ENVIRONMENTAL

RADIATION

DATA

REPORT 166

April–June 2016

United States Environmental Protection Agency

Office of Radiation and Indoor Air

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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/m³	0.0006
	Water	pCi/L	1.4
Tritium	Water	pCi/L	150
* Plutonium-238,239/240	Air	aCi/m³	6
	Water	pCi/L	0.3
† Uranium-234,238	Air	aCi/m³	8
	Water	pCi/L	0.4
† Uranium-235	Air	aCi/m³	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 ^{239}Pu and ^{240}Pu, 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 m^3.

‡ 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/m^3.

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
April 2016

Location	Number of Samples	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
AK: Anchorage	3	0.004	0.002	0.003
AK: Fairbanks	7	0.011	0.005	0.008
AK: Juneau	4	0.002	0.001	0.002
AL: Birmingham	8	0.011	0.005	0.007
AL: Mobile	2	0.005	0.005	0.005
AL: Montgomery/408	7	0.010	0.005	0.007
AR: Fort Smith	3	0.006	0.006	0.006
AR: Little Rock	7	0.009	0.006	0.008
AZ: Phoenix/956	3	0.013	0.004	0.008
AZ: Tucson	5	0.012	0.006	0.008
AZ: Yuma	1	0.014	0.014	0.014
CA: Anaheim	8	0.010	0.004	0.007
CA: Bakersfield	2	0.011	0.010	0.010
CA: Eureka	5	0.003	0.002	0.003
CA: Fresno	3	0.008	0.004	0.006
CA: Los Angeles	5	0.010	0.005	0.007
CA: Richmond	4	0.007	0.003	0.005
CA: Riverside	7	0.014	0.005	0.007
CA: Sacramento	8	0.012	0.004	0.008
CA: San Bernardino	6	0.014	0.006	0.009
CA: San Diego	3	0.009	0.005	0.007
CA: San Francisco	9	0.007	0.003	0.005
CA: San Jose	9	0.011	0.003	0.006
CO: Colorado Springs	3	0.008	0.007	0.007
CO: Denver	8	0.010	0.003	0.007
CO: Grand Junction	3	0.010	0.007	0.008
CT: Hartford	9	0.007	0.004	0.005
DC: Washington	9	0.010	0.005	0.008
DE: Dover	3	0.007	0.004	0.006
FL: Jacksonville	9	0.009	0.005	0.006
FL: Miami	2	0.007	0.004	0.006
FL: Orlando	6	0.008	0.004	0.006
FL: Tallahassee	2	0.008	0.004	0.006
FL: Tampa	8	0.009	0.006	0.008
GA: Atlanta	2	0.010	0.010	0.010
GA: Augusta	3	0.006	0.005	0.006
HI: Honolulu	8	0.006	0.002	0.005
IA: Des Moines	5	0.004	0.003	0.004

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

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
IA: Mason City	6	0.010	0.006	0.008
ID: Boise	4	0.006	0.004	0.005
ID: Idaho Falls	8	0.008	0.004	0.006
IL: Aurora	4	0.010	0.007	0.009
IL: Champaign	7	0.013	0.007	0.010
IL: Chicago	6	0.008	0.005	0.006
IN: Fort Wayne	4	0.009	0.006	0.008
IN: Indianapolis	9	0.010	0.005	0.007
KS: Kansas City	8	0.012	0.005	0.008
KS: Wichita	2	0.007	0.007	0.007
KY: Lexington	6	0.011	0.005	0.008
KY: Louisville	7	0.012	0.005	0.008
KY: Paducah	8	0.010	0.007	0.008
LA: Baton Rouge	8	0.007	0.004	0.005
LA: Shreveport	3	0.011	0.006	0.009
MA: Boston	9	0.008	0.005	0.006
MA: Worcester	7	0.010	0.006	0.008
MD: Baltimore	7	0.009	0.006	0.007
ME: Orono	3	0.007	0.006	0.006
ME: Portland	6	0.012	0.007	0.009
MI: Bay City 48708	7	0.007	0.005	0.006
MI: Detroit	4	0.008	0.005	0.007
MI: Grand Rapids	5	0.011	0.007	0.009
MN: Duluth	8	0.009	0.006	0.008
MN: St. Paul	3	0.012	0.009	0.010
MO: Jefferson City	9	0.010	0.005	0.007
MO: Springfield	7	0.012	0.007	0.009
MO: St. Louis	3	0.011	0.007	0.009
MS: Jackson/Deq	3	0.008	0.006	0.007
MT: Billings	4	0.008	0.004	0.006
NC: Charlotte	5	0.017	0.008	0.012
NC: Raleigh	4	0.006	0.004	0.005
NC: Wilmington	4	0.006	0.005	0.006
NE: Lincoln	8	0.011	0.004	0.007
NE: Omaha	3	0.010	0.009	0.009
NH: Concord	7	0.007	0.005	0.006
NJ: Edison	8	0.009	0.005	0.007
NM: Albuquerque	4	0.008	0.006	0.007

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

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
NM: Carlsbad	7	0.009	0.005	0.008
NM: Navajo Lake	4	0.007	0.005	0.006
NV: Las Vegas/913	2	0.007	0.006	0.007
NV: Reno	7	0.012	0.005	0.008
NY: Albany	8	0.009	0.005	0.007
NY: Lockport	9	0.010	0.006	0.008
NY: New York City	4	0.010	0.005	0.008
NY: Rochester	4	0.012	0.008	0.010
NY: Yaphank	5	0.008	0.006	0.007
OH: Cincinnati	6	0.010	0.005	0.007
OH: Cleveland	3	0.012	0.009	0.010
OH: Columbus	6	0.011	0.007	0.009
OH: Toledo	8	0.011	0.005	0.009
OK: Oklahoma City	7	0.010	0.005	0.008
OK: Tulsa	3	0.010	0.007	0.009
OR: Corvallis	7	0.006	0.004	0.005
OR: Portland	8	0.009	0.002	0.005
PA: Bloomsburg	9	0.007	0.004	0.005
PA: Philadelphia	3	0.009	0.006	0.007
PA: Pittsburgh	4	0.011	0.007	0.008
PR: San Juan	8	0.013	0.002	0.004
RI: Providence	2	0.009	0.005	0.007
SC: Columbia	4	0.010	0.006	0.007
SD: Pierre	9	0.008	0.002	0.005
SD: Rapid City	7	0.010	0.002	0.005
TN: Knoxville	3	0.013	0.005	0.008
TN: Memphis	6	0.009	0.006	0.008
TN: Nashville	9	0.014	0.006	0.009
TN: Oak Ridge/Bethel	8	0.013	0.006	0.010
TN: Oak Ridge/K25	8	0.013	0.006	0.009
TN: Oak Ridge/Melton	8	0.010	0.005	0.007
TN: Oak Ridge/Y12 E	8	0.014	0.006	0.009
TN: Oak Ridge/Y12 W	8	0.016	0.005	0.009
TX: Amarillo	6	0.012	0.008	0.010
TX: Austin	4	0.008	0.006	0.007
TX: Corpus Christi	9	0.015	0.007	0.009
TX: Dallas	5	0.009	0.005	0.007
TX: El Paso	6	0.009	0.005	0.007

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

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
TX: Fort Worth	2	0.009	0.008	0.008
TX: Harlingen	1	0.008	0.008	0.008
TX: Houston	5	0.008	0.004	0.006
TX: Laredo	4	0.010	0.007	0.009
TX: Lubbock	8	0.009	0.005	0.007
TX: San Angelo	8	0.014	0.006	0.009
TX: San Antonio	8	0.011	0.005	0.008
UT: Salt Lake City	2	0.006	0.005	0.006
UT: St. George	2	0.006	0.006	0.006
VA: Harrisonburg	9	0.011	0.006	0.009
VA: Richmond	4	0.009	0.005	0.007
VA: Virginia Beach	5	0.009	0.005	0.007
VT: Burlington	6	0.013	0.005	0.009
WA: Ellensburg	1	0.004	0.004	0.004
WA: Olympia	6	0.006	0.002	0.004
WA: Richland	1	0.004	0.004	0.004
WA: Seattle	4	0.009	0.004	0.006
WA: Spokane	8	0.016	0.004	0.006
WI: La Crosse	2	0.007	0.006	0.006
WI: Madison	9	0.017	0.007	0.011
WI: Milwaukee	6	0.011	0.005	0.008
WI: Shawano	8	0.011	0.005	0.008
WV: Charleston	4	0.008	0.006	0.007
WY: Casper	4	0.005	0.004	0.004

Table 3
Gross Beta in Airborne Particulates
May 2016

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
AK: Anchorage	4	0.007	0.002	0.005
AK: Fairbanks	4	0.004	0.002	0.003
AK: Juneau	4	0.004	0.001	0.002
AL: Birmingham	9	0.012	0.005	0.008
AL: Mobile	3	0.012	0.007	0.010
AL: Montgomery/408	6	0.010	0.005	0.007
AR: Fort Smith	4	0.006	0.004	0.005
AR: Little Rock	6	0.011	0.005	0.008
AZ: Phoenix/956	3	0.009	0.006	0.008
AZ: Tucson	6	0.011	0.008	0.009
AZ: Yuma	3	0.011	0.007	0.009
CA: Anaheim	9	0.010	0.002	0.006
CA: Bakersfield	4	0.009	0.003	0.006
CA: Eureka	2	0.002	0.002	0.002
CA: Fresno	3	0.006	0.002	0.004
CA: Los Angeles	3	0.005	0.003	0.004
CA: Richmond	5	0.004	0.002	0.004
CA: Riverside	9	0.013	0.003	0.008
CA: Sacramento	9	0.014	0.003	0.008
CA: San Bernardino	8	0.014	0.005	0.009
CA: San Diego	3	0.006	0.005	0.005
CA: San Francisco	9	0.006	0.002	0.004
CA: San Jose	6	0.008	0.003	0.006
CO: Colorado Springs	3	0.009	0.007	0.009
CO: Denver	9	0.014	0.004	0.010
CO: Grand Junction	4	0.010	0.006	0.008
CT: Hartford	8	0.009	0.001	0.004
DC: Washington	8	0.014	0.004	0.008
DE: Dover	4	0.008	0.004	0.006
FL: Jacksonville	8	0.008	0.004	0.007
FL: Miami	5	0.006	0.003	0.005
FL: Orlando	8	0.007	0.003	0.005
FL: Tallahassee	3	0.007	0.005	0.007
FL: Tampa	9	0.011	0.005	0.008
GA: Atlanta	4	0.014	0.008	0.011
GA: Augusta	4	0.010	0.006	0.007
HI: Honolulu	9	0.005	0.001	0.003
IA: Des Moines	9	0.006	0.002	0.004

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

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
IA: Mason City	4	0.009	0.007	0.008
ID: Boise	3	0.006	0.004	0.005
ID: Idaho Falls	7	0.010	0.005	0.007
IL: Aurora	4	0.010	0.006	0.008
IL: Champaign	7	0.016	0.005	0.009
IL: Chicago	9	0.011	0.003	0.007
IN: Fort Wayne	4	0.010	0.005	0.007
IN: Indianapolis	9	0.012	0.003	0.007
KS: Kansas City	7	0.009	0.003	0.006
KS: Wichita	6	0.009	0.005	0.007
KY: Lexington	7	0.012	0.005	0.008
KY: Louisville	8	0.009	0.004	0.007
KY: Paducah	9	0.012	0.005	0.008
LA: Baton Rouge	9	0.007	0.004	0.006
LA: Shreveport	3	0.010	0.006	0.008
MA: Boston	6	0.010	0.003	0.006
MA: Worcester	9	0.014	0.002	0.007
MD: Baltimore	7	0.009	0.003	0.006
ME: Orono	3	0.005	0.004	0.004
ME: Portland	4	0.008	0.003	0.005
MI: Bay City 48708	9	0.012	0.004	0.006
MI: Detroit	8	0.012	0.004	0.006
MI: Grand Rapids	1	0.006	0.006	0.006
MN: Duluth	8	0.011	0.003	0.005
MN: St. Paul	3	0.010	0.006	0.008
MO: Jefferson City	9	0.010	0.003	0.007
MO: Springfield	8	0.010	0.005	0.008
MO: St. Louis	1	0.010	0.010	0.010
MS: Jackson/Deq	5	0.013	0.009	0.010
MT: Billings	4	0.009	0.006	0.007
NC: Charlotte	8	0.015	0.005	0.009
NC: Greensboro	1	0.006	0.006	0.006
NC: Raleigh	4	0.008	0.005	0.005
NC: Wilmington	4	0.006	0.005	0.005
ND: Bismarck	3	0.008	0.006	0.007
NE: Lincoln	9	0.011	0.003	0.007
NE: Omaha	3	0.013	0.004	0.009
NH: Concord	7	0.008	0.001	0.004

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

Location	Number of Samples	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
NJ: Edison	5	0.009	0.002	0.006
NM: Albuquerque	1	0.005	0.005	0.005
NM: Carlsbad	6	0.009	0.006	0.008
NM: Navajo Lake	5	0.010	0.005	0.007
NV: Las Vegas/913	7	0.009	0.006	0.007
NV: Reno	9	0.014	0.003	0.008
NY: Albany	9	0.013	0.002	0.007
NY: Lockport	8	0.013	0.003	0.006
NY: New York City	1	0.012	0.012	0.012
NY: Rochester	4	0.008	0.004	0.006
NY: Yaphank	4	0.007	0.002	0.004
OH: Cincinnati	8	0.011	0.005	0.008
OH: Cleveland	9	0.016	0.005	0.009
OH: Columbus	7	0.014	0.003	0.008
OH: Toledo	9	0.015	0.004	0.008
OK: Oklahoma City	8	0.016	0.003	0.009
OK: Tulsa	7	0.009	0.004	0.007
OR: Corvallis	8	0.006	0.002	0.004
OR: Portland	8	0.005	0.002	0.003
PA: Bloomsburg	6	0.007	0.001	0.004
PA: Philadelphia	4	0.012	0.006	0.008
PA: Pittsburgh	6	0.011	0.005	0.007
PR: San Juan	8	0.011	0.002	0.006
RI: Providence	3	0.006	0.002	0.004
SC: Columbia	4	0.008	0.007	0.008
SD: Pierre	9	0.008	0.003	0.006
SD: Rapid City	8	0.010	0.004	0.007
TN: Knoxville	4	0.008	0.007	0.008
TN: Memphis	9	0.011	0.005	0.007
TN: Nashville	7	0.013	0.005	0.009
TN: Oak Ridge/Bethel	8	0.017	0.007	0.010
TN: Oak Ridge/K25	8	0.018	0.007	0.009
TN: Oak Ridge/Melton	8	0.011	0.004	0.006
TN: Oak Ridge/Y12 E	8	0.017	0.006	0.009
TN: Oak Ridge/Y12 W	8	0.016	0.006	0.009
TX: Amarillo	6	0.014	0.009	0.011
TX: Austin	3	0.010	0.005	0.007
TX: Corpus Christi	7	0.013	0.005	0.008

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

Location	Number of Samples	NAREL Lab Measurement Max (pCi/m³)	Min (pCi/m³)	Avg (pCi/m³)
TX: Dallas	5	0.009	0.005	0.007
TX: El Paso	4	0.009	0.006	0.007
TX: Fort Worth	1	0.009	0.009	0.009
TX: Harlingen	1	0.006	0.006	0.006
TX: Houston	6	0.013	0.006	0.008
TX: Laredo	3	0.009	0.008	0.008
TX: Lubbock	8	0.010	0.003	0.007
TX: San Angelo	9	0.010	0.003	0.006
TX: San Antonio	9	0.010	0.004	0.008
UT: Salt Lake City	4	0.007	0.005	0.006
UT: St. George	5	0.008	0.004	0.006
VA: Harrisonburg	8	0.013	0.005	0.008
VA: Richmond	3	0.006	0.004	0.005
VA: Virginia Beach	4	0.008	0.005	0.007
VT: Burlington	8	0.012	0.003	0.006
WA: Olympia	8	0.005	0.002	0.004
WA: Richland	6	0.007	0.004	0.006
WA: Seattle	4	0.006	0.003	0.005
WA: Spokane	7	0.008	0.004	0.006
WI: La Crosse	2	0.005	0.003	0.004
WI: Madison	9	0.013	0.005	0.009
WI: Milwaukee	6	0.010	0.002	0.007
WI: Shawano	8	0.011	0.004	0.007
WV: Charleston	6	0.011	0.006	0.007
WY: Casper	4	0.006	0.003	0.005

Table 4
Gross Beta in Airborne Particulates
June 2016

Location	Number of Samples	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
AK: Anchorage	4	0.003	0.001	0.002
AK: Fairbanks	4	0.007	0.004	0.005
AK: Juneau	3	0.002	0.001	0.002
AL: Birmingham	8	0.013	0.005	0.008
AL: Mobile	3	0.008	0.007	0.007
AL: Montgomery/408	9	0.010	0.004	0.008
AR: Fort Smith	4	0.012	0.006	0.008
AR: Little Rock	9	0.014	0.007	0.009
AZ: Tucson	8	0.018	0.008	0.014
CA: Anaheim	7	0.008	0.004	0.007
CA: Bakersfield	3	0.013	0.004	0.007
CA: Eureka	2	0.002	0.002	0.002
CA: Fresno	3	0.010	0.005	0.008
CA: Los Angeles	2	0.007	0.005	0.006
CA: Richmond	4	0.003	0.002	0.003
CA: Riverside	7	0.011	0.007	0.009
CA: Sacramento	9	0.012	0.003	0.007
CA: San Bernardino	4	0.012	0.009	0.010
CA: San Diego	2	0.011	0.004	0.008
CA: San Francisco	3	0.005	0.003	0.003
CA: San Jose	7	0.006	0.002	0.004
CO: Colorado Springs	1	0.010	0.010	0.010
CO: Denver	3	0.015	0.013	0.014
CO: Grand Junction	1	0.015	0.015	0.015
CT: Hartford	9	0.009	0.003	0.004
DC: Washington	8	0.010	0.006	0.008
DE: Dover	1	0.005	0.005	0.005
FL: Jacksonville	8	0.012	0.005	0.008
FL: Miami	3	0.004	0.003	0.004
FL: Orlando	2	0.005	0.003	0.004
FL: Tallahassee	4	0.006	0.006	0.006
FL: Tampa	8	0.011	0.005	0.007
GA: Atlanta	4	0.016	0.008	0.012
GA: Augusta	6	0.011	0.006	0.008
HI: Honolulu	8	0.004	0.002	0.003
IA: Des Moines	7	0.006	0.003	0.003
IA: Mason City	6	0.014	0.005	0.008
ID: Boise	5	0.006	0.003	0.005

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

Location	Number of Samples	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
ID: Idaho Falls	8	0.011	0.006	0.008
IL: Aurora	5	0.010	0.007	0.008
IL: Champaign	5	0.015	0.007	0.011
IL: Chicago	8	0.008	0.003	0.006
IN: Fort Wayne	4	0.010	0.006	0.008
IN: Indianapolis	9	0.010	0.004	0.007
KS: Kansas City	9	0.013	0.006	0.009
KS: Wichita	6	0.013	0.007	0.010
KY: Lexington	7	0.012	0.006	0.009
KY: Louisville	6	0.010	0.006	0.008
KY: Paducah	7	0.017	0.006	0.011
LA: Baton Rouge	6	0.013	0.003	0.007
LA: Shreveport	3	0.013	0.009	0.011
MA: Boston	8	0.006	0.003	0.005
MA: Worcester	9	0.008	0.005	0.006
MD: Baltimore	6	0.008	0.005	0.006
ME: Orono	2	0.003	0.003	0.003
ME: Portland	6	0.009	0.003	0.006
MI: Bay City 48708	6	0.005	0.003	0.004
MI: Detroit	8	0.009	0.004	0.006
MI: Grand Rapids	4	0.010	0.007	0.008
MN: Duluth	9	0.008	0.003	0.005
MN: St. Paul	4	0.010	0.007	0.009
MO: Jefferson City	8	0.016	0.007	0.010
MO: Springfield	7	0.013	0.006	0.010
MO: St. Louis	4	0.010	0.008	0.009
MS: Jackson/Deq	3	0.016	0.008	0.012
MT: Billings	4	0.012	0.008	0.009
NC: Charlotte	7	0.011	0.006	0.008
NC: Greensboro	1	0.006	0.006	0.006
NC: Raleigh	5	0.006	0.004	0.005
NC: Wilmington	5	0.008	0.005	0.006
ND: Bismarck	3	0.008	0.007	0.007
NE: Lincoln	7	0.013	0.005	0.009
NE: Omaha	2	0.010	0.007	0.009
NH: Concord	5	0.005	0.003	0.004
NJ: Edison	6	0.010	0.004	0.007
NM: Carlsbad	5	0.011	0.005	0.008

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

Location	Number of Samples	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
NM: Navajo Lake	3	0.013	0.009	0.010
NV: Las Vegas/913	5	0.015	0.008	0.011
NV: Reno	1	0.012	0.012	0.012
NY: Albany	9	0.008	0.004	0.006
NY: Lockport	6	0.009	0.005	0.007
NY: New York City	3	0.008	0.006	0.007
NY: Rochester	4	0.006	0.004	0.005
NY: Yaphank	6	0.009	0.005	0.007
OH: Cincinnati	8	0.010	0.004	0.008
OH: Cleveland	7	0.010	0.005	0.008
OH: Columbus	6	0.014	0.006	0.009
OH: Toledo	9	0.008	0.005	0.006
OK: Oklahoma City	7	0.013	0.006	0.010
OK: Tulsa	6	0.012	0.006	0.008
OR: Corvallis	7	0.007	0.002	0.004
OR: Portland	6	0.004	0.001	0.003
PA: Bloomsburg	7	0.006	0.003	0.004
PA: Philadelphia	4	0.009	0.006	0.007
PA: Pittsburgh	4	0.010	0.006	0.008
PR: San Juan	8	0.012	0.004	0.007
RI: Providence	4	0.006	0.004	0.005
SC: Columbia	3	0.013	0.007	0.010
SD: Pierre	9	0.009	0.004	0.006
SD: Rapid City	8	0.009	0.005	0.008
TN: Knoxville	4	0.012	0.008	0.010
TN: Memphis	9	0.012	0.005	0.009
TN: Nashville	9	0.014	0.006	0.010
TN: Oak Ridge/Bethel	9	0.015	0.007	0.011
TN: Oak Ridge/K25	9	0.014	0.007	0.011
TN: Oak Ridge/Melton	9	0.010	0.005	0.007
TN: Oak Ridge/Y12 E	9	0.016	0.006	0.011
TN: Oak Ridge/Y12 W	9	0.014	0.006	0.010
TX: Amarillo	7	0.018	0.011	0.014
TX: Austin	3	0.011	0.005	0.008
TX: Corpus Christi	7	0.016	0.004	0.009
TX: Dallas	6	0.012	0.005	0.008
TX: El Paso	8	0.014	0.007	0.009
TX: Fort Worth	3	0.014	0.011	0.012

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

Location	Number of Samples	NAREL Lab Measurement (pCi/m³) Max	Min	Avg
TX: Harlingen	1	0.003	0.003	0.003
TX: Houston	8	0.016	0.004	0.008
TX: Laredo	5	0.010	0.006	0.007
TX: Lubbock	8	0.011	0.006	0.009
TX: San Angelo	8	0.009	0.003	0.006
TX: San Antonio	1	0.008	0.008	0.008
UT: Salt Lake City	1	0.011	0.011	0.011
UT: St. George	3	0.010	0.006	0.009
VA: Harrisonburg	7	0.014	0.007	0.009
VA: Richmond	2	0.009	0.007	0.008
VA: Virginia Beach	5	0.007	0.006	0.007
VT: Burlington	7	0.007	0.002	0.004
WA: Ellensburg	2	0.003	0.003	0.003
WA: Olympia	6	0.006	0.003	0.004
WA: Richland	1	0.005	0.005	0.005
WA: Seattle	3	0.005	0.003	0.004
WA: Spokane	8	0.010	0.002	0.005
WI: La Crosse	4	0.004	0.004	0.004
WI: Madison	7	0.011	0.006	0.009
WI: Milwaukee	8	0.010	0.005	0.007
WI: Shawano	11	0.008	0.002	0.005
WV: Charleston	5	0.011	0.006	0.008
WY: Casper	3	0.007	0.006	0.006

Table 5
Gamma-Emitters in Precipitation
April 2016

Location	Nuclide	pCi/L ± 2*u*	
AL: Montgomery/408	Be-7	31	19
AR: Little Rock		ND	
CA: Richmond	Be-7	67	25
CT: Hartford	Be-7	85	23
FL: Jacksonville		ND	
GA: Atlanta	Be-7	33	19
HI: Honolulu		ND	
ID: Idaho Falls	Be-7	35	16
KS: Kansas City	Be-7	25	20
MI: Lansing		ND	
MN: St. Paul		ND	
MN: Welch/510	Be-7	69	26
NC: Charlotte	Be-7	51	20
NC: Wilmington		ND	
NY: Albany	Be-7	58	23
OR: Portland		ND	
PA: Harrisburg		ND	
TN: Knoxville		ND	
TN: Nashville		ND	
TN: Oak Ridge/K25	Be-7	39	24
TN: Oak Ridge/Melton	Be-7	62	19
TN: Oak Ridge/Y12 E	Be-7	64	21
TX: Austin	Be-7	29	15
UT: Salt Lake City	Be-7	33	17
VA: Lynchburg		ND	
WA: Olympia	Be-7	31	24

Table 6
Gamma-Emitters in Precipitation
May 2016

Location	Nuclide	pCi/L ± 2*u*	
AL: Montgomery/408	Be-7	40	16
CA: Richmond		ND	
CT: Hartford	Be-7	39	30
FL: Jacksonville		ND	
GA: Atlanta	Be-7	95	31
HI: Honolulu		ND	
ID: Idaho Falls	Be-7	75	19
KS: Kansas City	Be-7	31	17
MA: Boston	Be-7	111	32
MI: Lansing		ND	
MN: St. Paul		ND	
NC: Charlotte	Be-7	35	15
NC: Wilmington		ND	
NY: Albany	Be-7	64	31
OR: Portland		ND	
PA: Harrisburg		ND	
TN: Knoxville		ND	
TN: Nashville		ND	
TN: Oak Ridge/K25	Be-7	90	36
TN: Oak Ridge/Melton	Be-7	48	22
TN: Oak Ridge/Y12 E	Be-7	85	36
TX: Austin		ND	
UT: Salt Lake City	Be-7	56	29
VA: Lynchburg		ND	

Table 7
Gamma-Emitters in Precipitation
June 2016

Location	Nuclide	pCi/L ± 2*u*	
AL: Montgomery/408	K-40	15	14
CT: Hartford	Be-7	41	19
FL: Jacksonville	Be-7	26	14
GA: Atlanta	Be-7	55	25
HI: Honolulu	K-40	18	13
	Ra-228	3.9	3.8
KS: Kansas City	Be-7	49	21
MA: Boston	Be-7	16	10
MI: Lansing	Be-7	46	21
MN: St. Paul	Be-7	22	18
	K-40	14	13
MN: Welch/510	Be-7	44	21
NC: Charlotte	Be-7	85	30
NC: Wilmington		ND	
NY: Albany	Be-7	31	14
OR: Portland	Be-7	32	20
PA: Harrisburg	K-40	16	14
TN: Knoxville	Be-7	27	14
TN: Nashville	Be-7	40	22
TN: Oak Ridge/K25	Be-7	58	17
TN: Oak Ridge/Melton	Be-7	65	14
TN: Oak Ridge/Y12 E	Be-7	63	18
TX: Austin		ND	
UT: Salt Lake City	Be-7	30	18
VA: Lynchburg		ND	
WA: Olympia	Be-7	42	18

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 m^3 to 500,000 m^3. The aliquot analyzed is a fraction of the total volume and is typically between 5,000 m^3 and 30,000 m^3.

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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
April–June 2016

Location	Date Collected	^{3}H pCi/L	± 2*u*
AK: Fairbanks	05/25/16	−12	81
AL: Dothan	04/01/16	31	77
AL: Montgomery/408	04/12/16	−27	90
AL: Muscle Shoals	04/06/16	60	78
AL: Scottsboro	04/05/16	−24	75
AR: Little Rock	05/12/16	127	94
CO: Denver	05/02/16	−6	90
CT: Hartford	04/15/16	−45	88
DE: Dover	04/25/16	−89	86
FL: Miami	06/27/16	57	84
FL: Tampa	06/30/16	−23	59
GA: Baxley	05/17/16	122	88
GA: Savannah	06/08/16	43	84
HI: Honolulu	05/27/16	6	80
IA: Cedar Rapids	05/11/16	101	93
ID: Idaho Falls	06/13/16	8	82
IL: Chicago	04/12/16	−45	88
KS: Topeka	05/13/16	−31	89
LA: New Orleans	05/13/16	−37	89
MD: Baltimore	06/15/16	41	84
MD: Conowingo	06/28/16	63	84
MI: Detroit	04/11/16	122	96
MN: St. Paul	04/04/16	−35	75
MN: Welch	04/04/16	−4	75
MO: Jefferson City	06/16/16	33	83
MT: Helena	06/28/16	28	60
ND: Bismarck	04/26/16	−33	89
NE: Lincoln	04/07/16	−4	76
NJ: Trenton	06/06/16	25	83
NJ: Waretown	06/09/16	49	84
NY: Albany	06/30/16	8	82
NY: New York	06/17/16	22	83
OH: Cincinnati	05/13/16	147	95
OH: Columbus	06/14/16	88	86
OH: E. Liverpool	06/02/16	21	83
OH: Painesville	05/18/16	143	97
OH: Toledo	06/21/16	70	85
OK: Oklahoma City	06/30/16	13	60
PA: Columbia	06/28/16	68	85
PA: Harrisburg	06/29/16	4	59

Table 8 (continued)
Tritium in Drinking Water
April–June 2016

Location	Date Collected	^{3}H pCi/L	± 2*u*
PA: Pittsburgh	06/02/16	−2	79
SC: Barnwell	04/21/16	−44	90
SC: Columbia	04/20/16	12	92
SC: Hartsville	04/13/16	27	92
SC: Jenkinsville	04/19/16	−27	89
SC: Jenkinsville	06/30/16	7	57
SC: Rock Hill	04/20/16	370	110
SC: Seneca	04/15/16	−54	88
TN: Knoxville	04/06/16	−4	76
TN: Oak Ridge/#360	04/05/16	−37	74
TN: Oak Ridge/#371	04/05/16	96	80
TN: Oak Ridge/#768	04/05/16	−11	75
TN: Oak Ridge/#772	04/05/16	−18	75
TX: Austin	04/04/16	−17	75
WA: Richland	06/21/16	75	85
WI: Madison	05/06/16	23	83

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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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USEPA – ORIA, Radiation Protection Division

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