

CONTRACT NO.: DE-AC13-96GJ87335
TASK ORDER NO.: MAC01-06
CONTROL NO.: 3100-T01-0440

March 13, 2001

Project Manager
Department of Energy
Grand Junction Office
2597 B3/4 Road
Grand Junction, CO 81503
ATTN: Mr. Art Kleinrath

SUBJECT: Contract No. DE-AC13-96GJ87335—Radon and Direct Gamma Monitoring at the Shiprock, NM Disposal Site

Dear Mr. Kleinrath:

MACTEC-ERS has completed radon and direct gamma monitoring at the Shiprock, NM disposal site. The attached data summary tables demonstrate that both radon and direct gamma radiation levels at the disposal site are indistinguishable from naturally occurring background levels. Therefore, we conclude that the disposal cell is effectively containing radon emissions and is in compliance with applicable standards and regulations.

Background: The U.S. Department of Energy (DOE) conducted radon and direct gamma monitoring at the Shiprock disposal site in response to a request by the Navajo Nation. The objectives of the monitoring were to determine if either radon concentrations or gamma radiation levels at the disposal site exceeded regulatory thresholds.

Monitoring at the Shiprock site was performed in accordance with the *Long-Term Surveillance and Maintenance Program Sampling and Analysis Plan (SAP) for Radon and Direct Gamma Radiation at the Shiprock, NM Disposal Site* (DOE, 1999). MACTEC-ERS monitored both radon and direct gamma radiation at sixteen locations on and near the Shiprock disposal site for a period of fourteen months (August 26, 1999 through November 3, 2000). The SAP specified thirteen on-site monitoring locations/stations, and three off-site (background) monitoring locations/stations (see Figures 1 and 2).

Each monitoring station contained one radon cup and one thermoluminescent dosimeter (TLD). "Radtrak" radon cups were provided by Landaur Inc.; TLDs were supplied by Teledyne Brown Environmental Services Laboratory. Radon cups and TLDs were exposed and replaced approximately every 90 days, and sent to their respective laboratories for analysis.

Radon Monitoring Results: The U.S. Environmental Protection Agency (EPA) standard for the release of radon into the atmosphere is found at 40 CFR §192.02(b)(2). This standard requires that the control or cover:

SHE 100.02 ✓-5
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"... be designed to provide reasonable assurance that releases of radon-222 from residual radioactive materials to the atmosphere will not increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half pico-curie per liter (0.5 pCi/l)."

Radon monitoring results are summarized in Tables 1 and 2. A site-specific radon standard was derived using data from the three off-site background-monitoring locations. Once the site-specific standard was calculated, it was then compared to the four-quarter averages for each monitoring location/station. As can be seen from the Table 1, the four-quarter averages for all on-site monitoring stations were below the site-specific standard (1.53 pCi/l), and all were consistent with the average radon concentrations observed at the background (off-site) monitoring locations. The average radon concentration for all on-site stations was calculated to be 0.99 pCi/l (calculated by averaging the four-quarter averages for monitoring stations SHP-1 through SHP-13), and the average radon concentration for all off-site (background) stations was calculated to be 1.03 pCi/l (calculated by averaging the four-quarter averages for monitoring stations SHP-14 through SHP-16).

Direct Gamma Monitoring Results: The DOE standard for total off-site dose to the public is 100 mrem/yr above background (DOE Order 5400.5, *Radiation Protection of the Public and the Environment*). Gamma monitoring results are summarized in Table 3. A site-specific gamma standard was derived using data from two of the three background monitoring locations (SHP-14 and SHP-16). The TLD at background station SHP-15 was found to be missing after the fourth quarter of 1999; therefore, the incomplete data set from this station could not be used in the calculation of the site-specific standard. The site standard was calculated by summing the average annual value for the two background stations (134.9 mrem/yr), and the DOE standard (100 mrem/yr above background). Subsequently, the site gamma standard was derived to be 235 mrem/yr. Once the site-specific standard was calculated, it was then compared to the annual average values for each on-site monitoring station. All on-site monitoring stations were below the site-specific standard for gamma radiation exposures (Table 3).

Conclusion: The cover of the Shiprock disposal site provides an effective radon barrier that is in compliance with 40 CFR §192.02(b)(2). The radon concentrations observed on the disposal cell itself do not vary significantly from naturally occurring (background) radon concentrations as measured in the outlying areas of Shiprock, NM. Similarly, data collected from the on-site monitoring locations demonstrate that gamma radiation exposure rates at the disposal site are below the DOE standard calculated for this site. The gamma radiation measurements observed on and surrounding the Shiprock disposal site cover, do not vary significantly from naturally occurring (background) gamma levels as measured in the outlying areas of Shiprock, NM.

Mr. Art Kleinrath
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Unless there is follow-on work, this report concludes the radon and gamma monitoring project at the Shiprock disposal site. Upon your concurrence with the findings of this report, please forward the attached letter and data to Ms. Madeline Roanhorse, Director of the Navajo UMTRA Program. Please call me at Extension 6568 or Mr. Mike Gardner at Extension 6031 if you have any questions or concerns regarding this information.

Sincerely,



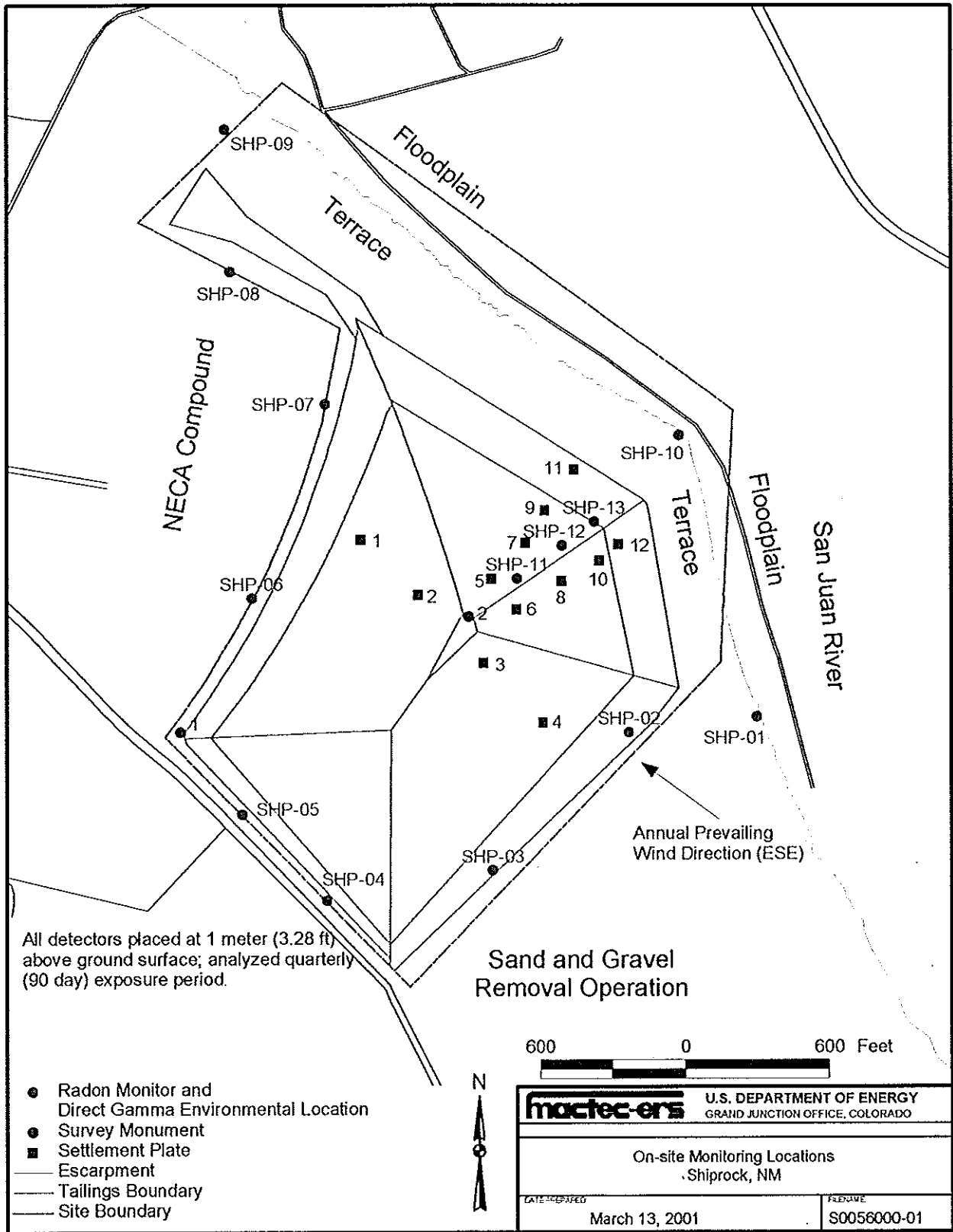
Carl L. Jacobson
LTSM Program Manager

MJG/ksy

Attachments

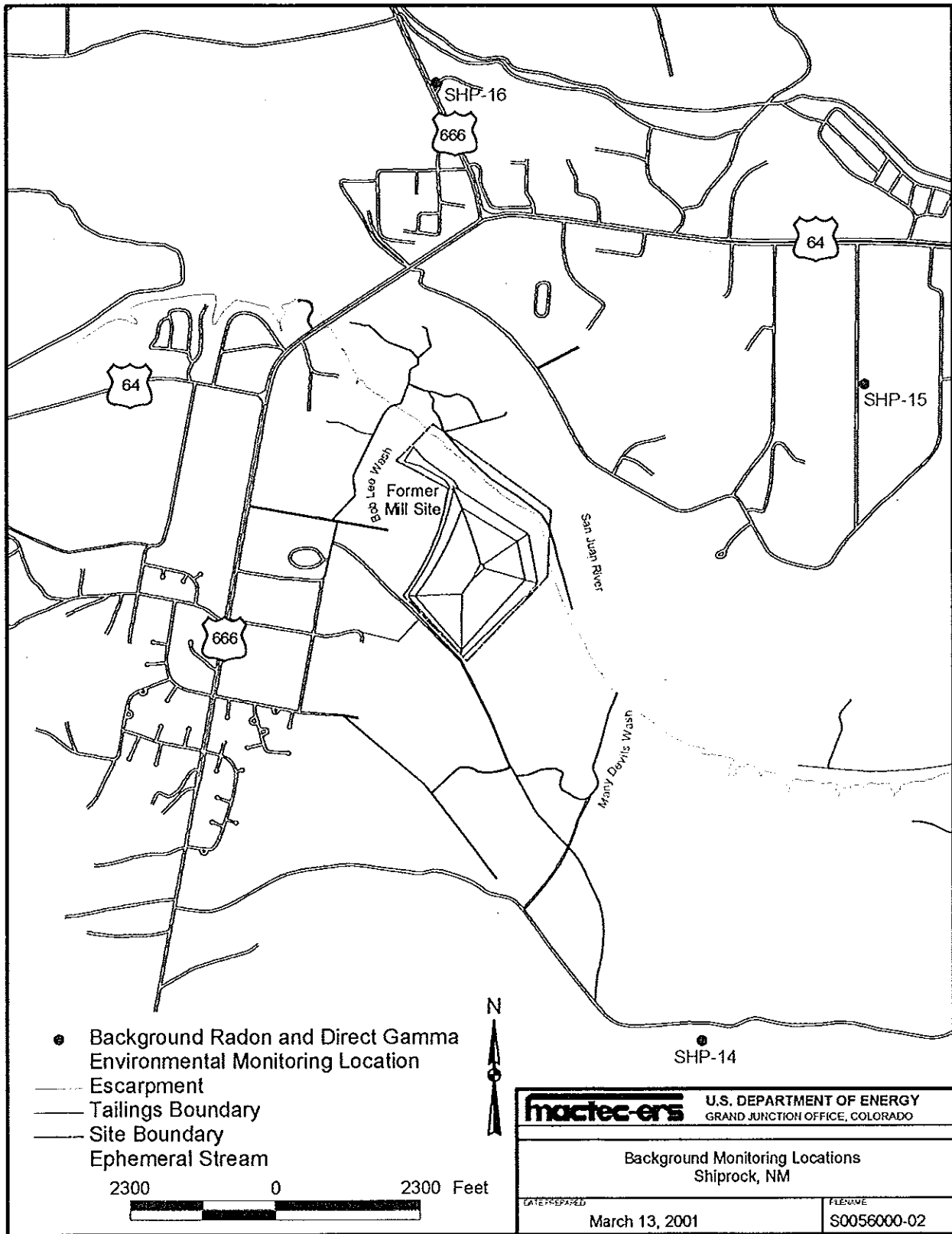
cc w/: M. Gardner, MACTEC-ERS
J. Gilmore, DOE-GJO
C. Jones, MACTEC-ERS
M. Plessinger, MACTEC-ERS
M. Widdop, MACTEC-ERS
LSHP 7.3 (A. Garcia)

cc w/o: Contract File (J. Dearborn)



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Figure 1. On-site Monitoring Locations at Shiprock, NM



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Figure 2. Background Monitoring Locations at Shiprock, NM

*Table 1. Summary of Radon Monitoring Data for the Shiprock, New Mexico Disposal Site
(August 26, 1999 through November 3, 2000)*

Station Number	4 th Quarter 1999 (8/26/99 – 12/15/99) (pCi/l) ¹	1 st Quarter 2000 (12/15/99 - 4/19/00) (pCi/l) ¹	2 nd Quarter 2000 (4/19/00 - 7/13/00) (pCi/l) ¹	3 rd Quarter 2000 (7/13/00 - 11-03/00) (pCi/l) ¹	Four-Quarter Average (pCi/l) ¹	Site Standard (pCi/l) ¹
SHP-1	1.2	1.2	0.7	1.0	1.0	1.53
SHP-2	0.8	1.2	0.7	1.3	1.0	1.53
SHP-3	0.8	1.4	1.0	1.3	1.1	1.53
SHP-4	0.6	0.7	0.6	1.1	0.8	1.53
SHP-5	0.7	0.7	0.7	1.8	1.0	1.53
SHP-6	0.8	0.8	0.9	0.9	0.9	1.53
SHP-7	0.8	1.1	0.5	1.2	0.9	1.53
SHP-8	1.0	0.8	0.8	1.3	1.0	1.53
SHP-9	0.8	0.8	0.7	1.8	1.0	1.53
SHP-10	0.6	0.7	0.5	1.3	0.8	1.53
SHP-11	0.9	1.0	1.2	1.5	1.2	1.53
SHP-12	1.0	1.2	0.5	1.6	1.1	1.53

*Table 1. Summary of Radon Monitoring Data for the Shiprock, New Mexico Disposal Site
(August 26, 1999 through November 3, 2000)*

Station Number	4 th Quarter 1999 (8/26/99 – 12/15/99) (pCi/l) ¹	1 st Quarter 2000 (12/15/99 - 4/19/00) (pCi/l) ¹	2 nd Quarter 2000 (4/19/00 - 7/13/00) (pCi/l) ¹	3 rd Quarter 2000 (7/13/00 - 11-03/00) (pCi/l) ¹	Four-Quarter Average (pCi/l) ¹	Site Standard (pCi/l) ¹
SHP-13	1.2	0.7	0.8	1.2	1.0	1.53
SHP-14 ²	0.7	1.7	1.1	1.3	1.2	1.53
SHP-15 ²	0.8	1.2	1.1	1.6	1.2	1.53
SHP-16 ²	0.7	0.4	0.6	1.1	0.7	1.53

¹ 1 pCi/l = 3.7×10^{-2} becquerels per liter.

² Denotes a background monitoring location. SHP-14 was located approximately 2 miles south of the disposal cell past Many Devils Wash; SHP-15 was located approximately 2 miles east of the disposal cell near Highway 64; SHP-16 was located approximately 2 miles northwest of the disposal cell past the Shiprock High School on Highway 64. All background stations were located in areas that were representative of natural, undisturbed soils. Detectors were not placed near areas where human activity (or contamination sources) could adversely affect or influence the background radon measurements.

Table 2. Summary of Calculations to Determine Site Specific Radon Standard

Background Station Location	Four-quarter average background value (pCi/l)	Four-quarter average plus 0.5 (pCi/l)
SHP-14	1.2	$1.2 + 0.5 = 1.7$
SHP-15	1.2	$1.2 + 0.5 = 1.7$
SHP-16	0.7	$0.7 + 0.5 = 1.2$
	Average Background : 1.03	Site Specific Standard: 1.53

Table 3. Summary of Direct Gamma Environmental Monitoring Data for the Shiprock, New Mexico Disposal Site (August 26, 1999 through November 3, 2000)

Station Number	4 th Quarter 1999 (8/26/99 - 12/15/99) (mrem/91 days)	1 st Quarter 2000 (12/15/99 - 4/19/00) (mrem/91 days) ¹	2 nd Quarter 2000 (4/19/00 - 7/13/00) (mrem/91 days) ¹	3 rd Quarter 2000 (7/13/00 - 11-03/00) (mrem/91 days) ¹	Approximate Annual Average (mrem/yr) ¹	Site Standard (mrem/yr) ²
SHP-1	46.3	23.5	29.8	27.7	127.3	235
SHP-2	43.5	20.5	26.1	24.9	115.0	235
SHP-3	41.8	20.9	26.2	25.6	114.5	235
SHP-4	41.5	22.1	25.1	25.7	114.4	235
SHP-5	42.1	21.6	25.7	25.5	114.9	235
SHP-6	39.9	19.6	25.1	24.2	108.8	235
SHP-7	42.1	22.4	25.2	25.2	114.9	235
SHP-8	41.8	24.2	25.1	27.9	119.0	235
SHP-9	46.1	25.1	30.8	29.4	131.4	235
SHP-10	46.9	23.7	29.8	28.4	128.8	235
SHP-11	46.0	25.7	29.8	30.1	131.6	235

Table 3. Summary of Direct Gamma Environmental Monitoring Data for the Shiprock, New Mexico Disposal Site (August 26, 1999 through November 3, 2000)

Station Number	4 th Quarter 1999 (8/26/99 - 12/15/99) (mrem/91 days)	1 st Quarter 2000 (12/15/99 - 4/19/00) (mrem/91 days) ¹	2 nd Quarter 2000 (4/19/00 - 7/13/00) (mrem/91 days) ¹	3 rd Quarter 2000 (7/13/00 - 11-03/00) (mrem/91 days) ¹	Approximate Annual Average (mrem/yr) ¹	Site Standard (mrem/yr) ²
SHP-12	47.2	26.7	29.2	30.2	133.3	235
SHP-13	44.6	21.8	26.7	25.9	119.0	235
SHP-14 ³	52.7	27.6	34.9	33.6	148.8	235
SHP-15 ³	-NA-	24.6	27.8	28.6	-NA-	235
SHP-16 ³	45.0	22.6	27.4	26.0	121.0	235

¹ 1 mrem/yr = 0.01 millisieverts per year.

² The site standard was calculated by averaging the annual values for background stations SHP-14 and Shp-16, then adding 100 mrem/yr (the DOE standard). Background station SHP-15 was not used in the calculation due to missing data for the fourth quarter of 1999 (the TLD was found to be missing from the monitoring station). The average background exposure rate for background stations SHP-14 and SHP-16 is 134.9 mrem/yr. The site standard is calculated by summing the background value (134.9 mrem/yr) and the DOE standard (100 mrem/yr), or 234.9 mrem/yr (rounded to 235 mrem/yr).

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Madeline Roanhorse, Director
Navajo UMTRA Program
Division of Natural Resources
P.O. Box 1875
Window Rock, AZ 86515

SUBJECT: Radon and Direct Gamma Monitoring at the Shiprock, NM Disposal Site

Dear Ms. Roanhorse:

The U.S. Department of Energy Grand Junction Office (DOE-GJO) has completed radon and direct gamma monitoring at the Shiprock, NM disposal site. The enclosed data summary tables demonstrate that both radon and direct gamma radiation levels at the disposal site are indistinguishable from naturally occurring background levels. Therefore, we conclude that the disposal cell is effectively containing radon emissions and is in compliance with applicable standards and regulations.

Background: The DOE-GJO conducted radon and direct gamma monitoring at the Shiprock disposal site in response to a request by the Navajo Nation. The objectives of the monitoring were to determine if either radon concentrations or gamma radiation levels at the disposal site exceeded regulatory thresholds.

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"... be designed to provide reasonable assurance that releases of radon-222 from residual radioactive materials to the atmosphere will not increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half pico-curie per liter (0.5 pCi/l)."

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Conclusion: The cover of the Shiprock disposal site provides an effective radon barrier that is in compliance with 40 CFR §192.02(b)(2). The radon concentrations observed on the disposal cell itself do not vary significantly from naturally occurring (background) radon concentrations as measured in the outlying areas of Shiprock, NM. Similarly, data collected from the on-site monitoring locations demonstrate that gamma radiation exposure rates at the disposal site are below the DOE standard calculated for this site. The gamma radiation measurements observed on and surrounding the Shiprock disposal site cover, do not vary significantly from naturally occurring (background) gamma levels as measured in the outlying areas of Shiprock, NM.

Unless there is follow-on work, this report concludes the radon and gamma monitoring project at the Shiprock disposal site. Please call me at (970) 248-6037 or Mr. Carl Jacobson at (970) 248-6568 if you have any questions or concerns regarding this information.

Sincerely,

Art Kleinrath
Project Manager

Enclosures

cc w/enclosures:

J. Gilmore, DOE-GJO
M. Gardner, MACTEC-ERS
LSHP 7.3 (A. Garcia)

cc w/o enclosures:

C. Jacobson, MACTEC-ERS
C. Jones, MACTEC-ERS
M. Plessinger, MACTEC-ERS
M. Widdop, MACTEC-ERS