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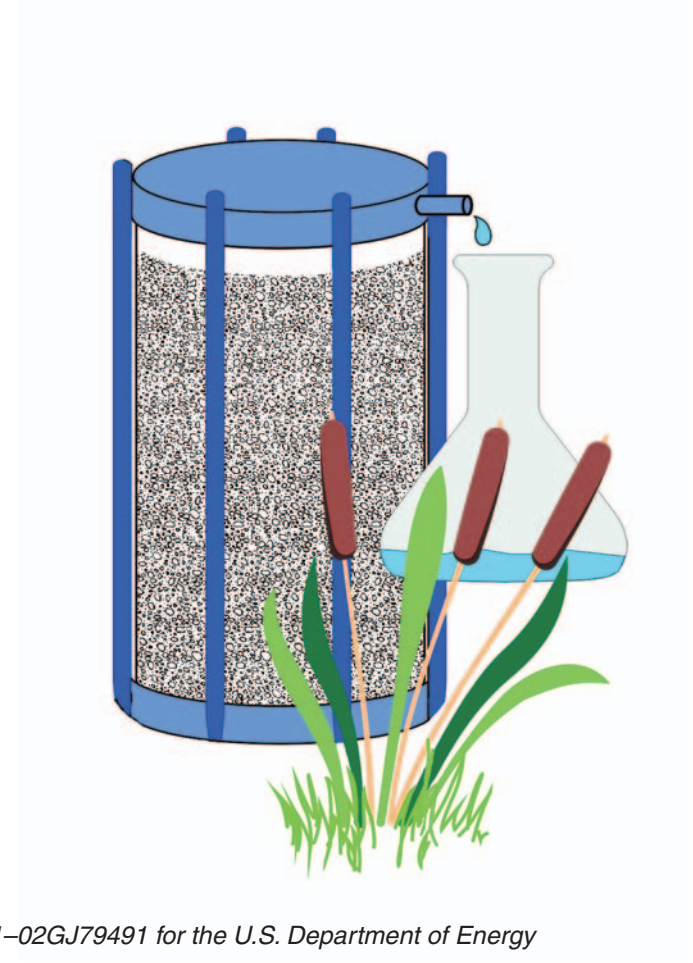
Environmental Sciences Laboratory

Gamma Survey of a Permeable Reactive Barrier at Monticello, Utah

October 2005



Prepared for
U.S. Department of Energy
Grand Junction, Colorado

Work Performed Under DOE Contract No. DE–AC01–02GJ79491 for the U.S. Department of Energy
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Work Performed by S.M. Stoller Corporation under DOE Contract No. DE–AC01–02GJ79491
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1.0 Introduction

A permeable reactive barrier (PRB) is an engineered zone of chemically reactive material placed in an aquifer to stabilize or degrade dissolved contaminants as ground water flows through it. One such funnel-and-gate PRB, installed by the U.S. Department of Energy (DOE) at the Monticello Mill Tailings Site (MMTS), Monticello, Utah (Figure 1), has been the subject of numerous studies to evaluate PRB treatment technology. This report describes a total-count gamma survey conducted to characterize the distribution of uranium sequestered in the Monticello PRB. The work is based on the assumption that uranium accumulations in the PRB can be identified by gross gamma activity from the decay of uranium-235 and certain uranium-238 progenies. This measurement technique potentially represents a low-cost method to gage the rate of uranium deposition in a PRB over time and identify areas of reactivity loss or preferential flow.

2.0 Description of the Monticello Permeable Reactive Barrier

Remediation of MMTS by DOE is being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Uranium and vanadium ore was processed at the former Monticello mill from about 1940 to 1960, resulting in the contamination of an alluvial aquifer and surface water within the valley of a small perennial stream (Montezuma Creek). Operable Unit (OU) III comprises contaminated the ground water and surface water of MMTS. A PRB was constructed in June 1999 across the contaminant plume as a treatibility study under a CERCLA interim remedial action for OU III. The treatment system has since been monitored routinely for OU III performance assessment purposes (DOE 2002 and 2004a). Other independent studies performed by the DOE Environmental Sciences Laboratory at Grand Junction, Colorado, including various hydraulic tests, tracer tests, and core sample analysis, are described in DOE 2002, DOE 2004b, and DOE 2005. The location of the PRB within OU III of the MMTS is shown in Figure 2.

The PRB is 105 foot (ft) long (west to east) perpendicular to the direction of ground water flow, by 8 ft wide. It is constructed of three distinct zones: farthest upgradient is a 2-ft wide pretreatment zone of three-quarter inch crushed and washed gravel mixed with 13-percent by volume of zero-valent iron (ZVI), the reactive component of the installation; the central section of the PRB comprises a 4-ft wide zone of 100-percent ZVI; last is a 2-ft wide zone of 100-percent gravel that serves to evenly distribute treated water to the aquifer. These three zones, and the associated network of ground water monitoring wells, are depicted in Figure 3. To construct the PRB, corrugated steel sheet pilings were driven by a crane-mounted hydraulic vibratory hammer until refusal in bedrock, forming a rectangular steel box. The pilings were withdrawn after the alluvium in the box was excavated to bedrock and replaced with PRB materials.

The top of the PRB is 3 ft below ground surface. Its base is keyed 1 to 2 ft into low-permeability mudstone that underlies the alluvial aquifer at a depth of about 13 ft below ground surface. Ground water is funneled to the PRB by slurry walls, also keyed into bedrock, that are constructed of bentonite-amended soil mixed with ground water. The walls extend north and south of the PRB about 100 and 250 ft, respectively, but are short of fully spanning the aquifer and so some bypass flow occurs.

The ZVI used in the PRB consists of elongate cast iron cuttings obtained from Peerless Metal Powders & Abrasives, Detroit, Michigan. The product was pre-sorted through #8 (2.36 millimeter) and #20 (0.83 millimeter) U.S. Standard sieves. It was placed in the PRB at a loose density of 115 pounds per cubic foot, resulting in a porosity of about 60 percent. Laboratory-determined hydraulic conductivity of fresh ZVI samples was 3.6E-02 centimeters per second. Estimated ground water flow through the PRB early in its operational history was between 5 and 10 gallons per minute (DOE 2002, 2004b). Recent evidence indicates that the treatment rate has since decreased significantly from mineralization and consequent loss of hydraulic conductivity (DOE 2005).

2.1 Ground Water Radiochemistry at the PRB

Remedial investigations that began in 1992 characterized OU III ground water and surface water for specific radionuclides as well as other mill-related inorganic contaminants (DOE 1998, 2004a). Table 1 summarizes recent radionuclide concentrations in ground water among several monitoring wells located upgradient of the former millsite ("Background") and others immediately upgradient of the PRB ("PRB Influent"). Analysis for uranium (U)-234 and -238, thorium (Th)-230, radium (Ra)-226 and -228, lead (Pb)-210, and radon (Rn)-222 were discontinued in 2001. Uranium-235 has not been analyzed since 1999.

Table 1. Radionuclide Concentrations in Ground Water at the Monticello Site

Constituent	Representative Concentration in Ground Water[a]	
Uranium Series	Background	PRB Influent
U (total)	4 to 7	200 to 400
U-238 (parent)	1 to 2	150 to 200
U-234	2 to 4	150 to 200
Th-230	<0.1[b]	<0.3
Ra-226	<1	<0.2
Rn-222	600 to 1,000	1,000 to 2,000
Pb-210	<0.3	0.4
Thorium Series		
Th-232 (parent)	<0.06	<0.3
Ra-228	<1	<1
Actinium Series		
U-235 (parent)	<0.3	10

[a]All concentrations in picocuries per liter (pCi/L) except total uranium in micrograms per liter (µg/L).
[b]Less-than symbol (<) indicates analytical result below given limit of detection.

Sequestration of uranium and other site contaminants in the PRB is confirmed in the results of routine water quality analysis and by chemical analysis of PRB core samples (DOE 2002, 2004b). The uranium in the influent ground water and that sequestered in the PRB is at isotopic equilibrium with respect to U-238 and U-234 (Table 1 and Appendix A). Although neither is a significant gamma emitter, accumulations of uranium in the PRB, which range up to about 800 milligrams per kilogram (mg/kg) (predominantly as U-238 because of the equilibrium condition and much shorter half-life of U-234), may be identifiable by the gamma energies emitted during the decay of Th-234, protactinium (Pa)-234, and Pa-234m, the immediate daughters of U-238. These nuclides have short half-lives (24 days, 6.8 hours, and 1.2 minutes,

respectively) and so would rapidly (approximately 0.5 years) achieve equilibrium with U-238 deposits in the PRB through ingrowth. They are likely to also occur in the influent ground water at equilibrium with U-238 and therefore be susceptible to sequestration in the PRB directly from the dissolved phase. Because the branching ratio for the transition of Pa-234m to Pa-234 is only 0.15 percent, the primary gammas associated with Pa-234 decay (131, 882, and 946 kiloelectron volts [keV] energies) are not likely to contribute greatly to the total gamma activity of the PRB in comparison to Pa-234m. Gamma spectrometry confirmed the presence of Th-234 in core samples collected from the Monticello PRB in February 2002. The activity of Pa-234 and Pa-234m was not quantified; however, abundant Pa-234m, as well as Th-234, was detected in ZVI cores obtained in 1998 from a PRB constructed to treat similarly contaminated water at the Durango, Colorado, mill tailings site. Core sample analytical results are provided in Appendix A. The activity of Pa-234 reported for the Durango samples is actually that of Pa-234m, as quantified by the intensities of the 766, 926, and 1,001 keV gamma energies associated with Pa-234m decay.

Farther down the uranium series, Th-230 and Ra-226 will not be present in the PRB because they are absent in the influent ground water, and due to their long-half lives compared to the operating period of the PRB, their ingrowth from the decay of U-234 will not be significant. As a result, there are no constituents sequestered from ground water to support Ra-222 and its strong gamma-emitting products, Pb-214 and bismuth (Bi)-214, in the PRB. The influent water is naturally abundant in Ra-222 (Table 1), and owing to its short half-life (3.8 days), equilibrium activities of Pb-214 and Bi-214 will occur in its presence. These products cannot accumulate in the PRB to exceed the activity of the parent, which if assumed to be equivalent to the maximum observed concentration of the influent (approximately 2,000 picocuries per liter), is about 0.5 picocuries Pb-214 and Bi-214 per gram of the solid matrix. Given that this result is at or near the laboratory detection limit for these nuclides in PRB core samples (Appendix A), their contribution to the total-count measured by the field probe in the current study is probably negligible. Gamma energies associated with nuclides below Bi-214 are also likely unimportant to the current study. Of secondary interest regarding the occurrence of radon, determining the extent of its decay during transport through the PRB, assuming that the quantity of internal support is known, may provide a measure of the ground water residence time (flow rate) in the PRB.

In the thorium series, neither the parent nuclide (Th-232) nor its daughter (Ra-228) is present at detectable levels in the influent ground water and so the several subsequent short-lived gamma-emitting radionuclides are assumed absent from the PRB system. Uranium-235, the parent nuclide of the actinium series is present in the influent ground water at relatively low concentration in proportion to its natural isotopic mass abundance (0.72 percent) (CRC 1981) and its sequestration in the PRB is confirmed by gamma spectral analysis of core samples (Appendix A). This presence and the relatively high intensity gamma emissions associated with U-235 decay probably contribute significantly to the measurement results presented in the next section. The influent ground water may contain equilibrium concentrations of Th-231, the immediate daughter of U-235. It may also rapidly ingrow in the PRB owing to its short half-life, but the low intensity gamma energies from its decay likely are not measurable under field conditions. Next in the series, sufficient time has not elapsed since the onset of ground water contamination or installation of the PRB for significant Pa-231 (weak gamma emitter) or subsequent products to be present in the ground water near or in the PRB.

3.0 Field Investigation

Gross gamma activity was measured using a downhole scintillometer lowered in 6-inch increments to total depth in 36 monitoring wells completed in the PRB and five wells completed in native alluvium along the influent edge of the PRB. The counting period was 60 seconds at each measurement depth. One field technician conducted the survey during December 6 through 8, 2004. The logging configuration (well construction and detector) was not calibrated to a known uranium source.

The monitoring wells are constructed of 1-inch diameter PVC casing and screen installed using a Geoprobe rig. The wells within the PRB were completed by collapse of the surrounding media; no artificial filter pack or annular materials were emplaced. Alluvial wells were completed in a 2.2-inch diameter borehole with silica sand filter pack to about 2 ft above the top of the screen, and then bentonite chips to ground surface. All wells are screened across the lowermost 5 ft of the completion. The depth to water was measured in each well before inserting the gamma probe and varied from about 3.5 ft below ground surface in the alluvial aquifer immediately upgradient of the PRB, to about 4 to 4.5 ft in the gravel/ZVI zone, and 5 to 6 ft in the ZVI zone.

3.1 Gamma Measurement Equipment

The gamma logging system consisted of an Eberline E-600 rate meter and Alpha Spectra gamma probe. The stainless steel probe measures 0.75-inch in diameter ×12-inch long and houses a 0.5-inch diameter × 2.5-inch long sodium iodide crystal detector. The detector was replicated from a model manufactured by Bicron. Website information through Saint-Gobain, the parent company of Bicron, indicates that the efficiency of this type of detector decreases exponentially from 100 percent at gamma ray energies up to about 100 keV to 25 to 20 percent at energies between about 1,000 to 2,000 keV. Other factors that contribute to instrument sensitivity, such as crystal dead-time, shielding by the detector housing, and counting threshold are unknown.

3.1.1 Total-Count Gamma Signal

On the basis of the preceding information, the primary potential contributors to the total gamma activity of the PRB are Th-234, Pa-234m, and U-235, which are each present as a result of uranium sequestration in the PRB. The primary gamma energies associated with the disintegration of these nuclides are about 100 keV for Th-234, 100 to 200 keV for U-235, and 100 to 1,001 keV for Pa-234m. Assuming that the instrumentation employed in this study is sensitive to those energies, the field method should reliably identify accumulations of uranium within the PRB.

4.0 Results and Discussion

Copies of the field data forms that record the gamma logging information and results are provided in Appendix B (most of the forms are mislabeled as the Moab Project Site). Calibration date entries and the “K-factor” appearing on the forms are in reference to a method developed at DOE facility in Grand Junction, Colorado, in the 1970s to estimate radium-226 based on the gross gamma activity associated with uranium mill tailings dispersed in subsurface soil. The gamma counting system was calibrated to radiometric logging models at the DOE facility that

were designed and constructed with specific application to assessing the depth of contamination based on a radium-226 cleanup standard. The calibration information appearing on the forms in Appendix B are thus not applicable to the current study.

Table 2 summarizes the field data according to zone of well completion (alluvium, gravel/ZVI, and ZVI). Gross gamma activity among all surveyed locations range from about 200 to 14,000 counts per minute (cpm). Color scaling of the total gamma counts is shown in Figure 4 at each survey well. Several distinct zones of gamma intensity are recognized in this figure. Each is described separately below.

4.1 Gamma Activity in Alluvial Deposits

The first row of wells in Figure 4 (R1-series wells) are those completed in the alluvial aquifer immediately upgradient of the PRB. Gamma intensity at those locations is about 3,000 to 4,000 cpm in the upper depth intervals (to about 5 or 6 ft) and 2,000 to 3,000 cpm through the lower intervals. Because most of the alluvial profile was below the water table at the time of the gamma the survey, this difference is likely unrelated to water content and energy attenuation, but may instead be due to the finer composition and greater clay content of the upper intervals compared to the more granular, often gravelly deposits at depth. The gamma radiation detected in the alluvial deposits is attributed to uranium, thorium, and potassium-bearing mineral fractions of the sediment. Some of the alluvial wells extend several or more inches into mudstone bedrock to possibly account for the increased gamma counts in the lowest measurement interval. The higher gamma activity of the bedrock and fine-grained alluvium possibly reflects their greater clay mineral content and the associated increase of potassium-40, which can emit a high energy (1,460 keV) gamma photon during its decay.

4.2 Gamma Activity in the Gravel/ZVI Zone

Figure 5 illustrates the PRB in a typical cross section showing its construction details, the position of the water table in October 1999 and December 2004, and the gamma survey results for the monitoring wells located in that transect (wells R1-M3 to R5-M4). Within the gravel/ZVI zone, relatively high gamma activity (approximately 6,000 to 13,000 cpm) is characteristic of the lower measurement intervals and lesser activities (2,000 to 4,000 cpm) characterize the upper intervals. The gamma activity is similar for the upper portion of the gravel/ZVI zone and the alluvium, but due to different sources equivalent uranium content cannot be assumed.

Several factors may account for the observed vertical distribution of gamma activity in the gravel/ZVI zone, given that contamination in the ground water is not vertically stratified, as confirmed at paired shallow and deep wells completed in and upgradient of the PRB (Figure 3, well suffix “S” [shallow] and “D” [deep]). First, much of the upper half of the PRB was not saturated until the relatively abrupt water level rise after about October 2002. The reactive media comprising the upper interval was therefore not in contact with contaminated ground water for a significant period of PRB operation, while flow through the lower interval was continuous. Second, the hydraulic conductivity of the aquifer likely is greatest at depth, corresponding to the more granular composition of the basal deposits, and thus, greater quantities of contaminated ground water may have flowed through the lower half of the PRB, independent of water level behavior. Either case would result in greater deposition of uranium in the lower portion of the PRB.

Analysis of about 100 randomly distributed core samples collected below the water table in February 2002 found no relationship between uranium content and sample depth in the gravel/ZVI zone (DOE 2002). However, this sampling occurred when water levels were several or more feet lower than in December 2004 when the gamma survey was conducted, therefore the upper measurement intervals of the gamma survey have no corresponding core sample data to independently confirm the apparent relationship between gamma activity and depth.

The available data also cannot be used to determine a relationship between gross gamma activity and uranium concentration in the PRB because the measurement system was not calibrated, and because the core data do not closely correspond in location or time to the gamma measurements. For example, the observed doubling of the uranium concentration from about 256 mg/kg in February 2002 to about 487 mg/kg in August 2003 (DOE 2004b) suggests the possibility of much higher concentrations in the gravel/ZVI zone in December 2004. As a very general approximation, assuming a similar rate of deposition since August 2003, when uranium concentrations ranged between approximately 275 to 820 mg/kg, the gamma activity measured in December 2004 (approximately 6,000 to 13,000 cpm) is equivalent to uranium concentrations of between about 500 and 1,600 mg/kg.

4.3 Gamma Activity in the ZVI Zone

The relatively low gamma activity of the ZVI zone (300 to 400 cpm) is consistent with core analysis that showed only minor accumulation of uranium when sampled in August 2003. At that time, the mean concentration of uranium among 10 core samples of ZVI was 1.9 mg/kg, a small increase from the mean uranium concentration of the parent material (0.06 mg/kg) (DOE 2002). Because a baseline gamma survey of the Monticello PRB was not conducted, the measured activity in December 2004 in the ZVI zone (300 to 400 cpm) cannot be distinguished between the accumulated uranium and background.

5.0 Summary

- Forty-one shallow (<15 ft deep) wells were logged for total gamma activity over a 3-day period by one field technician. Data reduction and development requirements were minimal. This work demonstrates that quick and inexpensive gamma surveys can characterize the distribution of uranium in the PRB.
- The gamma radiation detected in the gravel/ZVI zone of the PRB is primarily from the decay of uranium-235, thorium-234, and protactinium-234m, which are present as a result of uranium sequestration. Natural uranium, thorium, and potassium in the gravel fraction of this zone (background) probably contribute not more than 1,000 to 2,000 cpm to the total count.
- Gamma activity of the gravel/ZVI zone (including background) varied between about 6,000 and 14,000 cpm. Equivalent uranium concentrations are estimated to range from 500 to 1,600 mg/kg.
- Most of the uranium has accumulated in the lower half of the gravel/ZVI zone because the aquifer is more conductive at depth where ground water enters the PRB and because much of the upper half of the PRB was below the water table only during the latter half of PRB

operation. A greater volume of ground water thus flowed through the lower half of the PRB since its installation. Contamination is not vertically stratified in ground water upon entry to the PRB.

- Total gamma activity in the ZVI zone of the PRB varied between about 300 and 400 cpm. Uranium concentrations likely are not greater than several parts per million in this zone. The parent material contained about 0.06 mg/kg uranium. The proportion of gamma activity from accumulated uranium and background sources in this zone is not known.
- Major regions of the gravel/ZVI zone do not appear to have been bypassed by preferential flow.

6.0 Recommendations

- Calibrate the gamma logging system to known concentrations of uranium and field conditions similar to the Monticello PRB then repeat the gamma survey of the Monticello PRB. Or, if repeat surveys are to be conducted, consider the use of a field verification source to verify comparable measurement sensitivity between successive surveys.
- Monitor radon-222 as a natural tracer to estimate ground water residence time and volumetric flow rate at the Monticello PRB.
- Establish a baseline gamma profile at new PRB installations used for uranium remediation.

7.0 References

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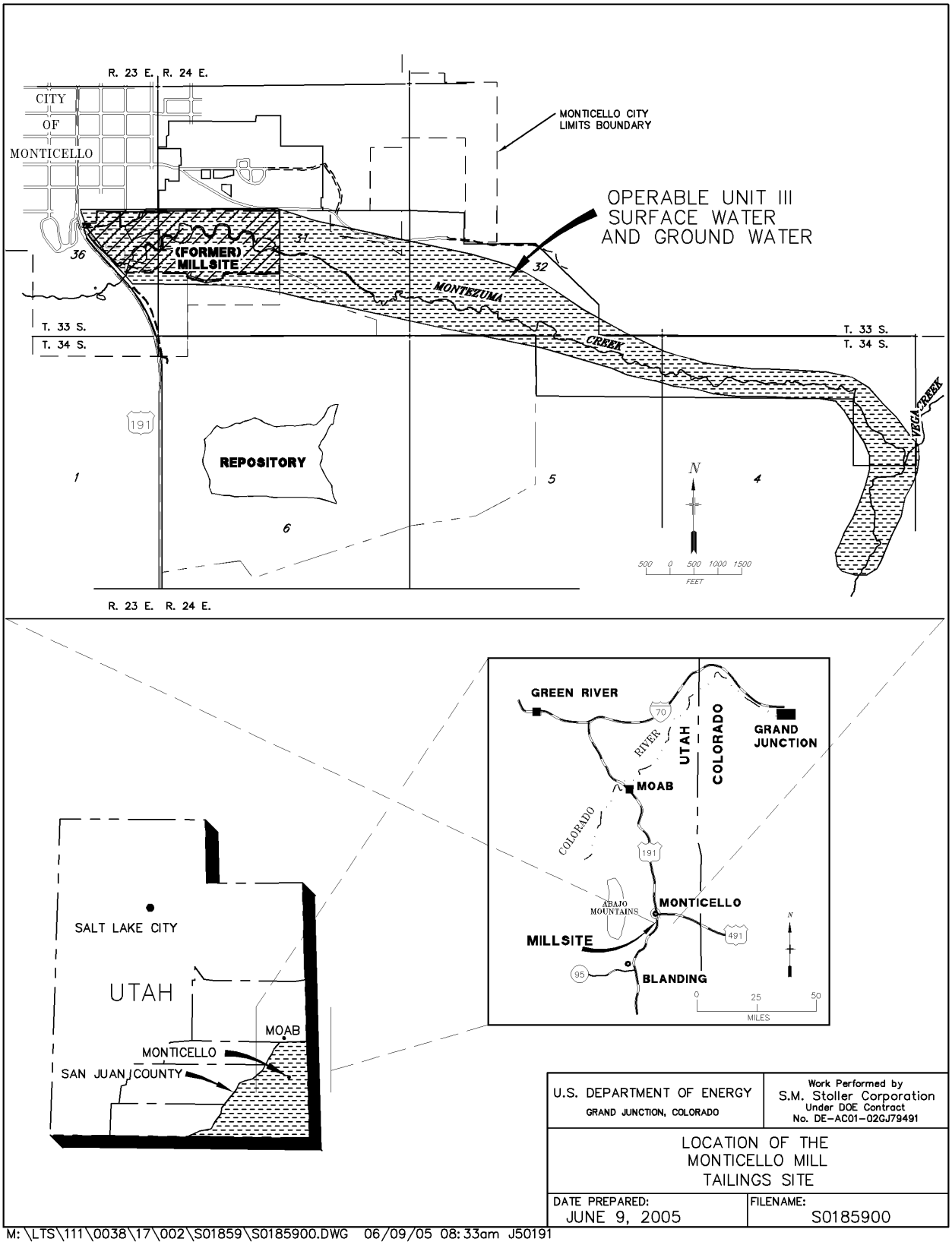

Figure 1. Location of Monticello Mill Tailings Site

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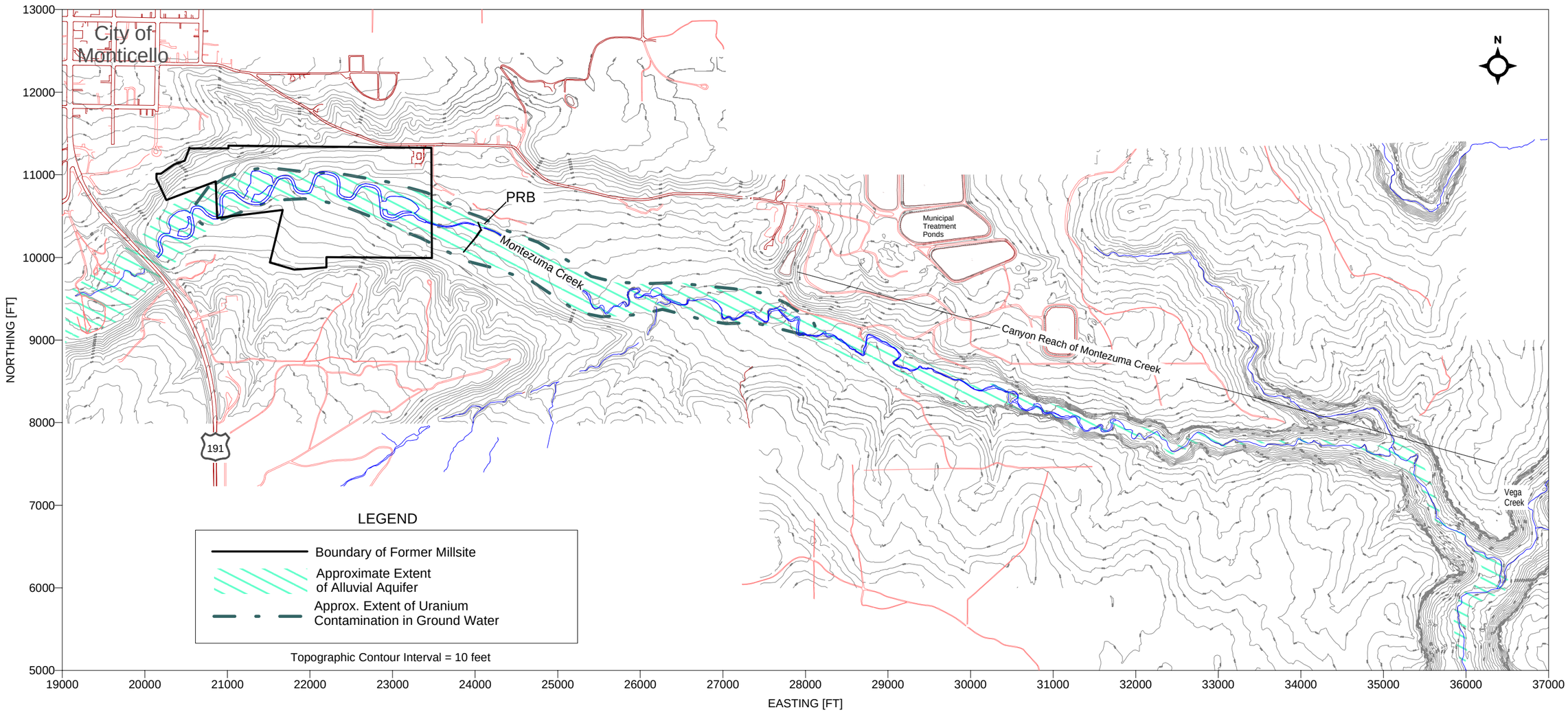

Figure 2. Site Area Features

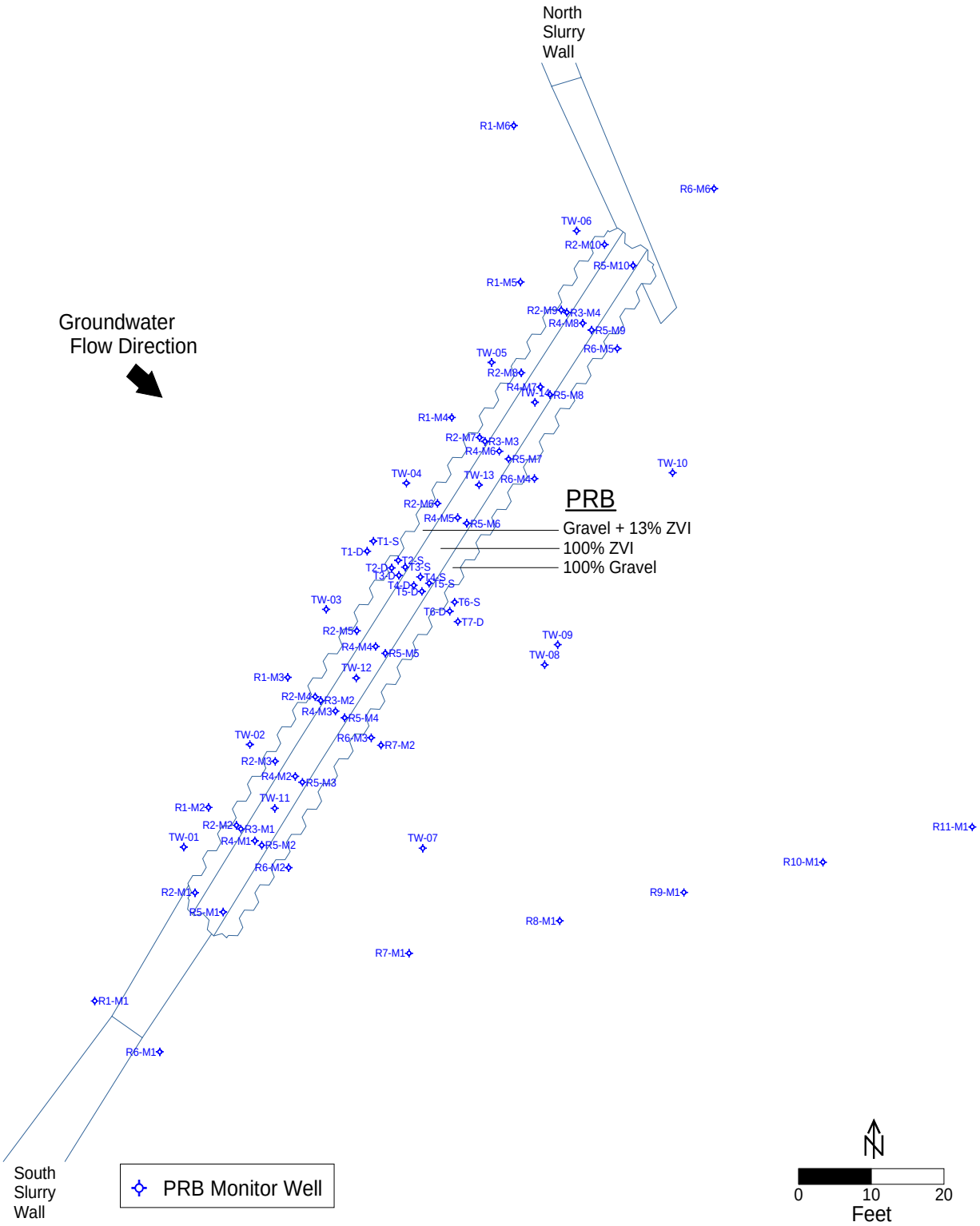

Figure 3. PRB Zones and Ground Water Monitoring Wells

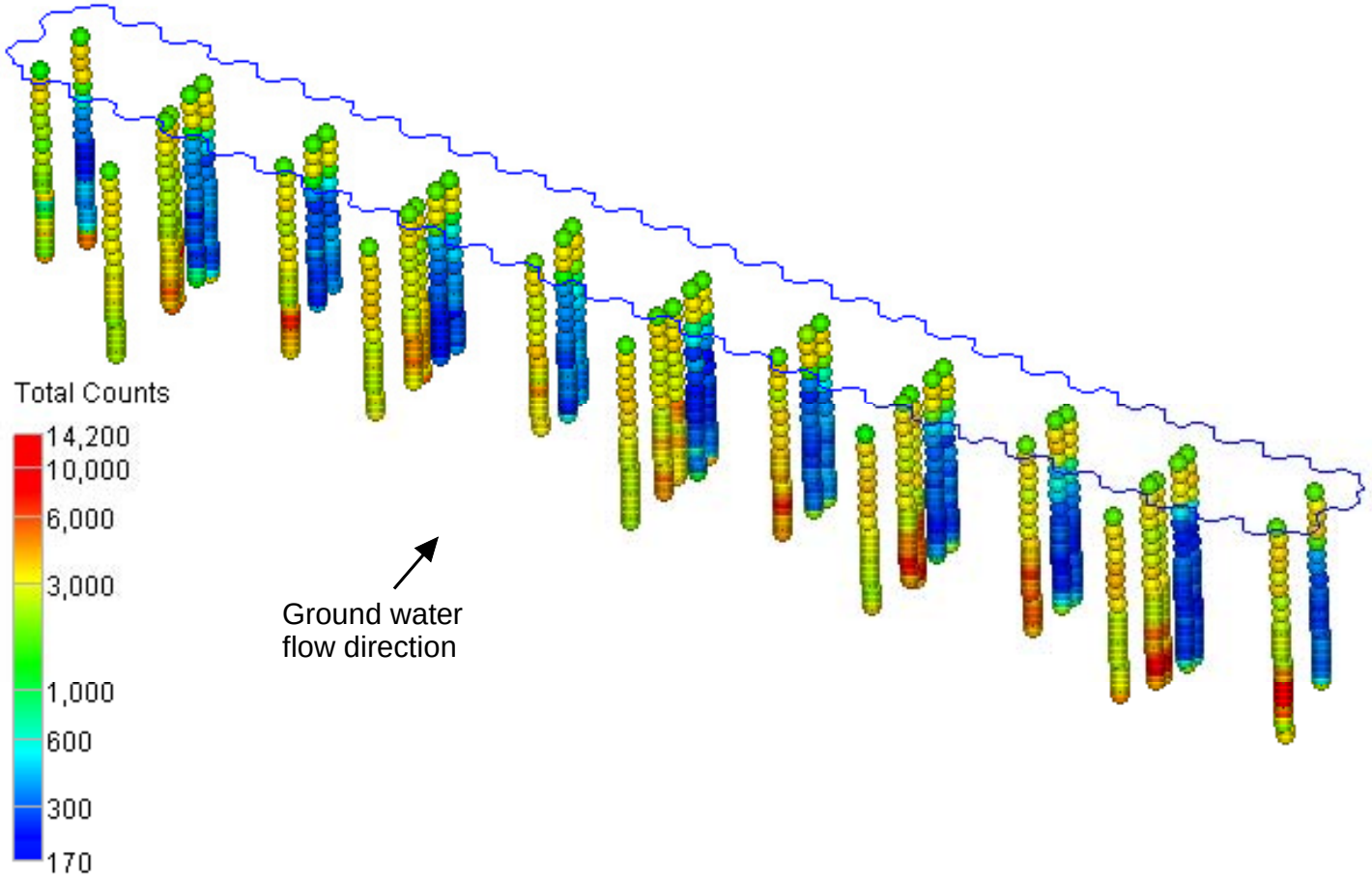

Figure 4. Total-count Gamma Intensity in PRB at all Survey Locations

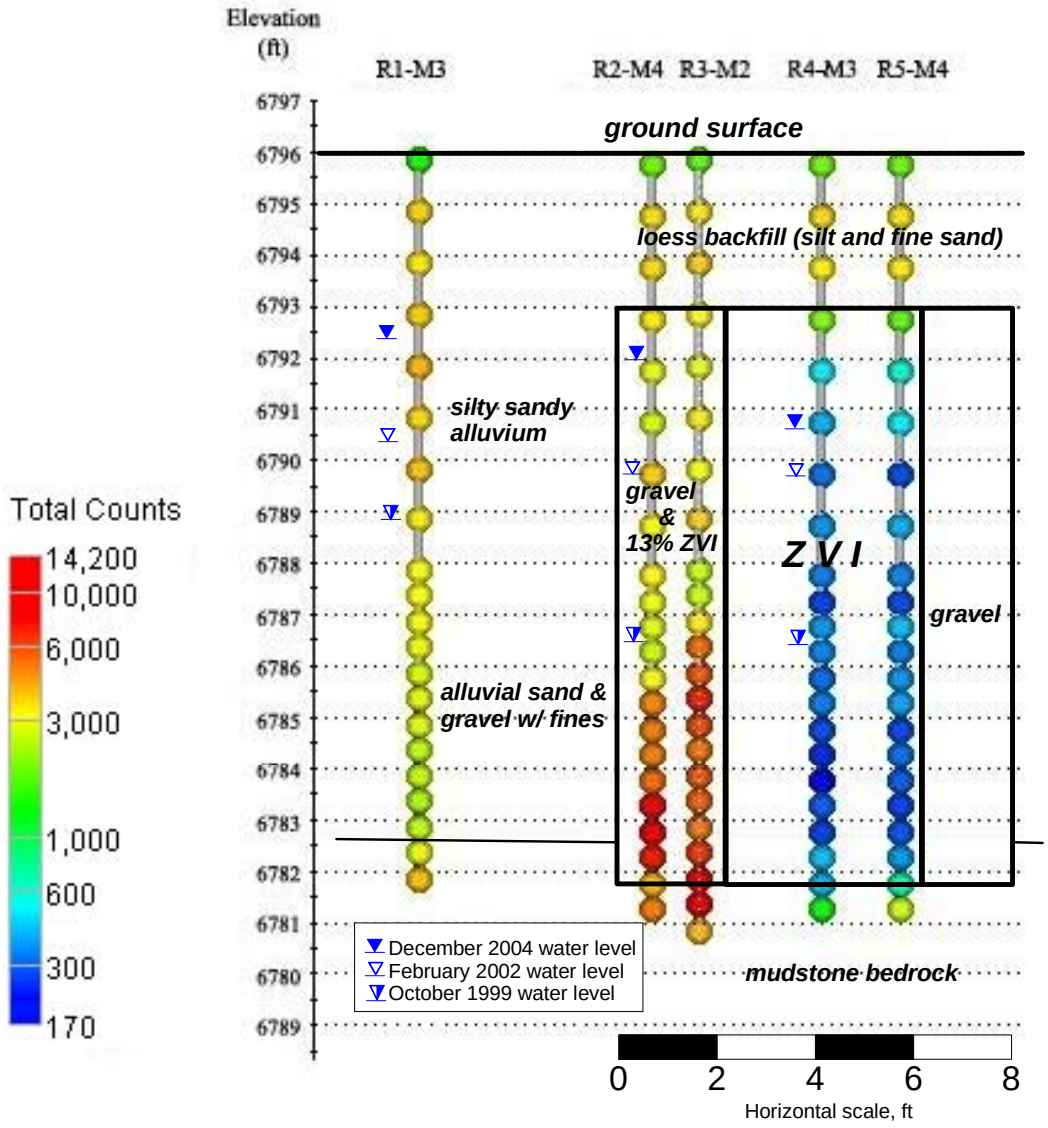

Figure 5. Total-count Gamma Intensity Through a Typical Transect of PRB

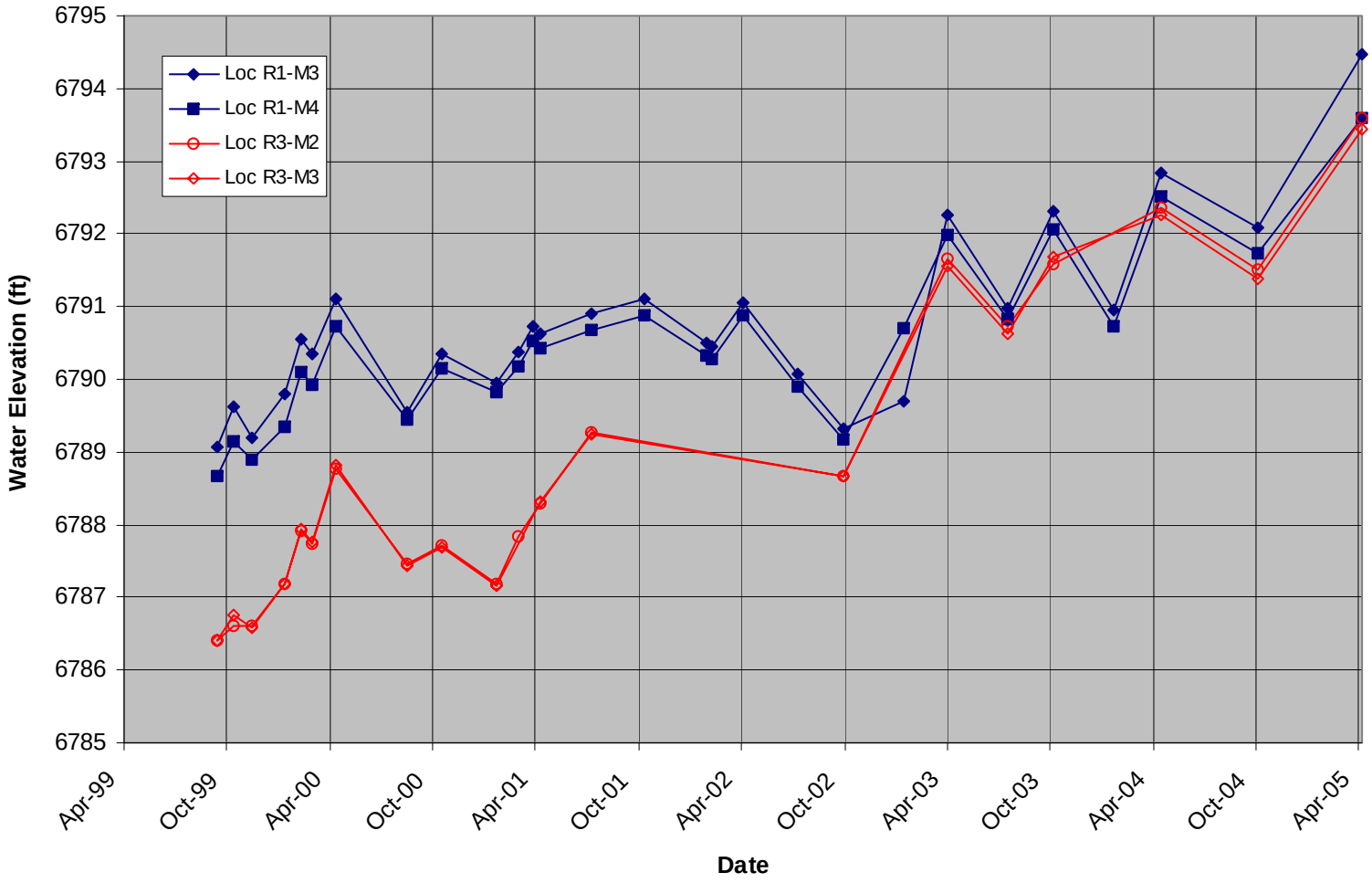

Figure 6. Water Level Hydrographs for Selected PRB Monitoring Wells

Table 2. Total-count Gamma Activity at the Monticello PRB, December 2004

Count depth below ground surface		Total counts per minute at alluvial wells						Total counts per minute in gravel + ZVI zone wells				
Inches	Feet	R1-M2	R1-M3	R1-M4	R1-M5	T1-D		R2-M1	R2-M2	R2-M3	R2-M4	R2-M5
0	0	1,790	1,310	1,760	1,626	1,655		1,810	1,830	1,840	1,750	1,790
12	1	3,360	3,550	3,340	2,960	3,260		3,440	3,260	3,450	3,390	3,550
24	2	3,450	3,230	3,550	3,352	3,390		3,530	3,410	3,320	3,450	3,360
36	3	3,230	3,590	3,510	3,488	3,510		3,670	3,230	3,140	3,230	2,490
48	4	3,980	3,880	3,630	3,240	3,780		2,860	2,390	2,580	2,720	2,960
60	5	4,140	3,440	3,850	2,665	3,720		3,690	2,750	3,410	2,580	3,770
72	6	3,770	3,660	3,420	3,219	3,460		2,380	2,820	2,930	3,560	3,260
84	7	3,390	3,250	2,875	3,020	3,090		2,810	3,660	3,110	2,870	3,680
96	8	2,520	2,960	2,522	2,844	3,010		2,520	3,280	3,730	3,110	3,810
102	8.5	2,760	3,020	2,741	3,120	2,940		2,710	3,320	3,230	2,860	3,550
108	9	2,810	2,880	2,965	3,084	2,590		2,880	2,650	4,050	2,630	3,490
114	9.5	2,430	2,790	2,880	3,337	2,520		2,620	2,570	4,160	2,470	4,550
120	10	2,900	2,540	2,555	3,050	2,470		2,550	2,510	6,310	3,040	3,990
126	10.5	2,720	2,720	2,490	2,943	2,630		2,320	2,820	6,650	4,660	3,130
132	11	2,640	2,660	2,440	2,620	2,550		2,360	2,940	4,630	4,870	4,460
138	11.5	2,660	2,350	2,479	2,487	2,340		5,230	4,860	4,820	4,750	5,850
144	12	2,470	2,410	2,980	2,050	2,870		4,120	5,540	6,060	5,080	8,480
150	12.5	2,980	2,160	2,822	2,376	20		10,460	4,120	3,770	7,360	6,330
156	13	3,030	2,380	2,510	2,480	2,460		11,060	3,750	5,250	9,660	3,880
162	13.5	3,090	2,770	3,400	2,412	2,630		14,200	5,980	5,480	6,820	4,240
168	14	3,570	3,790		2,360	2,410		8,700	12,100	5,760	3,870	4,360
174	14.5	4,580			2,480	2,150		4,380	13,300	4,050	4,750	4,610
180	15				2,345			5,820	10,200	4,190		
186	15.5							3,150	4,840			
192	16							2,220	4,260			
198	16.5							3,280				
204	17							3,360				

Table 2 (continued). Total-count Gamma Activity at the Monticello PRB, December 2004

Count depth below ground surface		Total counts per minute in gravel + ZVI zone wells										
Inches	**Feet**	**R2-M6**	**R2-M7**	**R2-M8**	**R2-M9**	**R2-M10**	**T2-D**	**R3-M1**	**R3-M2**	**R3-M3**	**R3-M4**	**T3-D**
0	0	1,930	1,828	1,650	1,639	1,324	1,691	1,830	1,620	1,800	1,910	1,660
12	1	3,360	3,330	2,920	3,381	3,550	3,360	3,260	3,340	3,430	3,520	2,980
24	2	3,320	3,380	3,190	3,170	3,430	3,447	3,410	3,670	3,250	3,640	3,350
36	3	2,750	2,765	3,560	2,645	2,630	2,844	3,230	3,120	2,090	2,760	3,610
48	4	2,600	2,550	2,660	2,630	2,320	2,530	2,390	2,640	2,410	2,950	2,780
60	5	2,770	2,889	2,520	2,337	2,300	2,830	2,750	3,220	2,850	2,300	2,750
72	6	3,130	2,944	2,970	2,420	1,730	2,960	2,820	2,890	2,760	2,660	2,820
84	7	3,860	2,755	3,360	2,550	2,640	3,410	2,660	3,570	3,440	2,620	2,930
96	8	3,650	2,560	3,240	2,382	2,230	2,620	3,280	2,430	3,520	2,370	5,020
102	8.5	3,100	3,040	2,650	2,440	1,943	2,590	3,320	2,410	3,670	2,280	4,460
108	9	2,680	2,998	3,160	2,610	1,990	2,670	2,650	3,230	3,380	2,220	4,140
114	9.5	3,310	4,020	2,660	3,075	2,156	3,280	2,570	5,090	4,040	2,630	2,850
120	10	4,540	4,454	2,520	3,340	3,390	4,150	2,510	5,540	3,990	3,750	2,540
126	10.5	4,150	4,500	2,170	3,190	775	3,930	2,820	6,560	4,130	4,110	4,120
132	11	3,370	4,120	2,800	3,766	980	3,260	2,940	5,790	3,710	11,800	4,440
138	11.5	3,130	5,190	4,120	3,440	1,590	3,030	4,860	4,990	4,550	4,420	3,310
144	12	3,220	4,340	6,810	3,290	2,760	2,980	5,540	5,530	4,190	3,140	3,170
150	12.5	3,080	3,770	6,690	4,168	2,980	3,850	4,120	5,360	4,260	3,000	3,180
156	13	3,540	2,970	4,760	4,210	3,740	5,390	3,750	4,940	3,380	3,480	3,240
162	13.5	3,160	3,050	4,410	5,630	2,260	4,140	5,980	6,190	5,180	4,860	3,290
168	14			3,950	4,720	2,120	4,360	12,100	13,400		3,730	3,540
174	14.5			3,730	3,824	1,890	4,620	13,300	10,600		2,920	
180	15			3,350	5,240	4,130		10,280	3,930		4,080	
186	15.5							4,840				
192	16							4,160				
198	16.5											
204	17											

Table 2 (continued). Total-count Gamma Activity at the Monticello PRB, December 2004

Count depth below ground surface		Total counts per minute in ZVI zone wells										
Inches	**Feet**	**R4-M1**	**R4-M2**	**R4-M3**	**R4-M4**	**R4-M5**	**R4-M6**	**R4-M7**	**R4-M8**	**R4-M9**	**T4-D**	**R5-M1**
0	0	1,860	1,690	1,760	2,220	1,730	1,790	1,597	1,600	1,755	1,720	1,750
12	1	3,470	3,440	3,420	3,490	3,240	3,250	3,250	3,286	3,260	3,380	3,230
24	2	3,220	3,770	3,210	3,360	3,360	3,280	3,120	3,230	3,515	3,090	3,570
36	3	2,890	2,610	1,880	1,530	1,390	1,720	1,250	1,310	2,432	810	3,620
48	4	490	460	460	350	390	440	376	400	736	532	1,660
60	5	280	620	370	250	370	370	254	396	270	260	390
72	6	240	450	300	310	360	330	308	348	337	390	360
84	7	250	290	340	340	330	280	291	364	364	270	280
96	8	320	270	310	300	350	310	291	330	368	230	310
102	8.5	310	310	250	280	340	320	410	388	393	250	300
108	9	320	320	340	270	290	260	284	340	408	240	250
114	9.5	260	250	320	240	270	240	295	220	388	230	320
120	10	260	320	290	310	260	190	265	290	349	260	260
126	10.5	250	270	310	250	380	180	254	330	292	220	270
132	11	280	220	260	360	390	210	290	290	320	270	320
138	11.5	230	230	230	340	330	200	284	250	344	320	300
144	12	260	220	190	310	350	190	246	330	380	290	370
150	12.5	320	260	280	280	340	170	235	250	300	340	330
156	13	250	240	250	320	270	170	424	290	275	740	340
162	13.5	260	270	390	340	250	300		270	270	330	290
168	14	280	410	370	330	220			750	299	360	310
174	14.5	270	540	1,260	2,110	640			890	534	310	330
180	15	250	2,240						1,340	2,920	1,240	580
186	15.5	260										2,430
192	16	690										
198	16.5	2,240										
204	17											

Table 2 (continued). Total-count Gamma Activity at the Monticello PRB, December 2004

Count depth below ground surface		Total counts per minute in ZVI zone wells								
Inches	**Feet**	**R5-M2**	**R5-M3**	**R5-M4**	**R5-M5**	**R5-M6**	**R5-M7**	**R5-M8**	**R5-M10**	**T5-D**
0	0	1,730	1,750	1,730	1,680	1,720	1,660	1,680	1,510	1,680
12	1	3,320	3,380	3,330	3,460	3,400	3,220	3,210	3,460	3,200
24	2	3,730	3,440	3,220	3,290	3,320	3,040	3,090	3,710	3,130
36	3	2,930	3,130	1,640	1,920	1,940	1,130	1,474	3,400	990
48	4	570	880	580	730	960	586	543	1,560	450
60	5	320	650	460	510	550	360	330	596	350
72	6	230	380	260	320	450	450	288	380	220
84	7	240	330	370	360	390	320	310	340	210
96	8	300	290	320	420	370	374	391	330	290
102	8.5	270	270	260	380	364	360	420	240	260
108	9	310	260	390	330	458	410	370	208	240
114	9.5	290	240	310	270	403	380	340	220	280
120	10	250	210	340	340	420	325	320	236	220
126	10.5	330	230	360	370	360	219	290	219	260
132	11	260	270	260	320	410	290	327	260	240
138	11.5	220	290	300	280	320	280	366	420	280
144	12	240	260	280	440	330	290	398	460	330
150	12.5	200	310	250	390	310	320		420	350
156	13	280	330	270	370	430	250		346	310
162	13.5	310	260	340	350	357	368		370	360
168	14	250	300	650	380	478			420	540
174	14.5	290	440	2,460	2,170				406	3,990
180	15	270	770						560	
186	15.5	280							1,940	
192	16	260							5,150	
198	16.5	620							4,840	
204	17									

Appendix A

Radiochemistry of Core Samples from the Monticello and Durango PRBs

ANALYTICAL REPORT INDEX

This report is the final data package for Requisition 17833 generated by the Analytical Laboratory for the PeRT OU III project in Monticello, Utah. It is the official record, and requestors are responsible for proper record keeping in compliance with project requirements.

CONTENTS **PAGE**

ANALYTICAL SUMMARY

This report contains the results for two miscellaneous samples received February 14, 2002, under Project No. 360705012 and Requisition No. 17833.

The samples were submitted for the determination of gamma emitting nuclides, total uranium, calcium, vanadium, uranium-234, uranium-235, and uranium-238. Vanadium, calcium, and total uranium will be reported on Requisition 17837.

The determination of gamma emitting nuclides was done by gamma spectrometry according to the Grand Junction Office Analytical Laboratory Standard Operating Procedure (SOP) GS-1. A gamma data package consists of individual sample packets each identified by a laboratory sample ID number. The results are presented in the raw data in the portion of the sample packet labeled "Summary of Nuclide Activity" and in Section I. The samples were canned "as is" and analyzed before the radium-226 had ingrown for 21days.

Uranium-235 and uranium-238 were analyzed in accordance with SOP AS-6, which is the laboratory SOP for inductively coupled plasma-mass spectrometry (ICP-MS). The determination of uranium-234 was done by ICP-MS using a flow injection analysis system (FIAS) according to SOP AS-16. A result for uranium-235 was also obtained by gamma spectrometry.

A "B" qualifier next to a gamma spectrometry result indicates the analyte was detected in the associated method blank. A "U" qualifier indicates the result is less than the minimum detectable activity (MDA).

Except as noted, all applicable laboratory quality control requirements were met during the course of these analyses.

RELEASE OF THE DATA CONTAINED IN THIS PACKAGE HAS BEEN AUTHORIZED BY THE LABORATORY MANAGER OR THE MANAGER'S DESIGNEE.

Gretchen Adams for BFC 3/5/02
LABORATORY MANAGER: DATE

Susan E. Ball 4 March 2002
PREPARED BY: DATE

DEFINITION OF INORGANIC QUALIFIERS

U The analyte was not detected. The value reported is the instrument detection limit (DL) corrected for any dilution in sample preparation and for percent solids if the sample is a solid.

B The reported value was obtained from a reading that was less than the Required Detection Limit (RDL) but greater than or equal to the DL.

E The reported value is estimated because of the possible presence of interference. The E qualifier is present if the result of the ICP serial dilution is not within limits.

N Matrix spike sample recovery is not within limits.

* Duplicate analysis is not within limits.

> Greater than.

DEFINITION OF RADIOLOGICAL QUALIFIERS

U The result is less than the minimum detectable activity (MDA).

< The result is less than the MDA. (Customer specific)

B The analyte was detected in the laboratory blank associated with the sample.

H A laboratory control sample (LCS) associated with the sample analysis had high recovery or the sample had high tracer yield.

L A laboratory control sample (LCS) associated with the sample analysis had low recovery or the sample had low tracer yield.

SECTION I

Customer Id: MONT-RPM-5-5 **Requisition:** 17833 **Date Sampled:** 2/14/02

Ticket: NDR 204 **Requestor:** STAN MORRISON **Date Received:** 2/14/02

Sample: 285384 **Project:** 360705012

Matrix: MISCELLANEOUS

REQUESTED ANALYSIS	RESULTS	QUALIFIERS	ERROR	MDA/DL	UNITS	DATE ANALYZED	ANALYTICAL METHOD
Americium-241	0.48	U	0	0.48	PCI/G	02/18/02	GS-1 R05
Antimony-125	0.4	U	0	0.4	PCI/G	02/18/02	GS-1 R05
Barium-133	0.21	U	0	0.21	PCI/G	02/18/02	GS-1 R05
Bismuth-211	1.47		0.45	0.93	PCI/G	02/18/02	GS-1 R05
Bismuth-214	0.37	U	0	0.37	PCI/G	02/18/02	GS-1 R05
Cadmium-109	0.07	U	0	0.07	PCI/G	02/18/02	GS-1 R05
Cerium-144	1.02	U	0	1.02	PCI/G	02/18/02	GS-1 R05
Cesium-134	0.18	U	0	0.18	PCI/G	02/18/02	GS-1 R05
Cesium-137	0.16	U	0	0.16	PCI/G	02/18/02	GS-1 R05
Cobalt-57	0.13	U	0	0.13	PCI/G	02/18/02	GS-1 R05
Cobalt-58	0.15	U	0	0.15	PCI/G	02/18/02	GS-1 R05
Cobalt-60	0.14	U	0	0.14	PCI/G	02/18/02	GS-1 R05
Europium-152	0.39	U	0	0.39	PCI/G	02/18/02	GS-1 R05
Europium-154	0.27	U	0	0.27	PCI/G	02/18/02	GS-1 R05
Europium-155	0.59	U	0	0.59	PCI/G	02/18/02	GS-1 R05
Lead-210	3.44	U	0	3.44	PCI/G	02/18/02	GS-1 R05
Lead-212	0.83	B	0.17	0.36	PCI/G	02/18/02	GS-1 R05
Lead-214	0.34	U	0	0.34	PCI/G	02/18/02	GS-1 R05
Manganese-54	0.17	U	0	0.17	PCI/G	02/18/02	GS-1 R05
Niobium-95	0.17	U	0	0.17	PCI/G	02/18/02	GS-1 R05
Potassium-40	6.62	B	0.77	1.96	PCI/G	02/18/02	GS-1 R05
Protactinium-233	0.29	U	0	0.29	PCI/G	02/18/02	GS-1 R05
Radium-226	59		6.74	5.19	PCI/G	02/18/02	GS-1 R05
Ruthenium-103	0.15	U	0	0.15	PCI/G	02/18/02	GS-1 R05
Ruthenium-106	1.6	U	0	1.6	PCI/G	02/18/02	GS-1 R05
Silver-108 (meta)	0.13	U	0	0.13	PCI/G	02/18/02	GS-1 R05
Silver-110 (meta)	0.15	U	0	0.15	PCI/G	02/18/02	GS-1 R05
Sodium-22	0.15	U	0	0.15	PCI/G	02/18/02	GS-1 R05
Thallium-208	0.18	U	0	0.18	PCI/G	02/18/02	GS-1 R05
Thorium-227	1.07	U	0	1.07	PCI/G	02/18/02	GS-1 R05
Thorium-234	26.1		1.9	1.68	PCI/G	02/18/02	GS-1 R05
Uranium-234	216			0.36	PCI/G	02/21/02	AS-16 R03
Uranium-235	2.13		0.3	0.32	PCI/G	02/18/02	GS-1 R05
Uranium-235	10			0.02	PCI/G	02/21/02	AS-6 R07
Uranium-238	219			0.5	PCI/G	02/21/02	AS-6 R07
Zinc-65	0.3	U	0	0.3	PCI/G	02/18/02	GS-1 R05

Grand Junction Office Analytical Laboratory

2/25/02

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ANALYTICAL RESULTS

SECTION I

Customer Id: MONT-RPM-5-5 **Requisition:** 17833 **Date Sampled:** 2/14/02

Ticket: NDR 204 **Requestor:** STAN MORRISON **Date Received:** 2/14/02

Sample: 285384 **Project:** 360705012

Matrix: MISCELLANEOUS

REQUESTED ANALYSIS	RESULTS	QUALIFIERS	ERROR	MDA/DL	UNITS	DATE ANALYZED	ANALYTICAL METHOD
Zirconium-95	0.31	U	0	0.31	PCI/G	02/18/02	GS-1 R05

Grand Junction Office Analytical Laboratory

2/25/02

ANALYTICAL RESULTS

SECTION I

Customer Id: MONT-RPM-5-6 **Requisition:** 17833 **Date Sampled:** 2/14/02

Ticket: NDR 205 **Requestor:** STAN MORRISON **Date Received:** 2/14/02

Sample: 285385 **Project:** 360705012

Matrix: MISCELLANEOUS

REQUESTED ANALYSIS	RESULTS	QUALIFIERS	ERROR	MDA/DL	UNITS	DATE ANALYZED	ANALYTICAL METHOD
Americium-241	0.35	U	0	0.35	PCI/G	02/18/02	GS-1 R05
Antimony-125	0.37	U	0	0.37	PCI/G	02/18/02	GS-1 R05
Barium-133	0.19	U	0	0.19	PCI/G	02/18/02	GS-1 R05
Bismuth-211	1.8		0.51	0.94	PCI/G	02/18/02	GS-1 R05
Bismuth-214	0.34	U	0	0.34	PCI/G	02/18/02	GS-1 R05
Cadmium-109	0.05	U	0	0.05	PCI/G	02/18/02	GS-1 R05
Cerium-144	0.84	U	0	0.84	PCI/G	02/18/02	GS-1 R05
Cesium-134	0.16	U	0	0.16	PCI/G	02/18/02	GS-1 R05
Cesium-137	0.14	U	0	0.14	PCI/G	02/18/02	GS-1 R05
Cobalt-57	0.11	U	0	0.11	PCI/G	02/18/02	GS-1 R05
Cobalt-58	0.13	U	0	0.13	PCI/G	02/18/02	GS-1 R05
Cobalt-60	0.14	U	0	0.14	PCI/G	02/18/02	GS-1 R05
Europium-152	0.32	U	0	0.32	PCI/G	02/18/02	GS-1 R05
Europium-154	0.22	U	0	0.22	PCI/G	02/18/02	GS-1 R05
Europium-155	0.43	U	0	0.43	PCI/G	02/18/02	GS-1 R05
Lead-210	2.72	U	0	2.72	PCI/G	02/18/02	GS-1 R05
Lead-212	0.57	B	0.14	0.33	PCI/G	02/18/02	GS-1 R05
Lead-214	1.13		0.2	0.31	PCI/G	02/18/02	GS-1 R05
Manganese-54	0.16	U	0	0.16	PCI/G	02/18/02	GS-1 R05
Niobium-95	0.14	U	0	0.14	PCI/G	02/18/02	GS-1 R05
Potassium-40	8.93	B	0.76	1.47	PCI/G	02/18/02	GS-1 R05
Protactinium-233	0.26	U	0	0.26	PCI/G	02/18/02	GS-1 R05
Radium-226	18.4		2.76	4.17	PCI/G	02/18/02	GS-1 R05
Ruthenium-103	0.14	U	0	0.14	PCI/G	02/18/02	GS-1 R05
Ruthenium-106	1.44	U	0	1.44	PCI/G	02/18/02	GS-1 R05
Silver-108 (meta)	0.12	U	0	0.12	PCI/G	02/18/02	GS-1 R05
Silver-110 (meta)	0.13	U	0	0.13	PCI/G	02/18/02	GS-1 R05
Sodium-22	0.14	U	0	0.14	PCI/G	02/18/02	GS-1 R05
Thallium-208	0.16	U	0	0.16	PCI/G	02/18/02	GS-1 R05
Thorium-227	0.94	U	0	0.94	PCI/G	02/18/02	GS-1 R05
Thorium-234	16.2		1	3.2	PCI/G	02/18/02	GS-1 R05
Uranium-234	161			0.36	PCI/G	02/21/02	AS-16 R03
Uranium-235	0.21	U	0	0.21	PCI/G	02/18/02	GS-1 R05
Uranium-235	8.1			0.02	PCI/G	02/21/02	AS-6 R07
Uranium-238	172			0.5	PCI/G	02/21/02	AS-6 R07
Zinc-65	0.27	U	0	0.27	PCI/G	02/18/02	GS-1 R05

Grand Junction Office Analytical Laboratory

2/25/02

ANALYTICAL RESULTS

SECTION I

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Customer Id: MONT-RPM-5-6 **Requisition:** 17833 **Date Sampled:** 2/14/02

Ticket: NDR 205 **Requestor:** STAN MORRISON **Date Received:** 2/14/02

Sample: 285385 **Project:** 360705012

Matrix: MISCELLANEOUS

REQUESTED ANALYSIS	RESULTS	QUALIFIERS	ERROR	MDA/DL	UNITS	DATE ANALYZED	ANALYTICAL METHOD
Zirconium-95	0.25	U	0	0.25	PCI/G	02/18/02	GS-1 R05

ANALYTICAL REPORT INDEX

This report is the final data package for Requisition 16174 generated by the Analytical Laboratory for the Durango Bodo Box site. It is the official record, and requestors are responsible for proper record-keeping in compliance with project requirements.

CONTENTS

ANALYTICAL SUMMARY

This report contains the results for eleven soil samples received August 17, 1998, under Project Number 320802008 and Requisition Number 16174.

The determinations of arsenic, calcium, chromium, iron, magnesium, manganese, selenium, and vanadium were done using an inductively coupled plasma-atomic emission spectrometer (ICP-AES) according to the Grand Junction Office Analytical Laboratory Standard Operating Procedure (SOP) AS-5. Molybdenum and uranium were analyzed in accordance with SOP AS-6, which is the laboratory SOP for inductively coupled plasma-mass spectrometry (ICP-MS). Total inorganic carbon (TIC) was determined by coulometry according to SOP K-5.

The determination of gamma emitting nuclides was done by gamma spectrometry in accordance with SOP GS-1. A gamma data package consists of individual sample packets each identified by a laboratory sample ID number. The results are presented in the raw data in the portion of the sample packet labeled "Summary of Nuclide Activity".

A "B"qualifier next to a result indicates that the reported value was obtained from a reading that was less than the required detection limit (RDL) but greater than or equal to the actual instrument detection limit (IDL). A "U" qualifier indicates that the analyte was not detected.

All quality control requirements were met during the course of these analyses.

RELEASE OF THE DATA CONTAINED IN THIS PACKAGE HAS BEEN AUTHORIZED BY THE LABORATORY MANAGER OR THE MANAGER'S DESIGNEE.

Mark Kelly for PBL 9-17-98

LABORATORY MANAGER: DATE

Susan Lyster 9/17/98

PREPARED BY: DATE

1.01 ANALYTICAL RESULTS

SECTION 1

Customer ID: DUR 2
Ticket ID: NDB 882

Date: September 16, 1998
Lab ID: 253661

Requestor: S. MORRISON
Sample Matrix: MILLED SOIL
Project Number: 320802008

Case: 16174
Date Received: Aug 17, 1998
Date Collected: Aug 16, 1998

ANALYSIS REQUESTED	RESULTS	QUALI's	ERROR	UNITS	DATE ANALYZED	METHOD OF ANALYSIS
Actinium-224	<28.74	U	NA	pCi/g	08/20/98	GS-1 R04
Actinium-228	<0.70	U	NA	pCi/g	08/20/98	GS-1 R04
Arsenic-73	<2.62	U	NA	pCi/g	08/20/98	GS-1 R04
Arsenic-74	<0.40	U	NA	pCi/g	08/20/98	GS-1 R04
Beryllium-7	<2.06	U	NA	pCi/g	08/20/98	GS-1 R04
Bismuth-212	<2.06	U	NA	pCi/g	08/20/98	GS-1 R04
Bismuth-214	<0.55	U	NA	pCi/g	08/20/98	GS-1 R04
Cadmium-109	<0.01	U	NA	pCi/g	08/20/98	GS-1 R04
Cobalt-57	<0.41	U	NA	pCi/g	08/20/98	GS-1 R04
Cobalt-60	<0.16	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-134	<0.26	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-134(meta)	<54.32	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-137	<0.26	U	NA	pCi/g	08/20/98	GS-1 R04
Iodine-131	<0.27	U	NA	pCi/g	08/20/98	GS-1 R04
Potassium-40	<2.16	U	NA	pCi/g	08/20/98	GS-1 R04
Manganese-54	<0.23	U	NA	pCi/g	08/20/98	GS-1 R04
Sodium-22	<0.16	U	NA	pCi/g	08/20/98	GS-1 R04
Protactinium-234	103.37		19.19	pCi/g	08/20/98	GS-1 R04
Lead-210	<5.22	U	NA	pCi/g	08/20/98	GS-1 R04
Lead-212	<0.53	U	NA	pCi/g	08/20/98	GS-1 R04
Lead-214	<0.59	U	NA	pCi/g	08/20/98	GS-1 R04
Radium-224	<5.95	U	NA	pCi/g	08/20/98	GS-1 R04
Radium-226	<22.94	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-83	<0.47	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-86	<1.86	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-86(meta)	0.00		NA	pCi/g	08/20/98	GS-1 R04
Ruthenium-103	<0.24	U	NA	pCi/g	08/20/98	GS-1 R04
Selenium-72	<0.38	U	NA	pCi/g	08/20/98	GS-1 R04
Selenium-75	<0.40	U	NA	pCi/g	08/20/98	GS-1 R04
Thorium-228	<3.67	U	NA	pCi/g	08/20/98	GS-1 R04
Thorium-234	527.38		49.41	pCi/g	08/20/98	GS-1 R04
Thallium-208	<0.27	U	NA	pCi/g	08/20/98	GS-1 R04
Thallium-210	<0.25	U	NA	pCi/g	08/20/98	GS-1 R04
Zinc-65	<0.37	U	NA	pCi/g	08/20/98	GS-1 R04
Uranium-235	67.18		3.21	pCi/g	08/20/98	GS-1 R04

1.01

ANALYTICAL RESULTS

SECTION 1

Customer ID: DUR 4
Ticket ID: NDB 883

Requestor: S. MORRISON
Sample Matrix: MILLED SOIL
Project Number: 320802008

Date: September 16, 1998
Lab ID: 253662

Case: 16174
Date Received: Aug 17, 1998
Date Collected: Aug 16, 1998

ANALYSIS REQUESTED	RESULTS	QUALI's	ERROR	UNITS	DATE ANALYZED	METHOD OF ANALYSIS
Actinium-224	<19.19	U	NA	pCi/g	08/20/98	GS-1 R04
Actinium-228	<0.41	U	NA	pCi/g	08/20/98	GS-1 R04
Arsenic-73	<0.67	U	NA	pCi/g	08/20/98	GS-1 R04
Arsenic-74	<0.20	U	NA	pCi/g	08/20/98	GS-1 R04
Beryllium-7	<0.99	U	NA	pCi/g	08/20/98	GS-1 R04
Bismuth-212	<0.98	U	NA	pCi/g	08/20/98	GS-1 R04
Bismuth-214	<0.29	U	NA	pCi/g	08/20/98	GS-1 R04
Cadmium-109	<0.01	U	NA	pCi/g	08/20/98	GS-1 R04
Cobalt-57	<0.12	U	NA	pCi/g	08/20/98	GS-1 R04
Cobalt-60	<0.12	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-134	<0.13	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-134 (meta)	<31.99	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-137	0.31		0.04	pCi/g	08/20/98	GS-1 R04
Iodine-131	<0.13	U	NA	pCi/g	08/20/98	GS-1 R04
Potassium-40	<1.91	U	NA	pCi/g	08/20/98	GS-1 R04
Manganese-54	<0.12	U	NA	pCi/g	08/20/98	GS-1 R04
Sodium-22	<0.11	U	NA	pCi/g	08/20/98	GS-1 R04
Protactinium-234	86.76		10.09	pCi/g	08/20/98	GS-1 R04
Lead-210	<1.58	U	NA	pCi/g	08/20/98	GS-1 R04
Lead-212	<0.23	U	NA	pCi/g	08/20/98	GS-1 R04
Lead-214	<0.27	U	NA	pCi/g	08/20/98	GS-1 R04
Radium-224	<2.56	U	NA	pCi/g	08/20/98	GS-1 R04
Radium-226	<5.44	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-83	<0.23	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-86	<1.35	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-86 (meta)	0.00		NA	pCi/g	08/20/98	GS-1 R04
Ruthenium-103	<0.11	U	NA	pCi/g	08/20/98	GS-1 R04
Selenium-72	<0.12	U	NA	pCi/g	08/20/98	GS-1 R04
Selenium-75	<0.17	U	NA	pCi/g	08/20/98	GS-1 R04
Thorium-228	<1.08	U	NA	pCi/g	08/20/98	GS-1 R04
Thorium-234	20.81		2.16	pCi/g	08/20/98	GS-1 R04
Thallium-208	<0.13	U	NA	pCi/g	08/20/98	GS-1 R04
Thallium-210	<0.12	U	NA	pCi/g	08/20/98	GS-1 R04
Zinc-65	<0.25	U	NA	pCi/g	08/20/98	GS-1 R04
Uranium-235	3.04		0.19	pCi/g	08/20/98	GS-1 R04

V1.01

ANALYTICAL RESULTS

SECTION 3

Customer ID: DUR 5
Ticket ID: NDB 884

Date: September 16, 1998
Lab ID: 253663

Requestor: S. MORRISON
Sample Matrix: MILLED SOIL
Project Number: 320802008

Case: 16174
Date Received: Aug 17, 1998
Date Collected: Aug 16, 1998

ANALYSIS REQUESTED	RESULTS	QUALI's	ERROR	UNITS	DATE ANALYZED	METHOD OF ANALYSIS
Actinium-224	<42.74	U	NA	pCi/g	08/20/98	GS-1 R04
Actinium-228	<0.49	U	NA	pCi/g	08/20/98	GS-1 R04
Arsenic-73	<1.27	U	NA	pCi/g	08/20/98	GS-1 R04
Arsenic-74	<0.26	U	NA	pCi/g	08/20/98	GS-1 R04
Beryllium-7	<1.29	U	NA	pCi/g	08/20/98	GS-1 R04
Bismuth-212	<1.34	U	NA	pCi/g	08/20/98	GS-1 R04
Bismuth-214	<0.36	U	NA	pCi/g	08/20/98	GS-1 R04
Cadmium-109	<0.01	U	NA	pCi/g	08/20/98	GS-1 R04
Cobalt-57	<0.20	U	NA	pCi/g	08/20/98	GS-1 R04
Cobalt-60	<0.16	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-134	<0.18	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-134(meta)	<75.38	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-137	0.69		0.07	pCi/g	08/20/98	GS-1 R04
Iodine-131	<0.17	U	NA	pCi/g	08/20/98	GS-1 R04
Potassium-40	<2.12	U	NA	pCi/g	08/20/98	GS-1 R04
Manganese-54	<0.15	U	NA	pCi/g	08/20/98	GS-1 R04
Sodium-22	<0.14	U	NA	pCi/g	08/20/98	GS-1 R04
Protactinium-234	442.74		29.62	pCi/g	08/20/98	GS-1 R04
Lead-210	<2.63	U	NA	pCi/g	08/20/98	GS-1 R04
Lead-212	<0.31	U	NA	pCi/g	08/20/98	GS-1 R04
Lead-214	<0.37	U	NA	pCi/g	08/20/98	GS-1 R04
Radium-224	<3.53	U	NA	pCi/g	08/20/98	GS-1 R04
Radium-226	<10.67	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-83	<0.31	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-86	<1.57	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-86(meta)	0.00		NA	pCi/g	08/20/98	GS-1 R04
Ruthenium-103	<0.15	U	NA	pCi/g	08/20/98	GS-1 R04
Selenium-72	<0.20	U	NA	pCi/g	08/20/98	GS-1 R04
Selenium-75	<0.23	U	NA	pCi/g	08/20/98	GS-1 R04
Thorium-228	<1.80	U	NA	pCi/g	08/20/98	GS-1 R04
Thorium-234	107.42		10.23	pCi/g	08/20/98	GS-1 R04
Thallium-208	<0.17	U	NA	pCi/g	08/20/98	GS-1 R04
Thallium-210	<0.16	U	NA	pCi/g	08/20/98	GS-1 R04
Zinc-65	<0.29	U	NA	pCi/g	08/20/98	GS-1 R04
Uranium-235	13.37		0.68	pCi/g	08/20/98	GS-1 R04

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01 ANALYTICAL RESULTS

Customer ID: DUR 3
Ticket ID: NDB 885

Date: September 16, 1998
Lab ID: 253664

Requestor: S. MORRISON
Sample Matrix: MILLED SOIL
Project Number: 320802008

Case: 16174
Date Received: Aug 17, 1998
Date Collected: Aug 16, 1998

ANALYSIS REQUESTED	RESULTS	QUALI's	ERROR	UNITS	DATE ANALYZED	METHOD OF ANALYSIS
Actinium-224	<131.74	U	NA	pCi/g	08/20/98	GS-1 R04
Actinium-228	<0.81	U	NA	pCi/g	08/20/98	GS-1 R04
Arsenic-73	<3.04	U	NA	pCi/g	08/20/98	GS-1 R04
Arsenic-74	<0.46	U	NA	pCi/g	08/20/98	GS-1 R04
Beryllium-7	<2.35	U	NA	pCi/g	08/20/98	GS-1 R04
Bismuth-212	<2.37	U	NA	pCi/g	08/20/98	GS-1 R04
Bismuth-214	<0.61	U	NA	pCi/g	08/20/98	GS-1 R04
Cadmium-109	<0.01	U	NA	pCi/g	08/20/98	GS-1 R04
Cobalt-57	<0.46	U	NA	pCi/g	08/20/98	GS-1 R04
Cobalt-60	0.63		0.06	pCi/g	08/20/98	GS-1 R04
Cesium-134	<0.29	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-134(meta)	<255.95	U	NA	pCi/g	08/20/98	GS-1 R04
Cesium-137	3.10		0.23	pCi/g	08/20/98	GS-1 R04
Iodine-131	<0.32	U	NA	pCi/g	08/20/98	GS-1 R04
Potassium-40	<2.56	U	NA	pCi/g	08/20/98	GS-1 R04
Manganese-54	<0.26	U	NA	pCi/g	08/20/98	GS-1 R04
Sodium-22	<0.18	U	NA	pCi/g	08/20/98	GS-1 R04
Protactinium-234	61.57		22.42	pCi/g	08/20/98	GS-1 R04
Lead-210	<5.99	U	NA	pCi/g	08/20/98	GS-1 R04
Lead-212	<0.60	U	NA	pCi/g	08/20/98	GS-1 R04
Lead-214	<0.67	U	NA	pCi/g	08/20/98	GS-1 R04
Radium-224	<6.69	U	NA	pCi/g	08/20/98	GS-1 R04
Radium-226	<25.55	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-83	<0.54	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-86	<2.37	U	NA	pCi/g	08/20/98	GS-1 R04
Rubidium-86(meta)	0.00		NA	pCi/g	08/20/98	GS-1 R04
Ruthenium-103	<0.27	U	NA	pCi/g	08/20/98	GS-1 R04
Selenium-72	<0.45	U	NA	pCi/g	08/20/98	GS-1 R04
Selenium-75	<0.45	U	NA	pCi/g	08/20/98	GS-1 R04
Thorium-228	<4.07	U	NA	pCi/g	08/20/98	GS-1 R04
Thorium-234	630.77		59.09	pCi/g	08/20/98	GS-1 R04
Thallium-208	<0.31	U	NA	pCi/g	08/20/98	GS-1 R04
Thallium-210	<0.29	U	NA	pCi/g	08/20/98	GS-1 R04
Zinc-65	<0.41	U	NA	pCi/g	08/20/98	GS-1 R04
Uranium-235	73.95		3.56	pCi/g	08/20/98	GS-1 R04

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V1.01

ANALYTICAL RESULTS

(SECTION 9)

Customer ID: DUR 6
Ticket ID: NDB 886

Date: September 16, 1998
Lab ID: 253665

Requestor: S. MORRISON
Sample Matrix: MILLED SOIL
Project Number: 320802008

Case: 16174
Date Received: Aug 17, 1998
Date Collected: Aug 16, 1998

ANALYSIS REQUESTED	RESULTS	QUALI's	ERROR	UNITS	DATE ANALYZED	METHOD OF ANALYSIS
Actinium-224	0.00		NA	pCi/g	08/24/98	GS-1 R04
Actinium-228	<0.61	U	NA	pCi/g	08/24/98	GS-1 R04
Arsenic-73	<2.07	U	NA	pCi/g	08/24/98	GS-1 R04
Arsenic-74	<0.38	U	NA	pCi/g	08/24/98	GS-1 R04
Beryllium-7	<1.83	U	NA	pCi/g	08/24/98	GS-1 R04
Bismuth-212	<1.74	U	NA	pCi/g	08/24/98	GS-1 R04
Bismuth-214	<0.47	U	NA	pCi/g	08/24/98	GS-1 R04
Cadmium-109	<0.01	U	NA	pCi/g	08/24/98	GS-1 R04
Cobalt-57	<0.33	U	NA	pCi/g	08/24/98	GS-1 R04
Cobalt-60	0.55		0.05	pCi/g	08/24/98	GS-1 R04
Cesium-134	<0.22	U	NA	pCi/g	08/24/98	GS-1 R04
Cesium-134 (meta)	0.00		NA	pCi/g	08/24/98	GS-1 R04
Cesium-137	2.38		0.18	pCi/g	08/24/98	GS-1 R04
Iodine-131	<0.32	U	NA	pCi/g	08/24/98	GS-1 R04
Potassium-40	4.32		0.73	pCi/g	08/24/98	GS-1 R04
Manganese-54	<0.19	U	NA	pCi/g	08/24/98	GS-1 R04
Sodium-22	<0.15	U	NA	pCi/g	08/24/98	GS-1 R04
Protactinium-234	65.83		13.53	pCi/g	08/24/98	GS-1 R04
Lead-210	<4.07	U	NA	pCi/g	08/24/98	GS-1 R04
Lead-212	<0.44	U	NA	pCi/g	08/24/98	GS-1 R04
Lead-214	<0.51	U	NA	pCi/g	08/24/98	GS-1 R04
Radium-224	<4.98	U	NA	pCi/g	08/24/98	GS-1 R04
Radium-226	<17.77	U	NA	pCi/g	08/24/98	GS-1 R04
Rubidium-83	<0.42	U	NA	pCi/g	08/24/98	GS-1 R04
Rubidium-86	<2.07	U	NA	pCi/g	08/24/98	GS-1 R04
Rubidium-86 (meta)	0.00		NA	pCi/g	08/24/98	GS-1 R04
Ruthenium-103	<0.22	U	NA	pCi/g	08/24/98	GS-1 R04
Selenium-72	<0.41	U	NA	pCi/g	08/24/98	GS-1 R04
Selenium-75	<0.34	U	NA	pCi/g	08/24/98	GS-1 R04
Thorium-228	<2.90	U	NA	pCi/g	08/24/98	GS-1 R04
Thorium-234	298.29		28.08	pCi/g	08/24/98	GS-1 R04
Thallium-208	<0.23	U	NA	pCi/g	08/24/98	GS-1 R04
Thallium-210	<0.21	U	NA	pCi/g	08/24/98	GS-1 R04
Zinc-65	<0.36	U	NA	pCi/g	08/24/98	GS-1 R04
Uranium-235	41.65		2.01	pCi/g	08/24/98	GS-1 R04

Appendix B

Field Data for December 2004 Gamma Survey of the Monticello PRBs

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: T1-D

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 3'6"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1655	132	2550	264	
6		138	2340	270	
12	3260	144	2870	276	
18		150	2820	282	
24	3390	156	2460	288	
30		162	2630	294	
36	3510	168	2410	300	
42		174	2150	306	
48	3780	180		312	
54		186		318	
60	3720	192		324	
66		198		330	
72	3460	204		336	
78		210		342	
84	3090	216		348	
90		222		354	
96	3010	228		360	
102	2940	234		366	
108	2590	240		372	
114	2520	246		378	
120	2470	252		384	
126	2630	258		390	

Verified By: L White Date: 12-07-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R1-M2

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 3'9"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1790	132	2640	264	
6		138	2660	270	
12	3360	144	2470	276	
18		150	2980	282	
24	3450	156	3030	288	
30		162	3090	294	
36	3230	168	3570	300	
42		174	4580	306	
48	3980	180		312	
54		186		318	
60	4140	192		324	
66		198		330	
72	3770	204		336	
78		210		342	
84	3390	216		348	
90		222		354	
96	2520	228		360	
102	2760	234		366	
108	2810	240		372	
114	2430	246		378	
120	2900	252		384	
126	2720	258		390	

Verified By: [signature] Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R1-M3

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 3'3"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1610	132	2660	264	
6		138	2350	270	
12	3550	144	2410	276	
18		150	2160	282	
24	3230	156	2380	288	
30		162	2770	294	
36	3590	168	3790	300	
42		174		306	
48	3880	180		312	
54		186		318	
60	3440	192		324	
66		198		330	
72	3660	204		336	
78		210		342	
84	3250	216		348	
90		222		354	
96	2960	228		360	
102	3020	234		366	
108	2880	240		372	
114	2790	246		378	
120	2540	252		384	
126	2720	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R1-M4

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 3' 8"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1760	132	2440	264	
6		138	2479	270	
12	3340	144	2980	276	
18		150	2822	282	
24	3550	156	2510	288	
30		162	3400	294	
36	3510	168		300	
42		174		306	
48	3630	180		312	
54		186		318	
60	3850	192		324	
66		198		330	
72	3420	204		336	
78		210		342	
84	2875	216		348	
90		222		354	
96	2522	228		360	
102	2741	234		366	
108	2965	240		372	
114	2880	246		378	
120	2555	252		384	
126	2490	258		390	

Verified By: [signature] Date: 12-7-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-6-04

Operator: LW

Location No: R1 - m5

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 3' 6"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1626	132	2620	264	
6		138	2487	270	
12	2960	144	2050	276	
18		150	2376	282	
24	3352	156	2480	288	
30		162	2412	294	
36	3488	168	2360	300	
42		174	2480	306	
48	3240	180	2345	312	
54		186		318	
60	2665	192		324	
66		198		330	
72	3219	204		336	
78		210		342	
84	3020	216		348	
90		222		354	
96	2844	228		360	
102	3120	234		366	
108	3084	240		372	
114	3337	246		378	
120	3050	252		384	
126	2943	258		390	

Verified By: [signature] Date: 12-6-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: T2-D

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 3'9"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1691	132	3260	264	
6		138	3030	270	
12	3360	144	2980	276	
18		150	3850	282	
24	3447	156	5390	288	
30		162	4140	294	
36	2844	168	4360	300	
42		174	4620	306	
48	2530	180		312	
54		186		318	
60	2830	192		324	
66		198		330	
72	2960	204		336	
78		210		342	
84	3410	216		348	
90		222		354	
96	2620	228		360	
102	2590	234		366	
108	2670	240		372	
114	3280	246		378	
120	4150	252		384	
126	3930	258		390	

Verified By: [signature] Date: 12-07-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R2-M1

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 5'6"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1810	132	2360	264	
6		138	5230	270	
12	3440	144	4120	276	
18		150	10460	282	
24	3530	156	11000	288	
30		162	14200	294	
36	3670	168	8700	300	
42		174	4380	306	
48	2860	180	5820	312	
54		186	3150	318	
60	3690	192	2220	324	
66		198	3280	330	
72	2380	204	3360	336	
78		210		342	
84	2810	216		348	
90		222		354	
96	2520	228		360	
102	2710	234		366	
108	2880	240		372	
114	2620	246		378	
120	2550	252		384	
126	2320	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8

Operator: LW

Location No: R2 - M2

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS PTW 43"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1830	132	2940	264	
6		138	4860	270	
12	3260	144	5540	276	
18		150	4120	282	
24	3410	156	3750	288	
30		162	5980	294	
36	3230	168	12100	300	
42		174	13300	306	
48	2390	180	10200	312	
54		186	4840	318	
60	2750	192	4260	324	
66		198		330	
72	2820	204		336	
78		210		342	
84	3660	216		348	
90		222		354	
96	3280	228		360	
102	3320	234		366	
108	2650	240		372	
114	2570	246		378	
120	2510	252		384	
126	2820	258		390	

Verified By: L Wh

Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R2-M3

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 3'9"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1840	132	4630	264	
6		138	4820	270	
12	3450	144	6060	276	
18		150	3770	282	
24	3320	156	5250	288	
30		162	5480	294	
36	3140	168	5760	300	
42		174	4050	306	
48	2580	180	4190	312	
54		186		318	
60	3410	192		324	
66		198		330	
72	2930	204		336	
78		210		342	
84	3110	216		348	
90		222		354	
96	3730	228		360	
102	3230	234		366	
108	4050	240		372	
114	4160	246		378	
120	6310	252		384	
126	6650	258		390	

Verified By: [signature] Date: 12-06-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R2-M4

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 3'8"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1750	132	4870	264	
6		138	4750	270	
12	3390	144	5080	276	
18		150	7360	282	
24	3450	156	9660	288	
30		162	6820	294	
36	3230	168	3870	300	
42		174	4750	306	
48	2720	180		312	
54		186		318	
60	2580	192		324	
66		198		330	
72	3560	204		336	
78		210		342	
84	2870	216		348	
90		222		354	
96	3110	228		360	
102	2860	234		366	
108	2630	240		372	
114	2470	246		378	
120	3040	252		384	
126	4660	258		390	

Verified By: L W [illegible] Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R2-M5

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 3' 8"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1790	132	4460	264	
6		138	5850	270	
12	3550	144	8480	276	
18		150	6330	282	
24	3360	156	3880	288	
30		162	4240	294	
36	2490	168	4360	300	
42		174	4610	306	
48	2960	180		312	
54		186		318	
60	3770	192		324	
66		198		330	
72	3260	204		336	
78		210		342	
84	3680	216		348	
90		222		354	
96	3810	228		360	
102	3550	234		366	
108	3490	240		372	
114	4550	246		378	
120	3990	252		384	
126	3130	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R2-M6

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 4'9"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1930	132	3370	264	
6		138	3130	270	
12	3360	144	3220	276	
18		150	3080	282	
24	3320	156	3540	288	
30		162	3160	294	
36	2750	168		300	
42		174		306	
48	2600	180		312	
54		186		318	
60	2770	192		324	
66		198		330	
72	3130	204		336	
78		210		342	
84	3860	216		348	
90		222		354	
96	3650	228		360	
102	3100	234		366	
108	2680	240		372	
114	3310	246		378	
120	4540	252		384	
126	4150	258		390	

Verified By: [signature] Date: 12-07-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R2-M7

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW= 41'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1828	132	4120	264	
6		138	5190	270	
12	3330	144	4340	276	
18		150	3770	282	
24	3380	156	2970	288	
30		162	3050	294	
36	2765	168		300	
42		174		306	
48	2550	180		312	
54		186		318	
60	2889	192		324	
66		198		330	
72	2944	204		336	
78		210		342	
84	2755	216		348	
90		222		354	
96	2560	228		360	
102	3040	234		366	
108	2998	240		372	
114	4020	246		378	
120	4454	252		384	
126	4500	258		390	

Verified By: L Wilson Date: 12-7-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R2-M8

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 4'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1650	132	2800	264	
6		138	4120	270	
12	2920	144	6810	276	
18		150	6690	282	
24	3190	156	4760	288	
30		162	4410	294	
36	3560	168	3950	300	
42		174	3730	306	
48	2660	180	3350	312	
54		186		318	
60	2520	192		324	
66		198		330	
72	2970	204		336	
78		210		342	
84	3360	216		348	
90		222		354	
96	3240	228		360	
102	2650	234		366	
108	3160	240		372	
114	2660	246		378	
120	2520	252		384	
126	2170	258		390	

Verified By: L Nielsen Date: 12-7-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: ~~Moab~~ MONT. Project Site

Date: 11/17/04

Operator: SJM

Location No: R2-M8

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS: WATER Level (Depth) = 4.1 ft
TD ~ 12.7 ft

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0 0	1.802	11 132	5.41 K	264	
6		11.5 138	4.86 K	270	
1 12	3.10	12 144	4.45 K	276	
18		12.7 150 (TD)	3.45 K	282	
2 24	3.09	13 156		288	
30		162		294	
3 36	2.51	168		300	
42		174		306	
4 48	2.59	180		312	
54		186		318	
5 60	2.74	192		324	
66		198		330	
6 72	3.36	204		336	
78		210		342	
7 84	3.50	216		348	
90		222		354	
8 96	2.62	228		360	
102		234		366	
9 108	1.852	240		372	
9.5 114	4.03	246		378	
10 120	4.80	252		384	
10.5 126	7.22	258		390	

Verified By: _____ Date: _____

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R2-M9

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 4'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1639	132	3766	264	
6		138	3440	270	
12	3381	144	3290	276	
18		150	4168	282	
24	3170	156	4210	288	
30		162	5630	294	
36	2645	168	4720	300	
42		174	3824	306	
48	2630	180	5240	312	
54		186		318	
60	2337	192		324	
66		198		330	
72	2420	204		336	
78		210		342	
84	2550	216		348	
90		222		354	
96	2382	228		360	
102	2440	234		366	
108	2610	240		372	
114	3075	246		378	
120	3340	252		384	
126	3190	258		390	

Verified By: L White Date: 12-7-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: ~~Moab~~ Monticello Project Site

Date: 11/17/04

Operator: STM

Location No: R2-M9

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 4.0 ft TD = 14.8 ft

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0 0	1.944 K	~~12~~ 11 132	3.49 K	264	
6		11.5 138	3.28 K	270	
~~3~~ 1 12	3.46 K	~~13~~ 12 144	4.20 K	276	
18		12.5 150	4.61 K	282	
~~3~~ 2 24	3.07 K	~~14~~ 13 156	5.51 K	288	
30		13.5 162	4.17 K	294	
43 36	2.52 K	~~15~~ 14 168	3.78 K	300	
42		14.5 174	5.79 K (TD)	306	
~~5~~ 4 48	2.38 K	15 180		312	
54		186		318	
~~6~~ 5 60	2.33 K	192		324	
66		198		330	
~~7~~ 6 72	2.50 K	204		336	
78		210		342	
~~8~~ 7 84	2.61 K	216		348	
90		222		354	
~~9~~ 8 96	2.41 K	228		360	
102		234		366	
~~10~~ 9 108	2.68 K	240		372	
114		246		378	
10 120	3.18 K	252		384	
126		258		390	

Verified By: _____ Date: _____

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-6-04

Operator: LW

Location No: R2-m10

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 5' 4"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1324	132	980	264	
6		138	1590	270	
12	3550	144	2760	276	
18		150	2980	282	
24	3430	156	3740	288	
30		162	2260	294	
36	2630	168	2120	300	
42		174	1890	306	
48	2320	180	4130	312	
54		186		318	
60	2300	192		324	
66		198		330	
72	1730	204		336	
78		210		342	
84	2640	216		348	
90		222		354	
96	2230	228		360	
102	1943	234		366	
108	1990	240		372	
114	2156	246		378	
120	3390	252		384	
126	775	258		390	

Verified By: L Wilkins Date: 12-6-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: T3-D

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 3.9'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1660	132	4440	264	
6		138	3310	270	
12	2980	144	3170	276	
18		150	3180	282	
24	3350	156	3240	288	
30		162	3290	294	
36	3610	168	3540	300	
42		174		306	
48	2780	180		312	
54		186		318	
60	2750	192		324	
66		198		330	
72	2820	204		336	
78		210		342	
84	2930	216		348	
90		222		354	
96	5020	228		360	
102	4460	234		366	
108	4140	240		372	
114	2850	246		378	
120	2540	252		384	
126	4120	258		390	

Verified By: [signature] Date: 12-7-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R3-M1

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 4'3"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1830	132	2940	264	
6		138	4860	270	
12	3260	144	5540	276	
18		150	4120	282	
24	3410	156	3750	288	
30		162	5980	294	
36	3230	168	12100	300	
42		174	13300	306	
48	2390	180	10280	312	
54		186	4840	318	
60	2750	192	4160	324	
66		198		330	
72	2820	204		336	
78		210		342	
84	3660	216		348	
90		222		354	
96	3280	228		360	
102	3320	234		366	
108	2650	240		372	
114	2570	246		378	
120	2510	252		384	
126	2820	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R3-M2

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 3'8"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1620	132	5790	264	
6		138	4990	270	
12	3340	144	5530	276	
18		150	5360	282	
24	3670	156	4940	288	
30		162	6190	294	
36	3120	168	13400	300	
42		174	10600	306	
48	2640	180	3930	312	
54		186		318	
60	3220	192		324	
66		198		330	
72	2890	204		336	
78		210		342	
84	3570	216		348	
90		222		354	
96	2430	228		360	
102	2410	234		366	
108	3230	240		372	
114	5090	246		378	
120	5540	252		384	
126	6560	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R3 - M3

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS PTW = 4'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1800	132	3710	264	
6		138	4550	270	
12	3430	144	4190	276	
18		150	4260	282	
24	3250	156	3380	288	
30		162	5180	294	
36	2090	168		300	
42		174		306	
48	2410	180		312	
54		186		318	
60	2850	192		324	
66		198		330	
72	2760	204		336	
78		210		342	
84	3440	216		348	
90		222		354	
96	3520	228		360	
102	3670	234		366	
108	3380	240		372	
114	4040	246		378	
120	3990	252		384	
126	4130	258		390	

Verified By: L White Date: 12-7-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-6-04

Operator: LW

Location No: R3-M4

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 4'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1910	132	11800	264	
6		138	4420	270	
12	3520	144	3140	276	
18		150	3000	282	
24	3640	156	3480	288	
30		162	4860	294	
36	2760	168	3730	300	
42		174	2920	306	
48	2950	180	4080	312	
54		186		318	
60	2300	192		324	
66		198		330	
72	2660	204		336	
78		210		342	
84	2620	216		348	
90		222		354	
96	2370	228		360	
102	2280	234		366	
108	2220	240		372	
114	2630	246		378	
120	3750	252		384	
126	4110	258		390	

Verified By: L Wood Date: 12-6-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: ~~Moab~~ Monticello Project Site

Date: 11/17/04

Operator: SJM

Location No: R3-M4

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS WL (DTW) = 4.0 ft TD = 14.7 ft

	Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
	0	2.38 K	11 132	3.68 K	264	
	6		11.5 138	2.97 K	270	
1	12	3.49 K	12 144	3.24 K	276	
	18		12.5 150	3.47 K	282	
2	24	2.90 K	13 156	4.54 K	288	
	30		13.5 162	4.13 K	294	
3	36	2.46 K	14 168	3.02 K	300	
	42		14.5 174	3.30 K	306	
4	48	2.60 K	14.6 180	4.16 K (TD)	312	
	54		186		318	
5	60	2.32 K	192		324	
	66		198		330	
6	72	2.64 K	204		336	
	78		210		342	
7	84	2.75 K	216		348	
	90		222		354	
8	96	2.27 K	228		360	
	102		234		366	
9	108	2.66 K	240		372	
	114		246		378	
10	120	3.97 K	252		384	
	126		258		390	

Verified By: _____ Date: _____

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: T4-D

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 5'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1720	132	270	264	
6		138	320	270	
12	3380	144	290	276	
18		150	340	282	
24	3090	156	740	288	
30		162	330	294	
36	810	168	360	300	
42		174	310	306	
48	532	180	1240	312	
54		186		318	
60	260	192		324	
66		198		330	
72	390	204		336	
78		210		342	
84	270	216		348	
90		222		354	
96	230	228		360	
102	250	234		366	
108	240	240		372	
114	230	246		378	
120	260	252		384	
126	220	258		390	

Verified By: L Wheeler Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R4-m1

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW= 6'7"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1860	132	280	264	
6		138	230	270	
12	3470	144	260	276	
18		150	320	282	
24	3220	156	250	288	
30		162	260	294	
36	2890	168	280	300	
42		174	270	306	
48	490	180	250	312	
54		186	260	318	
60	280	192	690	324	
66		198	2240	330	
72	240	204		336	
78		210		342	
84	250	216		348	
90		222		354	
96	320	228		360	
102	310	234		366	
108	320	240		372	
114	260	246		378	
120	260	252		384	
126	250	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R4-M2

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 5'4"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1690	132	220	264	
6		138	230	270	
12	3440	144	220	276	
18		150	260	282	
24	3770	156	240	288	
30		162	270	294	
36	2610	168	410	300	
42		174	540	306	
48	460	180	2240	312	
54		186		318	
60	620	192		324	
66		198		330	
72	450	204		336	
78		210		342	
84	290	216		348	
90		222		354	
96	270	228		360	
102	310	234		366	
108	320	240		372	
114	250	246		378	
120	320	252		384	
126	270	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R4-M3

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS PTW 5.5"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1760	132	260	264	
6		138	230	270	
12	3420	144	190	276	
18		150	280	282	
24	3210	156	250	288	
30		162	390	294	
36	1880	168	370	300	
42		174	1260	306	
48	460	180		312	
54		186		318	
60	370	192		324	
66		198		330	
72	300	204		336	
78		210		342	
84	340	216		348	
90		222		354	
96	310	228		360	
102	250	234		366	
108	340	240		372	
114	320	246		378	
120	290	252		384	
126	310	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R4-M4

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 5'7"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	2220	132	360	264	
6		138	340	270	
12	3490	144	310	276	
18		150	280	282	
24	3360	156	320	288	
30		162	340	294	
36	1530	168	330	300	
42		174	2110	306	
48	350	180		312	
54		186		318	
60	250	192		324	
66		198		330	
72	310	204		336	
78		210		342	
84	340	216		348	
90		222		354	
96	300	228		360	
102	280	234		366	
108	270	240		372	
114	240	246		378	
120	310	252		384	
126	250	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R4-M5

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 5.64

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1730	132	390	264	
6		138	330	270	
12	3240	144	350	276	
18		150	340	282	
24	3360	156	270	288	
30		162	250	294	
36	1390	168	220	300	
42		174	640	306	
48	390	180		312	
54		186		318	
60	370	192		324	
66		198		330	
72	360	204		336	
78		210		342	
84	330	216		348	
90		222		354	
96	350	228		360	
102	340	234		366	
108	290	240		372	
114	270	246		378	
120	260	252		384	
126	380	258		390	

Verified By: [signature] Date: 12-07-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R4-M6

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 5'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1790	132	210	264	
6		138	200	270	
12	3250	144	190	276	
18		150	170	282	
24	3280	156	170	288	
30		162	300	294	
36	1720	168		300	
42		174		306	
48	440	180		312	
54		186		318	
60	370	192		324	
66		198		330	
72	330	204		336	
78		210		342	
84	280	216		348	
90		222		354	
96	310	228		360	
102	320	234		366	
108	260	240		372	
114	240	246		378	
120	190	252		384	
126	180	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R4-M7

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS PTW 5'2"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1597	132	290	264	
6		138	284	270	
12	3250	144	246	276	
18		150	235	282	
24	3120	156	424	288	
30		162		294	
36	1250	168		300	
42		174		306	
48	376	180		312	
54		186		318	
60	254	192		324	
66		198		330	
72	308	204		336	
78		210		342	
84	291	216		348	
90		222		354	
96	291	228		360	
102	410	234		366	
108	284	240		372	
114	295	246		378	
120	265	252		384	
126	254	258		390	

Verified By: L Wilkes Date: 12-7-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-6-04

Operator: LW

Location No: R4-m8

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 5'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1600	132	290	264	
6		138	250	270	
12	3286	144	330	276	
18		150	250	282	
24	3230	156	290	288	
30		162	270	294	
36	1310	168	750	300	
42		174	890	306	
48	400	180	1340	312	
54		186		318	
60	396	192		324	
66		198		330	
72	348	204		336	
78		210		342	
84	~~360~~ 364	216		348	
90		222		354	
96	330	228		360	
102	388	234		366	
108	340	240		372	
114	220	246		378	
120	290	252		384	
126	330	258		390	

Verified By: [signature] Date: 12-6-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: T5-D

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 6'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1680	132	240	264	
6		138	280	270	
12	3200	144	330	276	
18		150	350	282	
24	3130	156	310	288	
30		162	360	294	
36	990	168	540	300	
42		174	3990	306	
48	450	180		312	
54		186		318	
60	350	192		324	
66		198		330	
72	220	204		336	
78		210		342	
84	210	216		348	
90		222		354	
96	290	228		360	
102	260	234		366	
108	240	240		372	
114	280	246		378	
120	220	252		384	
126	260	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R5-M1

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 6'0"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1750	132	320	264	
6		138	300	270	
12	3230	144	370	276	
18		150	330	282	
24	3570	156	340	288	
30		162	290	294	
36	3620	168	310	300	
42		174	330	306	
48	1660	180	580	312	
54		186	2430	318	
60	390	192		324	
66		198		330	
72	360	204		336	
78		210		342	
84	280	216		348	
90		222		354	
96	310	228		360	
102	300	234		366	
108	250	240		372	
114	320	246		378	
120	260	252		384	
126	270	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R5-M2

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 5'8"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1730	132	260	264	
6		138	220	270	
12	3320	144	240	276	
18		150	200	282	
24	3730	156	280	288	
30		162	310	294	
36	2930	168	250	300	
42		174	290	306	
48	570	180	270	312	
54		186	280	318	
60	320	192	260	324	
66		198	620	330	
72	230	204		336	
78		210		342	
84	240	216		348	
90		222		354	
96	300	228		360	
102	270	234		366	
108	310	240		372	
114	290	246		378	
120	250	252		384	
126	330	258		390	

Verified By: L Wheeler Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R5-M3

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 5'3"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1750	132	270	264	
6		138	290	270	
12	3380	144	260	276	
18		150	310	282	
24	3440	156	330	288	
30		162	260	294	
36	3130	168	300	300	
42		174	440	306	
48	880	180	770	312	
54		186		318	
60	650	192		324	
66		198		330	
72	380	204		336	
78		210		342	
84	330	216		348	
90		222		354	
96	290	228		360	
102	270	234		366	
108	260	240		372	
114	240	246		378	
120	210	252		384	
126	230	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R5-M4

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 5'2"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1730	132	260	264	
6		138	300	270	
12	3330	144	280	276	
18		150	250	282	
24	3220	156	270	288	
30		162	340	294	
36	1640	168	650	300	
42		174	2460	306	
48	580	180		312	
54		186		318	
60	460	192		324	
66		198		330	
72	260	204		336	
78		210		342	
84	370	216		348	
90		222		354	
96	320	228		360	
102	260	234		366	
108	390	240		372	
114	310	246		378	
120	340	252		384	
126	360	258		390	

Verified By: L White Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-8-04

Operator: LW

Location No: R5-M5

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW-5'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1680	132	320	264	
6		138	280	270	
12	3460	144	440	276	
18		150	390	282	
24	3290	156	370	288	
30		162	350	294	
36	1920	168	380	300	
42		174	2170	306	
48	730	180		312	
54		186		318	
60	510	192		324	
66		198		330	
72	320	204		336	
78		210		342	
84	360	216		348	
90		222		354	
96	420	228		360	
102	380	234		366	
108	330	240		372	
114	270	246		378	
120	340	252		384	
126	370	258		390	

Verified By: [signature] Date: 12-08-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R5-M6

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 5'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1720	132	410	264	
6		138	320	270	
12	3400	144	330	276	
18		150	310	282	
24	3320	156	430	288	
30		162	357	294	
36	1940	168	478	300	
42		174		306	
48	960	180		312	
54		186		318	
60	550	192		324	
66		198		330	
72	450	204		336	
78		210		342	
84	390	216		348	
90		222		354	
96	370	228		360	
102	364	234		366	
108	458	240		372	
114	403	246		378	
120	420	252		384	
126	360	258		390	

Verified By: [signature] Date: 12-07-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-6-04

Operator: LW

Location No: R5-~~MW~~ M7

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 5'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1660	132	290	264	
6		138	280	270	
12	3220	144	290	276	
18		150	320	282	
24	3040	156	250	288	
30		162	368	294	
36	1130	168		300	
42		174		306	
48	586	180		312	
54		186		318	
60	360	192		324	
66		198		330	
72	450	204		336	
78		210		342	
84	320	216		348	
90		222		354	
96	374	228		360	
102	366	234		366	
108	410	240		372	
114	380	246		378	
120	325	252		384	
126	219	258		390	

Verified By: [signature] Date: 12-06-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R5-M8

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 4' 7"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1680	132	290	264	
6		138	327	270	
12	3210	144	366	276	
18		150	398	282	
24	3090	156		288	
30		162		294	
36	1474	168		300	
42		174		306	
48	543	180		312	
54		186		318	
60	330	192		324	
66		198		330	
72	288	204		336	
78		210		342	
84	310	216		348	
90		222		354	
96	391	228		360	
102		234		366	
108	420	240		372	
114	370	246		378	
120	340	252		384	
126	320	258		390	

Verified By: [signature] Date: 12-7-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-7-04

Operator: LW

Location No: R5-m9

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW = 5'

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1755	132	292	264	
6		138	320	270	
12	3260	144	344	276	
18		150	380	282	
24	3515	156	300	288	
30		162	275	294	
36	2432	168	270	300	
42		174	299	306	
48	736	180	534	312	
54		186	2920	318	
60	452	192		324	
66		198		330	
72	270	204		336	
78		210		342	
84	337	216		348	
90		222		354	
96	364	228		360	
102	368	234		366	
108	393	240		372	
114	408	246		378	
120	388	252		384	
126	349	258		390	

Verified By: L Whitt Date: 12-7-04

TOTAL-COUNT BOREHOLE DATA

DOE ID No.: Moab Project Site

Date: 12-6-04

Operator: LW

Location No: R5-M10

Model Type: Eberline E-600 / Bicron
Instrument No.: S-15759
Calibration Expires: 3-24-05
Probe No.: S-16750
Calibration Expires: 2-23-05
K - Factor: .05133
Attenuation Factor:
Count Time: 60 Seconds

COMMENTS DTW 4' 9"

Depth Inches	Total Counts	Depth Inches	Total Counts	Depth Inches	Total Counts
0	1510	132	260	264	
6		138	420	270	
12	3460	144	460	276	
18		150	420	282	
24	3710	156	346	288	
30		162	370	294	
36	3400	168	420	300	
42		174	406	306	
48	1560	180	560	312	
54		186	1940	318	
60	596	192	5150	324	
66		198	4840	330	
72	380	204		336	
78		210		342	
84	340	216		348	
90		222		354	
96	330	228		360	
102	240	234		366	
108	208	240		372	
114	220	246		378	
120	236	252		384	
126	219	258		390	

Verified By: L W [signature]

Date: 12-6-04