Analytical Results for the Community Environmental Monitoring Program (CEMP) Air Sampling and Dosimeter Network Second Quarter CY2022

The CEMP air-sampling network is designed to monitor and collect radioactive airborne particles from NNSS and non-NNSS related activities, as well as background environmental sources. This report is compiled by the Desert Research Institute (DRI) and summarizes the results from the analysis of the air samples collected by CEMP station managers.

The CEMP air-sampling network is comprised of 24 continuously operating environmental sampling stations. A total of 23 stations are equipped with a low volume air sampler/totalizer configuration to collect particulate radionuclides on glass fiber filter paper. Prior to October 1, 2013 all air samples were collected on a bi-weekly basis with a target collection time of 336 hours (two weeks). After October 1, 2013, approximately half of the stations were converted to 'stand by' status in which only one two-week sample was collected and analyzed every quarter year. Beginning October 1, 2017 all CEMP stations are again operating full time with samples being collected every two weeks. Currently, the procedure is to submit one sample set per quarter year for analysis. The remaining samples are archived to be accessed if needed. This protocol will be followed unless an important event were to occur on or off the NNSS (major fires, transportation incident, or an unusual result are a few examples). Archived samples would be used to assess conditions before and after an event. The samplers are calibrated on a quarterly basis by DRI to maintain a collection rate of 1.75 cfm (@ STP). All relevant information such as collection times, variations in flow rate, actual flow volumes, power outages, and other information documenting the integrity of the sample are recorded by the station managers. This allows for the proper interpretation of the analytical results. The air filters are analyzed by a commercial laboratory for gross alpha/beta activity as well as by high-resolution gamma spectrometry.

In the U.S., the principal reporting unit for the measurement of radioactivity in the atmospheric environment is pCi/m^3 (picocuries per cubic meter). DRI receives its data from the lab as picocuries per filter. DRI converts the laboratory data unit of measurement to pCi/m^3 for the ease in comparison of data for this report.

A summary of the second quarter CY2022 analytical results for gross alpha and beta analyses are found in Table 1. This table documents the results of the quarterly analyses for each of the 23 air-sampling network stations. The average annual value from the previous year (CY2021) is provided for comparison purposes. Overall, the gross alpha results for the second quarter of CY2022 reflect similar values to previous quarters. The second quarter CY2022 beta results are also consistent with previous results.

The second quarter gamma results for CY2022 are shown in Table 2. All of the samples were gamma spectrum negligible (i.e., gamma emitting radionuclides were not detected with the exception of beryllium (Be-7) and potassium (K-40) which are naturally occurring). Overall, these data are consistent with previous analytical results.

Prior to the fourth quarter of 2021, thermoluminescent dosimeters (TLDs) were used at the monitoring stations. Beginning in the fourth quarter of 2021, the decision was made to change from using TLDs to dosimeters featuring optically stimulated luminescence (OSL) technology. OSL dosimeters offer several operational advantages over TLDs (e.g., no annealing or maintenance of the detectors' sensitivity required, etc.). These dosimeters

measure radiation with aluminum oxide detectors. The readout process uses a light emitting diode (LED) array to stimulate the detectors on the dosimeter and the light emitted by the OSL material is measured by a photomultiplier tube; the amount of light emitted during optical stimulation is directly proportional to the radiation dose. The OSL dosimeters meet the standards of the American National Standards Institute and Health Physics Society.

Before presenting the second quarter 2022 dosimetry results, a discussion regarding the reported dosimeter results for previous years is warranted. Dosimeters measure ionizing radiation from all sources, including natural radioactivity from cosmic and terrestrial sources and from man-made radioactive sources. Consequently, the dosimeters utilized for the CEMP stations measure radiation present during use at the monitoring stations, as well as from sources other than that which occur at the monitoring stations themselves. For example, the dosimeters record radiation exposure that occurs in the mail when they are shipped from the manufacturer to DRI and back, while being transported in DRI vehicles to and from the stations during quarterly retrieval/deployment, and during use at the station itself (approximately 3 months). For purposes of clarity, we will refer to these radiation exposures as occurring during 1) shipping, 2) deployment, and 3) station use. It is solely the exposure that is recorded by the dosimeter during its actual use at the station that is of interest; exposure that occurs during shipping and deployment is extraneous as it does not occur at the station. Every result reported by the analytical lab for a dosimeter used at a station will include exposure incurred during shipment and deployment. Accordingly, to determine the exposure that occurred solely at the station, the extraneous shipping and deployment exposures must be removed or "subtracted out" from the gross result value provided by the analytical lab. DRI uses a set of "control" dosimeters to track exposures occurring during shipping and deployment.

During a recent QA review of historical analytical procedures, it was determined that in the early 2000s a convention was adopted to not "correct" the station dosimeter results by subtracting out the extraneous shipping exposures. As a result, dosimeter results for the stations have been overestimated since that time. Starting in the fourth quarter of 2021 all dosimeter results are corrected by removing extraneous exposure values so that the reported values will reflect only the exposure that occurred at the monitoring station itself.

The environmental dosimeter results for the second quarter of CY2022 are shown in Table 3. Data for the environmental dosimeters are reported in milliroentgens (mR). The 2021 pressurized ion chamber (PIC) exposure rate and dosimeter data are also provided for comparison. Dosimeter values are commonly lower than the PIC results, as the PIC offers greater sensitivity.

DRI welcomes and encourages input from the station managers regarding the content of the CEMP quarterly reports. If there is anything you feel we could provide to help you interpret the data or enable you to explain the information to someone in your community not familiar with the program, please let us know.

Table 1. Gross Alpha/Beta Results for the Second Quarter of Calendar Year 2022. (Data represents one analysis per quarter.)

Station	Gross Alpha (pCi/m^3)	2021 Average	Gross Beta (pCi/m^3)	2021 Average
Alamo	0.0008	0.0019	0.0158	0.0203
Amargosa	<MDC	0.0020	<MDC	0.0206
Beatty	0.0009	0.0019	0.0178	0.0203
Boulder City	0.0008	0.0018	0.0202	0.0205
Caliente	0.0012	0.0020	0.0190	0.0210
Cedar City	0.0007	0.0018	0.0168	0.0177
Delta	0.0006	0.0014	0.0168	0.0199
Duckwater	0.0007	0.0019	0.0162	0.0193
Ely	0.0009	0.0023	0.0146	0.0196
Goldfield	0.0010	0.0014	0.0155	0.0145
Henderson	0.0011	0.0021	0.0189	0.0216
Indian Springs	0.0010	0.0020	0.0176	0.0223
Las Vegas	0.0025	0.0023	0.0183	0.0205
Mesquite	0.0005	0.0017	0.0184	0.0208
Milford	0.0008	0.0018	0.0147	0.0224
Overton	0.0010	0.0020	0.0188	0.0226
Pahrump	0.0016	0.0027	0.0177	0.0183
Pioche	0.0011	0.0019	0.0174	0.0204
Rachel	0.0008	0.0020	0.0192	0.0187
Sarcobatus	0.0010	0.0022	0.0170	0.0221
St. George	0.0010	0.0016	0.0214	0.0230
Tecopa	0.0008	0.0018	0.0192	0.0244
Tonopah	0.0009	0.0017	0.0156	0.0202

Average analytical uncertainty gross alpha +/- 0.00036 (pCi/m^3)
Average analytical uncertainty gross beta +/- 0.00210 (pCi/m^3)

Table 2. Gamma Spectroscopy Results for the Second Quarter of Calendar Year 2022. (Data represents one analysis per quarter.)

Station	Cs-137 (pCi/m^3)	Cs-137 MDC, (pCi/m^3)	Be-7 (pCi/m^3)	Be-7 MDC, (pCi/m^3)	Pb-210 (pCi/m^3)
Alamo	<MDC	0.012	0.119	0.033	N.D.
Amargosa	<MDC	0.014	0.149	0.039	N.D.
Beatty	<MDC	0.011	0.179	0.013	N.D.
Boulder City	<MDC	0.010	N.D.	N/A	N.D.
Caliente	<MDC	0.008	0.121	0.039	N.D.
Cedar City	<MDC	0.010	0.133	0.036	N.D.
Delta	<MDC	0.012	0.132	0.039	N.D.
Duckwater	<MDC	0.016	0.142	0.049	N.D.
Ely	<MDC	0.008	0.124	0.024	N.D.
Goldfield	<MDC	0.013	N.D.	N/A	N.D.
Henderson	<MDC	0.016	0.140	0.054	N.D.
Indian Springs	<MDC	0.009	0.128	0.029	N.D.
Las Vegas	<MDC	0.010	0.154	0.029	N.D.
Mesquite	<MDC	0.011	0.137	0.026	N.D.
Milford	<MDC	0.011	0.116	0.041	N.D.
Overton	<MDC	0.013	0.121	0.029	N.D.
Pahrump	<MDC	0.010	0.117	0.031	N.D.
Pioche	<MDC	0.009	N.D.	N/A	N.D.
Rachel	<MDC	0.011	0.113	0.021	N.D.
Sarcobatus	<MDC	0.010	0.142	0.037	N.D.
St. George	<MDC	0.014	N.D.	N/A	N.D.
Tecopa	<MDC	0.014	N.D.	N/A	N.D.
Tonopah	<MDC	0.011	N.D.	N/A	N.D.

MDC = Minimum detectable concentration
N.D. = Not detected

Table 3. Dosimeter Analytical Results for the Second Quarter of Calendar Year 2022.

Station	Second Quarter Exposure (mR)	Est. Annual Exposure (mR/yr)	2021 Dosimeter Exposure (mR/yr)	2021 PIC Exposure (mR/yr)
Alamo	18	73	54	116
Amargosa	17	64	45	102
Beatty	30	118	85	152
Boulder City	21	69	48	133
Caliente	23	81	57	140
Cedar City	15	59	44	120
Delta	11	46	41	117
Duckwater	27	93	54	139
Ely	16	57	35	111
Goldfield	25	98	66	138
Henderson	23	77	63	120
Indian Springs	14	53	39	105
Las Vegas	16	55	40	92
Mesquite	13	50	48	104
Milford	24	95	88	163
Overton	8	28	19	96
Pahrump	5	19	14	78
Pioche	26	91	63	147
Rachel	26	104	77	138
Sarcobatus	29	114	81	151
St. George	17	68	59	124
Tecopa	16	62	47	100
Tonopah	22	91	83	143