	< 2.E+01
K-40	< 4.E+01
MN-54	< 2.E+00
CO-58	< 2.E+00
FE-59	< 4.E+00
CO-60	< 1.E+00
ZN-65	< 3.E+00
ZR-95	< 3.E+00
RU-103	< 3.E+00
RU-106	< 1.E+01
I-131	< 5.E+01
CS-134	< 2.E+00
CS-137	< 1.E+00
BA-140	< 4.E+01
LA-140	< 1.E+01
CE-141	< 4.E+00
CE-144	< 8.E+00
RA-226	< 3.E+01
TH-228	< 2.E+00

H-3 5.65E+02 ± 1.76E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 10D

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	11/28/2017
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 1.E+01	< 2.E+01	< 2.E+01	< 1.E+01
K-40	< 2.E+01	< 3.E+01	< 4.E+01	< 5.E+00
MN-54	< 9.E-01	< 1.E+00	< 1.E+00	< 7.E-01
CO-58	< 1.E+00	< 2.E+00	< 2.E+00	< 1.E+00
FE-59	< 3.E+00	< 5.E+00	< 4.E+00	< 3.E+00
CO-60	< 8.E-01	< 1.E+00	< 1.E+00	< 7.E-01
ZN-65	< 1.E+00	< 3.E+00	< 3.E+00	< 1.E+00
ZR-95	< 2.E+00	< 3.E+00	< 3.E+00	< 2.E+00
RU-103	< 2.E+00	< 2.E+00	< 3.E+00	< 2.E+00
RU-106	< 8.E+00	< 1.E+01	< 1.E+01	< 6.E+00
I-131	< 2.E+02	< 6.E+01	< 5.E+01	< 4.E+02
CS-134	< 9.E-01	< 1.E+00	< 1.E+00	< 6.E-01
CS-137	< 7.E-01	< 1.E+00	< 1.E+00	< 5.E-01
BA-140	< 9.E+01	< 4.E+01	< 4.E+01	< 1.E+02
LA-140	< 3.E+01	< 1.E+01	< 1.E+01	< 4.E+01
CE-141	< 4.E+00	< 5.E+00	< 5.E+00	< 5.E+00
CE-144	< 6.E+00	< 1.E+01	< 1.E+01	< 5.E+00
RA-226	< 2.E+01	< 3.E+01	< 4.E+01	< 1.E+01
TH-228	< 2.E+00	< 3.E+00	< 3.E+00	< 1.E+00
H-3	3.75E+02 ± 1.86E+02	3.12E+02 ± 1.76E+02	7.88E+02 ± 1.92E+02	5.71E+02 ± 1.97E+02

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 11

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	11/28/2017
GAMMA SPECTRUM ANALYSIS:				
BE-7	< 1.E+01	< 2.E+01	< 2.E+01	< 2.E+01
K-40	< 2.E+01	< 4.E+01	< 3.E+01	< 6.E+00
MN-54	< 9.E-01	< 1.E+00	< 2.E+00	< 8.E-01
CO-58	< 1.E+00	< 2.E+00	< 2.E+00	< 1.E+00
FE-59	< 3.E+00	< 5.E+00	< 5.E+00	< 4.E+00
CO-60	< 1.E+00	< 1.E+00	< 2.E+00	< 7.E-01
ZN-65	< 2.E+00	< 3.E+00	< 4.E+00	< 2.E+00
ZR-95	< 2.E+00	< 4.E+00	< 4.E+00	< 3.E+00
RU-103	< 2.E+00	< 3.E+00	< 3.E+00	< 2.E+00
RU-106	< 8.E+00	< 1.E+01	< 2.E+01	< 7.E+00
I-131	< 2.E+02	< 6.E+01	< 5.E+01	< 5.E+02
CS-134	< 7.E-01	< 2.E+00	< 2.E+00	< 8.E-01
CS-137	< 8.E-01	< 1.E+00	< 2.E+00	< 8.E-01
BA-140	< 8.E+01	< 5.E+01	< 5.E+01	< 1.E+02
LA-140	< 1.E+01	< 1.E+01	< 1.E+01	< 3.E+01
CE-141	< 5.E+00	< 5.E+00	< 6.E+00	< 6.E+00
CE-144	< 7.E+00	< 1.E+01	< 1.E+01	< 7.E+00
RA-226	< 2.E+01	< 4.E+01	< 4.E+01	< 2.E+01
TH-228	< 1.E+00	< 2.E+00	< 3.E+00	< 1.E+00
H-3	5.54E+02 ± 1.91E+02	2.99E+02 ± 1.75E+02	3.82E+02 ± 1.61E+02	4.72E+02 ± 1.93E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 12

DATE COLLECTED	6/15/2017	9/27/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)
BE-7		
K-40		
MN-54		
CO-58		
FE-59		
CO-60		
ZN-65		
ZR-95		
RU-103		
RU-106		
I-131		
CS-134		
CS-137		
BA-140		
LA-140		
CE-141		
CE-144		
RA-226		
TH-228		
H-3	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 13

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	12/14/2017
GAMMA SPECTRUM ANALYSIS:	(a)			
BE-7		< 2.E+01	< 2.E+01	< 1.E+01
K-40		< 9.E+00	< 2.E+01	< 6.E+00
MN-54		< 1.E+00	< 2.E+00	< 7.E-01
CO-58		< 2.E+00	< 2.E+00	< 1.E+00
FE-59		< 4.E+00	< 6.E+00	< 4.E+00
CO-60		< 1.E+00	< 2.E+00	< 9.E-01
ZN-65		< 2.E+00	< 3.E+00	< 2.E+00
ZR-95		< 3.E+00	< 4.E+00	< 2.E+00
RU-103		< 2.E+00	< 3.E+00	< 2.E+00
RU-106		< 1.E+01	< 1.E+01	< 7.E+00
I-131		< 5.E+01	< 5.E+01	< 1.E+02
CS-134		< 1.E+00	< 2.E+00	< 8.E-01
CS-137		< 1.E+00	< 2.E+00	< 8.E-01
BA-140		< 4.E+01	< 5.E+01	< 7.E+01
LA-140		< 1.E+01	< 1.E+01	< 2.E+01
CE-141		< 4.E+00	< 6.E+00	< 5.E+00
CE-144		< 9.E+00	< 1.E+01	< 7.E+00
RA-226		< 3.E+01	< 4.E+01	< 2.E+01
TH-228		< 3.E+00	< 3.E+00	< 1.E+00
H-3	< 3.E+02	1.56E+03 ± 2.54E+02	1.04E+03 ± 2.06E+02	2.64E+03 ± 3.34E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 14

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	12/14/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)	(a)	(a)
BE-7				
K-40				
MN-54				
CO-58				
FE-59				
CO-60				
ZN-65				
ZR-95				
RU-103				
RU-106				
I-131				
CS-134				
CS-137				
BA-140				
LA-140				
CE-141				
CE-144				
RA-226				
TH-228				
H-3	< 3.E+02	< 3.E+02	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 15

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	12/14/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)		(a)
BE-7			L.T. 2.E+01	
K-40			L.T. 3.E+01	
MN-54			L.T. 1.E+00	
CO-58			L.T. 2.E+00	
FE-59			L.T. 5.E+00	
CO-60			L.T. 2.E+00	
ZN-65			L.T. 3.E+00	
ZR-95			L.T. 4.E+00	
RU-103			L.T. 3.E+00	
RU-106			L.T. 1.E+01	
I-131			L.T. 6.E+01	
CS-134			L.T. 2.E+00	
CS-137			L.T. 2.E+00	
BA-140			L.T. 5.E+01	
LA-140			L.T. 1.E+01	
CE-141			L.T. 6.E+00	
CE-144			L.T. 1.E+01	
RA-226			L.T. 4.E+01	
TH-228			L.T. 3.E+00	
H-3	< 3.E+02	< 2.E+02	2.78E+02 ± 1.83E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 16

DATE COLLECTED	3/20/2017	6/13/2017	9/28/2017	12/14/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)	(a)	(a)
BE-7				
K-40				
MN-54				
CO-58				
FE-59				
CO-60				
ZN-65				
ZR-95				
RU-103				
RU-106				
I-131				
CS-134				
CS-137				
BA-140				
LA-140				
CE-141				
CE-144				
RA-226				
TH-228				
H-3	< 3.E+02	< 2.E+02	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 17

DATE COLLECTED	3/20/2017	6/13/2017	9/29/2017	12/14/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)	(a)	(a)
BE-7				
K-40				
MN-54				
CO-58				
FE-59				
CO-60				
ZN-65				
ZR-95				
RU-103				
RU-106				
I-131				
CS-134				
CS-137				
BA-140				
LA-140				
CE-141				
CE-144				
RA-226				
TH-228				
H-3	< 3.E+02	< 3.E+02	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

B-1

COOPER NUCLEAR STATION
WATER - GROUND (PCI/LITER)

STATION NUMBER 18

DATE COLLECTED	3/20/2017	6/13/2017	9/29/2017	12/14/2017
GAMMA SPECTRUM ANALYSIS:	(a)	(a)	(a)	(a)
BE-7				
K-40				
MN-54				
CO-58				
FE-59				
CO-60				
ZN-65				
ZR-95				
RU-103				
RU-106				
I-131				
CS-134				
CS-137				
BA-140				
LA-140				
CE-141				
CE-144				
RA-226				
TH-228				
H-3	< 3.E+02	< 2.E+02	< 2.E+02	< 3.E+02

(a) Gamma analysis not performed. Refer to section IV.A for additional information.

APPENDIX I
NON-ODAM REQUIRED SAMPLING, SUPPLEMENTARY STATIONS

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

Non-ODAM Required Sampling, Supplementary Stations

2017 Annual Report

January 1, 2017 to December 31, 2017

Prepared by
Teledyne Brown Engineering
2508 Quality Lane
Knoxville, TN 37931-3133

TABLE OF CONTENTS

I.Introduction 5

II.Summary 7

III.Results and Discussion of 2017 Analytical Results 9
- A.Airborne Particulates 10
- B.Airborne Iodine 10
- C.Thermoluminescent Dosimeters 10
- D.Errata Data 10

APPENDICES

Appendix A: Non-ODAM Required Sampling Locations A-1

Table A-1: Non-ODAM Sampling Station Description, Sample Type and Sample Location, Nebraska Public Power District, Cooper Nuclear Station, 2017 ..... A-2

Appendix B: Data Tables of Non-ODAM Required Sampling Locations B-1

Table B-1: Exposure Pathway – Airborne Air Particulate and Charcoal Filters B-2

Table B-2: Exposure Pathway – Airborne Composite Air Particulate Filters B-4

Table B-3: Exposure Pathway – Thermoluminescent Dosimetry B-5

SECTION I. INTRODUCTION

I. INTRODUCTION

This report contains a complete tabulation of data for non-ODAM required sampling stations collected during the period January through December 2017 by Teledyne Brown Engineering - Environmental Services.

In assessing all the data gathered for this report, it was concluded that the operation of CNS had no adverse radiological impact on the environment, and there are no known active releases into the groundwater or surface water at Nebraska Public Power District.

SECTION II. SUMMARY

II. Summary

Data from the radiological analyses of environmental media collected during 2017 for non-ODAM required stations are tabulated and discussed below.

Radiological analyses of environmental media characteristically approach and frequently fall below the detection limits of state-of-the-art measurement methods. The "less than" values in the data tables were calculated from each specific analysis and are dependent on sample size, detector efficiency, length of counting time, chemical yield (when appropriate) and the radioactive decay factor from time of counting to time of collection. Teledyne Brown Engineering meets the Lower Limit of Detection (LLD) requirements given in Table 2 of the USNRC Branch Technical Position, Radiological Monitoring Acceptable Program (November 1979, Revision 1).

The following is a discussion and summary of the results of the environmental measurements taken during the 2017 reporting period:

SECTION III. Results and Discussion of 2017 Analytical Results

III. Results and Discussion of 2017 Analytical Results

A. *Airborne Particulates*

Gross beta activity was observed in all 52 of the samples collected during 2017. The average concentration was 0.019 pCi/m^3 with a range of 0.009 to 0.036 pCi/m^3. The results of the gross beta activities are presented in Table B-1. The gross beta activities for 2017 were comparable to levels measured in the previous several years. Prior to that period the gross beta activities were higher due to atmospheric nuclear weapons testing performed in other countries. The preoperational period of 1971 through 1974 averaged 0.098 pCi/m^3 gross beta. Air particulate filters were collected weekly and composited by locations on a quarterly basis. They were analyzed by gamma ray spectroscopy. Beryllium-7 was observed in four of the four composites. The average concentration was 0.139 pCi/m^3 with a range of 0.096 to 0.203 pCi/m^3. The results are presented in Table B-2. All other gamma emitters were below the detection limits.

B. *Airborne Iodine*

Charcoal cartridges used to collect airborne iodine were collected weekly and analyzed by gamma spectrometry for iodine-131. The results are presented in Table B-1. All results were below the required lower limit of detection.

C. *Thermoluminescent Dosimeters*

Thermoluminescent dosimeters (TLDs) determine environmental radiation doses and the results are presented in Table B-3. Ambient radiation was monitored at 26 non-ODAM required locations and collected quarterly. The quarterly average for the locations was 23.8 millirem/quarter and a range from 18.8 to 27.8 millirem/quarter. The preoperational period of 1971 through 1974 averaged 37.0 millirem/quarter. Current year TLD averages deviate from the preoperational averages due to instrument variations from previous vendors.

The data from year to year is in good agreement and indicates no adverse changes in radiation exposure to the population near the Cooper Nuclear Station.

D. *Errata Data*

There was no errata data for 2017.

APPENDIX A
NON-ODAM REQUIRED SAMPLING STATIONS

TABLE A-1: NON-ODAM SAMPLE STATION DESCRIPTION, SAMPLE TYPE AND SAMPLE LOCATION

NEBRASKA PUBLIC POWER DISTRICT,
COOPER NUCLEAR STATION, 2017

Sample Station (a)	Sample Description – Type and Location
No. 111	Type: (1) Air Particulate and Charcoal Filters (2) Environmental Thermoluminescent Dosimetry Location: 10.8 miles west southwest and 1.3 miles west of Howe, Nebraska, NE ¼, S13, T4N, R13E, Nemaha County, Nebraska. Lon. 095.84.165 W – Lat. 40.31.955 N
N01	Type: (1) Environmental Thermoluminescent Dosimetry
N02	Type: (1) Environmental Thermoluminescent Dosimetry
N03	Type: (1) Environmental Thermoluminescent Dosimetry
N04	Type: (1) Environmental Thermoluminescent Dosimetry
N05	Type: (1) Environmental Thermoluminescent Dosimetry
N06	Type: (1) Environmental Thermoluminescent Dosimetry
N07	Type: (1) Environmental Thermoluminescent Dosimetry
N08	Type: (1) Environmental Thermoluminescent Dosimetry
N09	Type: (1) Environmental Thermoluminescent Dosimetry
N10	Type: (1) Environmental Thermoluminescent Dosimetry
N11	Type: (1) Environmental Thermoluminescent Dosimetry
N12	Type: (1) Environmental Thermoluminescent Dosimetry
N13	Type: (1) Environmental Thermoluminescent Dosimetry
N14	Type: (1) Environmental Thermoluminescent Dosimetry
N15	Type: (1) Environmental Thermoluminescent Dosimetry

TABLE A-1: NON-ODAM SAMPLE STATION DESCRIPTION, SAMPLE TYPE AND SAMPLE LOCATION

NEBRASKA PUBLIC POWER DISTRICT,
COOPER NUCLEAR STATION, 2017

Sample Station (a)	Sample Description – Type and Location
N16	Type: (1) Environmental Thermoluminescent Dosimetry
N17	Type: (1) Environmental Thermoluminescent Dosimetry
N18	Type: (1) Environmental Thermoluminescent Dosimetry
N19	Type: (1) Environmental Thermoluminescent Dosimetry
N20	Type: (1) Environmental Thermoluminescent Dosimetry
N21	Type: (1) Environmental Thermoluminescent Dosimetry
N22	Type: (1) Environmental Thermoluminescent Dosimetry
N23	Type: (1) Environmental Thermoluminescent Dosimetry
N24	Type: (1) Environmental Thermoluminescent Dosimetry
N25	Type: (1) Environmental Thermoluminescent Dosimetry

APPENDIX B
DATA TABLES OF NON-ODAM REQUIRED SAMPLING LOCATIONS

B-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 111

COLL START DATE	TIME STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
01/03/17	01/10/17	1.01E+04	CU.FT.	2.78E-02 ± 4.85E-03	< 5.E-02
01/10/17	01/17/17	1.00E+04	CU.FT.	2.37E-02 ± 4.49E-03	< 4.E-02
01/17/17	01/24/17	9.98E+03	CU.FT.	2.73E-02 ± 4.63E-03	< 5.E-02
01/24/17	01/31/17	1.00E+04	CU.FT.	2.25E-02 ± 4.21E-03	< 5.E-02
01/31/17	02/07/17	1.01E+04	CU.FT.	2.40E-02 ± 4.42E-03	< 4.E-02
02/07/17	02/14/17	1.01E+04	CU.FT.	1.65E-02 ± 4.27E-03	< 4.E-02
02/14/17	02/21/17	9.99E+03	CU.FT.	1.62E-02 ± 3.79E-03	< 5.E-02
02/21/17	02/28/17	1.02E+04	CU.FT.	1.25E-02 ± 3.71E-03	< 5.E-02
02/28/17	03/07/17	1.00E+04	CU.FT.	2.29E-02 ± 4.34E-03	< 2.E-02
03/07/17	03/14/17	1.00E+04	CU.FT.	1.49E-02 ± 3.91E-03	< 5.E-02
03/14/17	03/21/17	9.97E+03	CU.FT.	1.81E-02 ± 3.91E-03	< 6.E-02
03/21/17	03/28/17	1.01E+04	CU.FT.	1.66E-02 ± 4.04E-03	< 5.E-02
03/28/17	04/04/17	1.02E+04	CU.FT.	8.97E-03 ± 3.24E-03	< 6.E-02
04/04/17	04/11/17	1.02E+04	CU.FT.	1.65E-02 ± 3.50E-03	< 4.E-02
04/11/17	04/18/17	9.92E+03	CU.FT.	1.35E-02 ± 3.51E-03	< 5.E-02
04/18/17	04/25/17	1.01E+04	CU.FT.	8.64E-03 ± 3.25E-03	< 6.E-02
04/25/17	05/02/17	1.00E+04	CU.FT.	1.04E-02 ± 3.35E-03	< 5.E-02
05/02/17	05/09/17	2.83E+03	CU.FT.	1.49E-02 ± 1.03E-02	< 7.E-02
05/09/17	05/17/17	9.97E+03	CU.FT.	1.69E-02 ± 3.82E-03	< 3.E-02
05/17/17	05/23/17	8.60E+03	CU.FT.	1.19E-02 ± 3.78E-03	< 4.E-02
05/23/17	05/30/17	1.00E+04	CU.FT.	1.09E-02 ± 3.75E-03	< 7.E-02
05/30/17	06/06/17	1.00E+04	CU.FT.	1.78E-02 ± 4.05E-03	< 5.E-02
06/06/17	06/13/17	1.02E+04	CU.FT.	1.36E-02 ± 3.64E-03	< 3.E-02
06/13/17	06/20/17	1.00E+04	CU.FT.	1.13E-02 ± 3.58E-03	< 5.E-02
06/20/17	06/27/17	1.02E+04	CU.FT.	1.47E-02 ± 3.74E-03	< 2.E-02
06/27/17	07/03/17	8.46E+03	CU.FT.	1.71E-02 ± 4.48E-03	< 6.E-02
07/03/17	07/11/17	1.17E+04	CU.FT.	1.77E-02 ± 3.47E-03	< 4.E-02

B-1

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

AIR PARTICULATE AND CHARCOAL FILTERS

STATION NUMBER 111

COLL START DATE	TIME STOP DATE	SAMPLE VOLUME	UNITS	AP FILTER GROSS BETA (PCI/CU.M.)	CHARCOAL FILTER I-131 (PCI/CU.M.)
07/11/17	07/18/17	1.00E+04	CU.FT.	2.16E-02 ± 4.27E-03	< 5.E-02
07/18/17	07/25/17	9.78E+03	CU.FT.	1.94E-02 ± 4.17E-03	< 3.E-02
07/25/17	08/01/17	1.03E+04	CU.FT.	1.70E-02 ± 3.74E-03	< 3.E-02
08/01/17	08/08/17	1.01E+04	CU.FT.	1.77E-02 ± 4.15E-03	< 6.E-02
08/08/17	08/14/17	8.66E+03	CU.FT.	2.86E-02 ± 5.01E-03	< 3.E-02
08/14/17	08/22/17	1.15E+04	CU.FT.	1.92E-02 ± 3.89E-03	< 5.E-02
08/22/17	08/29/17	1.01E+04	CU.FT.	2.08E-02 ± 3.99E-03	< 4.E-02
08/29/17	09/05/17	1.01E+04	CU.FT.	2.42E-02 ± 4.39E-03	< 6.E-02
09/05/17	09/13/17	1.14E+04	CU.FT.	2.93E-02 ± 4.48E-03	< 6.E-02
09/13/17	09/19/17	8.54E+03	CU.FT.	3.00E-02 ± 5.53E-03	< 6.E-02
09/19/17	09/25/17	8.70E+03	CU.FT.	2.01E-02 ± 4.27E-03	< 5.E-02
09/25/17	10/03/17	1.15E+04	CU.FT.	1.63E-02 ± 3.62E-03	< 5.E-02
10/03/17	10/10/17	1.01E+04	CU.FT.	1.46E-02 ± 3.66E-03	< 6.E-02
10/10/17	10/16/17	8.61E+03	CU.FT.	9.01E-03 ± 3.63E-03	< 6.E-02
10/16/17	10/24/17	1.15E+04	CU.FT.	1.62E-02 ± 3.75E-03	< 3.E-02
10/24/17	10/31/17	1.01E+04	CU.FT.	1.24E-02 ± 3.74E-03	< 6.E-02
10/31/17	11/07/17	1.01E+04	CU.FT.	2.38E-02 ± 4.31E-03	< 4.E-02
11/07/17	11/14/17	1.00E+04	CU.FT.	3.40E-02 ± 5.12E-03	< 3.E-02
11/14/17	11/21/17	1.01E+04	CU.FT.	2.91E-02 ± 4.63E-03	< 5.E-02
11/21/17	11/28/17	1.01E+04	CU.FT.	1.99E-02 ± 3.89E-03	< 6.E-02
11/28/17	12/05/17	9.86E+03	CU.FT.	2.10E-02 ± 4.20E-03	< 3.E-02
12/05/17	12/11/17	8.79E+03	CU.FT.	1.68E-02 ± 4.03E-03	< 3.E-02
12/11/17	12/19/17	1.15E+04	CU.FT.	2.61E-02 ± 4.22E-03	< 4.E-02
12/19/17	12/27/17	1.14E+04	CU.FT.	1.73E-02 ± 3.47E-03	< 6.E-02
12/27/17	01/02/18	8.76E+03	CU.FT.	3.56E-02 ± 5.41E-03	< 7.E-02

B-2

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - AIRBORNE

COMPOSITE AIR PARTICULATE FILTERS

(PCI/CU.M.)

STATION NUMBER 111

DATE COLLECTED	01/03/17-04/04/17	04/04/17-07/03/17	07/03/17-10/03/17	10/03/17-01/02/18
GAMMA SPECTRUM ANALYSIS:				
BE-7	1.35E-01 ± 4.67E-02	2.03E-01 ± 4.67E-02	1.23E-01 ± 3.82E-02	9.60E-02 ± 2.43E-02
K-40	< 5.E-02	< 4.E-02	< 4.E-02	< 4.E-02
MN-54	< 3.E-03	< 4.E-03	< 3.E-03	< 3.E-03
CO-58	< 5.E-03	< 6.E-03	< 5.E-03	< 4.E-03
FE-59	< 2.E-02	< 1.E-02	< 1.E-02	< 1.E-02
CO-60	< 3.E-03	< 3.E-03	< 3.E-03	< 2.E-03
ZN-65	< 9.E-03	< 1.E-02	< 8.E-03	< 5.E-03
ZR-95	< 1.E-02	< 1.E-02	< 9.E-03	< 7.E-03
RU-103	< 9.E-03	< 9.E-03	< 7.E-03	< 5.E-03
RU-106	< 3.E-02	< 3.E-02	< 3.E-02	< 2.E-02
I-131	< 1.E+00	< 4.E-01	< 5.E-01	< 2.E-01
CS-134	< 4.E-03	< 3.E-03	< 4.E-03	< 2.E-03
CS-137	< 3.E-03	< 3.E-03	< 3.E-03	< 2.E-03
BA-140	< 3.E-01	< 2.E-01	< 2.E-01	< 1.E-01
LA-140	< 2.E-01	< 7.E-02	< 9.E-02	< 6.E-02
CE-141	< 2.E-02	< 9.E-03	< 1.E-02	< 7.E-03
CE-144	< 2.E-02	< 1.E-02	< 2.E-02	< 1.E-02
RA-226	< 6.E-02	< 5.E-02	< 6.E-02	< 3.E-02
TH-228	< 5.E-03	< 4.E-03	< 5.E-03	< 3.E-03

B-3

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - THERMOLUMINESCENT DOSIMETRY - TLD

COOPER NUCLEAR STATION 2017

Sample Nuclide	Station Number	First Quarter 01/01-03/31	Second Quarter 04/01-06/30	Third Quarter 07/01-09/30	Fourth Quarter 10/01-01/01	Quarter Average - 1 S.D.
TLD	111	22.1 ± 0.6	18.8 ± 0.2	23.9 ± 0.3	25.9 ± 0.8	22.7 ± 3.0
	N01	22.4 ± 1.0	22.0 ± 0.8	25.3 ± 0.7	25.5 ± 0.8	23.8 ± 1.9
	N02	22.9 ± 0.6	19.6 ± 0.7	24.3 ± 0.4	25.3 ± 0.1	23.0 ± 2.5
	N03	22.3 ± 0.2	22.8 ± 0.7	24.1 ± 0.8	24.8 ± 1.2	23.5 ± 1.2
	N04	21.2 ± 0.6	19.5 ± 0.4	23.2 ± 0.3	23.6 ± 0.8	21.9 ± 1.9
	N05	21.6 ± 1.1	20.7 ± 0.4	24.1 ± 0.4	24.7 ± 0.5	22.8 ± 1.9
	N06	22.2 ± 0.8	22.5 ± 0.7	24.7 ± 0.2	25.0 ± 0.5	23.6 ± 1.4
	N07	(a)	25.1 ± 1.0	25.3 ± 0.2	27.0 ± 0.3	25.8 ± 1.0
	N08	21.0 ± 0.4	20.2 ± 0.4	23.5 ± 0.7	23.6 ± 1.0	22.1 ± 1.7
	N09	20.9 ± 0.6	22.9 ± 1.2	23.9 ± 1.2	25.3 ± 0.6	23.3 ± 1.8
	N10	23.3 ± 0.3	22.8 ± 0.2	25.2 ± 0.5	26.9 ± 0.7	24.5 ± 1.9
	N11	(a)	23.0 ± 1.9	24.9 ± 0.4	25.7 ± 0.6	24.5 ± 1.4
	N12	23.5 ± 0.3	23.0 ± 1.0	25.9 ± 0.6	27.3 ± 0.4	24.9 ± 2.0
	N13	23.8 ± 0.4	23.5 ± 0.4	26.0 ± 0.4	27.8 ± 0.9	25.3 ± 2.0
	N14	22.5 ± 0.4	21.4 ± 0.7	24.0 ± 1.3	25.6 ± 0.2	23.4 ± 1.8
	N15	23.1 ± 0.1	22.0 ± 0.1	24.5 ± 0.7	24.5 ± 0.6	23.5 ± 1.2
	N16	24.2 ± 0.3	23.1 ± 0.4	26.0 ± 0.6	27.3 ± 0.4	25.1 ± 1.9
	N17	23.4 ± 0.6	22.3 ± 0.5	25.8 ± 1.3	26.3 ± 0.5	24.4 ± 1.9
	N18	21.3 ± 0.7	21.5 ± 0.7	24.6 ± 0.8	23.8 ± 0.3	22.8 ± 1.7
	N19	22.7 ± 0.9	22.4 ± 0.7	24.7 ± 0.9	26.6 ± 1.3	24.1 ± 1.9
	N20	24.2 ± 0.2	25.2 ± 0.5	27.5 ± 1.3	(a)	25.7 ± 1.7
	N21	21.9 ± 0.7	22.2 ± 0.5	23.3 ± 1.2	24.4 ± 0.4	23.0 ± 1.1

(a) Not collected due to damage

B-3

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

EXPOSURE PATHWAY - THERMOLUMINESCENT DOSIMETRY - TLD

COOPER NUCLEAR STATION 2017

Sample Nuclide	Station Number	First Quarter 01/01-03/31	Second Quarter 04/01-06/30	Third Quarter 07/01-09/30	Fourth Quarter 10/01-01/01	Quarter Average - 1 S.D.
	N22	22.6 ± 1.2	21.6 ± 0.9	25.9 ± 2.2	26.2 ± 0.8	24.1 ± 2.3
	N23	20.7 ± 1.0	21.3 ± 0.4	23.6 ± 0.4	24.4 ± 0.8	22.5 ± 1.8
	N24	23.3 ± 0.3	20.9 ± 0.4	25.8 ± 0.2	27.0 ± 0.6	24.2 ± 2.7
	N25	23.3 ± 1.0	22.4 ± 0.5	25.7 ± 0.6	26.6 ± 0.6	24.5 ± 2.0
Average/Quarter		22.5 ± 1.0	22.0 ± 1.5	24.8 ± 1.1	25.6 ± 1.2	
Range		(20.7-24.2)	(18.8-25.2)	(23.2-27.5)	(23.6-27.8)	
Detection/Total		24/26	26/26	26/26	25/26	