

***NEBRASKA PUBLIC POWER DISTRICT***  
***COOPER NUCLEAR STATION***  
***Non-ODAM Required Sampling, Supplementary Stations***  
***2015 Annual Report***  
***January 1, 2015 to December 31, 2015***

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**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 2015 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 2015 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 2015 reporting period:

### **SECTION III. RESULTS and Discussion of 2015 Analytical Results**



### **III. Results and Discussion of 2015 Analytical Results**

#### **A. *Airborne Particulates***

Gross beta activity was observed in all 52 of the samples collected during 2015. The average concentration was 0.019 pCi/m<sup>3</sup> with a range of 0.009 to 0.039 pCi/m<sup>3</sup>. The results of the gross beta activities are presented in Table B-1. The gross beta activities for 2015 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<sup>3</sup> 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 0.127 pCi/m<sup>3</sup> with a range of 0.108 to 0.140 pCi/m<sup>3</sup>. 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 24.4 millirem/quarter and a range from 21.6 to 27.1 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 2015.

**APPENDIX A**  
**NON-ODAM REQUIRED SAMPLING STATIONS**

**NON-ODAM SAMPLE STATION DESCRIPTION,**  
**SAMPLE TYPE AND SAMPLE LOCATION**

<u>Sample Station (a)</u>	<u>Sample Description – Type and Location</u>
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

**NON-ODAM SAMPLE STATION DESCRIPTION,**  
**SAMPLE TYPE AND SAMPLE LOCATION**

<u>Sample Station (a)</u>	<u>Sample Description – Type and Location</u>
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.)
12/30/14	01/06/15	1.02E+04	CU.FT.	3.91E-02 ± 5.54E-03	L.T. 7.E-02
01/06/15	01/13/15	1.01E+04	CU.FT.	1.42E-02 ± 3.47E-03	L.T. 5.E-02
01/13/15	01/20/15	1.02E+04	CU.FT.	2.06E-02 ± 4.01E-03	L.T. 7.E-02
01/20/15	01/27/15	9.85E+03	CU.FT.	1.26E-02 ± 3.33E-03	L.T. 6.E-02
01/27/15	02/03/15	1.01E+04	CU.FT.	1.57E-02 ± 3.94E-03	L.T. 7.E-02
02/03/15	02/10/15	1.01E+04	CU.FT.	2.81E-02 ± 4.71E-03	L.T. 6.E-02
02/10/15	02/17/15	1.00E+04	CU.FT.	2.39E-02 ± 4.66E-03	L.T. 6.E-02
02/17/15	02/24/15	1.01E+04	CU.FT.	2.87E-02 ± 4.50E-03	L.T. 7.E-02
02/24/15	03/03/15	1.00E+04	CU.FT.	1.53E-02 ± 3.67E-03	L.T. 4.E-02
03/03/15	03/11/15	1.15E+04	CU.FT.	1.86E-02 ± 3.99E-03	L.T. 3.E-02
03/11/15	03/17/15	8.53E+03	CU.FT.	1.98E-02 ± 4.47E-03	L.T. 6.E-02
03/17/15	03/24/15	1.02E+04	CU.FT.	1.72E-02 ± 3.82E-03	L.T. 5.E-02
03/24/15	03/31/15	1.00E+04	CU.FT.	1.30E-02 ± 3.73E-03	L.T. 3.E-02
03/31/15	04/07/15	1.01E+04	CU.FT.	1.74E-02 ± 3.91E-03	L.T. 5.E-02
04/07/15	04/14/15	1.01E+04	CU.FT.	1.61E-02 ± 3.96E-03	L.T. 4.E-02
04/14/15	04/21/15	9.98E+03	CU.FT.	1.32E-02 ± 3.63E-03	L.T. 4.E-02
04/21/15	04/28/15	1.01E+04	CU.FT.	1.39E-02 ± 3.26E-03	L.T. 3.E-02
04/28/15	05/05/15	1.00E+04	CU.FT.	1.84E-02 ± 4.10E-03	L.T. 6.E-02
05/05/15	05/12/15	1.00E+04	CU.FT.	8.99E-03 ± 3.42E-03	L.T. 6.E-02
05/12/15	05/19/15	1.01E+04	CU.FT.	1.02E-02 ± 3.20E-03	L.T. 6.E-02
05/19/15	05/26/15	1.02E+04	CU.FT.	1.20E-02 ± 3.59E-03	L.T. 6.E-02
05/26/15	06/01/15	9.97E+03	CU.FT.	1.32E-02 ± 3.35E-03	L.T. 7.E-02
06/01/15	06/09/15	1.01E+04	CU.FT.	1.75E-02 ± 3.91E-03	L.T. 5.E-02
06/09/15	06/16/15	1.01E+04	CU.FT.	1.26E-02 ± 3.51E-03	L.T. 7.E-02
06/16/15	06/23/15	1.00E+04	CU.FT.	1.71E-02 ± 4.06E-03	L.T. 7.E-02
06/23/15	06/30/15	1.01E+04	CU.FT.	1.33E-02 ± 3.45E-03	L.T. 4.E-02
06/30/15	07/08/15	1.15E+04	CU.FT.	1.76E-02 ± 3.45E-03	L.T. 1.E-02

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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.)
07/08/15	07/14/15	8.70E+03	CU.FT.	1.61E-02 ± 4.09E-03	L.T. 2.E-02
07/14/15	07/21/15	1.00E+04	CU.FT.	1.86E-02 ± 4.27E-03	L.T. 2.E-02
07/21/15	07/28/15	1.00E+04	CU.FT.	1.52E-02 ± 3.70E-03	L.T. 5.E-02
07/28/15	08/05/15	1.15E+04	CU.FT.	1.63E-02 ± 3.54E-03	L.T. 7.E-02
08/05/15	08/10/15	7.21E+03	CU.FT.	2.14E-02 ± 5.24E-03	L.T. 2.E-02
08/10/15	08/18/15	1.15E+04	CU.FT.	2.26E-02 ± 4.00E-03	L.T. 6.E-02
08/18/15	08/26/15	1.17E+04	CU.FT.	1.57E-02 ± 3.39E-03	L.T. 3.E-02
08/26/15	09/01/15	8.41E+03	CU.FT.	2.78E-02 ± 5.19E-03	L.T. 6.E-02
09/01/15	09/08/15	1.01E+04	CU.FT.	1.83E-02 ± 3.92E-03	L.T. 6.E-02
09/08/15	09/15/15	1.01E+04	CU.FT.	2.25E-02 ± 4.20E-03	L.T. 7.E-02
09/15/15	09/22/15	1.01E+04	CU.FT.	1.94E-02 ± 4.10E-03	L.T. 4.E-02
09/22/15	09/29/15	1.02E+04	CU.FT.	2.80E-02 ± 4.58E-03	L.T. 6.E-02
09/29/15	10/06/15	1.00E+04	CU.FT.	1.07E-02 ± 3.38E-03	L.T. 7.E-02
10/06/15	10/12/15	8.54E+03	CU.FT.	3.32E-02 ± 5.18E-03	L.T. 7.E-02
10/12/15	10/20/15	1.16E+04	CU.FT.	1.84E-02 ± 3.88E-03	L.T. 6.E-02
10/20/15	10/27/15	1.01E+04	CU.FT.	2.61E-02 ± 4.40E-03	L.T. 6.E-02
10/27/15	11/03/15	1.01E+04	CU.FT.	2.04E-02 ± 4.17E-03	L.T. 5.E-02
11/03/15	11/10/15	1.00E+04	CU.FT.	3.28E-02 ± 4.87E-03	L.T. 7.E-02
11/10/15	11/17/15	1.00E+04	CU.FT.	1.78E-02 ± 4.16E-03	L.T. 2.E-02
11/17/15	11/24/15	1.01E+04	CU.FT.	1.35E-02 ± 3.81E-03	L.T. 7.E-02
11/24/15	12/01/15	1.02E+04	CU.FT.	1.80E-02 ± 3.87E-03	L.T. 6.E-02
12/01/15	12/08/15	1.00E+04	CU.FT.	3.12E-02 ± 4.91E-03	L.T. 7.E-02
12/08/15	12/15/15	1.01E+04	CU.FT.	1.52E-02 ± 3.88E-03	L.T. 4.E-02
12/15/15	12/22/15	1.00E+04	CU.FT.	2.16E-02 ± 4.16E-03	L.T. 7.E-02
12/22/15	12/29/15	1.01E+04	CU.FT.	2.75E-02 ± 4.50E-03	L.T. 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	12/30-03/31/15	03/31-06/30/15	06/30-09/29/15	09/29-12/29/15
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GAMMA SPECTRUM ANALYSIS:

BE-7	1.27E-01 ± 3.99E-02	1.40E-01 ± 4.95E-02	1.33E-01 ± 3.70E-02	1.08E-01 ± 5.34E-02
K-40	L.T. 5.E-02	L.T. 6.E-02	L.T. 4.E-02	L.T. 7.E-02
MN-54	L.T. 3.E-03	L.T. 4.E-03	L.T. 3.E-03	L.T. 5.E-03
CO-58	L.T. 6.E-03	L.T. 6.E-03	L.T. 5.E-03	L.T. 8.E-03
FE-59	L.T. 1.E-02	L.T. 2.E-02	L.T. 1.E-02	L.T. 2.E-02
CO-60	L.T. 2.E-03	L.T. 2.E-03	L.T. 3.E-03	L.T. 4.E-03
ZN-65	L.T. 4.E-03	L.T. 9.E-03	L.T. 7.E-03	L.T. 1.E-02
ZR-95	L.T. 1.E-02	L.T. 2.E-02	L.T. 8.E-03	L.T. 2.E-02
RU-103	L.T. 8.E-03	L.T. 1.E-02	L.T. 7.E-03	L.T. 1.E-02
RU-106	L.T. 3.E-02	L.T. 4.E-02	L.T. 2.E-02	L.T. 4.E-02
I-131	L.T. 2.E+00	L.T. 1.E+00	L.T. 1.E+00	L.T. 3.E+00
CS-134	L.T. 3.E-03	L.T. 3.E-03	L.T. 3.E-03	L.T. 4.E-03
CS-137	L.T. 2.E-03	L.T. 3.E-03	L.T. 2.E-03	L.T. 4.E-03
BA-140	L.T. 4.E-01	L.T. 5.E-01	L.T. 3.E-01	L.T. 9.E-01
LA-140	L.T. 1.E-01	L.T. 2.E-01	L.T. 2.E-01	L.T. 3.E-01
CE-141	L.T. 1.E-02	L.T. 2.E-02	L.T. 9.E-03	L.T. 2.E-02
CE-144	L.T. 2.E-02	L.T. 2.E-02	L.T. 9.E-03	L.T. 2.E-02
RA-226	L.T. 4.E-02	L.T. 6.E-02	L.T. 3.E-02	L.T. 6.E-02
TH-228	L.T. 4.E-03	L.T. 6.E-03	L.T. 3.E-03	L.T. 5.E-03

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B-3  
**NEBRASKA PUBLIC POWER DISTRICT**  
**COOPER NUCLEAR STATION**  
**EXPOSURE PATHWAY - THERMOLUMINESCENT DOSIMETRY - TLD**  
**COOPER NUCLEAR STATION 2015**

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	23.6 ± 1.3	24.6 ± 1.2	23.2 ± 0.8	24.8 ± 1.7	24.1 ± 0.8
	N01	24.7 ± 1.9	24.7 ± 1.1	23.3 ± 0.6	26.0 ± 1.5	24.7 ± 1.3
	N02	24.4 ± 1.6	24.4 ± 0.3	22.8 ± 0.4	24.6 ± 1.5	24.1 ± 0.9
	N03	23.2 ± 0.5	24.7 ± 0.8	24.4 ± 0.7	25.4 ± 0.3	24.4 ± 0.6
	N04	22.8 ± 0.5	25.9 ± 1.5	21.8 ± 0.5	23.4 ± 0.7	23.5 ± 0.8
	N05	23.7 ± 0.6	24.7 ± 1.2	24.2 ± 0.6	25.4 ± 0.9	24.5 ± 0.9
	N06	24.4 ± 0.6	24.2 ± 0.4	22.4 ± 0.3	24.9 ± 1.7	24.0 ± 0.8
	N07	27.0 ± 2.0	25.2 ± 0.8	24.2 ± 0.9	27.1 ± 0.6	25.9 ± 1.1
	N08	22.4 ± 0.7	23.6 ± 0.4	21.6 ± 0.7	24.0 ± 0.7	22.9 ± 0.6
	N09	23.5 ± 0.7	23.7 ± 0.4	22.7 ± 0.3	24.4 ± 1.8	23.6 ± 0.8
	N10	24.9 ± 0.5	25.2 ± 1.5	24.0 ± 0.9	25.3 ± 2.1	24.8 ± 1.2
	N11	23.4 ± 1.0	24.3 ± 1.0	23.7 ± 0.1	24.0 ± 0.7	23.9 ± 0.7
	N12	24.2 ± 0.7	25.5 ± 1.0	25.1 ± 0.9	26.0 ± 0.9	25.2 ± 0.9
	N13	24.3 ± 0.7	26.1 ± 0.9	24.2 ± 0.1	26.5 ± 1.1	25.3 ± 0.7
	N14	22.9 ± 0.7	24.3 ± 0.6	22.8 ± 0.8	24.8 ± 0.7	23.7 ± 0.7
	N15	23.9 ± 0.8	22.9 ± 0.7	24.5 ± 0.7	26.0 ± 0.7	24.3 ± 0.7
	N16	23.7 ± 0.5	25.6 ± 0.3	23.9 ± 0.6	25.7 ± 0.8	24.7 ± 0.6
	N17	24.0 ± 0.9	25.9 ± 0.8	23.8 ± 0.2	25.4 ± 0.2	24.8 ± 0.5
	N18	22.6 ± 0.4	24.0 ± 0.5	22.9 ± 0.5	24.4 ± 0.7	23.5 ± 0.5
	N19	25.2 ± 0.5	25.0 ± 0.6	23.9 ± 0.6	25.4 ± 1.3	24.9 ± 0.7
	N20	25.7 ± 0.4	26.3 ± 0.7	23.3 ± 1.7	26.7 ± 0.5	25.5 ± 0.8
	N21	23.7 ± 1.5	25.1 ± 0.7	23.1 ± 1.1	24.7 ± 2.1	24.1 ± 1.3

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**NEBRASKA PUBLIC POWER DISTRICT**  
**COOPER NUCLEAR STATION**  
**EXPOSURE PATHWAY - THERMOLUMINESCENT DOSIMETRY - TLD**  
**COOPER NUCLEAR STATION 2015**

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	23.6 ± 0.6	25.1 ± 0.9	24.3 ± 0.7	26.1 ± 1.1	24.8 ± 0.8
	N23	22.9 ± 0.4	24.2 ± 0.2	22.8 ± 1.8	24.6 ± 1.0	23.6 ± 0.9
	N24	25.4 ± 0.3	26.1 ± 0.3	25.1 ± 0.6	27.1 ± 0.3	25.9 ± 0.4
	N25	24.5 ± 0.4	24.0 ± 1.0	23.4 ± 0.2	25.8 ± 1.2	24.4 ± 0.7
Average/Quarter		24.0 ± 1.1	24.7 ± 0.9	23.6 ± 1.0	25.3 ± 1.0	
Range		(20.6-25.3)	(24.2-26.0)	(24.1-27.8)	(21.5-26.4)	
Detection/Total		26/26	26/26	26/26	26/26	

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**END OF DOCUMENT**