

ENVIRONMENTAL

RADIATION

DATA

REPORT 168

October–December 2016

United States Environmental Protection Agency

Office of Radiation and Indoor Air

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Contents

	Page
List of Tables	v
Preface.....	vii
Acknowledgments.....	ix
Data Reporting Conventions.....	xi
1. Air Program	1
Airborne Particulates and Precipitation	1
Plutonium and Uranium in Airborne Particulates.....	17
2. Water Program.....	19

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List of Tables

Table		Page
1	Reporting Units and Minimum Detectable Concentrations	xiii
2	Gross Beta in Airborne Particulates: October 2016	2
3	Gross Beta in Airborne Particulates: November 2016	6
4	Gross Beta in Airborne Particulates: December 2016	10
5	Gamma-Emitters in Precipitation: October 2016	14
6	Gamma-Emitters in Precipitation: November 2016	15
7	Gamma-Emitters in Precipitation: December 2016	16
8	Tritium in Drinking Water: October–December 2016	20
9	Iodine-131 in Drinking Water: January–December 2016	22

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Preface

Environmental Radiation Data (ERD) contains data from the RadNet monitoring system (formerly ERAMS), which is operated by the Office of Radiation and Indoor Air's National Analytical Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama. ERD is published in electronic format. RadNet data are also available online in EPA's searchable Envirofacts database. Both the electronic ERD reports and the Envirofacts RadNet database can be accessed at:

<https://www.epa.gov/radnet/radnet-databases-and-reports>

The United States Environmental Protection Agency established RadNet in 1973 with an emphasis on identifying trends in the accumulation of long-lived radionuclides in the environment. RadNet is comprised of a nationwide network of sampling stations that provide air particulate, precipitation, and drinking water samples.

Sampling locations are selected to provide population and geographic coverage for the United States. The radiation analyses performed on RadNet samples may include gross alpha and gross beta analysis, gamma analyses, and radionuclide-specific analyses for isotopes of uranium, plutonium, strontium, iodine, and radium, and for tritium. This monitoring effort also provides information on natural background levels and possible releases into the environment.

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Acknowledgments

All sampling for the RadNet monitoring system (formerly ERAMS) is performed by volunteer collectors who are frequently members of health departments or related environmental agencies of their respective states. The National Analytical Radiation Environmental Laboratory (NAREL), on behalf of the U.S. Environmental Protection Agency, would like to acknowledge the time and effort of these volunteer collectors, who are so essential to the successful operation of RadNet. The efforts of the sample collectors are especially appreciated during times of emergency operation when sampling frequencies are increased and schedules are sometimes demanding.

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Data Reporting Conventions

Every laboratory measurement involves uncertainty. When there is little or no radioactivity in a sample, one consequence of measurement uncertainty is the possibility of obtaining a measured value that is less than zero. Such a negative result occurs when random effects in the measurement process cause the measured value for the sample to be less than that of the blank or background, which is subtracted from it. From April 1991 to December 1995, negative results were reported as “not detected” or “ND,” and gamma analysis results that were less than their estimated measurement uncertainties were also reported as “ND.” In January 1996, both of these practices were discontinued. Although negative activities are physically impossible, the inclusion of negative results in the report allows better statistical analysis of the data.

Results of gamma analyses are still reported as “ND” when gamma-emitting radionuclides are not detected.

Measurement Uncertainty

Each measured value y is reported with an expanded uncertainty $U = k u_c(y)$, which is determined from the combined standard uncertainty $u_c(y)$ and the coverage factor $k = 2$. The interval from $y - U$ to $y + U$ is estimated to have a level of confidence of approximately 95 %.

Significant Figures

Expanded uncertainties are reported to two significant figures. Measurement results are rounded to the corresponding number of decimal places.

Detection Capability

The minimum detectable concentrations (MDCs) for each radionuclide are shown in Table 1. The MDC is defined as the minimum concentration that gives a 95 % probability of detection when the detection criteria are chosen to give only a 5 % probability of false detection in a sample that is analyte-free.

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Table 1**Reporting Units and Minimum Detectable Concentrations
for Radionuclide Analyses**

Radionuclide	Media	Reporting Unit	Minimum Detectable Concentration
Gross Alpha	Water	pCi/L	1.8
Gross Beta	Air	pCi/m ³	0.0006
	Water	pCi/L	1.4
Tritium	Water	pCi/L	150
* Plutonium-238,239/240	Air	aCi/m ³	6
	Water	pCi/L	0.3
† Uranium-234,238	Air	aCi/m ³	8
	Water	pCi/L	0.4
† Uranium-235	Air	aCi/m ³	8
	Water	pCi/L	0.4
Radium-226	Water	pCi/L	0.4
Strontium-90	Water	pCi/L	1
‡ Iodine-131	Water (gamma)	pCi/L	4
	Water	pCi/L	0.7
Cesium-137	Water	pCi/L	5
‡ Barium-140	Water	pCi/L	15
Potassium-40	Water	pCi/L	50

* The MDC for air is based on an assumed total sample volume of 10,000 m³. Measurement by alpha spectrometry includes combined activities of ²³⁹Pu and ²⁴⁰Pu, since the relative contributions of these two isotopes cannot be determined.

† The MDCs for air are based on an assumed total sample volume of 10,000 m³.

‡ Activity as of the day of counting.

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1. Air Program

Airborne Particulates and Precipitation

Gross beta radioactivity measurements and certain specific analyses are performed on air particulates and precipitation samples as indicator measurements in assessing the general (national) impact of all contributing sources on environmental levels of radiation. Continuous air samplers collect airborne particulates at field stations representing wide geographic coverage throughout the United States.

Filters (10 cm diameter synthetic fiber) from air samplers are changed routinely, and the exposed filters are sent to NAREL for analysis in a gas proportional counter. Gamma scans are performed on all filters showing gross beta activity greater than 1 pCi/m³.

All stations routinely submit precipitation samples as rainfall, snow, or sleet occurs. The precipitation samples are composited at NAREL into single monthly samples for each station. Each month that precipitation occurs, an aliquant of the composited sample is analyzed for gamma-emitting radionuclides.

Table 2
Gross Beta in Airborne Particulates
October 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min (pCi/m ³)	Avg
AK: Fairbanks	9	0.013	0.004	0.008
AK: Juneau	3	0.008	0.005	0.006
AL: Birmingham	9	0.018	0.006	0.010
AL: Mobile	3	0.009	0.006	0.007
AL: Montgomery/408	7	0.014	0.008	0.010
AR: Fort Smith	3	0.009	0.006	0.007
AR: Little Rock	8	0.021	0.006	0.012
AZ: Phoenix/956	4	0.010	0.008	0.010
AZ: Tucson	9	0.018	0.006	0.011
CA: Anaheim	8	0.018	0.006	0.010
CA: Bakersfield	2	0.017	0.015	0.016
CA: Eureka	4	0.003	0.002	0.002
CA: Los Angeles	4	0.013	0.009	0.012
CA: Richmond	4	0.005	0.004	0.005
CA: Riverside	7	0.021	0.008	0.012
CA: Sacramento	8	0.010	0.003	0.007
CA: San Bernardino	6	0.024	0.011	0.015
CA: San Diego	3	0.013	0.010	0.011
CA: San Francisco	7	0.006	0.003	0.004
CA: San Jose	7	0.010	0.002	0.006
CO: Colorado Springs	3	0.016	0.011	0.013
CO: Denver	6	0.014	0.011	0.013
CO: Grand Junction	4	0.011	0.006	0.009
CT: Hartford	8	0.008	0.002	0.005
DC: Washington	8	0.012	0.004	0.007
DE: Dover	4	0.006	0.004	0.005
FL: Jacksonville	1	0.005	0.005	0.005
FL: Miami	3	0.002	0.002	0.002
FL: Orlando	5	0.007	0.001	0.004
FL: Tallahassee	5	0.014	0.005	0.009
FL: Tampa	7	0.014	0.002	0.006
GA: Augusta	4	0.012	0.005	0.008
HI: Honolulu	7	0.005	0.002	0.004
IA: Des Moines	4	0.013	0.006	0.009
IA: Fort Madison	6	0.008	0.006	0.007
IA: Mason City	6	0.021	0.006	0.010
ID: Boise	5	0.007	0.002	0.004
ID: Idaho Falls	9	0.012	0.002	0.007

Table 2 (continued)
Gross Beta in Airborne Particulates
October 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min (pCi/m ³)	Avg
IL: Aurora	4	0.013	0.006	0.009
IL: Champaign	8	0.014	0.007	0.012
IL: Chicago	6	0.011	0.005	0.008
IN: Fort Wayne	2	0.010	0.005	0.008
IN: Indianapolis	9	0.013	0.005	0.008
KS: Kansas City	8	0.023	0.007	0.011
KS: Wichita	8	0.022	0.007	0.012
KY: Lexington	8	0.018	0.008	0.012
KY: Louisville	6	0.012	0.007	0.009
KY: Paducah	7	0.022	0.006	0.013
LA: Baton Rouge	7	0.009	0.004	0.007
LA: Shreveport	2	0.017	0.008	0.012
MA: Boston	10	0.008	0.001	0.005
MA: Worcester	5	0.011	0.006	0.008
MD: Baltimore	7	0.008	0.003	0.006
ME: Orono	3	0.003	0.001	0.002
ME: Portland	8	0.009	0.001	0.005
MI: Bay City 48708	9	0.006	0.003	0.005
MI: Detroit	9	0.016	0.004	0.007
MI: Grand Rapids	4	0.008	0.003	0.006
MN: Duluth	9	0.009	0.004	0.006
MN: St. Paul	2	0.010	0.005	0.007
MO: Jefferson City	9	0.018	0.007	0.011
MO: Springfield	6	0.014	0.009	0.011
MO: St. Louis	3	0.012	0.009	0.010
MS: Jackson/Deq	4	0.014	0.007	0.011
MT: Billings	2	0.012	0.008	0.010
NC: Charlotte	6	0.012	0.004	0.009
NC: Greensboro	1	0.005	0.005	0.005
NC: Raleigh	4	0.007	0.003	0.006
NC: Wilmington	4	0.006	0.002	0.004
ND: Bismarck	8	0.019	0.004	0.009
NE: Lincoln	9	0.022	0.004	0.010
NE: Omaha	3	0.011	0.009	0.010
NH: Concord	7	0.007	0.002	0.004
NJ: Edison	3	0.008	0.005	0.006
NM: Albuquerque	1	0.009	0.009	0.009
NM: Carlsbad	7	0.015	0.008	0.010

Table 2 (continued)
Gross Beta in Airborne Particulates
October 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min	Avg
NV: Las Vegas/913	3	0.015	0.009	0.012
NV: Reno	6	0.014	0.004	0.007
NY: Albany	9	0.012	0.002	0.005
NY: Lockport	7	0.010	0.003	0.007
NY: New York City	2	0.009	0.005	0.007
NY: Rochester	5	0.008	0.002	0.005
NY: Yaphank	4	0.009	0.004	0.006
OH: Cincinnati	10	0.012	0.006	0.008
OH: Cleveland	8	0.012	0.006	0.008
OH: Columbus	7	0.014	0.007	0.010
OH: Toledo	9	0.015	0.005	0.008
OK: Oklahoma City	7	0.011	0.007	0.009
OK: Tulsa	7	0.024	0.008	0.012
OR: Corvallis	9	0.007	0.002	0.004
OR: Portland	4	0.005	0.001	0.003
PA: Bloomsburg	9	0.005	0.002	0.004
PA: Philadelphia	3	0.006	0.004	0.005
PA: Pittsburgh	4	0.008	0.004	0.006
PR: San Juan	8	0.008	0.002	0.005
RI: Providence	3	0.006	0.002	0.004
SC: Columbia	3	0.012	0.008	0.010
SD: Pierre	8	0.013	0.006	0.009
SD: Rapid City	6	0.011	0.003	0.007
TN: Knoxville	4	0.015	0.009	0.011
TN: Memphis	8	0.021	0.006	0.012
TN: Nashville	9	0.021	0.006	0.012
TN: Oak Ridge/Bethel	8	0.026	0.006	0.014
TN: Oak Ridge/K25	8	0.023	0.006	0.013
TN: Oak Ridge/Melton	8	0.015	0.004	0.009
TN: Oak Ridge/Y12 E	8	0.024	0.005	0.013
TN: Oak Ridge/Y12 W	8	0.018	0.005	0.012
TX: Amarillo	5	0.017	0.008	0.013
TX: Austin	3	0.007	0.005	0.006
TX: Corpus Christi	8	0.011	0.004	0.007
TX: Dallas	6	0.012	0.005	0.008
TX: El Paso	8	0.013	0.006	0.009
TX: Fort Worth	1	0.012	0.012	0.012
TX: Harlingen	1	0.005	0.005	0.005

Table 2 (continued)
Gross Beta in Airborne Particulates
October 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min (pCi/m ³)	Avg
TX: Houston	7	0.009	0.004	0.006
TX: Lubbock	8	0.012	0.005	0.010
TX: San Angelo	8	0.008	0.003	0.006
UT: St. George	3	0.011	0.008	0.009
VA: Harrisonburg	8	0.015	0.004	0.009
VA: Richmond	4	0.009	0.005	0.007
VA: Virginia Beach	4	0.009	0.004	0.007
VT: Burlington	6	0.006	0.001	0.003
WA: Ellensburg	2	0.006	0.006	0.006
WA: Olympia	7	0.006	0.003	0.004
WA: Richland	3	0.006	0.004	0.004
WA: Seattle	4	0.005	0.002	0.004
WA: Spokane	6	0.006	0.003	0.005
WI: La Crosse	4	0.006	0.004	0.005
WI: Madison	8	0.015	0.005	0.009
WI: Milwaukee	8	0.019	0.004	0.008
WI: Shawano	9	0.011	0.004	0.007
WV: Charleston	5	0.011	0.006	0.008
WY: Casper	3	0.006	0.005	0.006

Table 3
Gross Beta in Airborne Particulates
November 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min (pCi/m ³)	Avg
AK: Anchorage	4	0.007	0.001	0.005
AK: Fairbanks	8	0.010	0.004	0.006
AK: Juneau	2	0.006	0.001	0.003
AL: Birmingham	8	0.023	0.008	0.014
AL: Mobile	5	0.015	0.013	0.014
AL: Montgomery/408	7	0.021	0.008	0.013
AR: Fort Smith	2	0.015	0.010	0.012
AR: Little Rock	6	0.022	0.008	0.012
AZ: Tucson	7	0.017	0.006	0.011
CA: Anaheim	6	0.019	0.003	0.011
CA: Bakersfield	3	0.033	0.006	0.017
CA: Eureka	2	0.002	0.002	0.002
CA: Los Angeles	3	0.025	0.006	0.017
CA: Richmond	5	0.011	0.003	0.005
CA: Riverside	7	0.021	0.007	0.014
CA: Sacramento	8	0.030	0.004	0.010
CA: San Bernardino	8	0.021	0.006	0.013
CA: San Diego	5	0.020	0.006	0.010
CA: San Francisco	9	0.008	0.002	0.004
CA: San Jose	7	0.017	0.003	0.006
CO: Colorado Springs	3	0.016	0.006	0.011
CO: Denver	5	0.018	0.009	0.013
CO: Grand Junction	4	0.022	0.007	0.015
CT: Hartford	8	0.014	0.002	0.007
DC: Washington	7	0.014	0.006	0.010
DE: Dover	3	0.009	0.005	0.007
FL: Jacksonville	5	0.016	0.007	0.010
FL: Orlando	5	0.018	0.007	0.010
FL: Tallahassee	4	0.023	0.009	0.015
FL: Tampa	7	0.021	0.007	0.014
GA: Atlanta	2	0.019	0.014	0.016
GA: Augusta	4	0.025	0.011	0.017
HI: Honolulu	9	0.008	0.002	0.004
IA: Des Moines	7	0.021	0.007	0.012
IA: Fort Madison	4	0.015	0.009	0.013
IA: Mason City	3	0.017	0.010	0.013
ID: Boise	6	0.017	0.004	0.008
ID: Idaho Falls	8	0.021	0.004	0.011

Table 3 (continued)
Gross Beta in Airborne Particulates
November 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min (pCi/m ³)	Avg
IL: Aurora	4	0.016	0.011	0.014
IL: Champaign	7	0.035	0.009	0.019
IL: Chicago	5	0.038	0.011	0.019
IN: Fort Wayne	4	0.017	0.009	0.012
IN: Indianapolis	8	0.025	0.006	0.012
KS: Kansas City	4	0.033	0.009	0.016
KS: Wichita	5	0.022	0.009	0.014
KY: Lexington	5	0.027	0.008	0.016
KY: Louisville	6	0.030	0.007	0.016
KY: Paducah	4	0.024	0.010	0.015
LA: Baton Rouge	2	0.012	0.009	0.011
LA: Shreveport	3	0.017	0.011	0.014
MA: Boston	7	0.009	0.003	0.006
MA: Worcester	5	0.010	0.003	0.006
MD: Baltimore	5	0.015	0.005	0.009
ME: Orono	3	0.003	0.001	0.002
ME: Portland	7	0.008	0.002	0.005
MI: Bay City 48708	8	0.016	0.005	0.009
MI: Detroit	7	0.018	0.005	0.011
MI: Grand Rapids	4	0.011	0.011	0.011
MN: Duluth	8	0.015	0.004	0.009
MN: St. Paul	4	0.018	0.011	0.014
MO: Jefferson City	8	0.024	0.005	0.012
MO: Springfield	6	0.026	0.007	0.017
MO: St. Louis	1	0.013	0.013	0.013
MS: Jackson/Deq	4	0.019	0.014	0.017
MT: Billings	3	0.019	0.013	0.016
NC: Charlotte	8	0.028	0.007	0.015
NC: Greensboro	2	0.010	0.009	0.010
NC: Raleigh	4	0.014	0.007	0.009
NC: Wilmington	1	0.006	0.006	0.006
ND: Bismarck	7	0.023	0.005	0.012
NE: Lincoln	3	0.014	0.010	0.012
NH: Concord	8	0.007	0.002	0.004
NJ: Edison	5	0.007	0.005	0.006
NM: Albuquerque	4	0.015	0.007	0.010
NM: Carlsbad	6	0.016	0.009	0.013
NV: Las Vegas/913	5	0.031	0.004	0.016

Table 3 (continued)
Gross Beta in Airborne Particulates
November 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min (pCi/m ³)	Avg
NV: Reno	9	0.023	0.002	0.008
NY: Albany	5	0.017	0.005	0.008
NY: Lockport	8	0.014	0.003	0.008
NY: New York City	3	0.010	0.007	0.008
NY: Rochester	7	0.010	0.002	0.006
NY: Yaphank	6	0.010	0.005	0.007
OH: Cincinnati	9	0.018	0.006	0.012
OH: Cleveland	5	0.027	0.006	0.014
OH: Columbus	6	0.032	0.006	0.015
OH: Toledo	9	0.021	0.006	0.013
OK: Oklahoma City	6	0.019	0.006	0.014
OK: Tulsa	8	0.030	0.010	0.017
OR: Corvallis	6	0.006	0.002	0.004
OR: Portland	7	0.006	0.002	0.003
PA: Bloomsburg	7	0.011	0.004	0.006
PA: Philadelphia	6	0.026	0.008	0.012
PA: Pittsburgh	4	0.017	0.008	0.012
PR: San Juan	9	0.004	0.001	0.002
RI: Providence	4	0.006	0.002	0.004
SC: Columbia	5	0.021	0.008	0.015
SD: Pierre	6	0.018	0.004	0.011
SD: Rapid City	4	0.012	0.006	0.008
TN: Knoxville	1	0.020	0.020	0.020
TN: Memphis	7	0.020	0.010	0.014
TN: Nashville	6	0.023	0.008	0.016
TN: Oak Ridge/Bethel	5	0.037	0.017	0.025
TN: Oak Ridge/K25	5	0.035	0.015	0.026
TN: Oak Ridge/Melton	5	0.025	0.010	0.017
TN: Oak Ridge/Y12 E	5	0.038	0.015	0.025
TN: Oak Ridge/Y12 W	5	0.036	0.013	0.022
TX: Amarillo	4	0.020	0.010	0.014
TX: Austin	1	0.008	0.008	0.008
TX: Corpus Christi	7	0.020	0.006	0.012
TX: Dallas	8	0.022	0.012	0.015
TX: El Paso	8	0.016	0.006	0.010
TX: Fort Worth	2	0.023	0.014	0.019
TX: Harlingen	1	0.010	0.010	0.010
TX: Houston	8	0.032	0.008	0.015

Table 3 (continued)
Gross Beta in Airborne Particulates
November 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min	Avg
TX: Laredo	7	0.025	0.007	0.014
TX: Lubbock	6	0.019	0.007	0.011
TX: San Angelo	8	0.014	0.003	0.010
TX: San Antonio	9	0.022	0.006	0.014
UT: Salt Lake City	2	0.047	0.006	0.027
UT: St. George	2	0.010	0.007	0.009
VA: Harrisonburg	8	0.028	0.006	0.013
VA: Richmond	5	0.017	0.006	0.011
VA: Virginia Beach	3	0.015	0.006	0.011
VT: Burlington	8	0.009	0.002	0.005
WA: Ellensburg	2	0.010	0.006	0.008
WA: Olympia	6	0.006	0.002	0.004
WA: Richland	1	0.006	0.006	0.006
WA: Seattle	4	0.005	0.003	0.004
WA: Spokane	4	0.010	0.006	0.007
WI: La Crosse	2	0.009	0.006	0.008
WI: Madison	8	0.039	0.006	0.017
WI: Milwaukee	8	0.038	0.006	0.016
WI: Shawano	7	0.018	0.005	0.010
WV: Charleston	6	0.029	0.010	0.015
WY: Casper	4	0.011	0.005	0.007

Table 4
Gross Beta in Airborne Particulates
December 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min (pCi/m ³)	Avg
AK: Anchorage	2	0.008	0.004	0.006
AK: Fairbanks	5	0.015	0.005	0.009
AK: Juneau	3	0.006	0.001	0.004
AL: Birmingham	6	0.016	0.006	0.012
AL: Mobile	4	0.012	0.007	0.010
AL: Montgomery/408	8	0.012	0.004	0.008
AR: Fort Smith	2	0.014	0.008	0.011
AR: Little Rock	5	0.020	0.009	0.013
AZ: Phoenix/956	4	0.011	0.006	0.009
AZ: Tucson	7	0.015	0.007	0.011
AZ: Yuma	1	0.010	0.010	0.010
CA: Anaheim	9	0.014	0.004	0.009
CA: Eureka	4	0.005	0.002	0.003
CA: Fresno	3	0.024	0.009	0.015
CA: Los Angeles	2	0.012	0.007	0.010
CA: Richmond	4	0.008	0.004	0.006
CA: Riverside	7	0.013	0.005	0.008
CA: Sacramento	8	0.016	0.007	0.010
CA: San Bernardino	9	0.020	0.004	0.009
CA: San Diego	4	0.009	0.005	0.008
CA: San Francisco	9	0.011	0.002	0.005
CA: San Jose	7	0.011	0.003	0.005
CO: Colorado Springs	5	0.014	0.009	0.012
CO: Denver	8	0.028	0.008	0.015
CO: Grand Junction	4	0.021	0.010	0.018
CT: Hartford	9	0.014	0.004	0.007
DC: Washington	9	0.015	0.008	0.011
DE: Dover	1	0.008	0.008	0.008
FL: Jacksonville	4	0.008	0.005	0.007
FL: Miami	4	0.005	0.002	0.004
FL: Orlando	6	0.007	0.004	0.005
FL: Tallahassee	4	0.008	0.007	0.008
FL: Tampa	8	0.014	0.004	0.007
GA: Atlanta	5	0.019	0.009	0.014
GA: Augusta	6	0.011	0.005	0.008
HI: Honolulu	8	0.003	0.001	0.002
IA: Des Moines	8	0.018	0.008	0.012
IA: Fort Madison	5	0.018	0.009	0.013

Table 4 (continued)
Gross Beta in Airborne Particulates
December 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min	Avg
		(pCi/m ³)		
IA: Mason City	6	0.017	0.009	0.013
ID: Boise	7	0.029	0.003	0.012
ID: Idaho Falls	9	0.021	0.003	0.010
IL: Aurora	4	0.013	0.009	0.012
IL: Champaign	8	0.021	0.010	0.015
IL: Chicago	5	0.012	0.008	0.011
IN: Fort Wayne	3	0.014	0.010	0.012
IN: Indianapolis	9	0.015	0.007	0.010
KS: Dodge City	1	0.009	0.009	0.009
KS: Kansas City	7	0.021	0.009	0.015
KS: Wichita	8	0.020	0.007	0.013
KY: Lexington	8	0.025	0.008	0.015
KY: Louisville	6	0.015	0.010	0.012
KY: Paducah	4	0.021	0.012	0.016
LA: Baton Rouge	7	0.014	0.005	0.009
MA: Boston	6	0.010	0.004	0.007
MA: Worcester	8	0.013	0.004	0.006
MD: Baltimore	3	0.012	0.009	0.010
ME: Orono	2	0.006	0.001	0.003
ME: Portland	9	0.014	0.004	0.008
MI: Bay City 48708	8	0.015	0.006	0.010
MI: Detroit	8	0.017	0.007	0.011
MI: Grand Rapids	4	0.010	0.008	0.009
MN: Duluth	8	0.015	0.006	0.012
MN: St. Paul	4	0.016	0.010	0.012
MO: Jefferson City	8	0.020	0.007	0.012
MO: Springfield	5	0.017	0.009	0.013
MS: Jackson/Deq	4	0.014	0.009	0.011
MT: Billings	2	0.021	0.020	0.020
MT: Kalispell	2	0.008	0.004	0.006
NC: Charlotte	7	0.014	0.006	0.011
NC: Greensboro	1	0.008	0.008	0.008
NC: Raleigh	4	0.009	0.006	0.007
NC: Wilmington	3	0.008	0.006	0.007
ND: Bismarck	7	0.015	0.006	0.011
NE: Lincoln	7	0.018	0.006	0.012
NE: Omaha	3	0.021	0.012	0.016
NH: Concord	7	0.013	0.004	0.007

Table 4 (continued)
Gross Beta in Airborne Particulates
December 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min (pCi/m ³)	Avg
NJ: Edison	4	0.008	0.006	0.007
NM: Albuquerque	2	0.009	0.005	0.007
NM: Carlsbad	5	0.023	0.006	0.013
NV: Las Vegas/913	3	0.022	0.010	0.017
NV: Reno	8	0.014	0.003	0.007
NY: Albany	3	0.013	0.004	0.008
NY: Lockport	9	0.015	0.007	0.010
NY: New York City	4	0.011	0.006	0.009
NY: Rochester	6	0.011	0.005	0.007
NY: Syracuse	2	0.011	0.010	0.011
NY: Yaphank	9	0.015	0.005	0.009
OH: Cincinnati	8	0.014	0.007	0.010
OH: Cleveland	7	0.022	0.010	0.015
OH: Columbus	8	0.017	0.010	0.013
OH: Toledo	8	0.026	0.009	0.013
OK: Oklahoma City	5	0.017	0.007	0.011
OK: Tulsa	8	0.025	0.009	0.016
OR: Corvallis	9	0.017	0.002	0.005
OR: Portland	7	0.013	0.002	0.005
PA: Bloomsburg	7	0.010	0.004	0.006
PA: Philadelphia	5	0.010	0.006	0.008
PA: Pittsburgh	4	0.011	0.008	0.010
PR: San Juan	8	0.005	0.001	0.002
RI: Providence	3	0.007	0.004	0.005
SC: Columbia	3	0.012	0.009	0.011
SD: Pierre	5	0.013	0.005	0.008
SD: Rapid City	6	0.016	0.003	0.009
TN: Knoxville	4	0.013	0.007	0.011
TN: Memphis	6	0.022	0.010	0.015
TN: Nashville	8	0.019	0.009	0.013
TN: Oak Ridge/Bethel	8	0.021	0.011	0.015
TN: Oak Ridge/K25	8	0.024	0.010	0.015
TN: Oak Ridge/Melton	8	0.018	0.007	0.011
TN: Oak Ridge/Y12 E	8	0.026	0.009	0.015
TN: Oak Ridge/Y12 W	8	0.020	0.008	0.013
TX: Amarillo	9	0.030	0.007	0.015
TX: Austin	3	0.010	0.005	0.008
TX: Corpus Christi	6	0.019	0.005	0.013

Table 4 (continued)
Gross Beta in Airborne Particulates
December 2016

Location	Number of Samples	NAREL Lab Measurement		
		Max	Min (pCi/m ³)	Avg
TX: Dallas	8	0.039	0.006	0.014
TX: El Paso	8	0.018	0.004	0.010
TX: Fort Worth	2	0.015	0.013	0.014
TX: Harlingen	1	0.005	0.005	0.005
TX: Houston	6	0.021	0.004	0.011
TX: Laredo	2	0.008	0.005	0.006
TX: Lubbock	7	0.024	0.005	0.012
TX: San Angelo	5	0.030	0.005	0.012
TX: San Antonio	9	0.033	0.005	0.013
UT: Salt Lake City	3	0.012	0.005	0.009
UT: St. George	2	0.008	0.007	0.008
VA: Harrisonburg	5	0.012	0.006	0.009
VA: Richmond	4	0.012	0.006	0.010
VA: Virginia Beach	5	0.011	0.008	0.010
VT: Burlington	7	0.009	0.002	0.005
WA: Ellensburg	4	0.027	0.008	0.015
WA: Olympia	7	0.012	0.002	0.005
WA: Richland	3	0.016	0.002	0.008
WA: Seattle	4	0.008	0.002	0.005
WA: Spokane	8	0.017	0.003	0.008
WI: La Crosse	3	0.011	0.006	0.009
WI: Madison	9	0.020	0.010	0.014
WI: Milwaukee	8	0.014	0.007	0.012
WI: Shawano	7	0.013	0.006	0.010
WV: Charleston	2	0.009	0.007	0.008
WY: Casper	3	0.013	0.007	0.009

Table 5
Gamma-Emitters in Precipitation
October 2016

Location	Nuclide	pCi/L $\pm 2u$	
AL: Montgomery/408		ND	
AR: Little Rock	Be-7	42	20
CA: Richmond		ND	
CT: Hartford	Be-7	40	18
FL: Jacksonville		ND	
GA: Atlanta		ND	
HI: Honolulu		ND	
ID: Idaho Falls		ND	
KS: Kansas City	Be-7	24	17
MA: Boston	Be-7	25	16
MI: Lansing		ND	
MN: St. Paul		ND	
MN: Welch/510		ND	
NC: Charlotte		ND	
NC: Wilmington		ND	
NH: Concord		ND	
NY: Albany		ND	
OR: Portland	Be-7	30	20
PA: Harrisburg		ND	
TN: Oak Ridge/Melton		ND	
TN: Oak Ridge/Y12 E		ND	
UT: Salt Lake City		ND	
VA: Lynchburg		ND	
WA: Olympia		ND	

Table 6
Gamma-Emitters in Precipitation
November 2016

Location	Nuclide	pCi/L $\pm 2u$	
AL: Montgomery/408		ND	
AR: Little Rock		ND	
CA: Richmond		ND	
CT: Hartford	Be-7	37	14
HI: Honolulu		ND	
KS: Kansas City		ND	
MI: Lansing	Be-7	19	17
MN: St. Paul		ND	
MN: Welch/510		ND	
NC: Wilmington		ND	
NH: Concord		ND	
NY: Albany	Be-7	35	18
OR: Portland	Be-7	26	14
TN: Oak Ridge/K25	Be-7	38	14
TN: Oak Ridge/Melton	Be-7	51	21
TN: Oak Ridge/Y12 E	Be-7	26	13
UT: Salt Lake City		ND	
VA: Lynchburg		ND	
WA: Olympia		ND	

Table 7
Gamma-Emitters in Precipitation
December 2016

Location	Nuclide	pCi/L \pm 2 <i>u</i>	
AL: Montgomery/408		ND	
AR: Little Rock	Be-7	41	26
CA: Richmond		ND	
CT: Hartford	Be-7	33	13
FL: Jacksonville		ND	
GA: Atlanta		ND	
HI: Honolulu		ND	
ID: Idaho Falls	Be-7	59	16
KS: Kansas City		ND	
MA: Boston	Be-7	61	14
MN: St. Paul		ND	
MN: Welch/510		ND	
NC: Charlotte		ND	
NC: Wilmington		ND	
NH: Concord		ND	
NY: Albany	Be-7	19	11
OR: Portland	Be-7	34	17
TN: Knoxville		ND	
TN: Nashville		ND	
TN: Oak Ridge/K25	Be-7	52	16
TN: Oak Ridge/Melton	Be-7	40	14
TN: Oak Ridge/Y12 E	Be-7	32	11
TX: Austin		ND	
UT: Salt Lake City		ND	
VA: Lynchburg		ND	
WA: Olympia		ND	

Plutonium and Uranium in Airborne Particulates

Environmental radiation levels of plutonium and uranium are determined by the analysis of annually composited samples (air filters) collected from the airborne particulate samplers. Plutonium and uranium results are published in the ERD for the third quarter of the following year.

Concentrations of plutonium-238, combined plutonium-239 and 240, and uranium-234, 235, and 238 are determined by alpha-particle spectrometry following chemical separation. The total volume of air represented by all the samples received from one sampling location during a year typically ranges from 120,000 m³ to 500,000 m³. The aliquot analyzed is a fraction of the total volume and is typically between 5,000 m³ and 30,000 m³.

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2. Drinking Water Program

The RadNet drinking water program provides data on radionuclide concentrations in the nation's drinking water supplies. Sampling sites are either major population centers or selected nuclear facility environs.

Drinking water data are used to assess trends and anomalies in concentrations. The analysis scheme for RadNet samples is similar to that of EPA's "National Interim Primary Drinking Water Regulations." The analyses include (a) tritium on a quarterly basis; (b) gross alpha, gross beta, and gamma on annual composites; (c) radium-226 if the gross alpha exceeds 2 pCi/L and radium-228 if the radium-226 falls between 3 and 5 pCi/L on annual composites; (d) iodine-131 on one quarterly sample per year for each station; (e) plutonium-238, combined plutonium-239 and 240, and uranium-234, 235, and 238 for stations that demonstrate gross alpha levels greater than 2 pCi/L on annual composites; and (f) strontium-90 on one-fourth of the annual composites on a four year rotating schedule. Composite results are published in the ERD for the third quarter of the following year.

RadNet drinking water data should not be used to monitor compliance with drinking water regulations or for comparisons to those data since different procedures for collection and analysis may be used.

Table 8
Tritium in Drinking Water
October–December 2016

Location	Date Collected	³ H pCi/L ± 2 <i>u</i>
AK: Fairbanks	11/21/16	2 86
AL: Dothan	10/06/16	-60 87
AL: Montgomery/408	10/17/16	-46 87
AL: Muscle Shoals	10/13/16	61 92
AL: Scottsboro	10/12/16	171 96
AR: Little Rock	10/04/16	-110 85
CT: Hartford	10/25/16	40 88
DE: Dover	10/25/16	-13 86
FL: Miami	12/27/16	126 95
FL: Tampa	10/27/16	-46 85
FL: Tampa	12/30/16	-36 88
GA: Baxley	11/17/16	-64 84
GA: Savannah	12/16/16	-101 86
HI: Honolulu	11/15/16	-46 88
IA: Cedar Rapids	11/14/16	6 87
ID: Idaho Falls	11/10/16	17 87
KS: Topeka	12/02/16	-15 90
LA: New Orleans	12/22/16	91 94
MD: Baltimore	10/13/16	-31 88
MD: Conowingo	12/12/16	-72 87
MI: Detroit	12/20/16	73 93
MN: S. St. Paul	10/04/16	4 89
MN: Welch	10/04/16	-56 87
MO: Jefferson City	11/08/16	9 87
MT: Helena	12/30/16	72 92
ND: Bismarck	10/11/16	2 89
NE: Lincoln	10/12/16	-40 88
NJ: Trenton	10/19/16	127 92
NJ: Waretown	10/20/16	-15 85
NM: Santa Fe	10/18/16	-2 87
NY: New York City	12/28/16	21 91
NY: Niagara Falls	12/06/16	-27 89
NY: Syracuse	11/04/16	46 89
OH: Cincinnati	11/28/16	168 94
OH: Columbus	12/09/16	-29 89
OH: E. Liverpool	11/01/16	9 87
OH: Painesville	12/13/16	38 92
OH: Toledo	12/21/16	36 92
OK: Oklahoma City	12/22/16	-4 90
PA: Columbia	12/12/16	53 92

Table 8 (continued)
Tritium in Drinking Water
October–December 2016

Location	Date Collected	³ H pCi/L ± 2 <i>u</i>
PA: Harrisburg	12/30/16	-30 89
PA: Pittsburgh	11/01/16	28 88
RI: Providence	11/21/16	-25 89
SC: Barnwell	10/25/16	-11 86
SC: Columbia	10/17/16	30 88
SC: Hartsville	10/03/16	8 89
SC: Rock Hill	10/10/16	1360 140
SC: Seneca	10/05/16	25 90
TN: Knoxville	10/27/16	-27 85
TN: Oak Ridge/#360	10/04/16	15 90
TN: Oak Ridge/#371	10/04/16	-12 89
TN: Oak Ridge/#768	10/04/16	-25 89
TN: Oak Ridge/#772	10/04/16	-13 89
TX: Austin	10/03/16	-33 88
WA: Richland	12/08/16	-69 87

Table 9
Iodine-131 in Drinking Water
January–December 2016

Location	Date Collected	¹³¹ I	
		pCi/L	± 2u
AK: Fairbanks	02/24/16	0.06	0.31
AL: Dothan	01/05/16	0.02	0.16
AL: Montgomery/408	01/08/16	-0.03	0.14
AL: Muscle Shoals	01/14/16	0.05	0.32
AL: Scottsboro	01/13/16	0.00	0.18
AR: Little Rock	05/12/16	0.04	0.32
CO: Denver	05/02/16	-0.07	0.36
CT: Hartford	07/15/16	0.04	0.17
DE: Dover	03/14/16	0.07	0.18
FL: Miami	03/29/16	0.00	0.19
FL: Tampa	03/17/16	0.10	0.50
GA: Baxley	05/17/16	0.01	0.34
GA: Savannah	06/08/16	0.35	0.62
HI: Honolulu	05/27/16	0.11	0.52
IA: Cedar Rapids	01/22/16	0.04	0.13
ID: Idaho Falls	06/13/16	0.25	0.25
IL: W. Chicago	04/12/16	-0.01	0.16
KS: Topeka	03/23/16	0.02	0.17
LA: New Orleans	03/28/16	0.01	0.24
MD: Baltimore	01/29/16	0.27	0.52
MD: Conowingo	03/22/16	0.05	0.16
MI: Detroit	01/19/16	-0.03	0.19
MN: S. St. Paul	10/04/16	0.02	0.32
MN: St. Paul	04/04/16	0.21	0.21
MN: St. Paul	07/11/16	0.00	0.38
MN: Welch	04/04/16	0.27	0.40
MO: Jefferson City	02/26/16	0.14	0.28
MS: Jackson	03/08/16	0.10	0.32
MS: Port Gibson	03/08/16	0.08	0.16
MT: Helena	06/28/16	0.06	0.35
ND: Bismarck	04/26/16	0.07	0.64
NE: Lincoln	01/07/16	0.03	0.17
NJ: Trenton	06/06/16	0.32	0.27
NJ: Waretown	06/09/16	0.14	0.17
NM: Santa Fe	07/21/16	0.01	0.16
NY: Albany	06/30/16	0.21	0.33
NY: New York City	03/21/16	-0.04	0.18
NY: New York City	12/28/16	0.20	0.34
NY: Niagara Falls	07/06/16	0.23	0.22
NY: Syracuse	11/04/16	-0.03	0.51
OH: Cincinnati	05/13/16	0.02	0.46

Table 9 (continued)
Iodine-131 in Drinking Water
January–December 2016

Location	Date Collected	¹³¹ I	
		pCi/L	± 2 <i>u</i>
OH: Columbus	03/15/16	0.09	0.15
OH: E. Liverpool	02/04/16	0.13	0.17
OH: Painesville	05/18/16	0.12	0.32
OH: Toledo	03/29/16	-0.04	0.19
OK: Oklahoma City	03/09/16	0.05	0.25
PA: Columbia	02/25/16	0.11	0.19
PA: Columbia	06/28/16	0.07	0.19
PA: Harrisburg	09/28/16	0.1	1.1
PA: Pittsburgh	02/04/16	0.03	0.18
RI: Providence	07/05/16	0.02	0.21
SC: Barnwell	04/21/16	0.09	0.16
SC: Columbia	01/22/16	0.03	0.16
SC: Hartsville	04/13/16	-0.05	0.16
SC: Jenkinsville	01/12/16	-0.03	0.20
SC: Rock Hill	04/20/16	0.01	0.15
SC: Seneca	04/15/16	0.14	0.49
TN: Knoxville	02/04/16	0.06	0.19
TN: Oak Ridge/#360	01/04/16	-0.08	0.17
TN: Oak Ridge/#371	01/04/16	-0.01	0.18
TN: Oak Ridge/#768	01/04/16	-0.03	0.18
TN: Oak Ridge/#772	01/04/16	-0.03	0.21
TX: Austin	01/04/16	-0.04	0.20
WA: Richland	03/09/16	0.04	0.17
WI: Madison	07/19/16	0.03	0.17

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For More Information

Environmental Radiation Data (ERD) is published quarterly by the U.S. Environmental Protection Agency's Office of Radiation and Indoor Air.

Requests for information concerning the operation of RadNet, the data that are generated, or publication and distribution of ERD should be directed to:

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