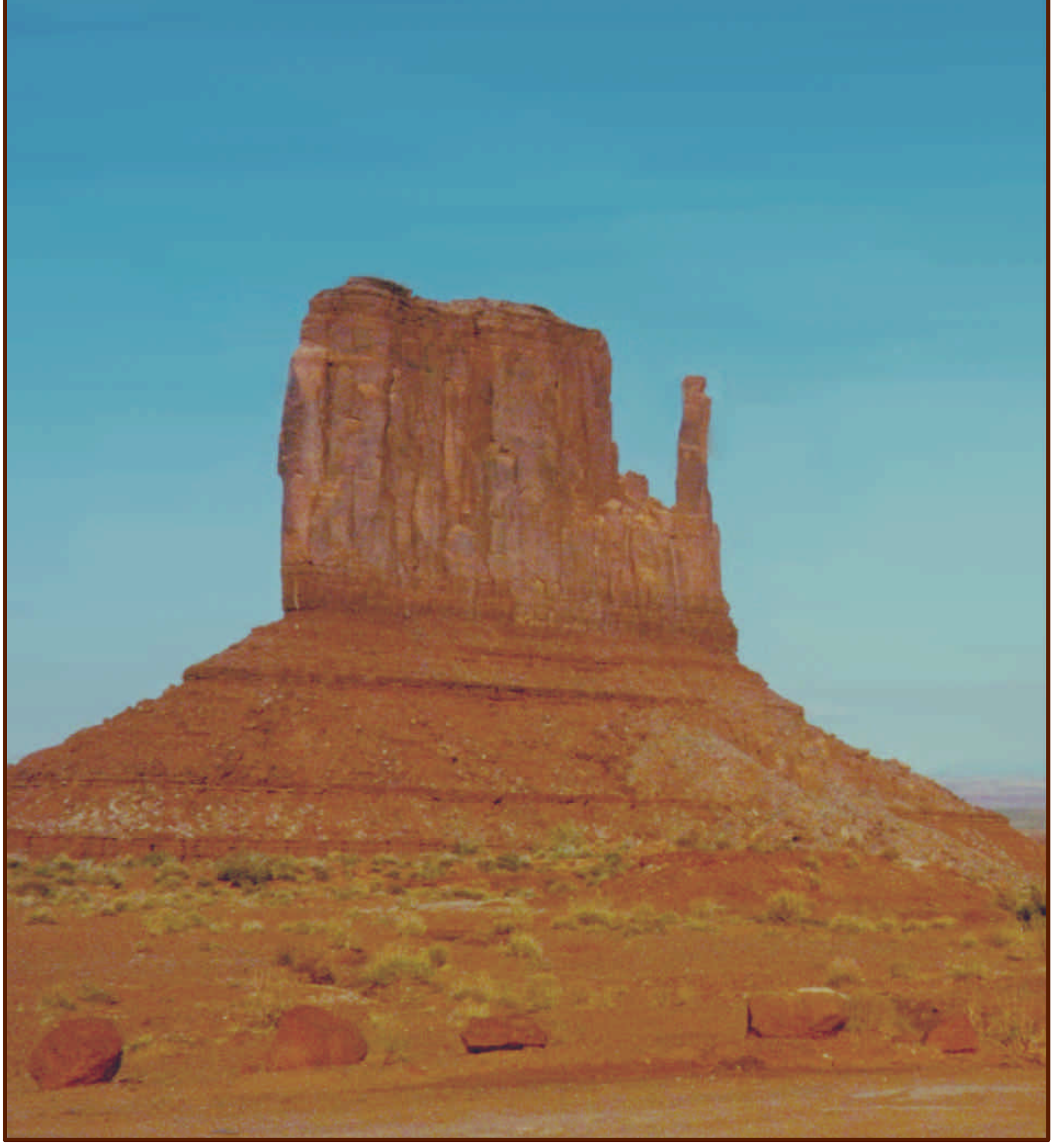
Section 7

MONUMENT VALLEY AREA

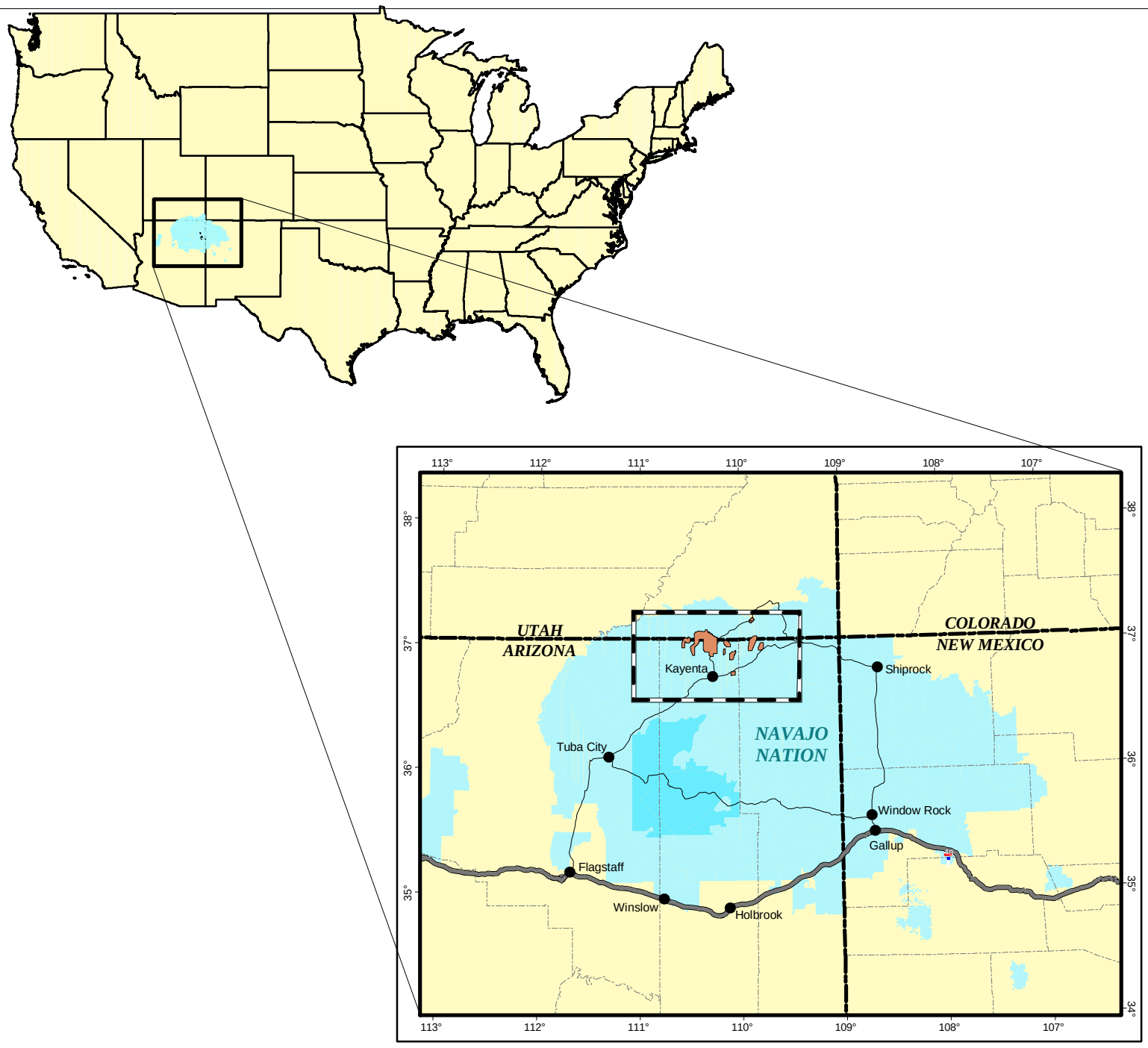


United States Environmental Protection Agency

ABANDONED URANIUM MINES PROJECT

Monument Valley Area

OVERVIEW MAP



Aspen Spring

Baby Rock Spring 8-44

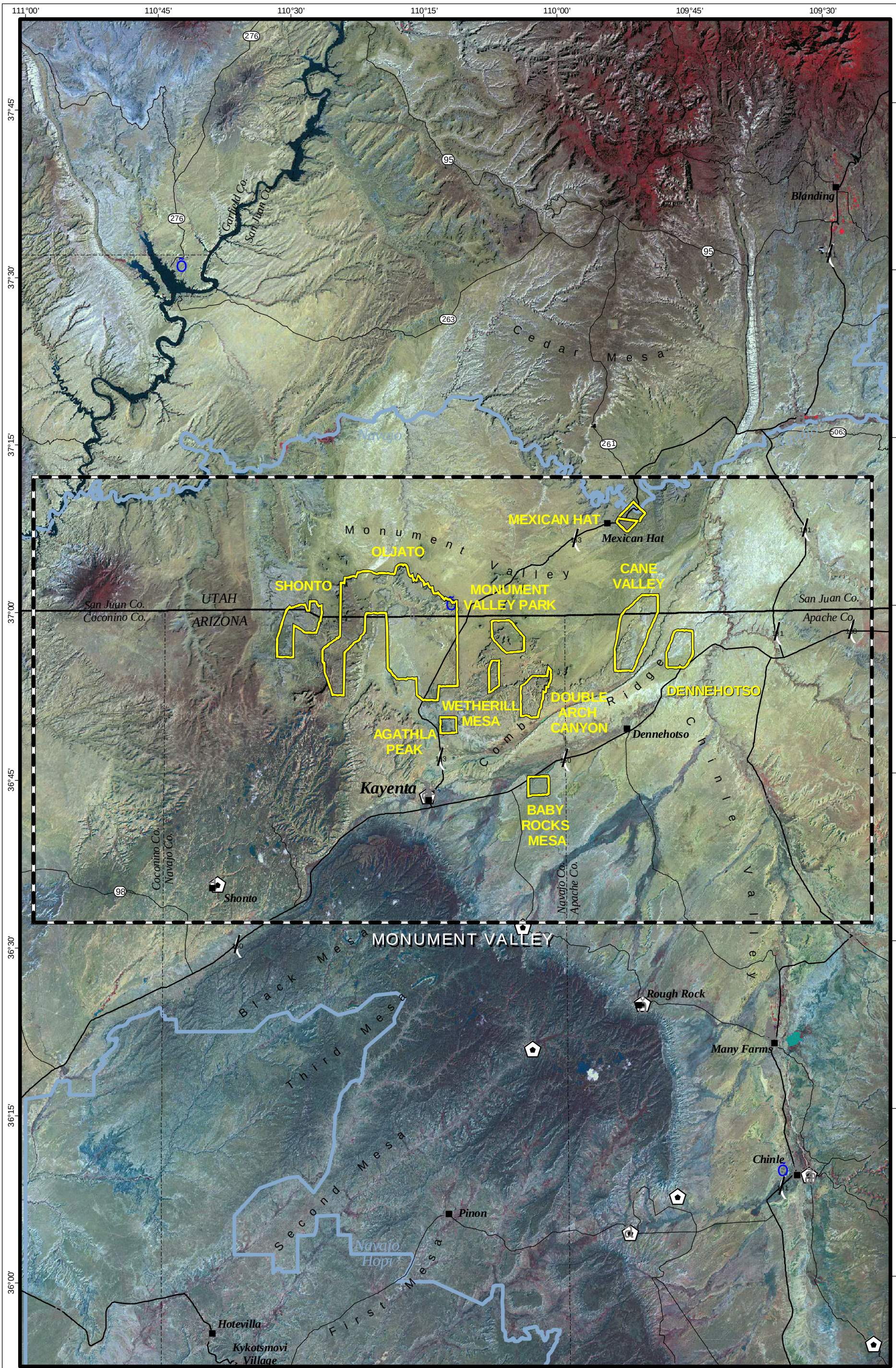
Sand Spring

Tsiah Spring

The Monument Valley area is located in northeastern Arizona and southeastern Utah. Some of the physiography of the area is shown above in photos taken by Glynn Alsup (USACE).

The overview map shown on the facing page provides the map extent boundary for the Monument Valley area maps presented in Section 7. Ten aerial radiation surveys were flown in the Monument Valley area: Baby Rocks Mesa, Cane Valley, Dennehotso, Double Arch Canyon, Mexican Hat, Monument Valley Park, Oljato, Shonto, Wetherill Mesa, and Agathla Peak.

Water samples from 31 sites were collected in the Monument Valley area.



MAP FEATURES

- Map Extent Boundary
- Aerial Survey Boundary

4

OVERVIEW MAP

10 0 10 Miles

10 0 10 Kilometers

Scale 1:600,000

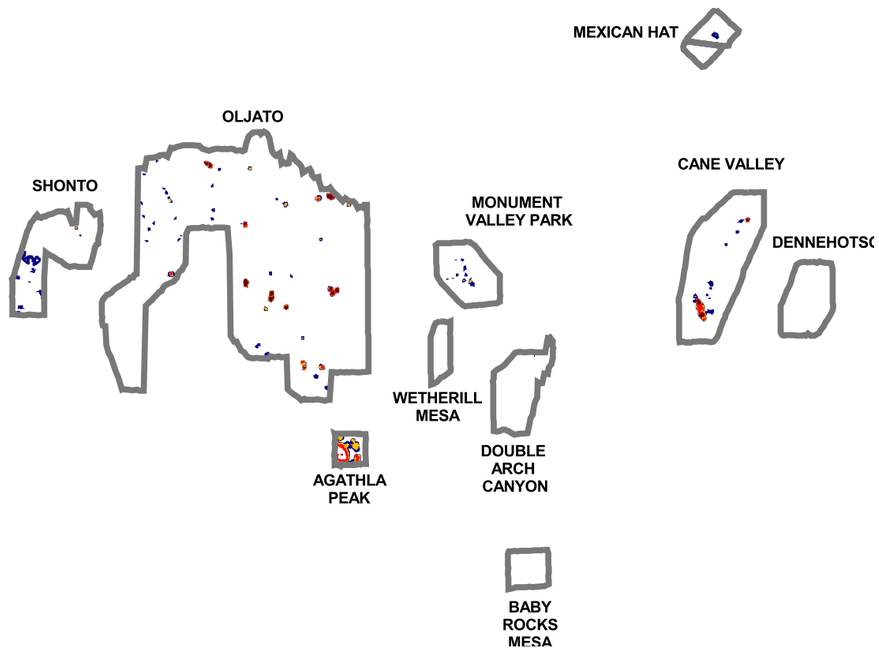
U.S. Environmental Protection Agency

ABANDONED URANIUM MINES PROJECT

Monument Valley Area

ABANDONED URANIUM
MINES PROJECT

MONUMENT VALLEY AREA
AERIAL RADIATION CONTOURS - GROSS COUNT



Aerial Radiation Contours

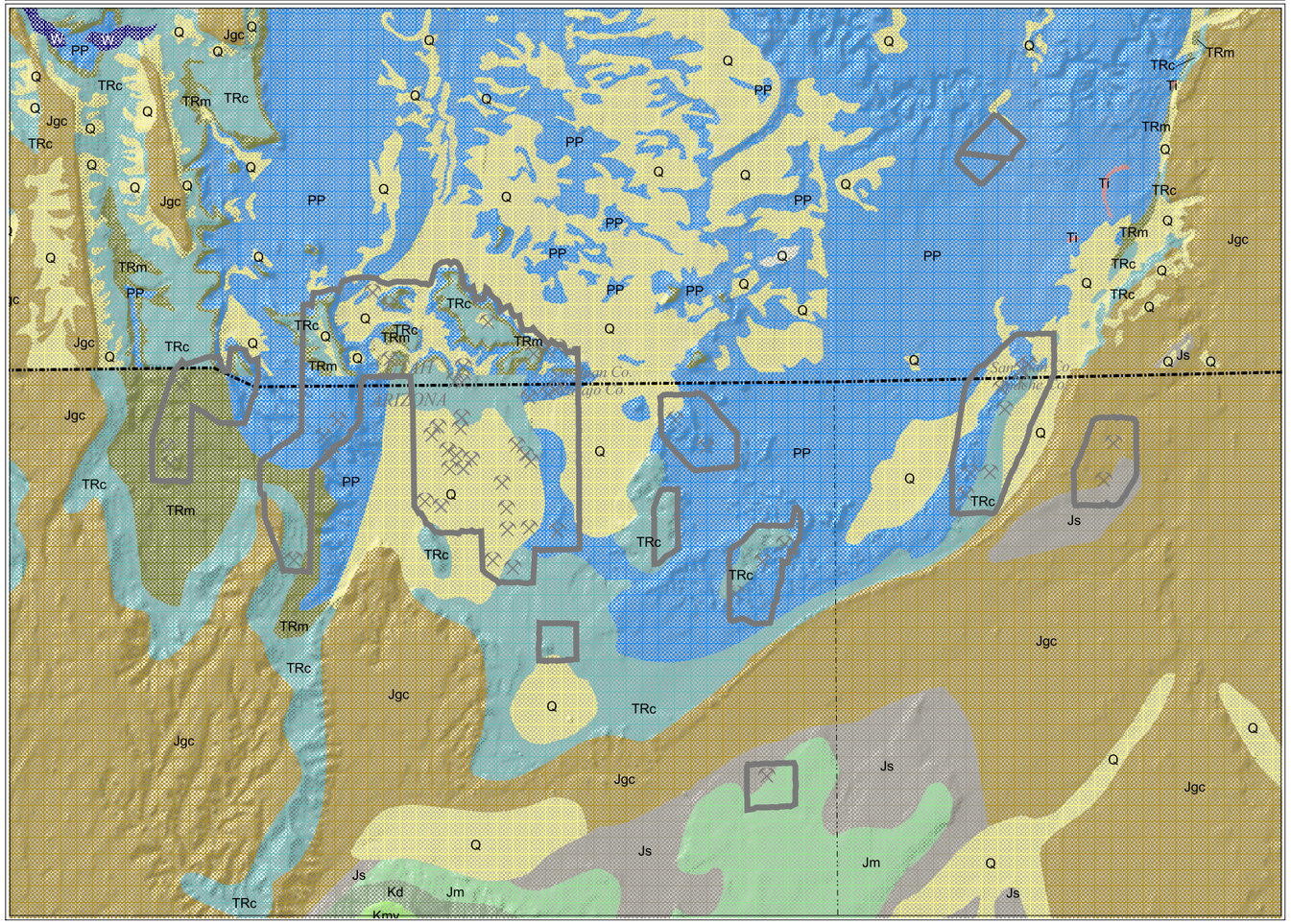
Derived terrestrial exposure rate at 1 meter above ground level. Does not include cosmic contribution (units: excess micro-R/hour)

- 9
- 12
- 16
- 24

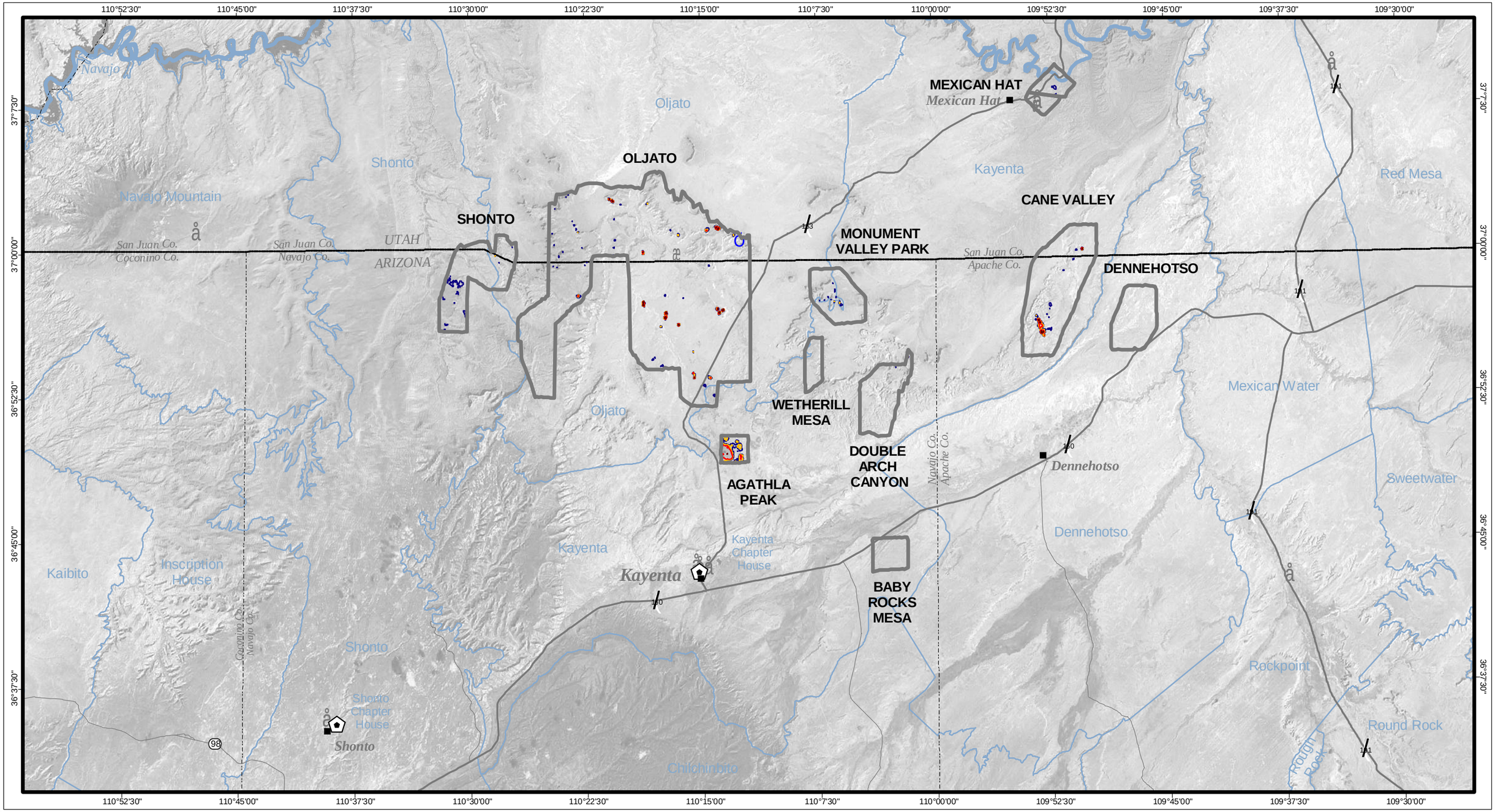
Aerial radiation contour values were compiled by Thane Hendricks, Department of Energy - Remote Sensing Laboratory. Units are in micro-Roentgens per hour. Derived from the total observed gamma spectrum. At the survey altitude of 150 feet, the footprint of the detection system is a circle approximately 300 feet in diameter. The data shown on this map are averages over this footprint at ground level.

Geological Units (Age and Unit Description)

- W Water
- Q Quaternary Alluvium and Colluvium
- Ti Tertiary Intrusives and Volcanics
- Kd Cretaceous Dakota Sandstone
- Jm Jurassic Morrison Formation
- Js Jurassic San Rafael Group
- Jgc Jurassic Glen Canyon Group
- TRc Triassic Chinle Formation
- TRm Triassic Moenkopi Formation
- PP Permian to Pennsylvanian Sedimentary Rocks



Sources: Aerial survey boundaries are from the Department of Energy, Remote Sensing Laboratory, Las Vegas Nevada. Geological information from the Geologic Map of Arizona, GIS database (Richard and Kneale, 1997), and the Digital Geologic Map of Utah (Willis, 2000). Uranium mine locations shown above are approximate and were compiled from various sources by Thane Hendricks, Department of Energy, Remote Sensing Laboratory.



See facing page for legend

4

AERIAL RADIATION CONTOURS GROSS COUNT

5 0 5 Miles

5 0 5 10 Kilometers

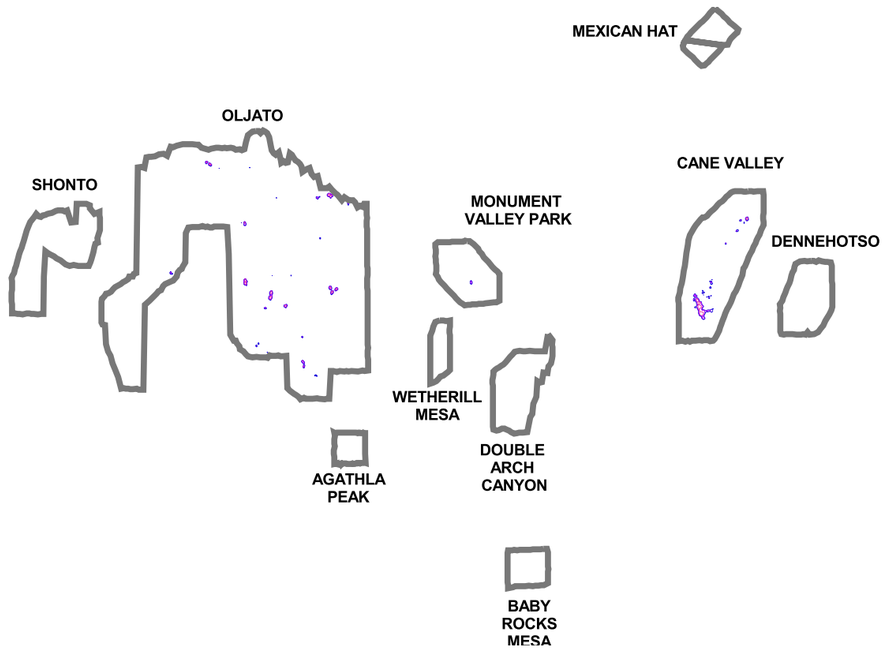
1:350,000

U.S. Environmental Protection Agency

ABANDONED URANIUM MINES PROJECT

Monument Valley Area

MONUMENT VALLEY AREA
AERIAL RADIATION CONTOURS - BISMUTH 214



Aerial Radiation Contours	Derived contour-level Bismuth 214 photo-peak (excess counts per second)	Estimated exposure rate from excess Bismuth 214 (excess micro-R/hour)
	80	3.5
	170	7.4
	250	10.9
	800	34.9
	1200	52.4

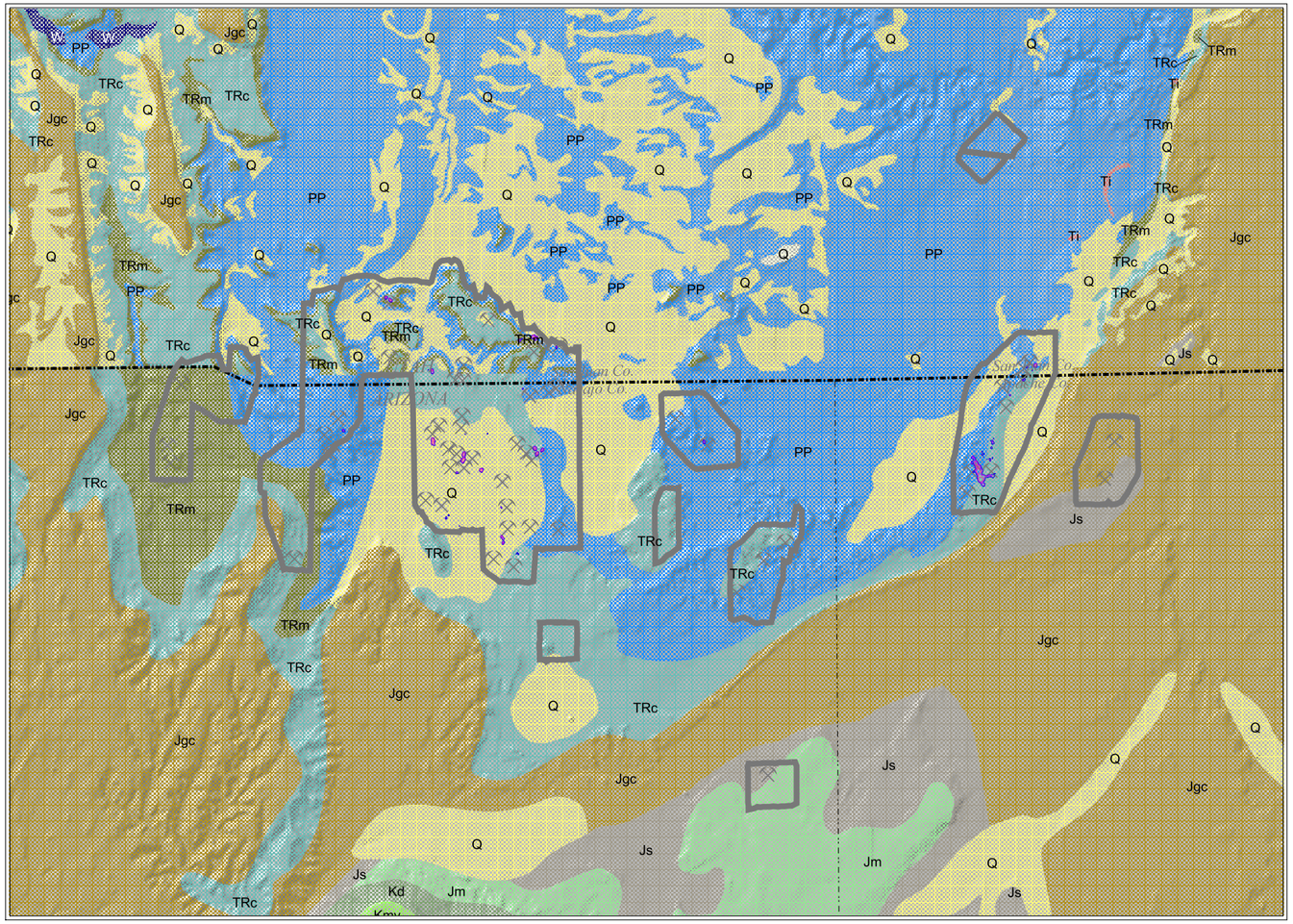
Aerial radiation gross count contours are indicative of uranium concentrations higher than the regional levels.

Units are in micro-Roentgens per hour. The Bismuth 214 photo peak is at 1760 KeV.
At the survey altitude of 150 feet above ground level, the footprint of the detection system is a circle approximately 300 feet in diameter. The data shown are averages over this footprint at ground level.

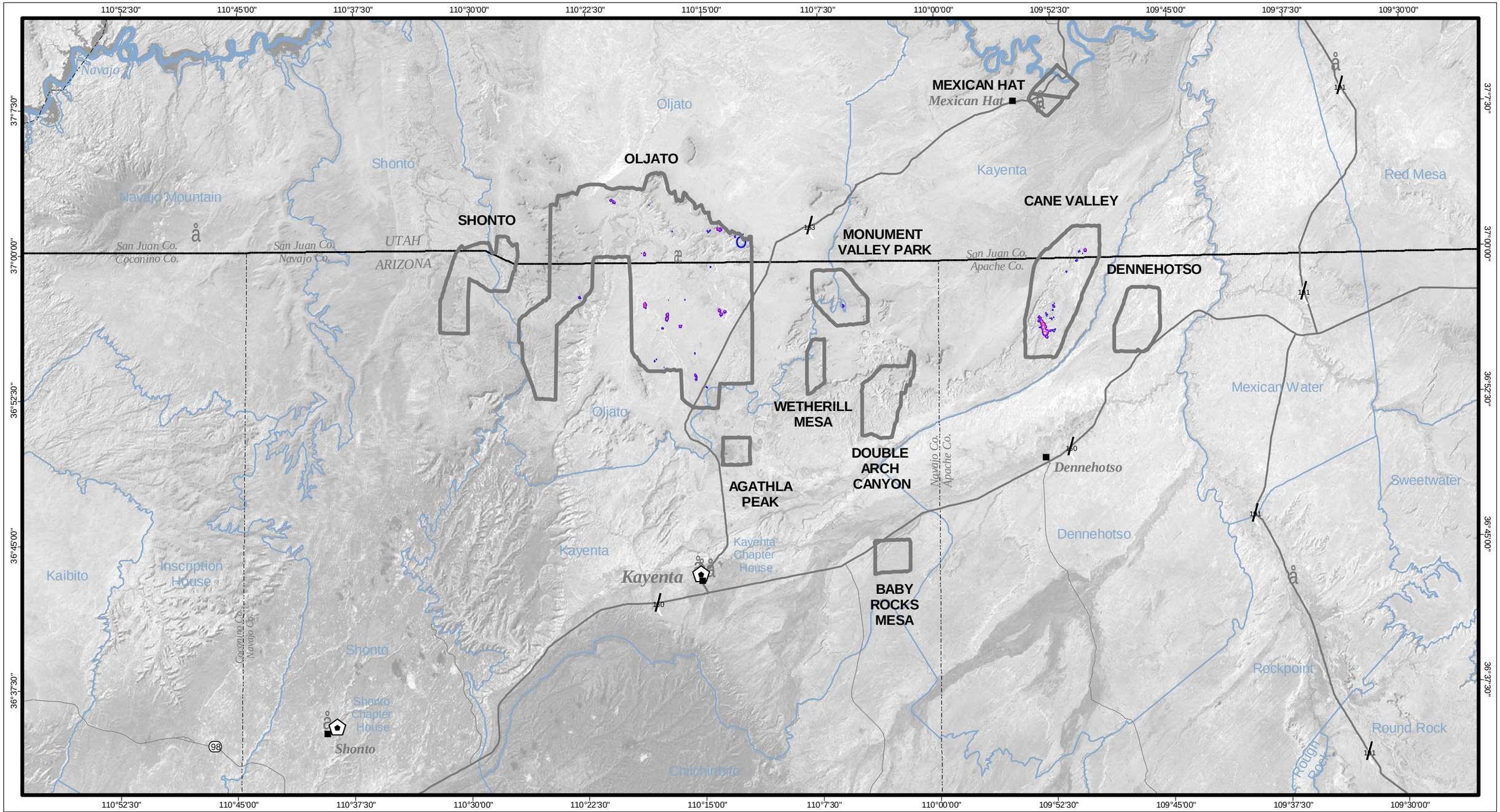
Derived and estimated values were compiled by Thane Hendricks, Department of Energy, Remote Sensing Laboratory, Las Vegas.

Geological Units (Age and Unit Description)

W	Water	Kd	Cretaceous Dakota Sandstone	Jgc	Jurassic Glen Canyon Group
Q	Quaternary Alluvium and Colluvium	Jm	Jurassic Morrison Formation	TRc	Triassic Chinle Formation
Ti	Tertiary Intrusives and Volcanics	Js	Jurassic San Rafael Group	TRm	Triassic Moenkopi Formation
				PP	Permian to Pennsylvanian Sedimentary Rocks



Sources: Aerial survey boundaries are from the Department of Energy, Remote Sensing Laboratory, Las Vegas, Nevada. Geological information from the Geologic Map of Arizona, GIS database (Richard and Kneale, 1997), and the Digital Geologic Map of Utah (Willis, 2000). Uranium mine locations shown above are approximate and were compiled from various sources by Thane Hendricks, Department of Energy, Remote Sensing Laboratory.



MAP FEATURES

Aerial Survey Boundary

4

AERIAL RADIATION CONTOURS
BISMUTH 214

5 0 5 Miles

5 0 5 10 Kilometers

1:350,000

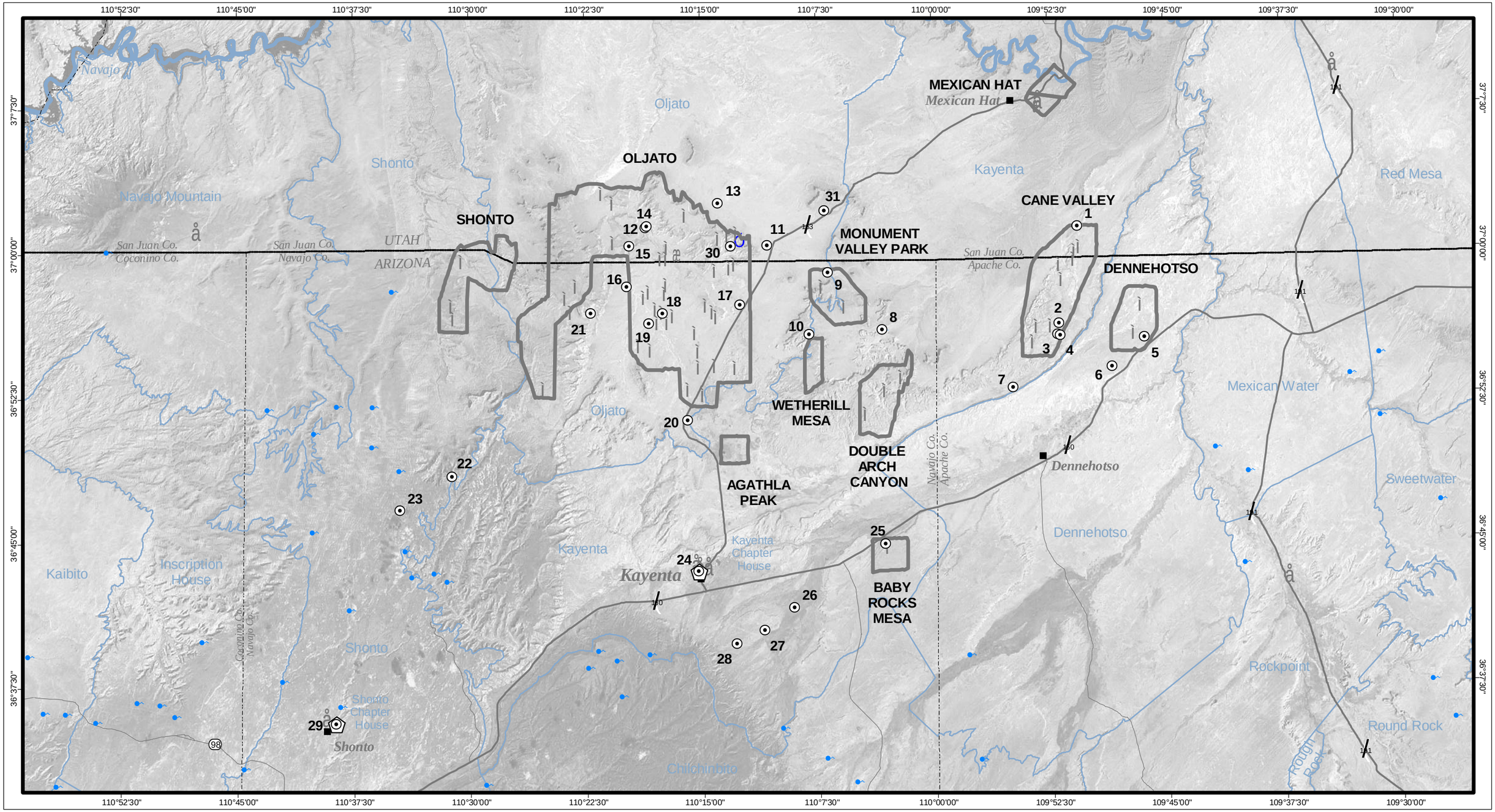
U.S. Environmental Protection Agency

ABANDONED URANIUM MINES PROJECT

Monument Valley Area

WATER SAMPLE INFORMATION

Map ID	Sample ID	Field Type	Sample Name	Longitude (DMS) (W)	Latitude (DMS) (N)	Elevation (ft)	Sample Date	Sample Time
1	KY980910OLS003	Spring	Tse-li-chee-hateh Spring	109 50 40.450	37 1 12.07919	4531	10-Sep-98	2:37 PM
2	KY980910OLW004	Well	Stockpile Well	109 51 54.831	36 56 10.0104	4802	10-Sep-98	10:45 AM
3	KY980910OLS002	Spring	Kiishzhinii-be-toh Spring	109 51 58.602	36 55 36.3593	4804	10-Sep-98	12:01 PM
4	KY981012OLW012	Well	Artesian Well 613	109 51 50.499	36 55 32.6430	4799	12-Oct-98	10:40 AM
5	KY980901DEW002	Wind Mill	Tank 8T-519	109 46 23.957	36 55 24.8562	5055	01-Sep-98	11:32 AM
6	KY980901DEW001	Wind Mill	Tank-East Of Chapter	109 48 29.801	36 53 54.5862	5140	01-Sep-98	10:13 AM
7	KY980910OLW005	Well	Shallow Well-Adakai	109 54 54.366	36 52 52.5528	4985	10-Sep-98	12:54 PM
8	KY980922OLS007	Spring	Sand Spring	110 3 19.8377	36 55 55.8119	5010	22-Sep-98	10:10 AM
9	KY980922OLW008	Well	Monument Valley Park	110 6 48.3239	36 58 53.5044	5530	22-Sep-98	8:34 AM
10	KY980922OLS008	Spring	Tsiah Spring	110 8 2.15520	36 55 41.3190	5422	22-Sep-98	4:59 PM
11	KY980922OLW009	Well	Monument Valley High School	110 10 42.511	37 0 20.16539	5120	22-Sep-98	11:36 AM
12	KY980921OLW007	Wind Mill	Tank 8AI-1	110 18 34.589	37 1 17.04720	4837	21-Sep-98	3:05 PM
13	KY980923OLW010	Wind Mill	Tank 8AI-3	110 13 51.923	37 2 32.83681	4878	23-Sep-98	7:58 AM
14	KY980921OLS004	Spring	Moonlight Water	110 18 30.982	37 1 21.65761	4829	21-Sep-98	1:55 PM
15	KY980921OLS006	Spring	Truck Cab Spring	110 19 36.643	37 0 19.27800	4836	21-Sep-98	4:01 PM
16	KY980909OLW003	Well	Shallow Well El Capitan	110 19 48.964	36 58 15.2357	4920	09-Sep-98	12:26 PM
17	KY980902OLW002	Wind Mill	Tank 8K-402	110 12 29.139	36 57 16.0674	5157	02-Sep-98	4:20 PM
18	KY980902OLW001	Wind Mill	Tank 8A-299	110 17 29.530	36 56 50.6478	5028	02-Sep-98	12:10 PM
19	KY980923OLW011	Well	Well 8T-525	110 18 22.740	36 56 19.8743	5011	23-Sep-98	9:51 AM
20	KY980923OLS009	Spring	8A-P.H.S.-22 Spring	110 15 55.235	36 51 16.8480	5257	23-Sep-98	11:28 AM
21	KY980909OLS001	Spring	Ramp Spring	110 22 7.0776	36 56 53.3940	5241	09-Sep-98	1:18 PM
22	KY980831SHS001	Spring	Aspen Spring	110 31 8.1977	36 48 26.5362	7383	31-Aug-98	11:27 AM
23	KY980831SHW001	Wind Mill	Tank 2K-305	110 34 29.954	36 46 41.8019	7270	31-Aug-98	9:53 AM
24	KY981009KYW002	Well	Kayenta Chapter House	110 15 17.050	36 43 27.9336	5603	09-Oct-98	9:31 AM
25	KY980901DES001	Spring	Baby Rock Spring 8-44	110 3 13.2743	36 44 49.6547	5229	01-Sep-98	1:45 PM
26	KY981009KYW003	Wind Mill	Tank 8A-138	110 9 7.85638	36 41 34.7219	5427	09-Oct-98	10:41 AM
27	KY981009KYS001	Spring	Kee Mi Kay Spring	110 11 1.5587	36 40 23.9987	5565	09-Oct-98	11:26 AM
28	KY981009KYW004	Wind Mill	Tank 8T-549	110 12 49.674	36 39 41.6148	5748	09-Oct-98	11:53 AM
29	KY980831SHS002	Spring	Shonto Chapter House	110 38 40.300	36 35 38.9843	6178	31-Aug-98	1:19 PM
30	KY000112OLW013	Well	Goulding Well	110 13 4.8168	37 0 17.62621	5368	12-Jan-00	1:07 PM
31	KY000112OLW014	Well	Monument Pass Well	110 6 59.9004	37 2 7.366811	5441	12-Jan-00	2:28 PM



MAP FEATURES

- Water Sample Site
- Spring (GNIS) used in project planning
- Mine or Mineral occurence (MRDS and MILS) used in project planning

4

WATER SAMPLE LOCATIONS

5 0 5 Miles

5 0 5 10 Kilometers

1:350,000

U.S. Environmental Protection Agency

ABANDONED URANIUM MINES PROJECT

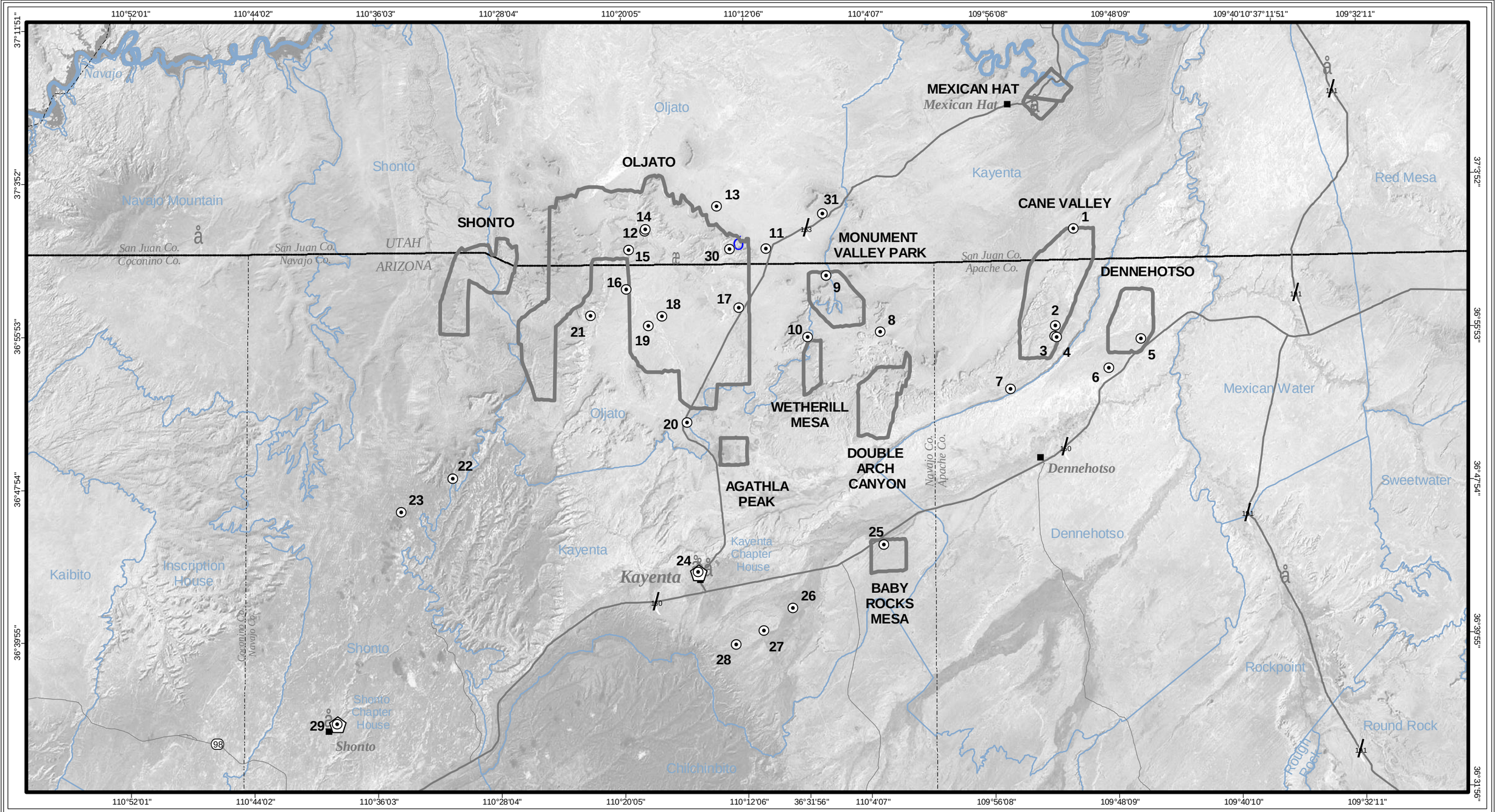
Monument Valley Area

WATER SAMPLE ANALYSIS FOR STABLE METALS

Map ID	Sample ID	Sample Name	Al	Sb[2]	As[2,4]	Ba	Be[2,4]	Cd[2,4]	Cr[2,5]	Cu[2]	Fe[2]	Pb[2]	Mn[2]	Hg[2]	Ni[2]	Se[2]	Ag[2]	Th[2,5]	V[2]	Zn[2]	ILCRsta[1,7]	HI[3,6]
		Primary MCLs in Micrograms per Liter (µg/L)[7]	1000	6	50	1000	4	5	100	1300	300	15	50	2	None	50	100	2	None	5000		
		PRG Limits in Micrograms per Liter (µg/L)[8]	37000	15	0.045	2600	73	18	180	1400	1100	4	1700	11	730	189	180	2.6	260	11000		
1	KY980910OLS003	Tse-li-chee-hateh Spring	58.8	0	7.6	64.4	0	0	0	0	0	0	0	0.071	0	4.0	0	0	10.6	5.2	1.69E-04	0.79
2	KY980910OLW004	Stockpile Well	222.0	0	8.2	9.5	0	0	0	2.5	4,050.0	1.5	43.3	0.190	0	0	0	0	1.0	30.8	1.82E-04	1.17
3	KY980910OLS002	Kiishzhinii-be-toh Spring	68.6	0	4.0	125.0	0	0	0	6.8	1270.0	16.8	96.4	0.071	0	0	0	0	1.0	3,720.0	8.89E-05	0.94
4	KY981012OLW012	Artesian Well 613	69.1	0	0	38.9	0.2	0	0	0	20.6	0	0	0.190	0	0	0	0	0.9	8.8	0.00E+00	0.04
5	KY980901DEW002	Tank 8T-519	48.0	0	2.8	20.2	0	0	0	0	56.7	2.3	0.6	0.071	0	0	0	0	8.4	479.0	6.22E-05	0.35
6	KY980901DEW001	Tank-East Of Chapter	45.7	0	0	13.0	0	0	0	16.0	329.0	0	1.6	0	0	0	0	3.6	3.2	142.0	0.00E+00	1.46
7	KY980910OLW005	Shallow Well-Adakai	90.8	0	6.6	34.5	0	0	0	2.2	95.3	3.0	29.4	0.072	0	0	0	0	6.9	283.0	1.47E-04	0.70
8	KY980922OLS007	Sand Spring	480.0	0	0	114.0	0.3	1.1	0	0	197.0	10.3	20.1	0.084	0	14.8	0	0	6.4	6.6	0.00E+00	0.26
9	KY980922OLW008	Monument Valley Park	72.6	0	0	278.0	0.4	0	0	11.2	0	0	0	0.140	0	0	0	0	2.8	28.1	0.00E+00	0.15
10	KY980922OLS008	Tsiah Spring	88.1	0	7.2	149.0	0.3	0	0	9.9	43.1	0	0.8	0.087	0	2.8	0	0	7.8	33.7	1.60E-04	0.79
11	KY980922OLW009	Monument Valley High School	82.0	0	0	282.0	0.3	0	0	119	0	4.2	0	0.130	2.7	0	0	0	2.6	30.5	0.00E+00	0.23
12	KY980921OLW007	Tank 8AI-1	98.1	0	0	27.7	0.1	0	0	29.2	325.0	1.6	14.8	0.130	0	18.4	0	0	2.2	105.0	0.00E+00	0.20
13	KY980923OLW010	Tank 8AI-3	246.0	0	3.3	6.8	0	0	5.0	0	139.0	0	7.7	0.120	0	13.2	0	4.0	7.5	346.0	7.33E-05	2.03
14	KY980921OLS004	Moonlight Water	97.7	0	0	211.0	0	0	0	0	118.0	2.0	23.2	0.170	0	0	0	0	0	27.6	0.00E+00	0.13
15	KY980921OLS006	Truck Cab Spring	683.0	0	0	32.3	0.1	0	0	0	651.0	0	39.8	0.130	0	0	0	3.1	3.6	23.9	0.00E+00	1.34
16	KY980909OLW003	Shallow Well El Capitan	73.3	0	0	45.1	0	0	0	2.8	0	0	0.6	0.072	0	0	0	0	2.4	49.2	0.00E+00	0.04
17	KY980902OLW002	Tank 8K-402	80.2	0	0	61.9	0	0	0	27.9	185.0	0	1.8	0.078	0	9.6	0	0	6.0	53.5	0.00E+00	0.15
18	KY980902OLW001	Tank 8A-299	89.9	0	13.7	13.1	0	0	0	0	182.0	0	16.4	0.072	5.3	0	0	0	0.0	86.2	3.04E-04	1.30
19	KY980923OLW011	Well 8T-525	2250.0	0	5	151.0	0.3	0	0	0	949.0	0	39.1	0.068	1.8	0	0	0	18.7	9.9	1.11E-04	0.77
20	KY980923OLS009	8A-P.H.S.-22 Spring	88.6	0	0	86.8	0.6	0	0	0	0	0	0	0.062	0	0	0	0	0	5.6	0.00E+00	0.05
21	KY980909OLS001	Ramp Spring	53.3	0	0	154.0	0	0	0	0	0	0	0	0.076	0	9.0	0	0	10.2	9.9	0.00E+00	0.16
22	KY980831SHS001	Aspen Spring	43.4	0	0	11.3	0	0	18.9	29.2	163.0	0	3.4	0.070	11.1	0	0	0	0.7	78.3	0.00E+00	0.18
23	KY980831SHW001	Tank 2K-305	57.5	0	0	98.2	0	0.4	0	0	0	0	2.7	0.067	1.6	0	0	0	1.1	1,240.0	0.00E+00	0.19
24	KY981009KYW002	Kayenta Chapter House	88.0	0	2.6	43.5	0.6	0.4	0	33.7	436.0	2.1	12.0	0.130	0	0	0	0	2.3	315.0	5.78E-05	0.41
25	KY980901DES001	Baby Rock Spring 8-44	4790.0	0	5.4	81.6	0.3	0	3.8	0	1,440.0	0	28.8	0.074	1.6	957.0	0	4.3	481.0	19.3	1.20E-04	9.40
26	KY981009KYW003	Tank 8A-138	318.0	0	5.7	10.4	0.6	0	4.3	0	1,280.0	7.5	18.7	0.120	2.0	0	0	2.9	66.4	38.0	1.27E-04	2.08
27	KY981009KYS001	Kee Mi Kay Spring	100.0	0	0	39.0	0.5	0	0	0	0	0	0	0.099	0	13.9	0	0	11.2	59.3	0.00E+00	0.16
28	KY981009KYW004	Tank 8T-549	106.0	0	8.8	2.4	0.5	0	0	0	346.0	3.5	3.6	0.1	0	0	0	0	18.7	307	1.96E-04	0.95
29	KY980831SHS002	Shonto Chapter House	74.7	0	0	152.0	0	0	0	3	0	0	0.4	0.072	0	0	0	0	4.4	91.0	0.00E+00	0.09
30	KY000112OLW013	Goulding Well	30.0	0	0.4	198.0	0	0	0	0	0	0	0	0	0	4.3	0	0	5.3	12.4	9.11E-06	0.16
31	KY000112OLW014	Monument Pass Well	38.0	0	3.9	46.6	0	0.3	0	238	351.0	25.4	14.1	0	0	7.4	0	0	35.4	134.0	8.56E-05	0.78

1. ILCR = Incremental Lifetime Cancer Risk with Respect to Stable Metals.
2. The values of "0" represent a result of either "not detected" at the detection limit of the laboratory method or a negative count. In both cases, the result can be considered "0".
3. The evaluation of Beta is in two steps. The initial screening level is 50 pCi/L. If the measured level of Beta exceeds the 50 pCi/L, a further evaluation is merited. Beta-emitting radionuclides would be screened.
4. The values of "0" in the Pb210 column represent analytical results that measured less than the Minimum Detectable Activity (MDA).
5. Definition of final calculations and ranking is described and published in Appendix A.1 *Summary of the Characterization of Risk Leading to Exposure Reduction.*
6. When comparing these PRG's with the U.S. EPA's PRG list, the calculated PRG used for U238 is less than the EPA's PRG for U238D (D meaning that its decay daughters are included in the risk calculations).
7. MCL – Maximum Contaminant Levels are the maximum permissible level of a contaminant in water delivered to users of a public water system.
8. PRG – Preliminary Remediation Goals are tools for evaluating and cleaning up contaminated sites. They are risk-based concentrations derived from standardized equations, combining exposure information assumptions and EPA toxicity data.

Al = Aluminum Sb = Antimony As = Arsenic Ba = Barium Be = Beryllium Cd = Cadmium Cr = Chromium Cu = Copper Fe = Iron Pb = Lead Mn = Manganese Hg = Mercury Ni = Nickel Se = Selenium Ag = Silver Th = Thallium V = Vanadium Zn = Zinc HI = Hazard Index



MAP FEATURES

⊙ Water Sample Site - Stable Metals

4

WATER SAMPLE ANALYSIS FOR STABLE METALS

5 0 5 Miles

5 0 5 10 Kilometers

1:350,000

U.S. Environmental Protection Agency

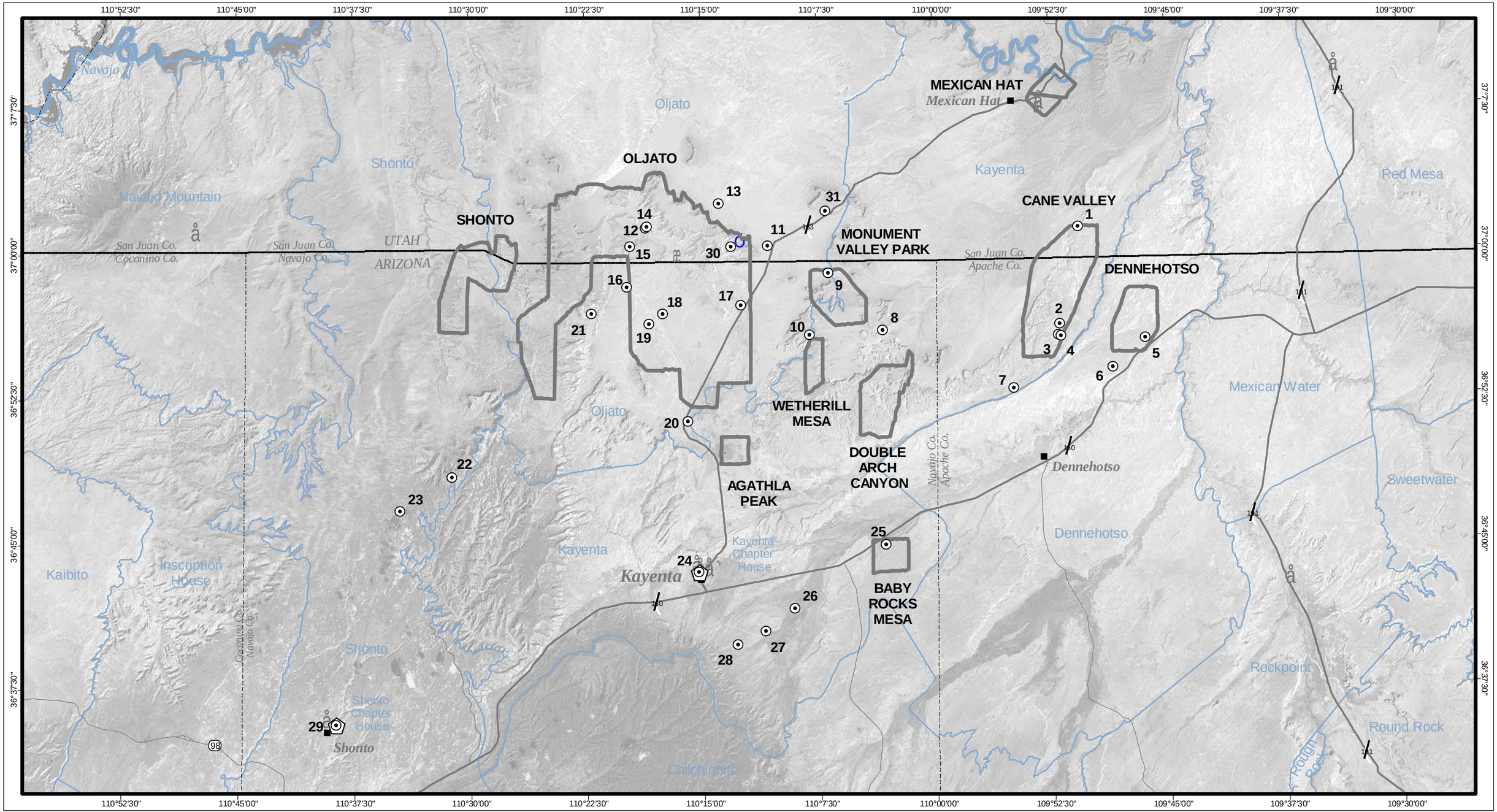
ABANDONED URANIUM MINES PROJECT

Monument Valley Area

WATER SAMPLE ANALYSIS FOR RADIOACTIVE METALS

Map ID	Sample ID	Sample Name	Alpha[2]	Beta[3]	Lead210[4]	Radium226[2]	Radium228[2]	Thorium228[2]	Thorium230[2]	Thorium232[2]	Uranium234[2]	Uranium235[2]	Uranium238[2,6]	ILCRrad[1,5]
		Primary MCLs in Pico-curies per Liter (pCi/L)[7]	15	50	None	5	5	None	None	None	20	20	20	
		PRG Limits in Pico-curies per Liter (pCi/L)[8]	None	None	0.047	0.16	0.19	0.21	1.3	1.5	1.1	1.1	0.71	
1	KY980910OLS003	Tse-li-chee-hateh Spring	4.39	2.51	1.32	0.056	0.416	-0.002	0.000	0.000	3.34	0.039	2.03	3.66E-05
2	KY980910OLW004	Stockpile Well	0.25	4.53	0.80	0.053	0.301	-0.001	0.012	0.000	0.35	0.055	0.06	1.94E-05
3	KY980910OLS002	Kiishzhinii-be-toh Spring	3.87	4.38	0.55	0.221	0.191	-0.008	0.013	-0.001	1.71	-0.021	1.53	1.77E-05
4	KY981012OLW012	Artesian Well 613	4.60	2.87	0.46	0.043	0.368	-0.012	0.010	0.005	2.37	0.041	1.31	6.25E-06
5	KY980901DEW002	Tank 8T-519	1.14	1.04	0.08	0.091	0.212	0.043	0.002	0.009	0.67	0.068	0.14	2.76E-06
6	KY980901DEW001	Tank-East Of Chapter	2.00	2.35	0.19	0.068	0.144	0.043	0.008	0.000	2.14	0.031	0.33	3.84E-06
7	KY980910OLW005	Shallow Well-Adakai	3.77	2.98	0.36	0.019	0.275	-0.011	0.009	0.000	1.86	0.046	1.17	4.95E-06
8	KY980922OLS007	Sand Spring	2.93	9.62	0.47	0.098	0.824	0.178	0.079	0.074	2.37	-0.016	1.41	1.00E-05
9	KY980922OLW008	Monument Valley Park	1.95	1.92	0.60	0.102	0.650	0.026	0.003	-0.002	1.29	0.046	0.49	1.88E-05
10	KY980922OLS008	Tsiah Spring	3.23	8.50	0.71	0.217	0.681	0.036	0.010	0.006	2.67	0.047	1.07	2.42E-05
11	KY980922OLW009	Monument Valley High School	1.14	2.25	0.33	0.099	0.864	0.027	0.005	-0.001	0.97	0.037	0.58	7.02E-06
12	KY980921OLW007	Tank 8AI-1	6.09	7.23	0.51	0.061	0.892	0.007	0.007	0.000	2.75	0.111	2.22	1.08E-05
13	KY980923OLW010	Tank 8AI-3	10.30	17.90	0.32	0.379	0.946	0.023	0.000	-0.045	10.30	0.347	4.56	2.36E-05
14	KY980921OLS004	Moonlight Water	4.15	6.59	0.28	0.172	0.604	0.004	-0.001	0.000	2.24	0.146	1.85	9.05E-06
15	KY980921OLS006	Truck Cab Spring	19.80	10.80	0.57	0.052	0.333	0.031	0.021	0.017	11.30	0.244	7.13	2.28E-05
16	KY980909OLW003	Shallow Well El Capitan	8.41	7.47	1.12	0.127	0.208	0.008	0.005	0.000	6.29	0.125	4.19	3.75E-05
17	KY980902OLW002	Tank 8K-402	1.59	5.13	0.61	0.080	0.217	0.015	-0.002	0.000	0.92	-0.003	0.48	1.61E-05
18	KY980902OLW001	Tank 8A-299	155.00	92.10	0.39	7.840	0.422	0.099	0.007	0.000	91.30	3.830	76.80	2.46E-04
19	KY980923OLW011	Well 8T-525	1.59	10.10	0.42	0.092	0.511	0.075	0.024	0.024	1.16	0.000	0.52	5.44E-06
20	KY980923OLS009	8A-P.H.S.-22 Spring	1.95	4.87	0.62	0.272	0.533	0.017	0.011	0.000	2.13	-0.017	1.57	8.74E-06
21	KY980909OLS001	Ramp Spring	4.53	9.20	0.62	0.124	0.016	-0.006	0.010	0.000	2.94	0.078	2.09	1.98E-05
22	KY980831SHS001	Aspen Spring	0.27	1.36	0.74	0.074	0.212	0.009	0.006	0.000	-0.01	0.037	-0.02	1.73E-05
23	KY980831SHW001	Tank 2K-305	1.77	2.35	2.68	0.070	0.353	-0.023	0.000	-0.003	0.50	-0.003	-0.01	5.98E-05
24	KY981009KYW002	Kayenta Chapter House	3.88	4.14	0.69	0.058	0.272	-0.021	0.005	0.000	2.98	0.081	1.17	6.23E-06
25	KY980901DES001	Baby Rock Spring 8-44	27.10	14.50	0.83	0.093	0.075	-0.011	-0.002	-0.002	18.40	0.687	17.20	6.01E-05
26	KY981009KYW003	Tank 8A-138	1.40	3.01	0.19	0.044	-0.017	-0.001	0.009	0.000	2.91	0.047	1.05	4.45E-06
27	KY981009KYS001	Kee Mi Kay Spring	12.00	7.70	2.33	0.400	0.183	0.015	0.004	0.000	5.83	0.302	3.98	6.43E-05
28	KY981009KYW004	Tank 8T-549	1.43	0.99	0.50	0.022	0.183	0.015	0.000	0.000	1.27	0.040	0.60	3.21E-06
29	KY980831SHS002	Shonto Chapter House	2.34	3.58	0.14	0.118	0.556	0.019	0.000	0.000	2.09	0.141	0.35	6.28E-06
30	KY000112OLW013	Goulding Well	1.20	3.10	1.60	0.000	2.300	0.300	0.300	0.300	1.50	0.400	1.30	1.75E-05
31	KY000112OLW014	Monument Pass Well	19.50	21.10	4.60	-0.100	1.800	0.200	0.200	0.200	24.40	0.900	14.70	5.44E-05

1. ILCR = Incremental Lifetime Cancer Risk with Respect to Radioactive Metals.
2. The values of "0" represent a result of either "not detected" at the detection limit of the laboratory method or a negative count. In both cases, the result can be considered "0".
3. The evaluation of Beta is in two steps. The initial screen level is 50pCi/l. If the measured level of Beta exceeds the 50 pCi/L, a further evaluation is merited. The Beta-emitting radionuclides would be screened.
4. The values of "0" in the Lead210 column represent analytical results that measured less than the Method Detection Activity (MDA).
5. Definition of final calculations and ranking is described and published in Appendix A.1 *Summary of the Characterization of Risk Leading to Exposure Reduction.*
6. When comparing these PRG's with the U.S. EPS's PRG list, the calculated PRG used for Uranium238 is less than the EPA's PRG for Uranium238D (D meaning that its decay daughters are included in the risk calculations).
7. MCL – Maximum Contaminant Levels are the maximum permissible level of a contaminant in water delivered to users of a public water system.
8. PRG – Preliminary Remediation Goals are tools for evaluating and cleaning up contaminated sites. They are risk-based concentrations derived from standardized equations, combining exposure information assumptions and EPA toxicity data.



MAP FEATURES

⊙ Water Sample Site - Radioactive Metals

4

WATER SAMPLE ANALYSIS FOR RADIOACTIVE METALS

5 0 5 Miles

5 0 5 10 Kilometers

1:350,000

U.S. Environmental Protection Agency

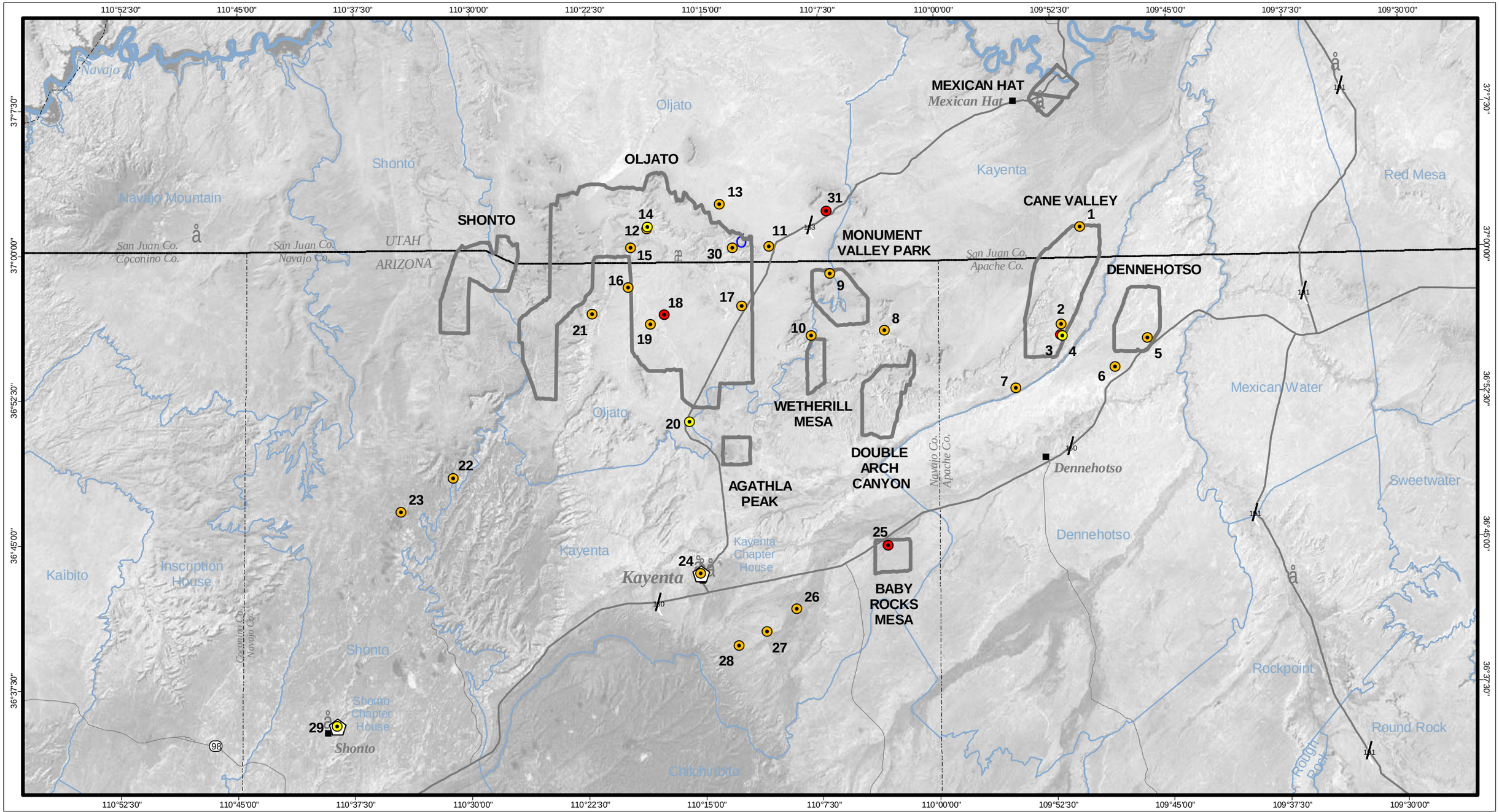
ABANDONED URANIUM MINES PROJECT

Monument Valley Area

SUMMARY OF WATER QUALITY ANALYSIS WITH RESPECT TO STABLE AND RADIOACTIVE METALS

Map ID	Sample ID	Sample Name	Total Cancer Risk	Hazard Index (HI)	Arsenic[3]	Lead[3]	Total U[2]	Water Quality with Respect to Stable and Radioactive Metals[4]			Risk Category	Risk Ranking[6]
		Primary MCLs in Micrograms per Liter (µg/L)[7]			50	15	30[5]					
		PRG Limits in Micrograms per Liter (µg/L)[8]			0.045	4	None	Less Risk	Some Risk	More Risk		
1	KY980910OLS003	Tse-li-chee-hateh Spring	2.05E-004	0.79	7.6	0	5.37		ILCR		SOME	21
2	KY980910OLW004	Stockpile Well	2.02E-004	1.17	8.2	1.5	0.35		ILCR, HI		SOME	20
3	KY980910OLS002	Kiishzhinii-be-toh Spring	1.07E-004	0.94	4	16.8	3.24			Lead	MORE	28
4	KY981012OLW012	Artesian Well 613	6.25E-006	0.04	0	0	3.68	X			LESS	2
5	KY980901DEW002	Tank 8T-519	6.50E-005	0.35	2.80	2.3	0.67		ILCR		SOME	13
6	KY980901DEW001	Tank-East Of Chapter	3.84E-006	1.46	0	0	2.47		HI		SOME	7
7	KY980910OLW005	Shallow Well-Adakai	1.52E-004	0.70	6.6	3	3.03		ILCR		SOME	22
8	KY980922OLS007	Sand Spring	1.00E-005	0.26	0	10.3	3.78		ILCR, Lead		SOME	26
9	KY980922OLW008	Monument Valley Park	1.88E-005	0.15	0	0	1.78		ILCR		SOME	8
10	KY980922OLS008	Tsiah Spring	1.84E-004	0.79	7.2	0	3.74		ILCR		SOME	18
11	KY980922OLW009	Monument Valley High School	7.02E-006	0.23	0	4.2	1.55		Lead		SOME	15
12	KY980921OLW007	Tank 8AI-1	1.08E-005	0.20	0	1.6	4.97		ILCR		SOME	14
13	KY980923OLW010	Tank 8AI-3	9.69E-005	2.03	3.3	0	15.21		ILCR, HI		SOME	25
14	KY980921OLS004	Moonlight Water	9.05E-006	0.13	0	2.0	4.09	X			LESS	4
15	KY980921OLS006	Truck Cab Spring	2.28E-005	1.34	0.0	0	18.43		ILCR, HI		SOME	24
16	KY980909OLW003	Shallow Well El Capitan	3.75E-005	0.04	0	0	10.48		ILCR		SOME	17
17	KY980902OLW002	Tank 8K-402	1.61E-005	0.15	0	0	1.40		ILCR		SOME	6
18	KY980902OLW001	Tank 8A-299	5.51E-004	1.30	13.7	0	171.93			Total U	MORE	31
19	KY980923OLW011	Well 8T-525	1.17E-004	0.77	5	0	1.68		ILCR		SOME	12
20	KY980923OLS009	8A-P.H.S.-22 Spring	8.74E-006	0.05	0	0	3.70	X			LESS	3
21	KY980909OLS001	Ramp Spring	1.98E-005	0.16	0	0	5.03		ILCR		SOME	11
22	KY980831SHS001	Aspen Spring	1.73E-005	0.18	0	0	0		ILCR		SOME	5
23	KY980831SHW001	Tank 2K-305	5.98E-005	0.19	0	0	0.5		ILCR		SOME	9
24	KY981009KYW002	Kayenta Chapter House	6.40E-005	0.41	2.6	2.1	4.15		ILCR		SOME	16
25	KY980901DES001	Baby Rock Spring 8-44	1.80E-004	9.40	5.4	0	36.29			Total U	MORE	29
26	KY981009KYW003	Tank 8A-138	1.31E-004	2.08	5.7	7.5	3.96		ILCR, Lead, HI		SOME	27
27	KY981009KYS001	Kee Mi Kay Spring	6.43E-005	0.16	0	0	10.11		ILCR		SOME	19
28	KY981009KYW004	Tank 8T-549	1.99E-004	0.95	8.8	3.5	1.87		ILCR		SOME	23
29	KY980831SHS002	Shonto Chapter House	6.28E-006	0.09	0	0	2.44	X			LESS	1
30	KY000112OLW013	Goulding Well	2.66E-005	0.16	0.4	0	3.20		ILCR		SOME	10
31	KY000112OLW014	Monument Pass Well	1.40E-004	0.78	3.9	25.4	40.00			Lead, Total U	MORE	30

1. ILCR = Incremental Lifetime Cancer Risk with Respect to Stable Metals and Radioactive Metals.
2. The PRG's and MCL's for Alpha, Beta, and Uranium are in Pico-Curies per Liter (pCi/L).
3. The PRG's and MCL's for Lead and Arsenic are in Micrograms per Liter (µg/L).
4. Water Quality Levels:
   - Less Risk — Total Cancer Risk is less than or equal to 1E-05 and Hazard Index is less than or equal to 1 and Lead is less than 4 and Total Uranium is less than 30.
   - Some Risk — Total Cancer Risk is less than or equal to 6E-04 but greater than 1E-05 or Hazard Index is less than 10 but greater than 1 or Lead is less than 15 but greater than 4 and Total Uranium is less than 30.
   - More Risk — Total Cancer Risk is greater than 6E-04 or Hazard Index is greater than 10 or Lead is greater than 15 or Total Uranium is equal to or greater than 30.
5. Proposed EPA MCl is 30 pCi/L for the sum of the three Uranium isotopes.
6. The definitions of the risk categories and the ranking is described and published in Appendix A.1 *Summary of the Characterization of Risk Leading to Exposure Reduction.*
7. MCL – Maximum Contaminant Levels are the maximum permissible level of a contaminant in water delivered to users of a public water system.
8. PRG – Preliminary Remediation Goals are tools for evaluating and cleaning up contaminated sites. They are risk-based concentrations derived from standardized equations, combining exposure information assumptions and EPA toxicity data.



Less Risk
Total Cancer Risk is less than or equal to 1E-05 and Hazard Index is less than or equal to 1 and Lead is less than 4 and U is less than 30.

Some Risk
Total Cancer Risk is less than or equal to 6E-04 but greater than 1E-05 or Hazard Index is less than 10 but greater than 1 or Lead is less than 15 but greater than 4 and U is less than 30.

More Risk
Total Cancer Risk is greater than 6E-04 or Hazard Index is greater than 10 or Lead is greater than 15 or U is equal to or greater than 30.

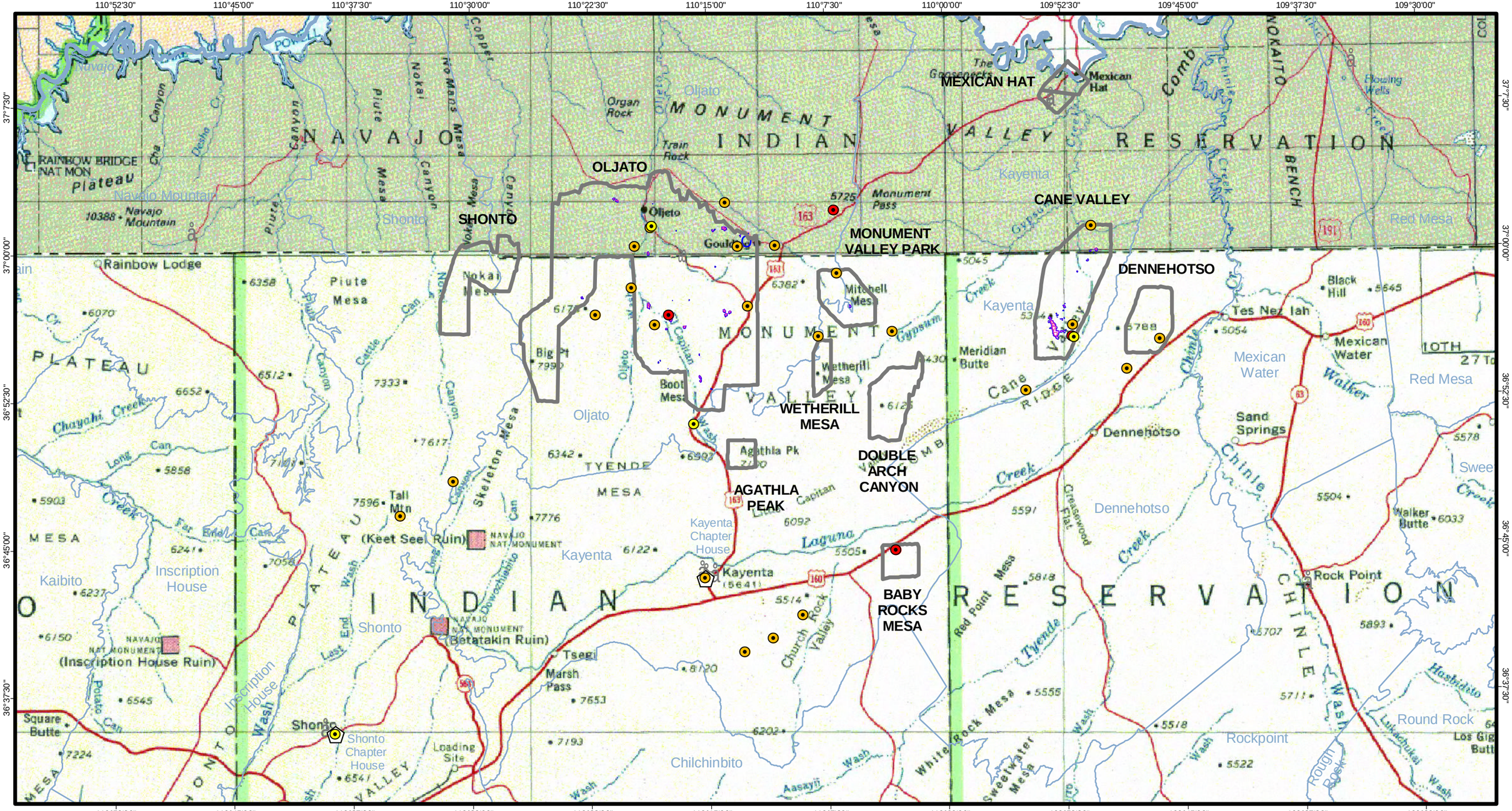
4

SUMMARY OF WATER QUALITY ANALYSIS WITH RESPECT TO STABLE AND RADIOACTIVE METALS

5 0 5 Miles
5 0 5 10 Kilometers
1:350,000

U.S. Environmental Protection Agency
ABANDONED URANIUM MINES PROJECT

Monument Valley Area



	Aerial Radiation Contours	Derived contour-level Bismuth 214 photo-peak (excess counts per second)	Estimated exposure rate from excess Bismuth 214 (excess micro-R/hour)
Less Risk		80	3.5
Some Risk		170	7.4
		250	10.9
		800	34.9
More Risk		1200	52.4

4

SUMMARY OF WATER QUALITY ANALYSIS AND BISMUTH 214 CONTOURS

5 0 5 Miles
5 0 5 10 Kilometers

1:350,000

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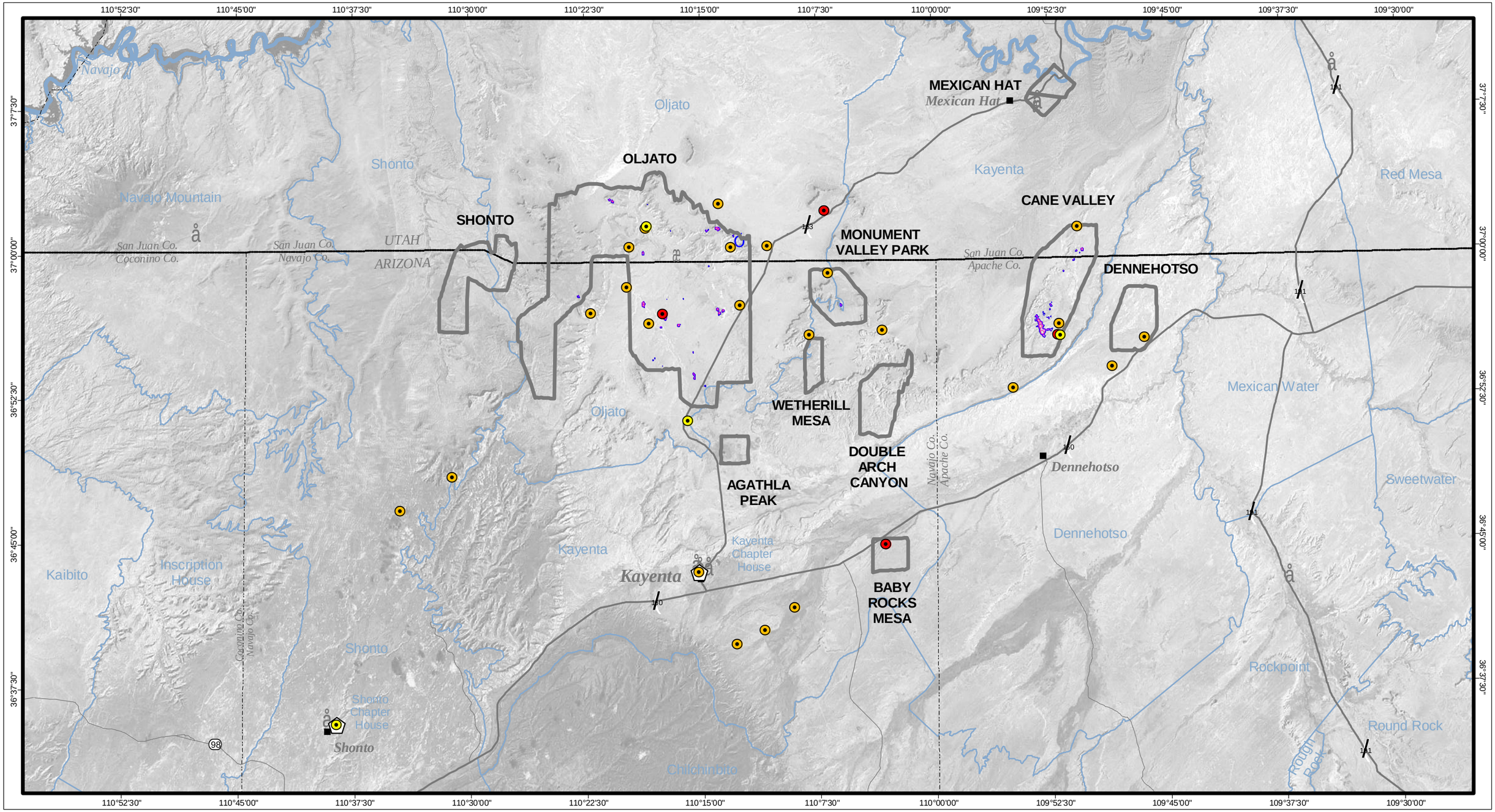
Monument Valley Area



Less Risk	Aerial Radiation Contours	Derived contour-level Bismuth 214 photo-peak (excess counts per second)	Estimated exposure rate from excess Bismuth 214 (excess micro-R/hour)
Some Risk		80	3.5
		170	7.4
		250	10.9
More Risk		800	34.9
		1200	52.4

4

SUMMARY OF WATER QUALITY ANALYSIS AND BISMUTH 214 CONTOURS

5 0 5 Miles
5 0 5 10 Kilometers
1:350,000

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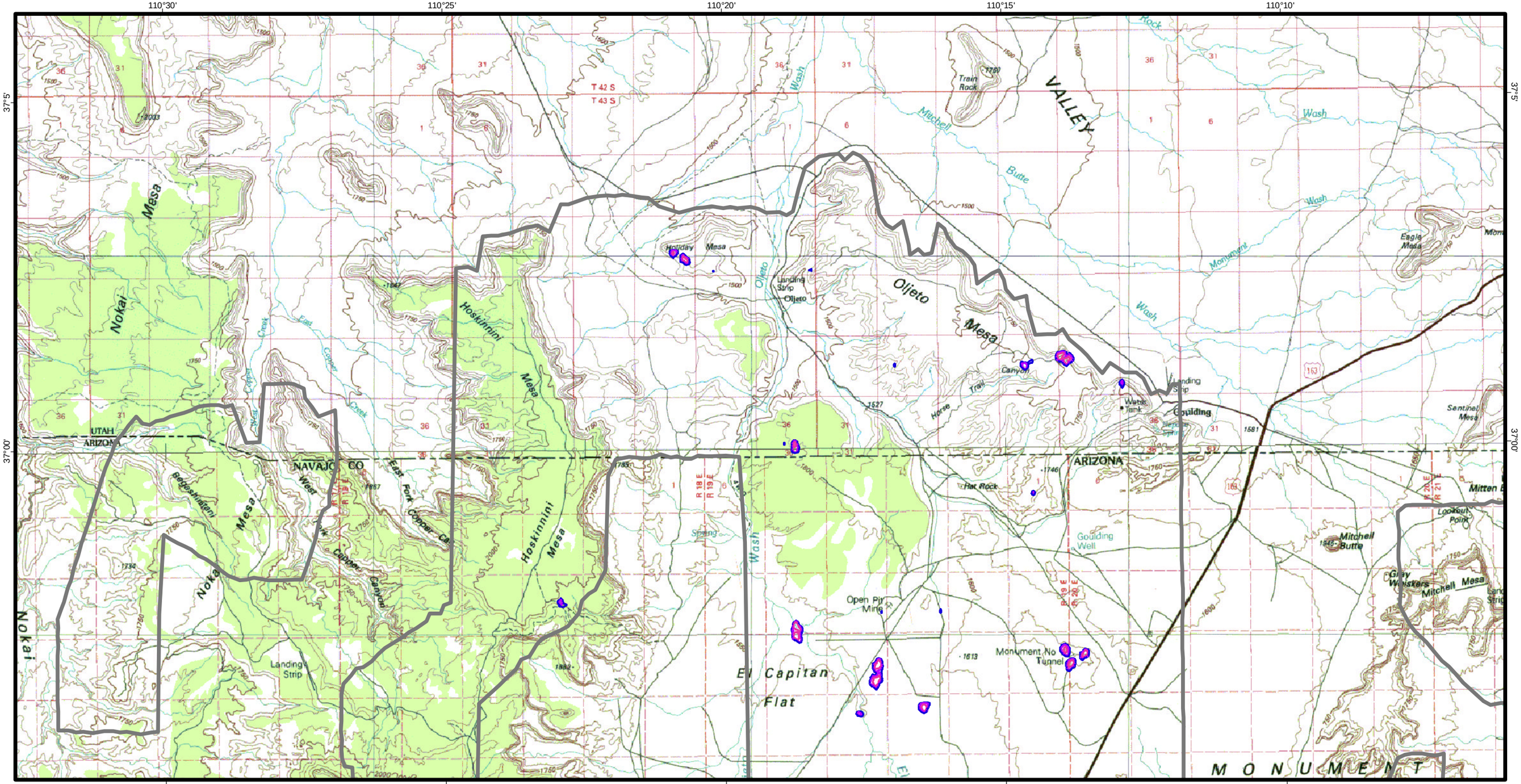
Monument Valley Area

110°30' 110°25' 110°20' 110°15' 110°10'

37°5'

37°00'



110°30' 110°25' 110°20' 110°15' 110°10'

OLJATO - NORTH

Aerial Radiation Contours	Derived contour-level Bismuth 214 photo-peak (excess counts per second)	Estimated exposure rate from excess Bismuth 214 (excess micro-R/hour)
	80	3.5
	170	7.4
	250	10.9
	800	34.9
	1200	52.4

4

AERIAL RADIATION CONTOURS
BISMUTH 214
OLJATO - NORTH

1 0 1 2 Miles

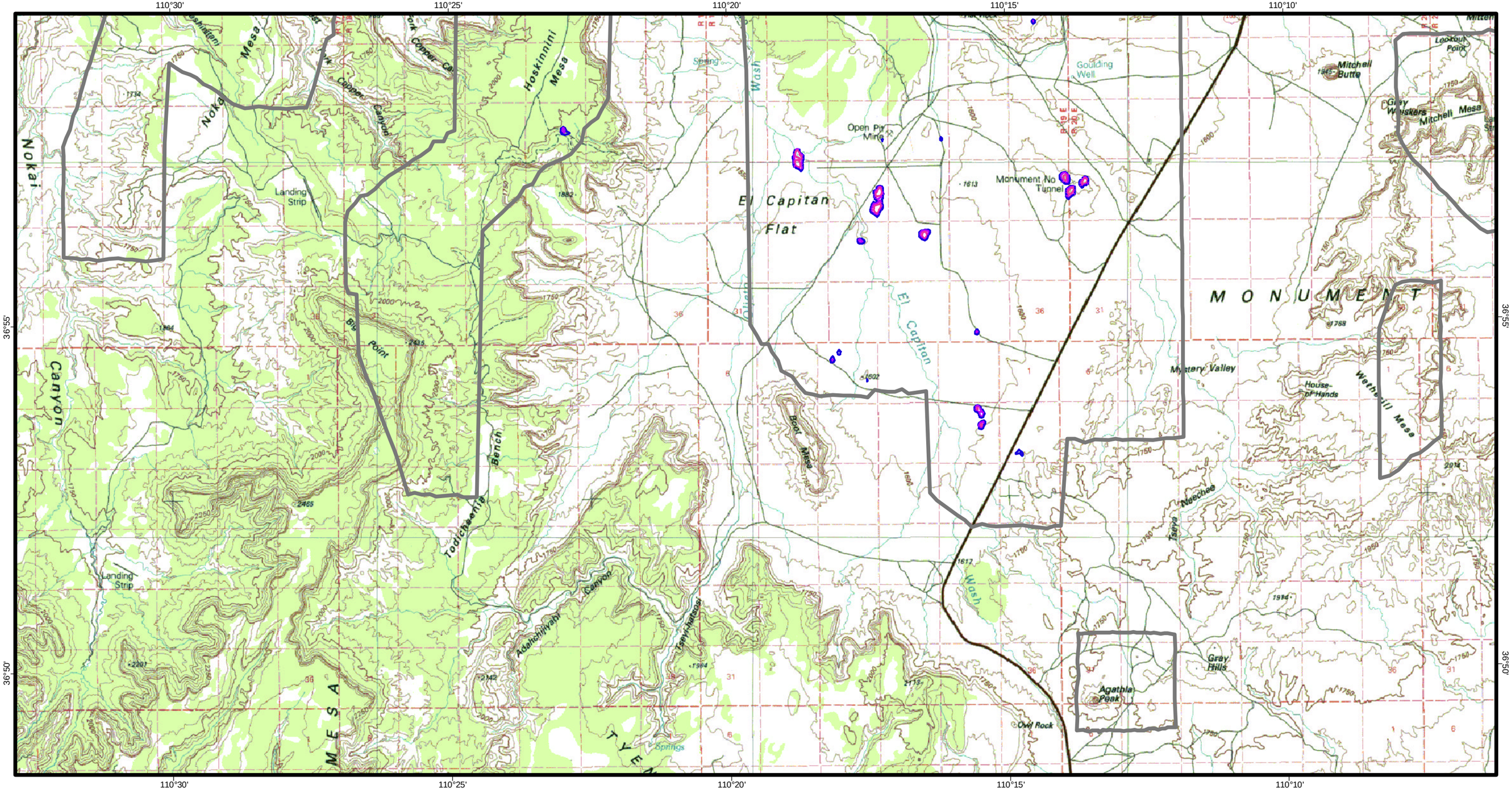
1 0 1 2 3 Kilometers

1:100,000

U.S. Environmental Protection Agency

ABANDONED URANIUM MINES PROJECT

Monument Valley Area



OLJATO - SOUTH

Aerial Radiation Contours	Derived contour-level Bismuth 214 photo-peak (excess counts per second)	Estimated exposure rate from excess Bismuth 214 (excess micro-R/hour)
	80	3.5
	170	7.4
	250	10.9
	800	34.9
	1200	52.4

4

AERIAL RADIATION CONTOURS
BISMUTH 214
OLJATO - SOUTH

1 0 1 2 Miles
1 0 1 2 3 Kilometers
1:100,000

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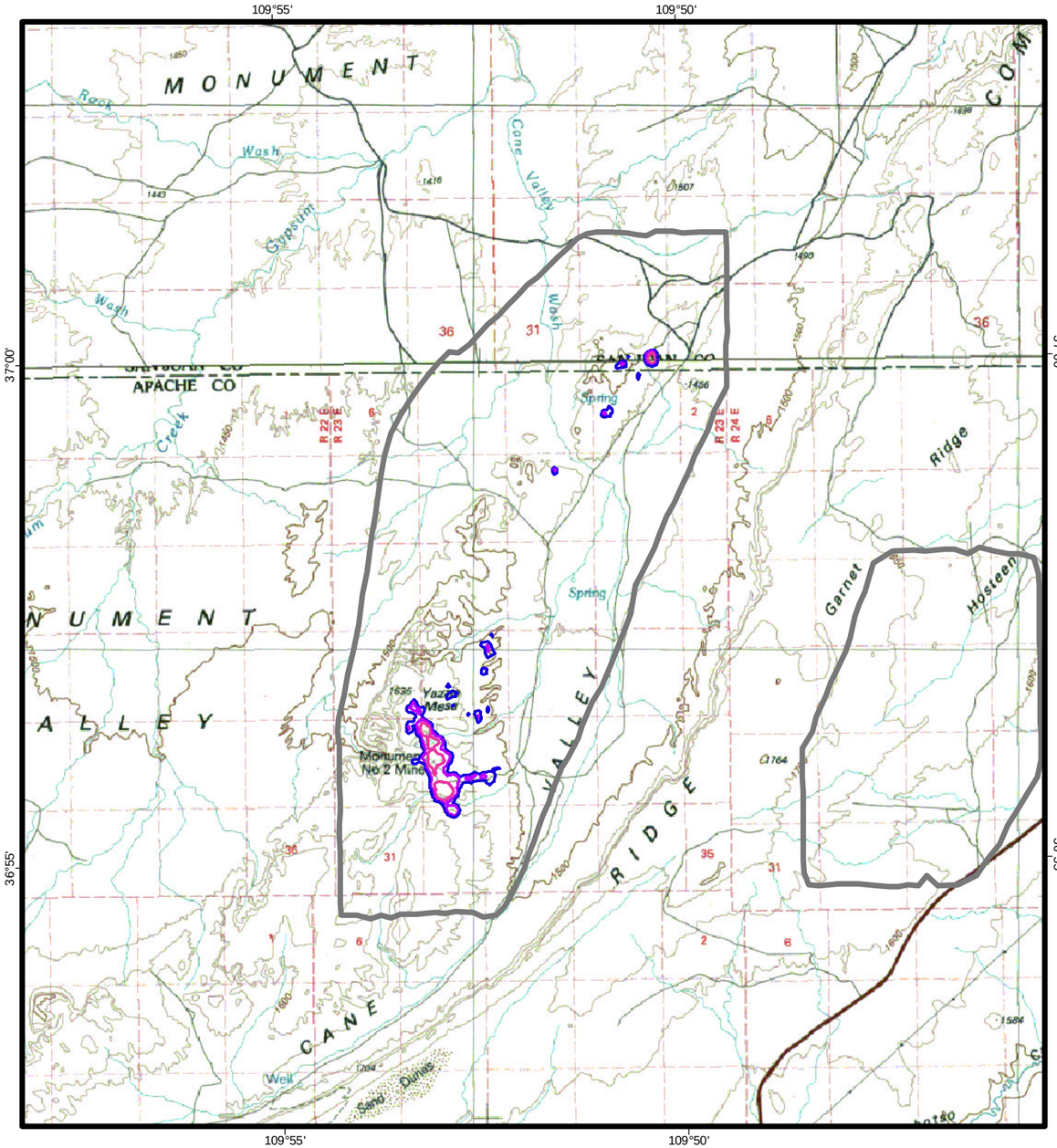
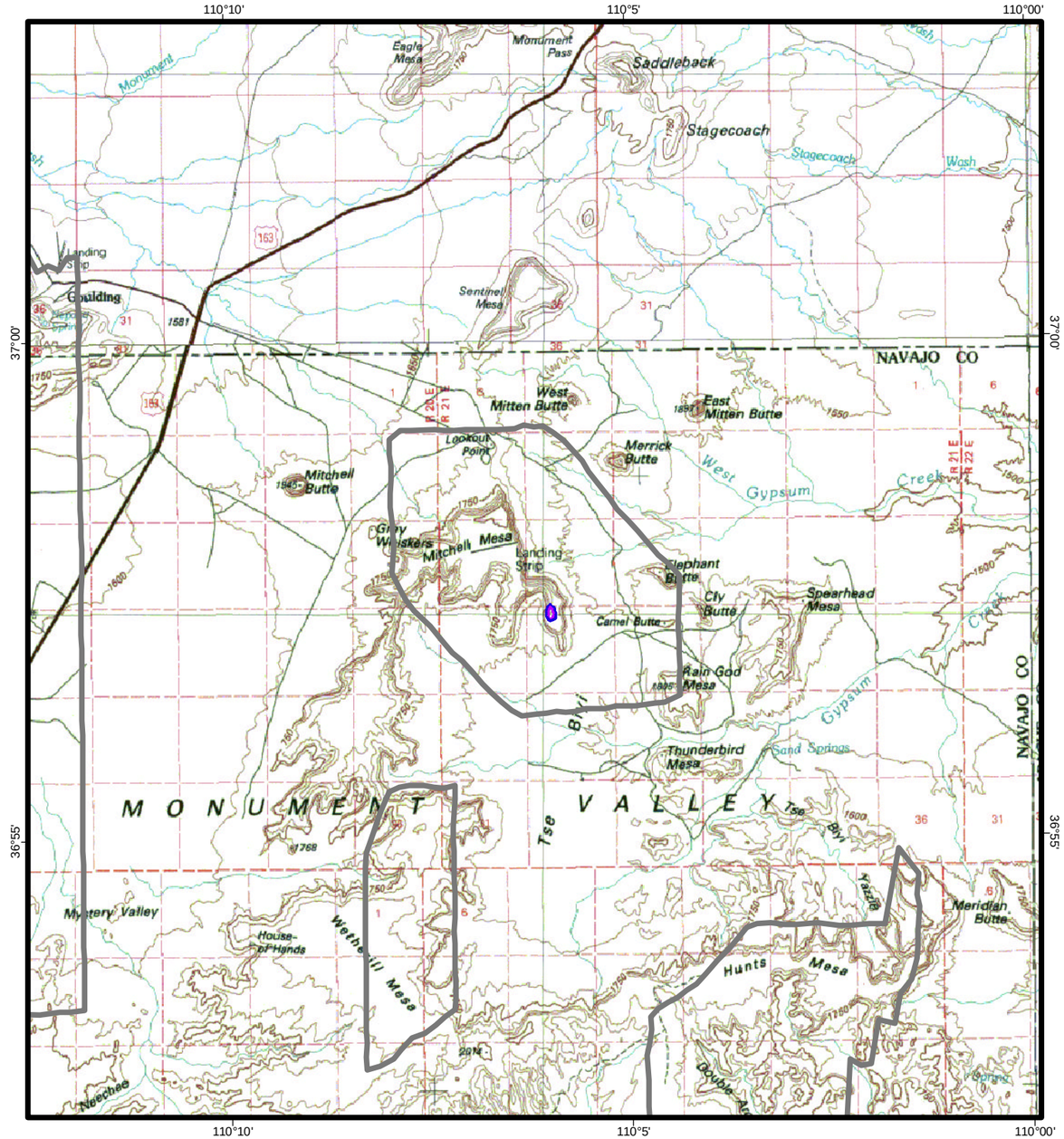
Monument Valley Area



CANE VALLEY



MONUMENT VALLEY PARK

Aerial Radiation Contours	Derived contour-level Bismuth 214 photo-peak (excess counts per second)	Estimated exposure rate from excess Bismuth 214 (excess micro-R/hour)
	80	3.5
	170	7.4
	250	10.9
	800	34.9
	1200	52.4

4

AERIAL RADIATION CONTOURS
BISMUTH 214
CANE VALLEY AND MONUMENT VALLEY PARK

1 0 1 2 Miles

1 0 1 2 3 Kilometers

1:100,000

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Monument Valley Area

7.20