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United States Department of Energy

ANALYSIS OF COBBLY SOILS FOR COBBLES-TO-FINES CORRECTIONS TO RADIONUCLIDE CONCENTRATIONS AT THE NEW RIFLE, COLORADO, PROCESSING SITE

May 1994

Uranium Mill Tailings Remedial Action Project

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Prepared for
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Albuquerque, New Mexico

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EXECUTIVE SUMMARY

A contamination depth and cobbly soil characterization study was performed in November and December 1993 at the Uranium Mill Tailings Remedial Action (UMTRA) Project's New Rifle, Colorado, processing site. This study was initiated due to a concurrence by the U.S. Nuclear Regulatory Commission (NRC) clarifying that the allowable residual contamination in soil should be averaged over the total mass of the soil volume, including cobbles and gravels (i.e., bulk concentration). The New Rifle processing site has a high percentage of cobbles and gravels underlying the pile and other contaminated areas, which preliminary excavation designs have identified for removal and disposal. The main purpose of this study was to evaluate the relative mass percentage and radionuclide concentrations of cobbles and gravels in order to determine the bulk contamination concentrations, revise the underlying excavation design depths, and improve verification methods. Another important goal of the study was to acquire more accurate contamination depth data (profile) for the subpile material. The observations from these components of the study resulted in the following conclusions:

- On average, 75 percent of the cobbly soil beneath the pile and contaminated areas is cobble and gravel having radionuclide levels below the cleanup standards. The cobbles and gravels will not require excavation, although excavation was indicated in previous designs.

- Radium-226 (Ra-226) contamination depths from past characterization studies were significantly overestimated in many areas; therefore, less excavation will be required in these areas.

- Thorium-230 (Th-230) has not migrated preferentially in suspect areas at the site in significant levels that would require excavation below the excavation depths required for Ra-226.

- The amount of excavation to be carried out below the water table has decreased significantly because 1) more accurate data on contamination depth have been compiled, and 2) cobble/gravel parameters have been used to meet the bulk concentration limits for contamination. These two factors have resulted in lower contamination levels at depth.

In summary, this recharacterization study will probably reduce the volume of material for excavation/disposal by several hundred thousand cubic yards and significantly reduce the amount of ground water expected to be pumped out of the excavation during cleanup.

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ALARA	as low as reasonably achievable
cm	centimeter
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	foot
m	meter
m^2	square meter
NRC	U.S. Nuclear Regulatory Commission
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/m^2s	picocuries per square meter per second
pH	acidity
Ra-226	radium-226
Rn-222	radon-222
Th-230	thorium-230
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act
μR/hr	microroentgens per hour

1.0 INTRODUCTION

1.1 STANDARDS AND CRITERIA

Remedial action at the New Rifle, Colorado, processing site is being performed under the *Uranium Mill Tailings Radiation Control Act* (UMTRCA) of 1978 (42 USC §7901 *et seq.*). Under the UMTRCA, the U.S. Environmental Protection Agency (EPA) is responsible for developing appropriate and applicable standards for the cleanup of radiologically contaminated land and buildings at 24 designated sites, including the New Rifle, Colorado, inactive processing site. The UMTRCA states that the U.S. Department of Energy (DOE) shall "select and perform remedial actions at the designated processing sites and disposal sites in accordance with the general standards" prescribed by the EPA. Regulations governing the required remedial action at inactive uranium processing sites were promulgated by the EPA in 1983 and are contained in 40 CFR Part 192 (1993), *Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings*.

Subpart B of 40 CFR Part 192 consists of standards for the cleanup of land and buildings. The standards applicable to land cleanup activities are as follows:

> Remedial actions shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials from any designated processing site, the concentration of radium-226 in land averaged over an area of 100 square meters (m^2) shall not exceed the background level by more than --
>
> 1) Five picocuries per gram (pCi/g), averaged over the first 15 centimeters (cm) of soil below the surface, and
>
> 2) Fifteen pCi/g, averaged over 15-cm-thick layers of soils more than 15 cm below the surface.

In addition, 40 CFR Part 192 provides criteria for applying supplemental standards for the cleanup and stabilization of other radionuclides that present a hazard commensurate with radium-226 (Ra-226) (40 CFR §192.21 (1993)), such as thorium-230 (Th-230). The *Generic Protocol for Thorium-230 Cleanup/Verification at UMTRA Project Sites* (Appendix A) under development by the DOE UMTRA Project Office has received oral NRC approval for implementation. Fundamental provisions of the protocol are as follows:

- Th-230 concentrations exceeding Ra-226 concentrations will be remediated such that Ra-226 concentrations 1000 years in the future, including both *in situ* Ra-226 and Ra-226 produced by natural decay of Th-230 over a 1000-year period, averaged over 100 m^2, will not exceed background levels

by more than 5 pCi/g in the first 15-cm surface soil layer or 15 pCi/g in successive 15-cm subsurface layers.

- For deeply buried material, excavations will be stopped when the RAECOM computer code, using site-specific parameters, calculates a radon-222 (Rn-222) flux of 3.9 picocuries per square meter per second (pCi/m^2s) and expected long-term conditions are appropriate, or when construction safety or feasibility becomes a concern.

- Excavation of elevated Th-230 encountered below the water table in the saturated zone will be assessed relative to the practicality with which dewatering can be performed. An as-low-as-reasonably-achievable (ALARA) analysis using pathway techniques will be performed in cases where a major portion of the site contains Th-230 that extends into the saturated zone, and excavation into the zone is impractical.

The EPA standards were originally based on an understanding of radiologically contaminated, fine-grained, tailings-like soil. However, the NRC has concurred that the soil cleanup standards for cobbly soil should have a universal interpretation of *bulk* soil concentrations, where bulk is defined as the total activity in picocuries divided by the total sample mass in grams, independent of the radionuclide distribution as a function of soil size fraction (Appendix A). Recognizing that UMTRA Project site cleanup activities will entail the cleanup of radiologically contaminated cobbly soil, the NRC also has concurred on a procedure developed by the DOE for excavation control and verification of cobbly subsoil (Appendix A). The accepted protocol is based on establishing a representative mass partition function that is the ratio of the mass of the soil fraction retained on a #4 sieve to the mass of the soil fraction passing a #4 sieve, and the characteristic radionuclide concentration on the larger soil size fraction retained on a #4 mesh sieve. The mass partition function can be developed and applied for the entire site or for each 100-m^2 grid (see Appendix A). Bulk radionuclide concentration can be determined using the mass partition function, the radionuclide concentration on the larger size soil fraction, and radiometric/radiochemical measurements of only the finer soil fraction passing a #4 sieve.

The standards given above are based on *bulk* Ra-226 concentrations elevated above background level. Measurements of background radioactivity near the New Rifle, Colorado, processing site, have resulted in the following determinations (DOE, 1992):

- Background gamma exposure rates at 1 meter (m) above the earth average 15 microroentgens per hour (μR/hr).

- Background Ra-226 concentrations in the soil near the processing site average 1.2 pCi/g.

- Background Rn-222 concentrations in air at various locations near the processing site average approximately 0.4 picocuries per liter (pCi/L).

1.2 REMEDIAL ACTION

The remedial action at the processing site will be conducted to remove the tailings and contaminated materials to meet the EPA *bulk* soil cleanup standards for surface and subsurface soils. The site areas disturbed by remedial action excavation will be either contoured or backfilled with uncontaminated soil and contoured to restore the site. The final contours will produce a final surface grade that will create positive drainage from the site.

2.0 PHYSICAL AND RADIOLOGICAL EVALUATION

A site characterization study was conducted in November and December 1993 to determine the nature of the cobbly subsoil profile and contamination levels underlying the New Rifle, Colorado, processing site and to ascertain 1) the mass partitioning of the subpile soil relative to a #4 mesh sieve, and 2) the radiological contamination associated with the cobbly soil size fractions passing and retained on a #4 mesh sieve. The purpose of this investigation was to obtain the necessary parameters to characterize the bulk radionuclide concentrations for the site foundation soil, particularly the subpile area. With these more recent site characterization data, appropriate depths for excavating radiologically contaminated cobbly subsoil may be determined. These data also provide necessary information regarding the way in which excavation control and verification should be performed in cobbly soils.

2.1 TEST PIT OPERATION AND CHARACTERIZATION RESULTS

Operations consisted of excavating 22 test pits with a backhoe. Lithological logging, sampling, and photographing of the pits were also carried out. Test pit locations are shown in Figures 2.1 and 2.2, and selected photographs of pits and operations are found in Appendix B. Pits were distributed over accessible areas of the subpile (11 total), around the north, south and east sides of the pile perimeter (8 total), and in areas representing background conditions for the site (3 total). Lithological logging data for each test pit are found in Appendix C.

Test pits were excavated into the cobbly soil layer underlying the site and sampled in accordance with the NRC-approved protocol (Appendix A). Sampling was terminated in general at or slightly below the level that free water was encountered in the test pits. This was done because of difficulty in obtaining representative samples from below the water surface. Test pit location 4 (M-CF-04 and M-CF-04A, Appendix C) was excavated a second time to obtain additional 1-foot (ft) (0.3-m) increment samples at depths from which the initial samples may have been accidentally cross-contaminated during the first sampling. The granular material in test pit location 29 (M-CF-29) was determined to be contaminated fill material from earlier site backfill operations; therefore, its cobbles-to-fines ratio (mass partition function) and radionuclide data were not representative of the site's natural cobbly soil. These data were not used in the study.

For each pit, a representative composite sample of the cobbly soil layer was divided using appropriate gradation techniques into fractions greater and less than a #4 mesh sieve to determine mass partition functions (Appendix D). Composite samples of both soil fractions in the cobbly soil were analyzed for Ra-226 and Th-230 (Appendix E). Table 2.1 lists the individual, average, and statistical mass partition functions and cobble (> #4 mesh) radionuclide concentrations for the test pits.

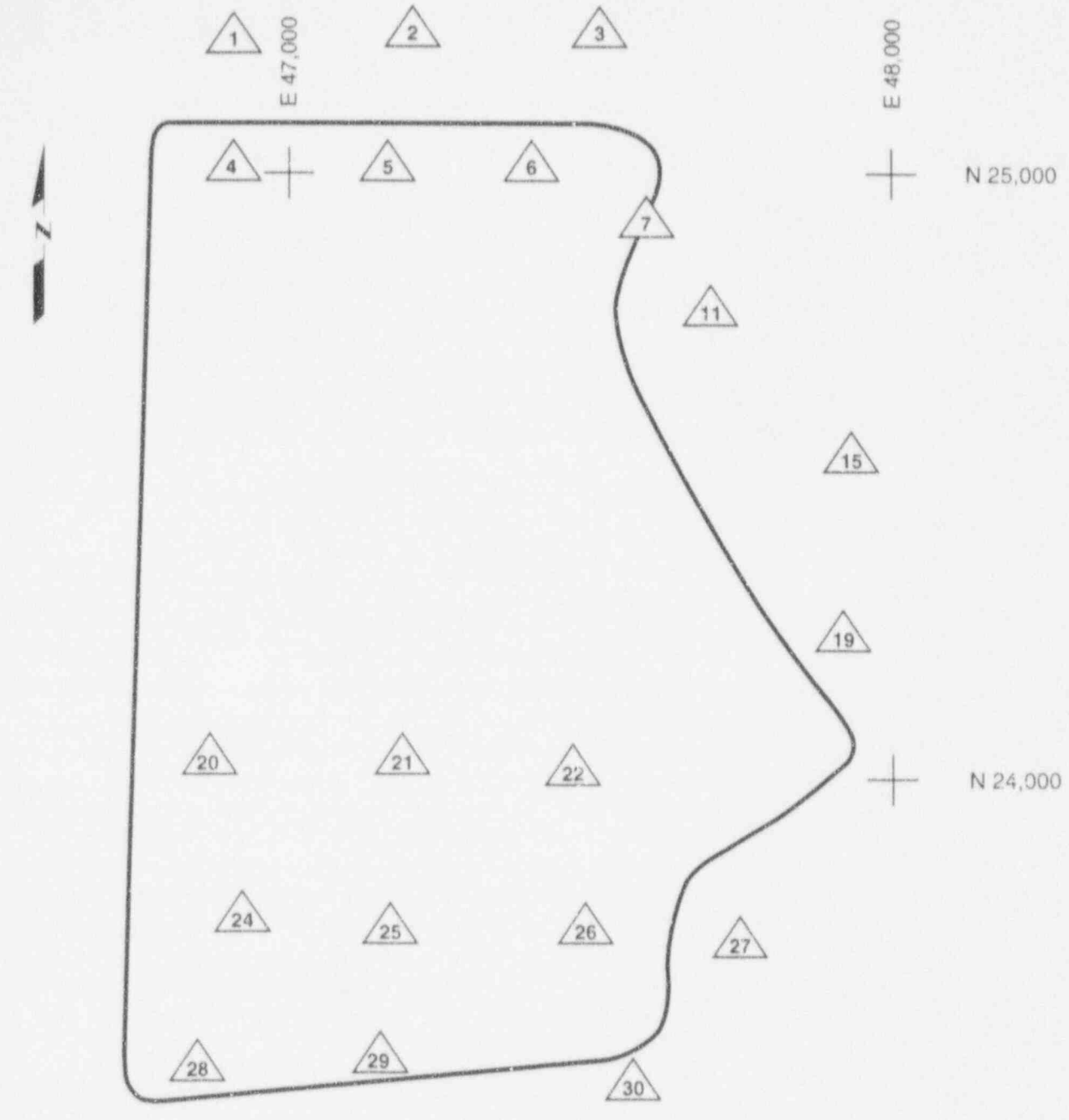

FIGURE 2.1
TEST PIT LOCATIONS, SUBPILE AND OFFPILE

MAC: SITE/RFL/CTOF/TPLOCS

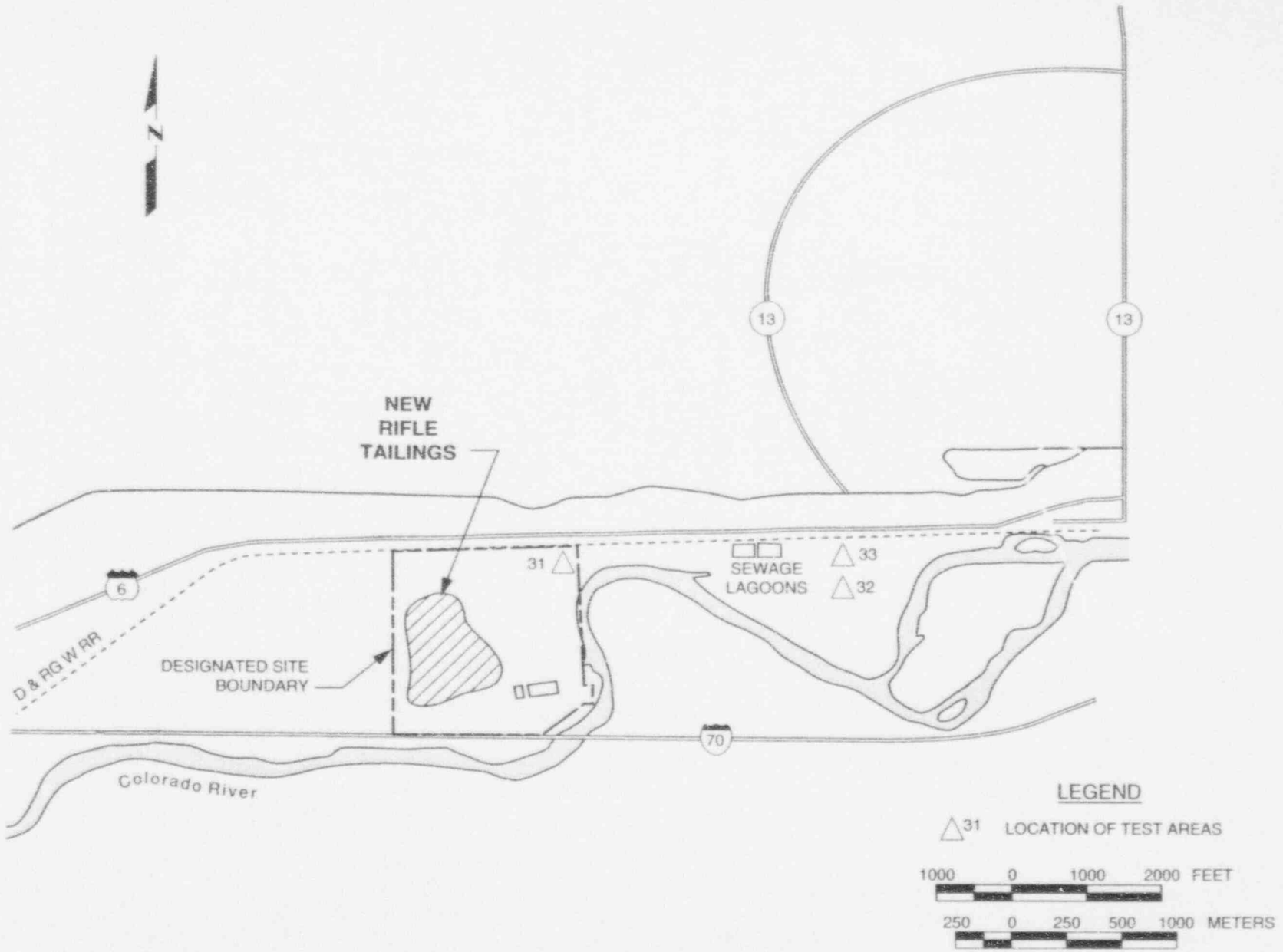

FIGURE 2.2
TEST PIT LOCATIONS, BACKGROUND

MAC:SITE/RFL/CTOF/WHOLERIFLE

Table 2.1 Summary of mass partition functions and radionuclide concentrations for composite soil samples retained on a #4 mesh sieve

Test pit ID and statistical summary	Location	Mass partition function[a]	Radionuclide concentration mass fraction > #4 sieve	
			Ra-226 (pCi/g)	Th-230 (pCi/g)
M-CF-01	Offpile	4.92	1.1	1.1
M-CF-02	Offpile	2.15	0.7	0.9
M-CF-03	Offpile	2.38	1.7	0.5
M-CF-04	Subpile	3.18	0.6	0.7
M-CF-05	Subpile	3.46	1.4	0.3
M-CF-06	Subpile	No data	3.3	1.6
M-CF-07	Subpile	2.72	2.0	1.7
M-CF-11	Offpile	3.24	0.8	0.4
M-CF-15	Offpile	2.88	0.9	0.8
M-CF-19	Offpile	3.22	0.8	0.7
M-CF-20	Subpile	5.41	0.5	0.8
M-CF-21	Subpile	4.49	1.6	1.2
M-CF-22	Subpile	3.83	0.9	0.9
M-CF-24	Subpile	1.84	0.9	0.7
M-CF-25	Subpile	3.65	0.8	1.3
M-CF-26	Subpile	1.90	0.7	0.5
M-CF-27	Offpile	5.67	0.8	0.8
M-CF-28	Subpile	9.42	0.8	0.5
M-CF-30	Offpile	3.85	1.2	0.6
M-CF-31	Background	3.59	0.9	0.7
M-CF-32	Background	4.21	1.8	1.1
M-CF-33	Background	4.52	1.6	0.5
Average	All	3.83	1.2	0.8
Standard deviation		1.67	0.6	0.4
95% confidence level[b]		3.20	1.4	0.9
Average	Background	4.11	1.4	0.8
Standard deviation		0.47	0.5	0.3
95% confidence level[b]		3.32	2.2	1.3
Average	Subpile	3.99	1.2	0.9
Standard deviation		2.20	0.8	0.5
95% confidence level[b]		2.71	1.6	1.2
Average	Offpile	3.54	1.0	0.7
Standard deviation		1.22	0.3	0.2
95% confidence level[b]		2.72	1.2	0.8
Average	Subpile and offpile	3.79	1.1	0.8
Standard deviation		1.80	0.7	0.4
95% confidence level[b]		3.05	1.4	1.0

[a]Mass partition function equates to cobbles-to-fines ratio, f = (M > #4)/(M < #4).
[b]The upper 95 percent confidence level value is shown for the radionuclide concentrations, and the lower 95 percent confidence level value for the mass partition functions.

In addition to the requirements in the cobbles-to-fines protocol, an aliquot of the fine soil size fraction (< #4 mesh sieve) was obtained from each 1-ft (0.3-m) test pit depth increment (except in tailings) and separately analyzed for Ra-226 and Th-232. One to four of these increment samples for each test pit were also analyzed for Th-230 to determine the potential for significant Th-230 contamination at depth below Ra-226 contamination. Measurements of acidity (pH) in selected soil layers in subpile and offpile test pits were also taken in the field to determine whether there were acidic conditions that would enhance Th-230 mobility (see data in lithological logs of Appendix C).

2.2 STATISTICAL PARAMETERS FOR COBBLES-TO-FINES CORRECTIONS

The original plans developed for test pit locations had a total of approximately 30 subpile and offpile test pits. Ten of these locations were inaccessible during the study because they were underneath about 50 ft (15.3 m) of tailings. However, the data gathered from this study are considered to be sufficient for obtaining the necessary parameters to implement the statistical approach of cobbles-to-fines corrections at the site due to the following:

- Observed consistency in the mass partition functions and low radionuclide concentrations in the cobbles (Table 2.1).
- Spatial representativeness of pit locations (Figure 2.1).
- Uniformity of the geological conditions in the underlying natural cobbly soil (Appendix C).

Additionally, the protocol's method for determining conservative values for the statistical mass partition functions and cobble radionuclide concentrations was reviewed. This review revealed that using data from less than 30 test pits should actually result in more conservatism in developing the statistical values when using representative sampling plans.

The average, standard deviation and statistical values for the mass partition function and cobble radionuclide concentrations for each grouping (subpile, offpile, background, and all combined) of test pits are shown at the bottom of Table 2.1. The data from test pit M-CF-29 were not used because of its apparent unnatural contents (backfill). No mass partition function was available for test pit M-CF-06, because technical problems (cave-in) rendered the measurement nonrepresentative.

This information demonstrates the relative consistency in the physical and radiological characteristics of the cobbly soil layer in all of the test pits. In determining the correct values for calculating bulk concentrations from cobbles-to-fines corrections, the subpile and offpile combined data appear to be the most applicable because of the proximity to areas that may apply the corrections. These critical values that will be used in the correction calculations are 3.05 for the statistical mass partition function, and 1.4 and 1.0 for the

statistical Ra-226 and Th-230 cobble radionuclide concentrations, respectively. Using the statistical mass partition function and statistical Ra-226 cobble concentration for all of the pits (1.4 pCi/g, which is more appropriate than using 2.2 pCi/g from the small number of background test pits), a bulk Ra-226 background concentration of 1.4 pCi/g is established in this study.

3.0 CHANGES TO EXCAVATION DESIGN

From the lithological logging data (Appendix C), the thickness of the layers of relatively clean fine-grained soil (sand, silt, clay, etc.) above the cobbly soil interface in these pits ranged from 0 ft to 16 ft (0 m to 4.9 m), and averaged 5 ft (1.5 m). Cobbly soil was encountered immediately at the surface in five of the subpile test pits where the sand/silt/clay layer was previously removed with the tailings (all on the south side of the pile). At other UMTRA Project sites, Ra-226 adsorbs or precipitates within the first 1 or 2 ft (0.3 or 0.6 m) of soil below the pile or other contaminated material (DOE, 1994). This process was also apparent in many of the test pits at New Rifle. From the results for Th-230 characterization of the fines (1-ft [0.3-m] increment samples, Appendix E), it can be concluded that mobilization of Th-230 below the Ra-226 contamination was not apparent in most of the test pits (see Ra-226 and Th-230 profile data in test pit logs of Appendix C). This was somewhat expected when considering the typically neutral-to-basic pH observed in the soils. The few pits that showed Th-230 mobilization (disequilibrium with Ra-226) did not reveal levels that would require excavation beyond the Ra-226 excavation depth.

From these observations and the profiling (1-ft [0.3-m] increment samples) data on the radionuclide contamination, it is apparent that the cobbles-to-fines corrections may not be needed in most remediated areas because the contamination does not extend into the cobbly subsoil. This has resulted in a significant change in contamination depths. Original site characterization data (DOE, 1985) used in the remedial action excavation design showed the contamination in many of the test pit areas to be deeper, from 1 to 6 ft (0.3 to 1.8 m). This change in known contamination depths affects estimated excavation depths in the design, as shown in Table 3.1. The data changes are most likely due to the original study using bore hole drilling techniques, which involved drilling and sampling the subpile soil through various depths of tailings and contaminated materials. It appears that using a backhoe and not having a large (approximately 50-ft [15-m]) layer of tailings to penetrate for sampling subpile soil improved the accuracy of data for the actual contamination depth. The availability of these improved contamination depth data enables engineering and scheduling efforts to more accurately handle disposal of the actual volume of contaminated material. These data indicate that the total volume of contaminated material is less than that originally identified by an estimated several hundred thousand cubic yards, if test pit conditions are representative of the remaining site contaminated areas.

Table 3.1 New Rifle, Colorado, estimated excavation depth based on cobbles-to-fines ratio and contamination profiles

	Plan excavation depth		Excavation based on cobbles/fines profiles		Delta[a]	
Area	ft	m	ft	m	ft	m
1	6	1.8	1	0.3	(5)	(1.5)
2	5	1.5	0	0	(5)	(1.5)
3	5-6	1.5-1.8	2	0.6	(3-4)	(0.9-1.2)
4, 4A	13	4.0	9	2.7	(4)	(1.2)
5	13	4.0	11	3.4	(2)	(0.6)
6	16	4.9	13+ insufficient data available	4.0+	--	--
7	14	4.3	14	4.3	0	0
11	5	1.5	2	0.6	(3)	(0.9)
15	5	1.5	4	1.2	(1)	(0.3)
19	6	1.8	1	0.3	(5)	(1.5)
20	5	1.5	0	0	(5)	(1.5)
21	5	1.5	0	0	(5)	(1.5)
22	6	1.8	6	1.8	0	0
24	4	1.2	0	0	(4)	(1.2)
25	6	1.8	1	0.3	(5)	(1.5)
26	6	1.8	1	0.3	(5)	(1.5)
27	6	1.8	8	2.4	2	0.6
28	2	0.6	1	0.3	(1)	(0.3)
29	3	0.9	Insufficient data available		--	--
30	6	1.8	4	1.2	(2)	(0.6)

[a]Numbers within parentheses indicate amount of reduced excavation; numbers without parentheses indicate amount of increased excavation.

4.0 CONCLUSIONS

Site cleanup, including the excavation control and verification, will involve the cobbles-to-fines corrections in remediated areas when applicable. Th-230 was not observed to be a significant concern in excavation design, and its residual concentrations will be further verified according to the requirements in the *Generic Protocol for Thorium-230 Cleanup/Verification at UMTRA Project Sites* (Appendix A). Whenever the application of the cobble-to-fines correction is in doubt (for example, when it appears that there is only a small percentage of cobbles), grid verification based on a representative sample will be used or grid-specific mass partition functions will be measured to demonstrate compliance with EPA soil cleanup standards.

For site verification, the *statistical cobbles radionuclide concentrations at the upper 95 percent confidence limit and the statistical mass partition function at the lower 95 percent confidence limit* are used to determine allowable fines concentrations in subpile and offpile areas (calculation JEG-RFL-03-94-09-06-00). On this basis, for cobbly subsoil to comply with the bulk cleanup standards (*total* 1000-year Ra-226 concentrations from residual Ra-226 and Th-230 not to exceed 15 pCi/g above background = 1.4 pCi/g *bulk* Ra-226 concentration), the corresponding concentrations in the finer soil size fraction (passing a #4 mesh sieve) in the subpile and offpile areas could vary as follows:

1. $C_{<\#4\ Ra}$ = 62.2 pCi/g Ra-226, when the Th-230 concentrations on the finer fraction, $C_{<\#4\ Th}$, are less than or equal to 63.7 pCi/g;

2. $C_{<\#4\ Th}$ = 176.5 pCi/g Th-230, if there is evidence that the Th-230 has differentially migrated relative to Ra-226, and the residual *bulk* Ra-226 concentration is 1.4 pCi/g ($C_{<\#4\ Ra}$ = 1.2 pCi/g), corresponding to average background concentrations; or

3. Th-230 concentrations (pCi/g) determined by the following relation for residual Ra-226 concentrations measured on the finer soil size fraction, ($C_{<\#4\ Ra}$), in the range of 1.2 to 62.2 pCi/g,

$$C_{<\#4\ Th} = 178.8 - 1.85 \times C_{<\#4\ Ra}$$

5.0 LIST OF CONTRIBUTORS

The following individuals contributed to the preparation of this report.

Name	Contribution
W. James	Author
J. Lommler	Document review
M. Miller	Peer review
L. Keith	Text processing
E. Steinhoff	Graphic design
D. Thalley	Technical editing

6.0 REFERENCES

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CODE OF FEDERAL REGULATIONS

40 CFR Part 192, *Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings*, U S. Environmental Protection Agency (1993).

UNITED STATES CODE

42 USC §7901 *et seq.*, *Uranium Mill Tailings Radiation Control Act*, November 8, 1978.

APPENDIX A

U.S. DEPARTMENT OF ENERGY/U.S. NUCLEAR REGULATORY COMMISSION CORRESPONDENCE

PROCEDURE FOR BULK RADIONUCLIDE DETERMINATION, EXCAVATION CONTROL, AND SITE VERIFICATION FOR SOILS CONTAINING COBBLES

GENERIC PROTOCOL FOR THORIUM-230 CLEANUP/VERIFICATION AT UMTRA PROJECT SITES

U.S. DEPARTMENT OF ENERGY/U.S. NUCLEAR
REGULATORY COMMISSION CORRESPONDENCE

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SEP 9 6 199[illegible]

FEDERAL EXPRESS

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Dear Mr. Surmeier:

Historically, the majority of Ra-226 contaminated materials being cleaned up at Uranium Mill Tailings Remedial Action (UMTRA) Project sites consisted of tailings, ore spoils, tailings intermixed with fine-grained soils (windblown and vicinity properties) and fine-grained soils under residual milling waste (tailings and raffinate ponds). However, in 1988, conditions encountered while remediating Th-230 contamination which persisted once Ra-226 had been removed at both the Riverton, Wyoming, and Durango, Colorado, sites were substantially different.

At both sites, which were located on alluvial floodplains, subsurface soils consisted of a large percentage of cobbles and gravels which were retained on a #4 sieve (4.76 mm). In addition, it was determined that approximately 95 percent of the total concentration of radioactivity was deposited on the fines (those soils passing a #4 sieve).

Based on these considerations and the fact that cleanup verification sampling routinely employed by the Remedial Action Contractors did not readily accommodate sampling and analysis of materials greater than #4 sieve, the following protocol for Th-230 cleanup/verification to a bulk subsurface concentration of 35 pCi/g was adopted and approved by the U.S. Department of Energy (DOE) and the U.S. Nuclear Regulatory Commission (NRC) in modifications to the Remedial Action Plans for those sites.

1. Determine the "fines mass fraction" by collecting several (10) representative bulk field samples, and separating fractions greater than and less than a #4 sieve:

   fines mass fraction = mass fines/mass total = unitless fraction

2. Determine Ra-226 (or Th-230) concentration (passing the #4 sieve) in verification samples collected and analyzed according to standard methodology described in MK-Ferguson Company (MK-F) Procedure RAC-015, "Verification Procedures for Vicinity Properties and Tailings Sites."

3. Determine "bulk" Ra-226 (or Th-230) concentration during cleanup and verification by correcting the Ra-226 (or Th-230) concentration on fines as follows:

   bulk Ra-226 concentration = (fines Ra-226 concentration) X (fines mass fraction) or,
   bulk Th-230 concentration = (fines Th-230 concentration) X (fines mass fraction)

The DOE proposes to adopt this basic protocol, on a site specific basis, as a standard operating practice for cleanup and verification of both residual Ra-226 and Th-230 contamination at UMTRA sites yet to be remediated. The bulk concentrations of Ra-226 and Th-230 determined by the above procedure will comply with the remediation standard for Ra-226, and supplemental cleanup requirements for Th-230, as specified in 40 CFR 192. Bulk Ra-226 concentrations will not exceed 5 and 15 pCi/g for respective 15 cm deep surface and subsurface layers averaged over 100 m^2. Similarly, the bulk concentration of subsurface Th-230 in 15 cm depth increments will not exceed 35 pCi/g averaged over 100 m^2. The details of the protocol will be more completely described in an added section to Procedure RAC-015 which will address when the protocol would be implemented; the number of samples needed to provide the initial value for the fines mass fraction; the frequency of updating/verifying the fines mass fraction as work progresses across a site; how the fines mass fraction used will be logged on field data sheets, etc. It will also be included in future updates of the Technical Approach Document and referenced as appropriate in Remedial Action Plans for sites where it will be applied.

The sites where this protocol could be applied would likely include Grand Junction, Gunnison, Rifle, Slick Rock, and Naturita, Colorado, since they are all located on alluvial floodplains possessing characteristics similar to those described above. Therefore, the DOE requests the NRC's concurrence that such a protocol is consistent with the requirements of 40 CFR 192 and that its contractors should be directed to formally incorporate the protocol into standard operating procedures and address its potential application in site Remedial Action Plans.

If you should have any further questions regarding this request, please call Mr. Don Metzler of my staff at (FTS) 845-5657.

Sincerely,

Clinton B. Smythe

for Mark L. Matthews, P.E.
Project Manager
Uranium Mill Tailings Remedial Action
Project Office

cc:
F. Bosiljevac, UMTRA
S. Hill, TAC
M. Miller, TAC
D. Gonzales, TAC
J. Oldham, MK-F
D. Carlson, MK-F
M. Madsen, CN-Geotech

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 17 1991

Mr. Mark L. Matthews P.E.
Project Manager
Uranium Mill Tailings Remedial Action
Project Office
Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Matthews:

Your letter of September 6, 1991, requested U.S. Nuclear Regulatory Commission (NRC) concurrence in the use of a procedure for determining and verifying radium-226 concentrations at locations with large quantities of cobbly material. Your letter states that at several Title I sites, DOE has encountered large quantities of radium-226 or thorium-230 contaminated material with a high content of cobbly material (greater than a No. 4 sieve size). Your tests show that the contained radioactivity is concentrated in the finer fraction with the coarse fraction containing negligible quantities (less than 5 percent). Procedures presently in use by your contractors for sampling and analyses are designed for relatively fine grained homogeneous soils with a minimum of larger material and are not adequate to characterize the radioactive concentrations in the heterogeneous size material being encountered. Your proposed approach would rely on measurement of the radium-226 or thorium-230 content in the finer fraction to obtain an average concentration for the entire sample.

We agree that determining an average radium-226 or thorium-230 content over an entire sample would be consistent with the Environmental Protection Agency (EPA) standards in 40 CFR 192 if the radium-226 content of the two size fractions and the percentage of each size fraction are properly factored. Part 192.12 states that the concentration of radium-226 in land can be averaged over an area of 100 square meters to meet the standards of not exceeding background level by more than 5 pCi/g averaged over the first 15 cm of soil below the surface and 15 pCi/g averaged over 15 cm thick layers of soil more than 15 cm below the surface.

You plan to address the details of the procedure in a section to be added to Procedure RAC-015 which will define when the procedure would be used, the number and distribution of samples to be taken, the determination of the radium-226 distribution and size fractions, and other appropriate details.

We agree that the proposed approach has the potential for maintaining compliance with EPA's standards while avoiding over excavation of contaminated

material. However, for final concurrence, we will have to review the details of your revised Procedure RAC-015 and the effects of its implementation on a site-specific basis. Any questions can be addressed to Allan Mullins of my staff at FTS-492-0578.

Sincerely,

John J. Surmeier, Chief
Uranium Recovery Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

cc: D. Metzler, DOE, Alb.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

APR 1 1992

Mr. Albert R. Chernoff, Project Manager
Uranium Mill Tailings Remedial Action
Project Office
U.S. Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Chernoff:

We have reviewed the procedure on "Bulk Radionuclide Determination, Excavation Control, and Site Verification For Cobbly Soils" sent with your letter of March 26, 1992, and supplemented by a revised Page 12 sent by facsimile on March 30, 1992. We hereby concur with its use on U.S. Department of Energy Uranium Mill Tailings Remedial Action Project sites containing a high percentage of cobbly subsoil. This procedure, designated RAC-OP-003, should be referenced in the specific Remedial Action Plans for those sites where it will be used.

One item of note concerns the section of the procedure discussing authority (Section 1.3). This section should be revised to reference this letter of concurrence rather than the September 17, 1991, letter cited, which agreed with the concept but did not concur with the procedure.

Any questions should be addressed to Allan Mullins of my staff at FTS 964-2578.

Sincerely,

John J. Surmeier, Chief
Uranium Recovery Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

cc: D. Metzler, DOE Alb
P. Mann, DOE Alb
D. Gonzalez, TAC

PROCEDURE FOR BULK RADIONUCLIDE DETERMINATION, EXCAVATION CONTROL, AND SITE VERIFICATION FOR SOILS CONTAINING COBBLES

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

FOR INFORMATION ONLY

CWM Federal Environmental Services, Inc.

INTERIM CHANGE NOTICE
(ICN) ICN NO. SOP-OP-003-4 ICN-01/REV#0

HP CONTROLLED COPY 45

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PROCEDURE NUMBER: OP-003-4 REVISION NUMBER: 0

TITLE : Soil Verification Using Cobbles-to-Fines Correction

EFFECTIVE DATE OF ICN: 9 / 21 / 92

CHANGES REQUESTED BY:
Steve Hamp (DOE)

CHANGES GENERATED BY:
Dave Andrews

PROBLEM STATEMENT/CORRECTIVE ACTION

The DOE has requested a few changes to improve clarity and content. Improvements shall be as indicated.

ACTION

Remove pages 4 through 11, Rev. 0 and replace with new pages 4 through 11, Rev. 0 ICN-01.

APPROVAL SIGNATURES
(Please sign and date)

HP & E MANAGER: David S Carlson DATE: 9/1/92

HPP MANAGER: [signature] DATE: 10/1/92

HPO MANAGER: [signature] DATE: 9/29/92

COORDINATOR: David Charlton DATE: 9/29/92

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

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CWM Federal Environmental Services, Inc.

Health Physics Standard Operating Procedures

Title:		
SOIL VERIFICATION USING COBBLES-TO-FINES CORRECTION		
Procedure No.: OP-003-4	Rev. No.: 0	Page 1 of 15

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APPROVAL

HP CONTROLLED COPY 45

APPROVED: Robert E. Lawrence 4-17-92
Project Director, Remedial Actions Contractor, UMTRA Project

APPROVED: David S. Carlson 4/17/92
Health Physics and Environment Manager, Remedial Actions Contractor, UMTRA Project

APPROVED: [signature] 4/17/92
Health Physics Programs Manager, Remedial Actions Contractor, UMTRA Project

APPROVED: [signature] 4-17-92
Health Physics Operations Manager, Remedial Actions Contractor, UMTRA Project

Soil Verification Using Cobbles-To-Fines Correction

1.0 SCOPE

1.1 Purpose

This procedure will be used for determining and verifying average bulk radionuclide concentrations for radium-226 (Ra-226), thorium-230 (Th-230), and, if necessary, thorium-232 (Th-232) at locations where the subsoil consists of a percentage of cobbles in the bulk sample sufficient to affect measurement of the total radionuclide concentration. Excavation control and verification will be based on bulk concentrations determined by this procedure.

1.2 Applicability

This procedure may be applied in areas designated for routine soil excavation and verification (see RAC-OP-003) where the subsoil media contains a high percentage of cobbles.

1.3 Authority

Letter to A.R. Chernoff, DOE/UMTRA from J.J. Surmeier, NRC dated April 4, 1992.

2.0 REFERENCES

2.1 RAC Health Physics Procedure RAC-RP-005 - Radiological Instrumentation.

2.2 RAC Health Physics Procedure RAC-OP-002 - Excavation Control Procedure

2.3 RAC Health Physics Procedure RAC-OP-003

3.0 DEFINITIONS

3.1 Cobbles - The portion of a composite soil sample which will not pass through a #4 mesh sieve.

3.2 Fines - The portion of a composite soil sample which will pass through a #4 mesh sieve.

3.3 Mass partition function, f, of a cobbly soil sample - the ratio of the dry mass of the cobbles ($M_{>\#4}$), to the dry mass of the fines ($M_{<\#4}$):

$f = M_{>\#4}/M_{<\#4}$ (cobble to fine ratio),

where the total dry mass of the sample, M_T, is

$M_T = M_{>\#4} + M_{<\#4}$.

3.4 Radiological concentration (Ra-226, Th-230, or Th-232), in picocuries per gram (pCi/g), for the fines or cobbles, are designated by $C_{<\#4}$ and $C_{>\#4}$, respectively.

3.5 Bulk radionuclide concentration (Ra-226, Th-230, or Th-232), in pCi/g, is designated by C_B, and calculated using

C_B = Total Sample Radioactivity (pCi) / Total Dry Mass of Sample (g)

$C_B = (C_{<\#4} \times M_{<\#4} + C_{>\#4} \times M_{>\#4}) / (M_{<\#4} + M_{>\#4})$

$C_B = C_{<\#4} (1/(1+f)) + C_{>\#4} (f/(1+f))$.

3.6 Student t distribution (t) - the mathematical quantity used to define the distribution of test statistics for small sample populations; used herein to determine the lower and upper 95 percent confidence values for mass partition function and cobble radionuclide concentrations respectively.

3.7 Running Average - The determination of statistical quantities based on the available data and recalculated as more data becomes available.

3.8 Statistical Mass Partition Function (f_L) - The mass partition function (f), at the lower 95 percent confidence value calculated from test pit or running average data.

3.9 Statistical Cobble Radionuclide Concentration ($C_{>U}$) - The cobble radionuclide concentration ($C_{>\#4}$) at the upper 95 percent confidence value calculated from test pit or running average data.

4.0 REQUIREMENTS

4.1 Prerequisites

4.1.1 All instruments used under this procedure shall have valid calibration.

4.1.2 Backup data (correlations, etc.) must be acquired, retained on-site, and made available for audit, on all methods and analyses used for excavation control and verification measurements.

4.2 Tools, Material, Equipment

4.2.1 Buckets, wheelbarrows, #4 mesh sieves or screens (4.8 millimeter), shovels or backhoe, weighing scale up to 200 lbs., drying oven, and other materials, as necessary, to obtain representative bulk soil samples. It should be noted that a 1/4 inch hardware cloth is approximately equivalent to a #4 mesh sieve, and may be used in lieu of a #4 mesh sieve.

4.3 Precautions/Limits

N/A

4.4 Acceptance Criteria

N/A

5.0 PROCEDURE

5.1 Site Evaluation

5.1.1 This guidance applies to processing sites and vicinity property areas. If the work area under consideration is less than 0.5 acre, the mass partition function (f) will be based on soil sampling from one centrally located test pit.

5.1.2 The statistical mass partition function (f_L) and statistical cobble radionuclide concentration ($C_{>u}$) may be determined by analysis of samples collected from test pits prior to construction. The purpose for developing a statistical mass partition function is only to obtain an estimate of the excavation depth required for compliance with radiological cleanup standards.

5.1.3 Approximately 30 (preferably uniformly distributed) sampling locations (test pits) should be used for the entire site. Fewer test pits may be used on small sites with prior approval from the HP & E Manager.

5.1.4 If test pit excavation activities are performed during remedial action, the statistical mass partition function (f_L) shall be obtained by calculating a running average of the corresponding parameters obtained as test pit work progresses across the site.

5.2 Test Pit Soil Sampling and Analysis

5.2.1 Dig each test pit to the estimated depth of contamination at the location, and record the test pit surface elevation and maximum depth of each test pit. If groundwater is encountered, the elevation of the water level at the time of test pitting shall be recorded.

5.2.2 Collect one composite sample from each test pit. The composite soil sample shall be comprised of all the material contained in a standard shovel from each one foot increment (no material shall be discarded). Sampling shall begin at the cobbly soil surface or tailings/cobbly soil interface and continue through a minimum of 5 feet of cobbly material or all the cobbly material (whichever is less).

5.2.3 Sieve the composite sample through a #4 mesh sieve, collecting the fines and cobbles in separate buckets of known weight. Weigh both fractions separately. Thoroughly mix the fine fraction and extract two (2) representative 500 gram can samples.

5.2.4 Determine the percent moisture content by weight of one of the can samples and calculate the adjusted dry weight of the fines. Calculate the adjusted dry weight of the cobbles assuming a moisture content of 1.5 percent. Record all pertinent information on the Cobbles to Fines Calculation Sheet (Attachment 1). Calculate the mass partition function (f) for the test pit using the adjusted dry weight of the fines and cobbles in the relation defined in Definition 3.3.

5.2.5 The second can shall be analyzed by the site laboratory for Ra-226 (and Th-232 if necessary) and sent to the vendor laboratory for Ra-226 and Th-230 analysis (and Th-232 if necessary). Record on-site and vendor analysis results on Attachment 1.

Note: Analysis for Th-232 shall only be performed if the site characterization indicates Th-232 is present.

5.2.5.1 Using the initial on-site analysis results and the vendor analysis results for all test pit or running average samples, a Ra-226 correction factor shall be established using the following equation:

$$Ra\text{-}226\ C.F. = \frac{R_1 + R_2 + \ldots R_n}{n}$$

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where, C.F. = correction factor,
R_n = Vendor results (pCi/g) divided by initial OCS, results (pCi/g) for the n^{th} sample (i.e., 1, 2, ...n), and
n = number of ratios.

5.2.5.2 The correction factor shall be updated using the pertinent analyses results from QA samples (section 5.10).

5.2.6 Ship the fraction retained on the #4 sieve from each test pit to the vendor laboratory, in the 5-gallon bucket. This material shall be cleaned, crushed, and analyzed for Ra-226, Th-230 and, if necessary, Th-232. Record vendor analysis results on Attachment 1.

5.2.7 Calculate the bulk radionuclide concentration (C_B) for the test pit using the mass partition function (f) for the test pit (section 5.2.4), the vendor radiological concentration of the fines ($C_{<\#4}$), and the radiological concentration of the cobbles ($C_{>\#4}$) in the equation defined in Definition 3.5. Bulk radionuclide concentrations should be calculated for Ra-226, Th-230, and Th-232 (if necessary).

5.3 Establish background bulk radionuclide concentrations for Ra-226, Th-230, and, if necessary, Th-232, by the sampling and analyses detailed in steps 5.2.1 through 5.2.6 at three uncontaminated background locations containing cobbly subsoil of similar geologic deposition.

5.4 Statistical Mass Partition Function - Alternative 1 (Test Pits)

5.4.1 Upon completion of test pit sampling, pertinent data shall be compiled on the Statistical Data Sheet (Attachment 2), and the statistical mass partition function shall be calculated using the following equation:

$$f_L = \overline{f} - t(s/\sqrt{n})$$

where, f_L = statistical average mass partition function at the lower 95 percent confidence value,
$\overline{f}$ = mean mass partition functions of n samples,
s = sample standard deviation for the n samples,
t = t from Attachment 3, and
n = number of observations.

5.4.2 The mean of the sample population is determined as follows:

$$\bar{f} = \frac{f_1 + f_2 + \ldots f_n}{n}$$

where, $f_{1,2 \text{ or } n}$ = the value of f for sample 1, 2, or n; and
n = the number of samples.

5.4.3 The standard deviation is calculated as follows:

$$S = \frac{\sqrt{\sum_{n=1}^{n} (f_n - \bar{f})^2}}{n - 1}$$

where, S = sample standard deviation,
f_n = value of f for sample n,
$\bar{f}$ = mean of f for n samples, and
n = number of samples.

5.4.4 The statistical cobble radionuclide concentration for Ra-226, Th-230 and Th-232 (if necessary) shall be calculated using the following equation:

$$C_{>u} = \bar{C} + t(s/\sqrt{n})$$

where, $C_{>u}$ = The statistical cobble radionuclide concentration at the upper 95 percent confidence value,
$\bar{C}$ = mean radionuclide concentration of the n samples,
s = standard deviation of the 30 samples,
t = t from Attachment 3, and
n = number of samples.

5.5 Statistical Mass Partition Function - Alternative 2 (Running Average)

5.5.1 The statistical mass partition function (f_L) and the statistical cobble radionuclide concentration ($C_{>u}$) may be obtained by calculating a running average of the corresponding parameters using the equations in sections 5.4.1 and 5.4.4 respectively. Compile data on the Statistical Data Sheet and recalculate f_L and $C_{>u}$ as data is obtained from each new test pit.

5.6 The statistical mass partition function and statistical cobble radionuclide concentration for alternative 1 or 2, will only be used for excavation control to obtain an estimate of the final excavation depth to comply with EPA's radiological cleanup standards. Final excavation depths and verification will be determined as described in section 5.7 through 5.9.

5.6.1 By solving the equation in section 3.5 for $C_{<\#4}$ and using the statistical mass partition function (f_L) and the statistical cobble radionuclide concentration ($C_{>u}$) an estimate of the allowable fines radionuclide concentration may be obtained as follows:

$$C_{<\#4} = \frac{C_B - C_{>u}\,[f_L/(1 + f_L)]}{[1/(1 + f_L)]}$$

where, $C_{<\#4}$ = The estimated fines radionuclide concentration,
C_B = the applicable limit (i.e., 5 or 15 pCi/g for Ra-226 or Th-232 or 35 pCi/g for Th-230),
f_L = statistical mass partition function, and
$C_{>u}$ = statistical cobble radionuclide concentration.

5.7 Verification Soil Sampling & Analysis

5.7.1 Grid the entire site into squares of 100 yd^2 (~100 m^2). Grids shall be uniformly distributed over the site so as to obtain representative data. Record location and elevation for each 100 yd^2 grid.

5.7.2 Further subdivide each grid where excavation control is being performed into approximately 10 x 10 foot squares (see below). Subdividing grids may normally be done visually by the technician performing the survey. Soil sample extraction will be performed at each of the nine 10 x 10 foot squares within the grid. Each soil plug should consist of all the material contained in a standard shovel. This will include soil, rock, small/large gravel and cobble. No material is to be discarded. The soil plug will be taken to a depth of 15 centimeters (cm). Sample collection shall be random (non-biased).

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(30')

	0	0	0
(30')	0	0	0
	0	0	0

0 = sample location

5.7.3 The nine soil plugs (80-100 lbs combined weight) comprise a composite sample.

5.7.4 Sieve the composite sample through a #4 mesh sieve, collecting the fines and cobbles in separate buckets of known weight. Thoroughly mix the fine fraction.

5.8 Site Verification Alternative 1 (Grid Specific)

5.8.1 For verification alternative 1, weigh both fractions separately and record information on Attachment 1.

5.8.2 Extract two (2) 500g can samples of the fine fraction for moisture content and radiological analysis.

5.8.3 Determine the moisture content of the fines and calculate the adjusted dry weight. Calculate the adjusted dry weight of cobbles assuming a moisture content of 1.5 percent. Calculate and record the mass partition function for the grid (Attachment 1).

5.8.4 Analyze the second can sample of fines for Ra-226 and, if necessary, Th-232 with the on-site OCS. Calculate the corrected radionuclide concentration using the site Ra-226 correction factor determined in section 5.2.5.1.

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5.8.5 Calculate the bulk radionuclide concentration C_B for the grid using the grid specific mass partition function, radionuclide concentration of the fines (the initial corrected concentration shall be used for calculating the Ra-226 bulk radionuclide concentration) and the statistical cobbles radionuclide concentration ($C_{>u}$) in the formula in section 3.5. All data shall be recorded on Form F1-OP-003-4.

5.8.6 Dry, seal and store the sample for 20 day on-site analysis.

5.8.7 After a minimum of 20 days, reanalyze the sample and calculate the final bulk radionuclide concentration (C_B) for the grid.

5.9 Site Verification Alternative 2 (Statistical - Running Average)

5.9.1 For each 100 m^2 grid, a 9-plug composite soil sample of the fines soil will be obtained following the technique outlined in Section 5.7.

5.9.2 Extract a 500g can sample of the fine fraction for radiometric analysis. Discard the larger size soil fraction.

5.9.3 Analyze the can sample for Ra-226 and, if necessary, Th-232 with the on-site OCS. Calculate the corrected radionuclide concentration using the site correction factor determined in section 5.2.5.1.

5.9.4 Calculate the bulk radionuclide concentration for the grid using the radionuclide concentration of the fines (the initial corrected concentration shall be used for calculating the Ra-226 bulk radionuclide concentration), the statistical mass partition function (f_L) and the statistical cobble radionuclide concentration ($C_{>u}$) in the formula from section 3.5 as modified below.

$$C_B = C_{<\#4}[1/(1 + f_L)] + C_{>u}[f_L/(1 + f_L)]$$

Record the pertinent data on the Alternative 2 Bulk Concentration Data Sheet (Attachment 4).

5.9.5 Dry, seal and store the sample for 20 day on-site analysis.

5.9.6 After a minimum of 20 days, reanalyze the sample and calculate the final bulk radionuclide concentration (C_B) for the grid.

5.10 The verification sample from the 25th 100 m^2 grid of each block will be sent to an outside Vendor laboratory for independent Ra-226, Th-230, and, if necessary, Th-232 analyses in accordance with Quality Assurance requirements.

6.0 RECORDS/REPORTS/NOTIFICATIONS

6.1 All data shall be recorded on the appropriate data sheet.

7.0 ATTACHMENTS

7.1 Attachment 1 - Cobble to Fines Calculation Sheet (F1-OP-003-4)

7.2 Attachment 2 - Statistical Data Sheet (F2-OP-003-4)

7.3 Attachment 3 - Critical Values of t.

7.4 Attachment 4 - Alternative 2 Bulk Concentration Data Sheet (F4-OP-003-4)

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Attachment 1

COBBLES TO FINES CALCULATION SHEET

Site: _____ Sheet _____ of _____

Sample/Grid I.D _____ Date: _____

Fines	Cobbles	Moisture Content Fines
Wt. Sample & Bucket _____	Wt. Sample & Bucket _____	Wet Wt. Sample/Pan _____
Wt. Bucket _____	Wt. Bucket _____	Dry Wt. Sample/Pan _____
Wt. Sample _____	Wt. Sample _____	Tare Wt. Pan* _____
Adjusted Dry Wt.($M_{<\#4}$)* _____	Adjusted Dry Wt.($M_{>\#4}$)** _____	Wt. Water* _____
		Wt. Soil** _____
		Percent Water(*/**) _____

* Adjusted Dry Wt. of the Fines = Wt. Sample x (1 - % water)

** Adjusted Dry Wt. of the Cobbles = Wt. Sample x (1 - .015)

Mass Partition function (f) = $M_{>\#4}/M_{<\#4}$ = _____

Radiological Analysis	^{226}Ra (pCi/g)	^{230}Th (pCi/g)	^{232}Th (pCi/g)	COMMENTS
Cobbles ($C_{>\#4}$)				
On-Site Analysis Fines ($C_{<\#4}$)	*	N/A		
	**			
	***			
Vendor Analysis Fines ($C_{<\#4}$)				
Bulk Radionuclide Concentration (C_B)	#			
	##			
	###			

* Initial; ** Initial Corrected; *** 20 day (N/A for Test Pit or Running AVE.)
\# Using Vendor; ## Using Initial Corrected; ### Using 20 day (N/A for Test Pits or Running AVE.)

^{226}Ra Correction Factor: _____

Reviewed By: _____ Date: _____

F1-OP-003-4

STATISTICAL DATA SHEET

Site: _____ Date: _____ Sheet _____ of _____

Test Pit No.	f	$C_{>\#4}$ Vendor			$C_{<\#4}$ On-Site		$C_{<\#4}$ Vendor			$^{226}Ra_2/^{226}Ra_1$
		^{226}Ra	^{230}Th	^{232}Th	$^{226}Ra_1$	^{232}Th	$^{226}Ra_2$	^{230}Th	^{232}Th	

Statistical Mass Partition Function (f_L) = _____

Statistical Cobble Radionuclide Concentration ($C_{>U}$) = ^{226}Ra _____ ^{230}Th _____ ^{232}Th _____

^{226}Ra Correction Factor (C.F.) = _____

Reviewed By: _____ Date: _____

F2-OP-003-4

Attachment 2

Attachment 3

CRITICAL VALUES OF t

n-1	$t_{.050}$
1	6.314
2	2.920
3	2.353
4	2.132
5	2.015
6	1.943
7	1.895
8	1.860
9	1.833
10	1.812
11	1.796
12	1.782
13	1.771
14	1.761
15	1.753
16	1.746
17	1.740
18	1.734
19	1.729
20	1.725
21	1.721
22	1.717
23	1.714
24	1.711
25	1.708
26	1.706
27	1.703
28	1.701
29	1.699
inf.	1.645

Attachment 4

ALTERNATIVE 2 BULK CONCENTRATION DATA SHEET

SITE: _____ Radiological Analysis (Fines) DATE: _____

Grid I.D. Number	$C_{<\#4}$ ^{226}Ra (pCi/g)		Bulk ^{226}Ra Concentration (pCi/g)	$C_{<\#4}$ ^{232}Th (pCi/g	Bulk ^{232}Th Concentration (pCi/g)	^{230}Th Vendor Results	Bulk ^{230}Th Concentration (pCi/g)
	Initial	Initial Corrected	Initial Corrected				
	20 Day		20 Day				

Bulk Concentration $C_B = C_{<\#4}[1 / (1 + f)] + C_{>\#4}[f / (1 + f_L)]$

Statistical Cobbles Radionuclide Concentration $C_{>\#4}$ _____ Statistical Mass Partition Function f_L _____ ^{226}Ra correction factor _____

Reviewed By: _____ Date: _____

F4-OP-003-4

GENERIC PROTOCOL FOR THORIUM-230 CLEANUP/VERIFICATION AT UMTRA PROJECT SITES

Generic Protocol for Thorium-230 Cleanup/Verification at UMTRA Project Sites

The excavation of materials contaminated with thorium-230 (Th^{230}) at one or more UMTRA Project sites may require extensive, deep removal of soil materials to ensure that the radium-226 (Ra^{226}) concentrations will comply with EPA's surface and subsurface soil cleanup standards (i.e., 40 CFR 192). The following discussion presents a unified approach for the future application of standards for Th^{230} at the UMTRA Sites.

1. Introduction

The cleanup of radiologically contaminated soils on UMTRA Project sites provides explicit requirements for the remediation of soils contaminated with Radium-226 (Ra^{226}), which include limits of 5 and 15 picocuries/gram (pCi/g) for the initial and successive 15 centimeter (cm) deep layers, respectively, averaged over an area of 100 m^2. If other radionuclides are encountered in sufficient quantities and concentrations to constitute a significant radiological hazard, the supplemental standards provisions of 40 CFR 192.21 and 40 CFR 192.22 provide guidance for performing remedial action for these radionuclides to reduce residual radioactivity to levels that are as low as reasonable achievable.

Thorium-230 (Th^{230}), which naturally decays, with a half-life of 77,000 years, to form Ra^{226} is also present in uranium mill tailings and contaminated soils. Therefore, it may be readily shown that for soils containing initial Ra^{226} and Th^{230} concentrations, at time $t=0$, of $Ra^{226}(t=0)$ and $Th^{230}(t=0)$, respectively, the Ra^{226} concentration at any later time, t, is:

$$Ra^{226}(t) = Ra^{226}(t=0)\, e^{-\lambda t} + Th^{230}(t=0)\,(1 - e^{-\lambda t}),$$

where λ is the decay constant for Ra^{226}, or 4.32×10^{-4} yrs^{-1}.

Furthermore, the geochemical behavior of Ra^{226} and Th^{230} in typical UMTRA site environments have been observed to be significantly different. Under neutral or basic soil conditions, neither Ra^{226} nor Th^{230} are preferentially mobile geochemically (i.e., both radionuclides will form chemical compounds that have similar potential for migrating into soils). However, under acidic conditions, the chemical forms taken by these radionuclides are significantly different in their potential for depth migration in soil, with Th^{230} being more mobile than Ra^{226}.

In windblown tailings areas, mill yards, and ore storage areas of UMTRA sites, it has been observed that: 1) the surface and subsurface soils are normally at neutral pH; 2) the radiological material does not contain abundant quantities of free acid; and 3) the Ra^{226} and Th^{230} concentrations are in near secular equilibrium (their activities are approximately equal). The near secular equilibrium for the radiological contamination in these areas results from the fact that most of the uranium ores processed were in near equilibrium. Therefore, the application of soil cleanup procedures for Ra^{226} according to EPA standards would also reduce the Th^{230} concentrations to acceptable levels by default, and the total Ra^{226} as a function of time will not exceed 5 or 15 pCi/g, for surface and subsurface soil respectively.

However, under acidic soil conditions that may prevail in the foundation soil under uranium mill tailings, the subpile region, or in surface and subsurface soils of raffinate or evaporation

pond, the different geochemical interactions of Ra^{226} and Th^{230} will cause these radionuclides to differentially migrate. Generally, under these conditions, Ra^{226} is adsorbed or co-precipitated on soil within a depth of one to two feet, and Th^{230} migrates deeper into the subsoil until neutralization of the transporting pore water occurs, where it is removed from solution by the formation of insoluble precipitates or co-precipitates (thorium or thoro-ferro hydroxides, for example). For example, at the Spook, Wyoming site, Th^{230} differentially migrated as deep as 20 feet below the raffinate pond before being stabilized by neutralization. In order to be in harmony with the supplemental standards provisions to reduce Th^{230} concentrations to as low as reasonably achievable (ALARA), and to come as close to meeting otherwise applicable standards as is reasonable under the circumstances, an excavation depth less than 20 feet was selected as a viable solution for this site.

It may be concluded that the cleanup of the initial Ra^{226} contamination according to standards does not necessarily mitigate against the ultimate ingrowth of residual Ra^{226} with time due to the radioactive decay of residual Th^{230} in all areas within a site. As a consequence, residual Ra^{226} concentrations at a later date, due to ingrowth from Th^{230} contamination, may pose an undesirable health hazard. Therefore, the supplemental standards provision of 40 CFR 192 requires the development of a cleanup criterion for Th^{230}, which is health protective by reducing exposures to levels that are ALARA, keeping in consideration the measures necessary to implement the remedial actions under the circumstances that exist at the site. The following procedure establishes appropriate remedial action concentration limits for Th^{230}, and is proposed to be implemented at UMTRA Project sites after concurrence from all governing agencies involved with activities at each site agree to its implementation.

2. Generic Protocol

As can be seen from the equation presented in the introduction, the overall 1000-year maximum concentration of Ra^{226} in the soils will either be equal to the present Ra^{226} inventory (if Th^{230} concentrations are equal to or less than Ra^{226} concentrations), or the total Ra^{226} inventory one thousand years in the future (if Th^{230} concentrations exceed Ra^{226} concentrations). If Ra^{226} concentrations are equal to or exceed Th^{230} concentrations, the site will already meet the Th^{230} supplemental standard by default when the site is remediated to the 40 CFR 192 standards for Ra^{226}.

(1) Therefore, the supplemental standard chosen for Th^{230} needs only to ensure that the overall Ra^{226} concentration one thousand years in the future, when averaged over 100 square-meter areas, will not exceed either 5 pCi/g in the first 15 cm layer or 15 pCi/g in successive 15 cm layers.

It should be noted that the Ra^{226} concentrations are considered to be bulk concentrations, as determined by the recently developed, NRC-approved protocol for excavation control and soil verification of cobbly subsoils.

2.1 Protocol for Contamination at Depth

As the depths of excavations become deeper to remove elevated Th^{230}, the thickness of overlying fill material that is eventually used to remediate the site will increase. As a result, attenuation of radon-222 (Rn^{222}) diffusing through the overlying fill material will also increase.

Therefore, as the overlying clean fill material thickness increases, the resultant attenuation of the radon generated from the associated ingrowth of Ra^{226} will allow higher residual concentrations of Th^{230} to be left in place, while still attaining a level of protection equivalent to the intent of the Ra^{226} soil cleanup standards. To determine this concentration, the NRC model (presented in the Draft Generic Environmental Impact Statement on Uranium Milling; NUREG-0511; April 1979) can be used to determine the radon-222 (Rn^{222}) flux that would produce 0.02 Working Levels (WL) in a hypothetical structure built on a 100 square-meter (m^2) grid. The following equation was used:

$C = FAB/(VR*1000)$, where:

C = Rn^{222} concentration (pCi/l)
F = Rn^{222} flux (pCi/m^2-s)
A = Area over which the flux enters (m^2)
B = Flux reduction factor for entering structure (unitless)
V = Volume of the structure (m^3)
R = Effective Rn^{222} removal rate (s^{-1})
1000 = conversion factor (l/m^3)

In areas where basements are feasible (based on local construction practices and deep groundwater table), it should be assumed that the thickness of fill material is eight feet less than the depth of the excavation. Using A = $103m^2$, B = 0.5, V = $250m^3$, and R = 1.98×10^{-4} s^{-1}, a flux of 3.9 pCi/m^2-s would produce indoor air concentrations of approximately 4.0 pCi/l Rn^{222}. Assuming radon daughters are present at 50% equilibrium, this would correspond to 0.02 WL.

(2) Thus, the RAECOM computer code can be used to calculate the resultant flux from higher concentrations at depth as one factor to consider in determining if further excavation is warranted. As long as the calculated flux is less than 3.9 pCi/m^2-s, it can be assumed that equivalent protection is provided as long as the backfill thickness is maintained. Therefore, the analysis will consider the potential future (at least 200 years) erosion and land use in the determination of excavation depth. The calculations shall use site-specific parameters when available. Reasonably conservative parameters that consider the expected site conditions shall be used when site-specific data are unavailable. Selection on backfill materials with superior (low) diffusion coefficients may be included in the ALARA considerations of the design. When evaluating this option for the Th-230 supplemental standard, considerations of the construction hazards to remedial action workers and the feasibility of the anticipated construction requirements should be taken into account.

2.2 Protocol for Contamination in the Saturated Zone

Another scenario potentially impacting excavations to remove elevated Th^{230} concentrations is when groundwater is encountered at shallow depths. Since the Th^{230} contamination has been present within the saturated zone long enough for soluble constituents to have been mobilized, it is reasonable to assume that any remaining Th^{230} that may be encountered within a saturated zone will not be appreciably mobilized by pH neutral groundwater. Furthermore, it is known that the diffusion coefficient decreases dramatically as soils approach full

saturation until it reaches values typical of water (Radon Attenuation Handbook for Uranium Mill Tailings Cover Design; NUREG/CR-3533; April 1984). It is therefore reasonable to assume that Rn^{222} generated within a saturated zone generally will not diffuse to the surface. Finally, it is very difficult to perform deep, cost effective excavations within a saturated zone.

(3) Therefore, whenever shallow groundwater is encountered, the following options will be considered:

(a) Excavation into the saturated zone will be considered when water pumping or other controls are reasonable and when high concentrations of Th^{230} extend only a short distance into the saturated zone.

(b) An ALARA analysis will be performed in cases where a major portion of the site contains Th-230 which extends into the saturated zone, and excavation into the zone is impractical. The ALARA analysis will use reasonably conservative assumptions to project future doses. If water pumping or other controls are not reasonable, excavation will halt at the level of the water table (a nominal extra foot of excavation may be considered so long as it does not require pumping/dewatering).

3. Verification Sampling

Under typical site conditions, verification of the Th^{230} supplemental standard is to be achieved by a three-tiered sampling approach.

(4) In areas within an UMTRA processing site that are suspected of preferentially mobilizing thorium contamination over radium contamination (e.g., under raffinate pits), based upon process knowledge or other sources such as previous sampling data, 100% of the grids are to be sampled and analyzed for Th^{230}.

(5) In subpile areas, 10% of the grids will be sampled.

(6) In areas where process knowledge and characterization data indicates no potential for preferential mobilization (e.g., windblown tailings), grids will not be sampled for Th^{230}.

An analysis of verification data from the Tuba City, Arizona, UMTRA site, which has completed remediation and used this strategy, found no instances in the area sampled at the rate of 1 out of 25 grids where Th^{230} concentrations would cause future (i.e., at $t = 1000$ years) expected Ra^{226} concentrations to exceed 40 CFR 192 standards for Ra^{226}. Furthermore, preliminary results confirm the expectation that Th^{230} concentrations are generally equal to or less than Ra^{226} concentrations in areas other than beneath the raffinate pits, and Ra^{226} concentrations are well correlated to Th^{230} concentrations in these areas.

If any verification samples exceed the Th^{230} criteria of this protocol, the surrounding eight grids will be examined to determine whether or not these grids also exceed the criteria. If sample results have not been generated for the surrounding grids already, archived samples of such grids will be analyzed. If any of the surrounding grids also exceed the Th^{230} criteria,

the surrounding eight grids around such grids will also be examined. This process will continue until no more of the surrounding grids exceed the Th^{230} criteria. All grids that exceed the criteria will undergo further remediation unless there is sufficient justification and concurring parties agreement to do otherwise.

4. Conclusion

Based upon the above discussions, the following generic protocol shall be used for the excavation of Th^{230} at all future UMTRA Project sites:

(1) Excavate bulk Th^{230} to a 1000-year corrected bulk Ra^{226} concentration of 5 or 15 pCi/g (as appropriate) in 15-cm layers;

(2) For deeply buried material, stop excavations when the RAECOM computer code, using site-specific parameters, calculates a Rn^{222} flux of 3.9 pCi/m^2-s and expected long-term conditions are appropriate or when construction safety or feasibility become a concern;

(3) Consider the following options whenever shallow groundwater is encountered:

(a) Excavate into the saturated zone when water pumping or other controls are reasonable, especially when high concentrations of Th^{230} extend only a short distance into the saturated zone.

(b) An ALARA analysis will be performed in cases where a major portion of the site contains Th-230 which extends into the saturated zone, and excavation into the zone is impractical. The ALARA analysis will use reasonably conservative assumptions to project future doses. Halt excavations at the level of the water table when water pumping or other controls are not reasonable (a nominal extra foot of excavation may be considered so long as it does not require pumping/dewatering).

(4) Perform verification sampling for bulk Th^{230} in all grids underneath raffinate pits or other areas suspected of having a mechanism to preferentially mobilize Th^{230} over Ra^{226};

(5) Perform verification sampling for bulk Th^{230} in 10% of the grids underneath sub-pile areas; and

(6) Do not perform verification sampling for bulk Th^{230} in grids for which process knowledge and characterization data indicates no potential for preferential migration.

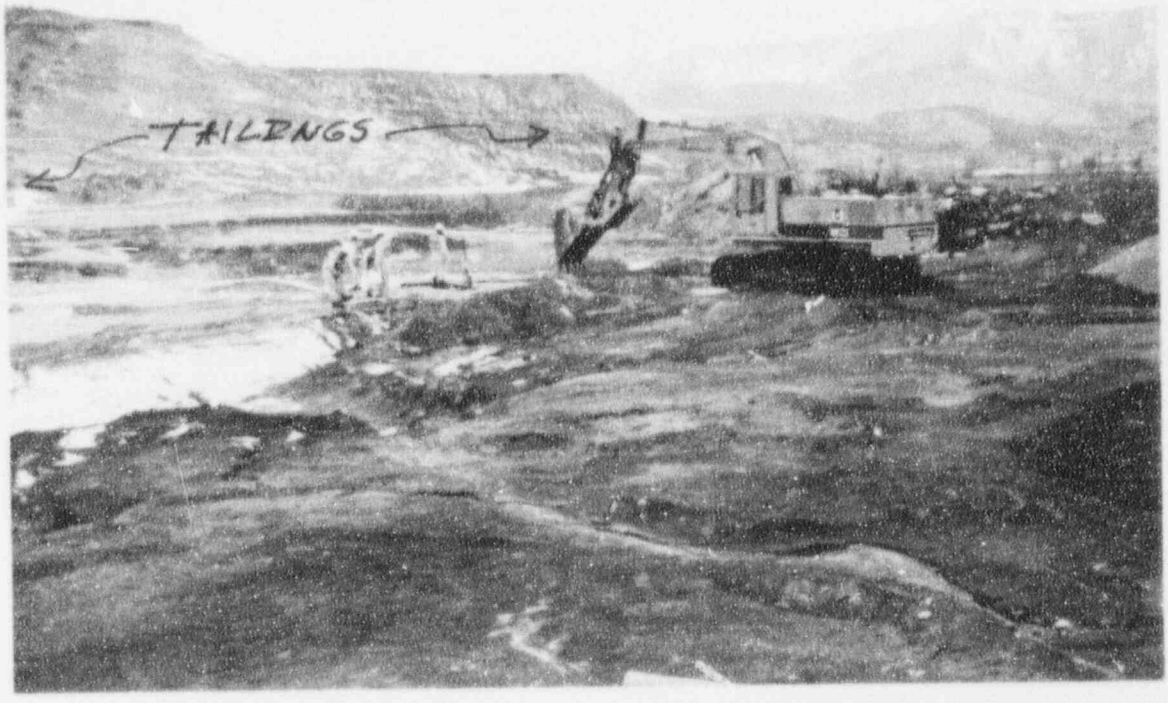
(7) When practical, delay backfilling until verification results are obtained.

APPENDIX B

PHOTOGRAPHS OF TEST PITS AND OPERATIONS

PHOTOS OF FIELD SAMPLING
AND GRADATION DETERMINATION

3/5



Test Pits were located around the perimeter of the tailings pile and in areas where the tailings have been removed.

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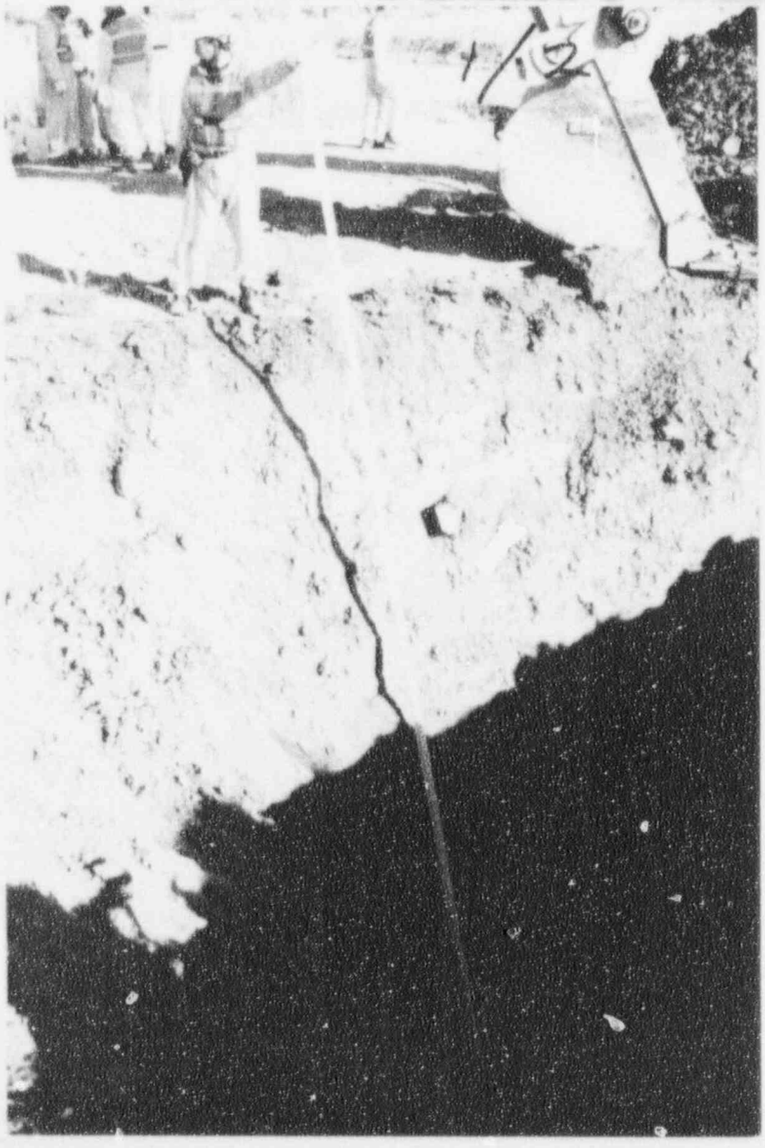
Test Pit Locations

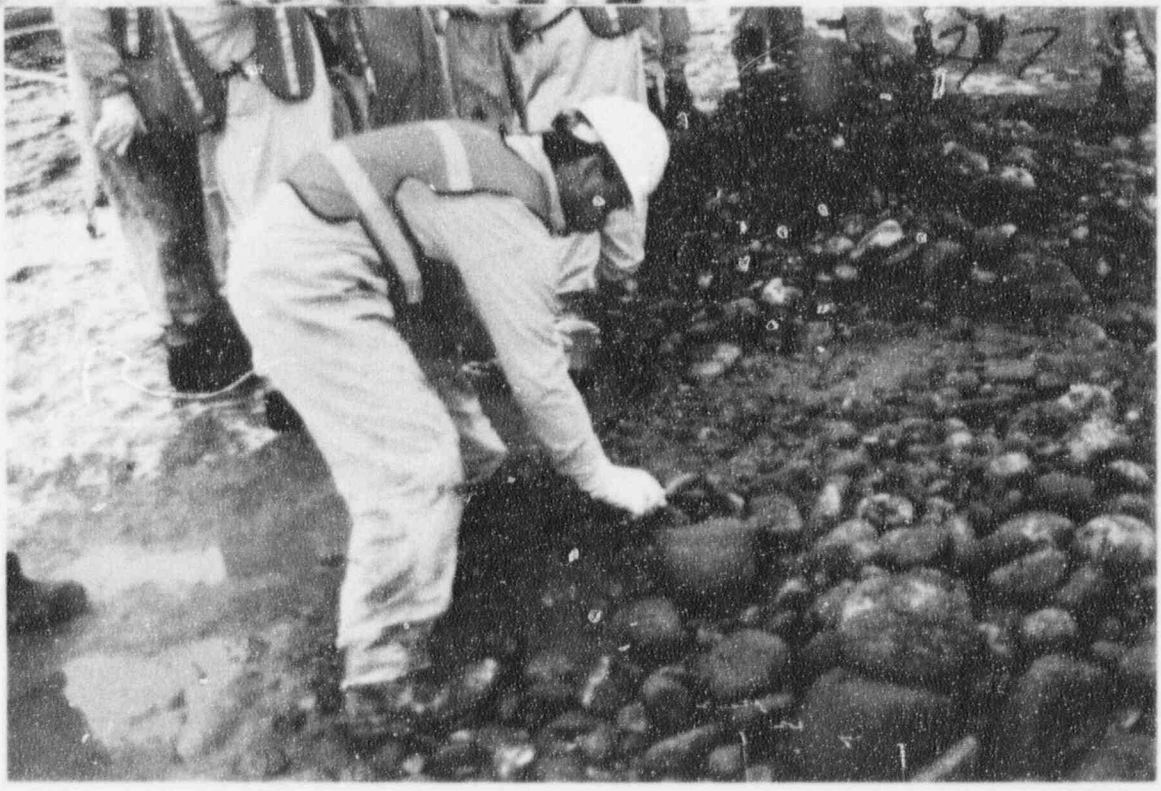
Excavation depths were measured using a survey rod.



Depth of test pit is measured upon completion of the pit.

Samples for radiological analysis were collected from test pit walls.

Samples of the gravel were taken for determination of radioactivity.



Gravel samples were collected in one-foot intervals and placed on plastic sheets in order to carry out the gradation analysis.

Sample of sand gravel and cobbles taken from the test pits.

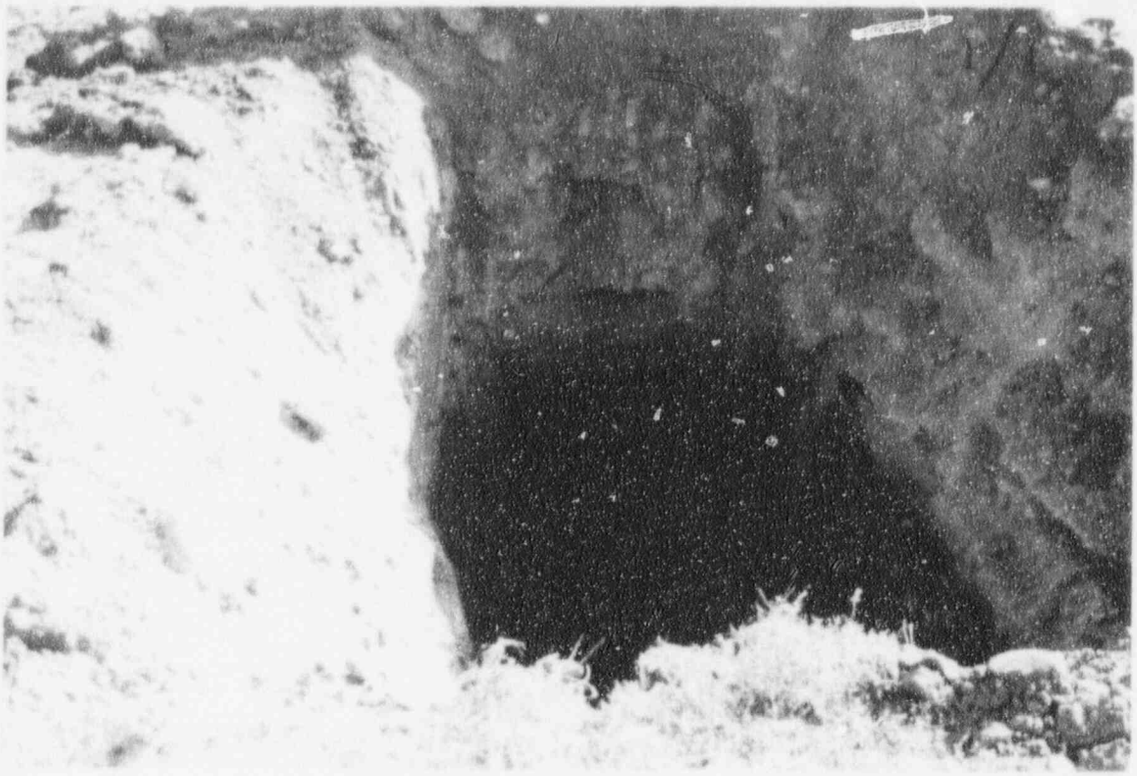
Drying and screening gravel (Cobbles and Fines) samples.

Sample too wet to screen (See photo above).

Screening semi-dry samples.

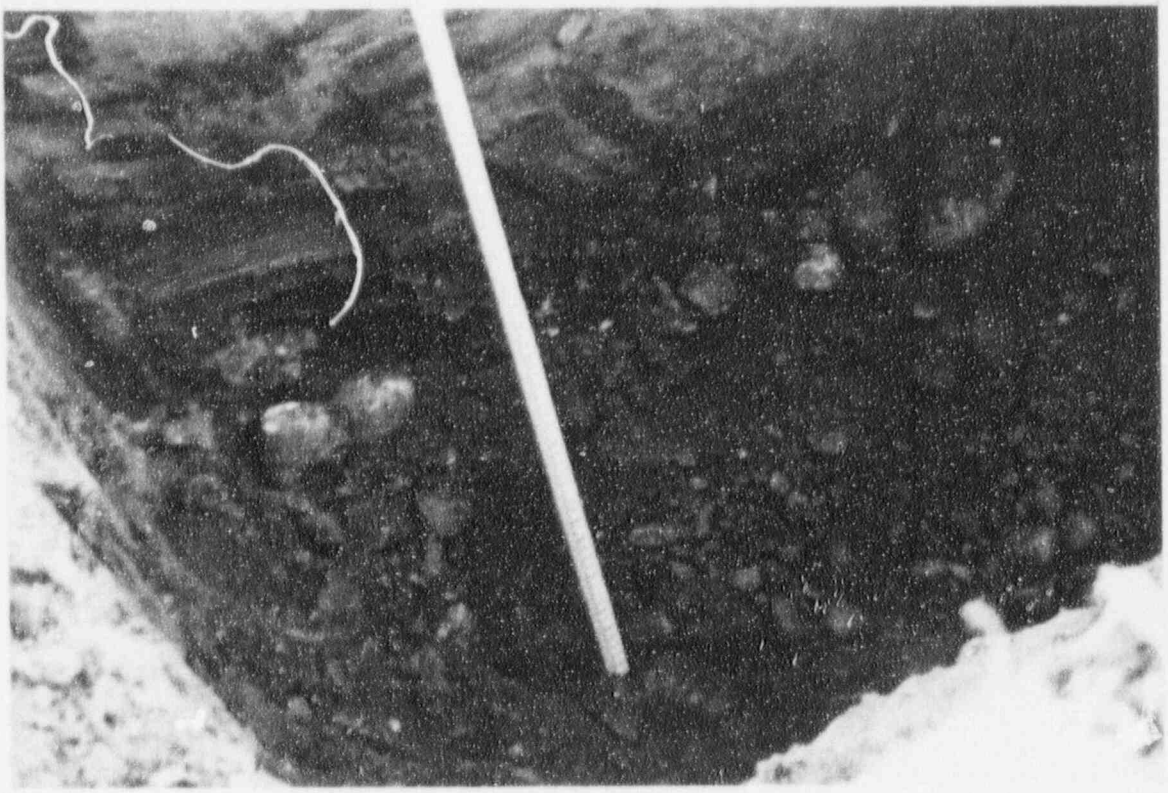
Screening and weighting gravel samples in order to determine the cobbles to fines ratio.

PHOTOS OF TEST PITS

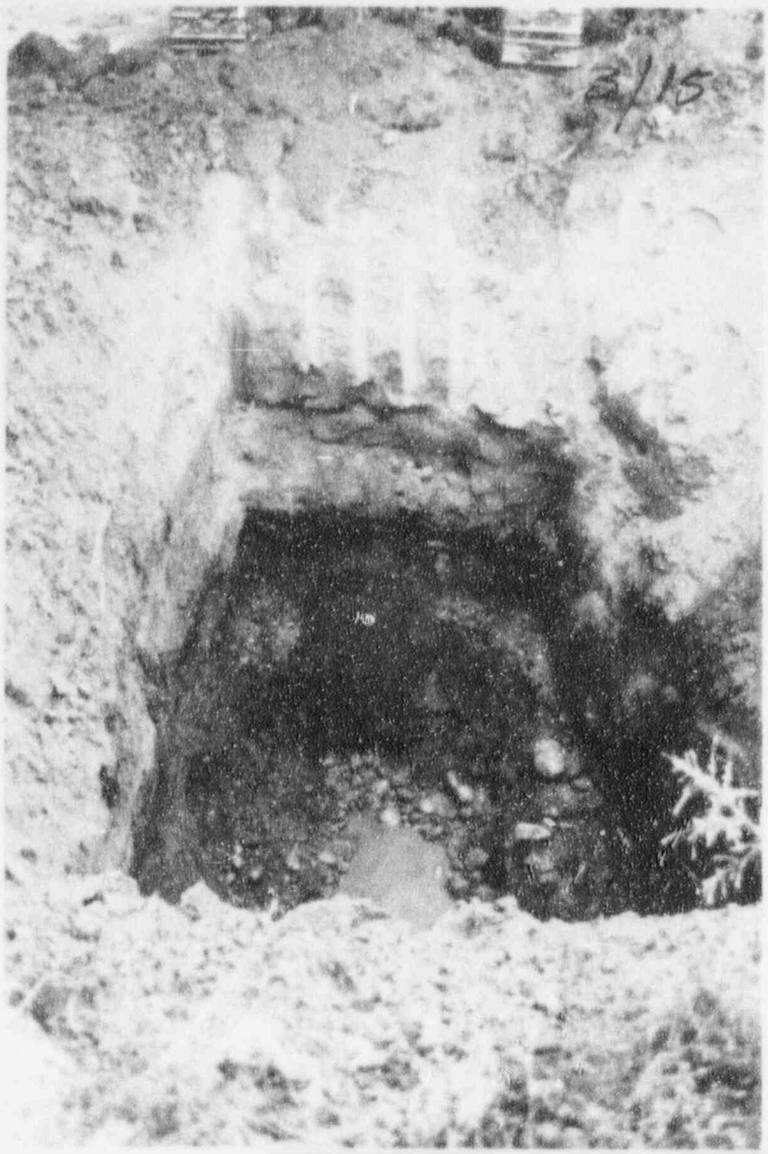


TP M-CF-01. Clay-silt soil overlying gravel deposits.

TP M-CF-01. Note organic rich clay layer above gravel deposit.

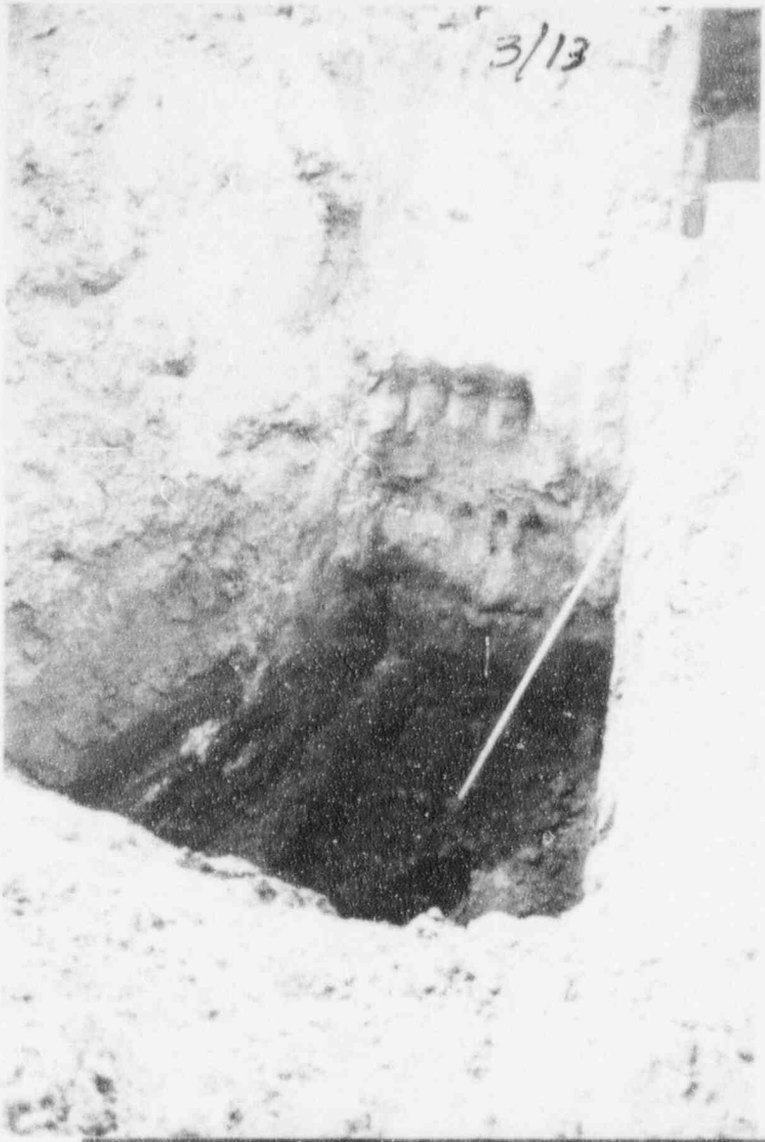


TP M-CF-01. Note sands, gravels, cobbles and boulders in the bottom of the test pit. Note the carbonaceous coating on the gravels and the film on the water surface.



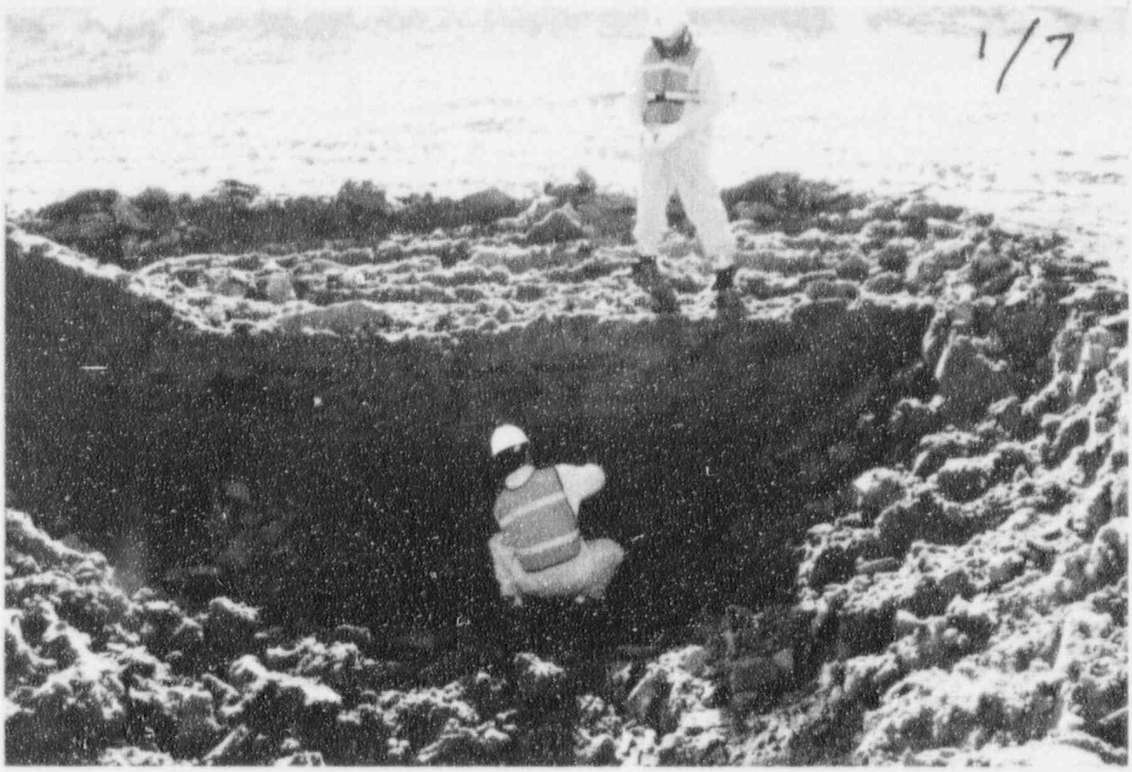
TP M-CF-02. Note highly carbonaceous (peat) layer.

TP M-CF-02. Note film and gas bubbles on water surface in bottom of the test pit.



TP M-CF-03. Very dry soil overlying gravels. Note black carbonaceous coating on gravels.

TP M-CF-03. Bottom of test pit. Note film on surface of the ground water.



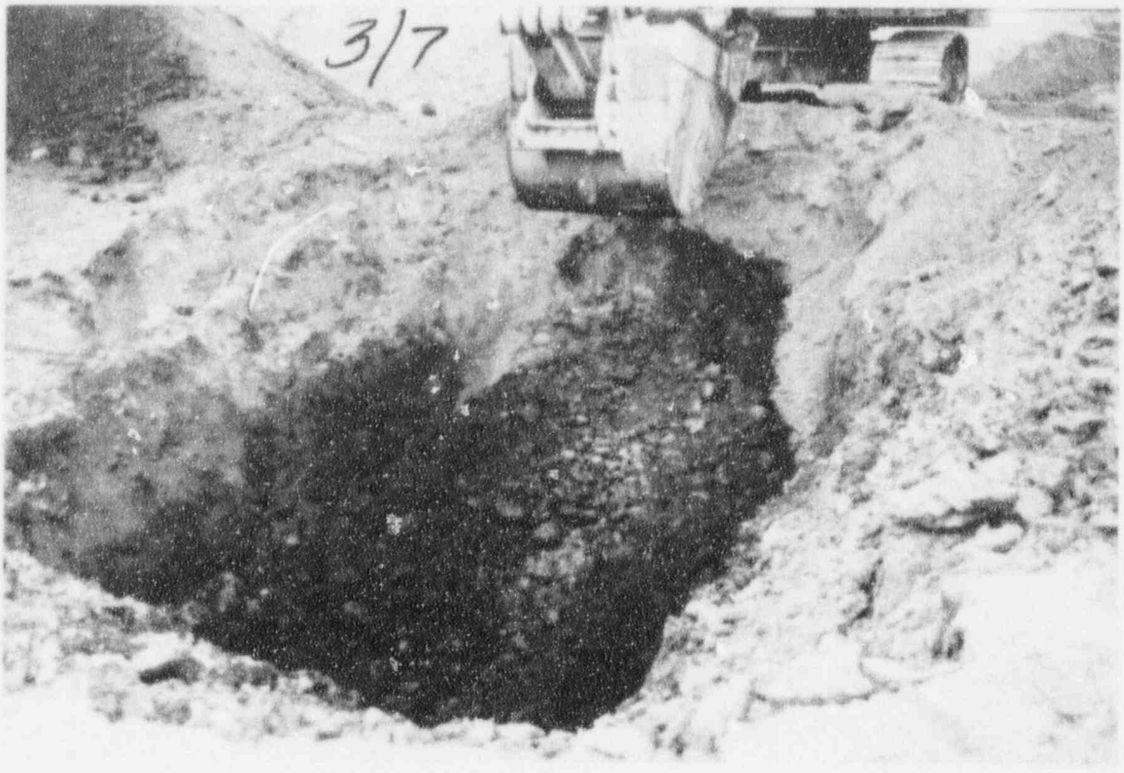
TP M-CF-04. The top five feet of the test pit is in tailings. Personnel are collecting tailings samples for radiological analysis.

TP M-CF-04. Soil profile beneath tailings with gravels in the bottom.

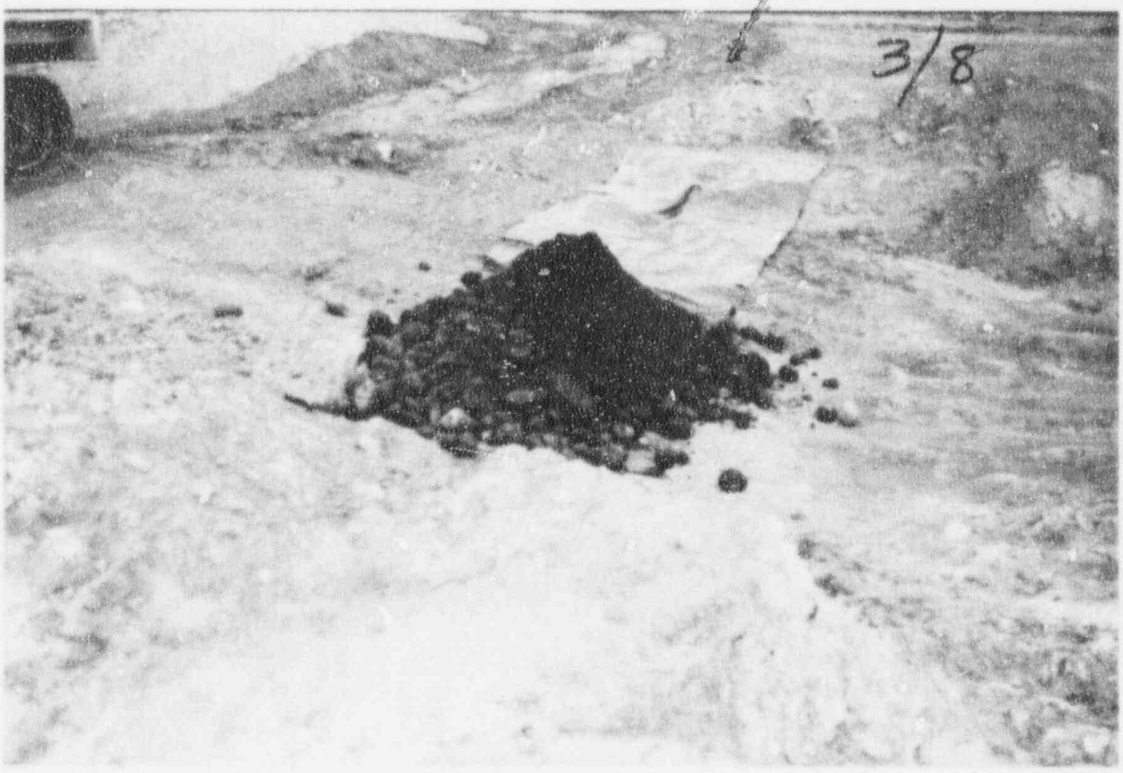
TP M-CF-05. Test pit profile showing lavender colored tailings on top of the original vegetated ground surface. Bottom of test pit shows gravels with a black carbonaceous coating.

TP M-CF-06. Lavender and yellow tailings overlying clayey soil. Bottom of test pit shows slightly carbonaceous gravels.

TP M-CF-07. Tailings overlying clay soil and gravels. Perched water in the tailings and equipment vibration caused severe caving of the tailings resulting in contamination of samples from the underlying material.



TP M-CF-11. Excavation at old collection pond. Note oxidized and acidified upper sediments (yellow pockets) of tailings. Gravels are highly organic (carbonaceous).



TP M-CF-11. Sample of highly carbonaceous gravels and cobbles.

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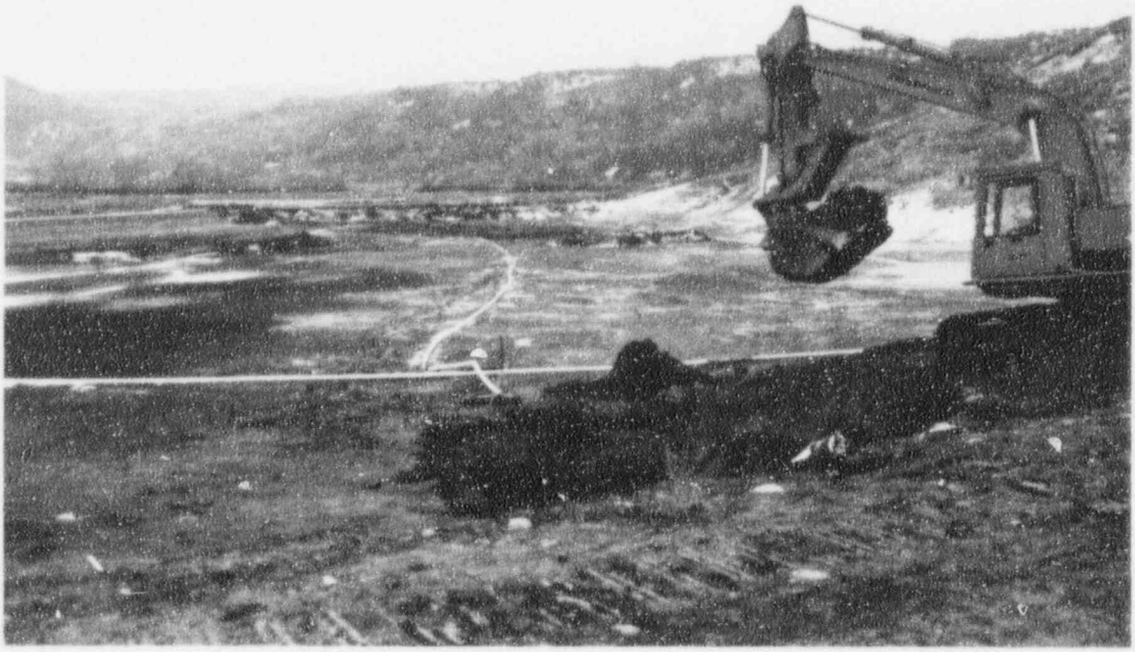
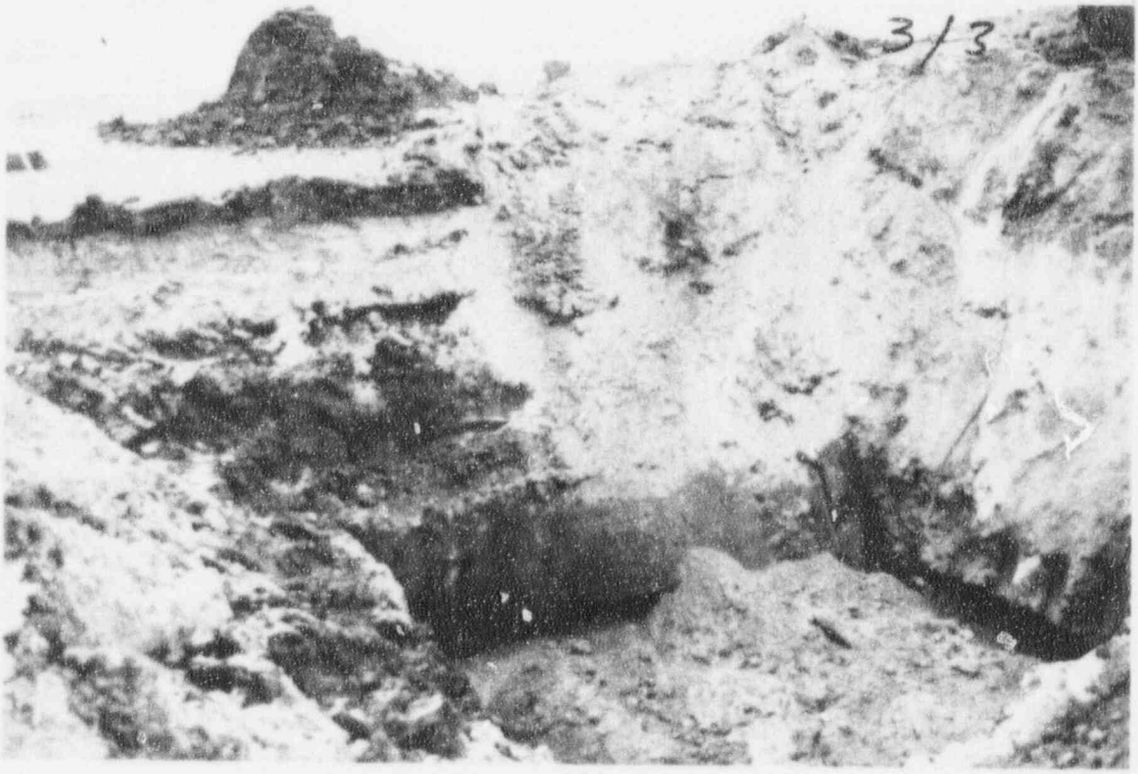


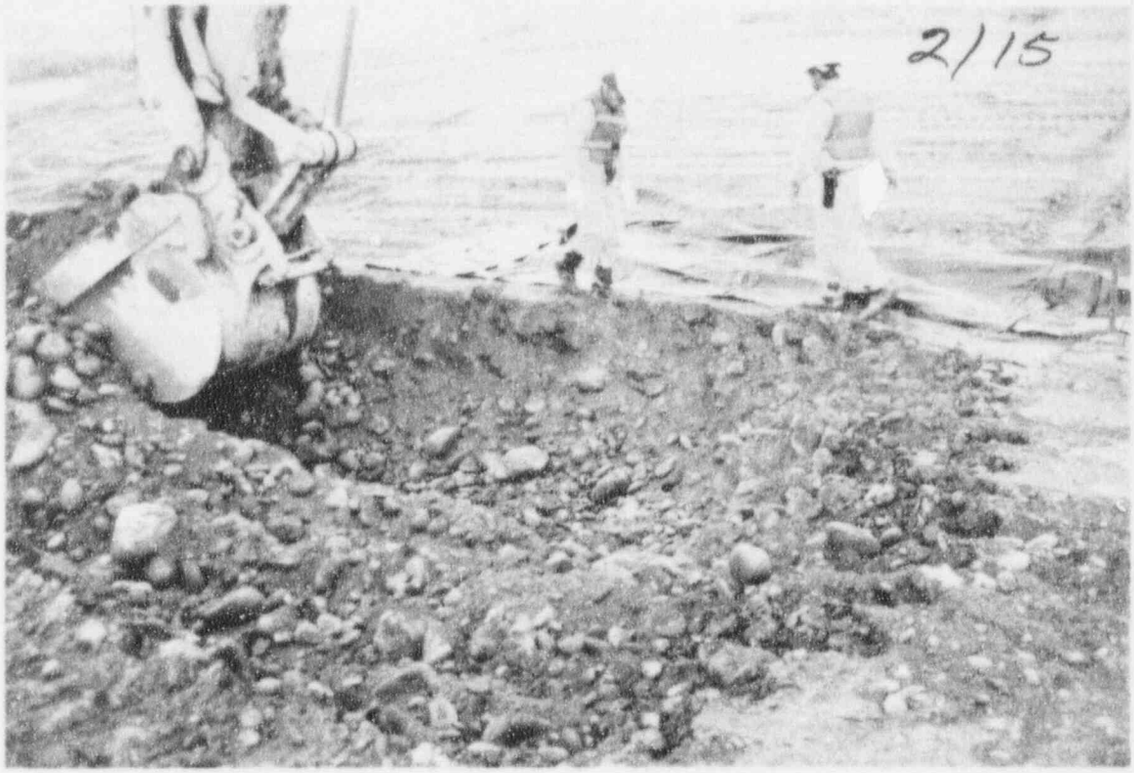
TP M-CF-15. Excavation at North end of old acid pond.

3/3



TP M-CF-15. Pond sediments overlying tailings which overlie clay soil in the bottom of the test pit.

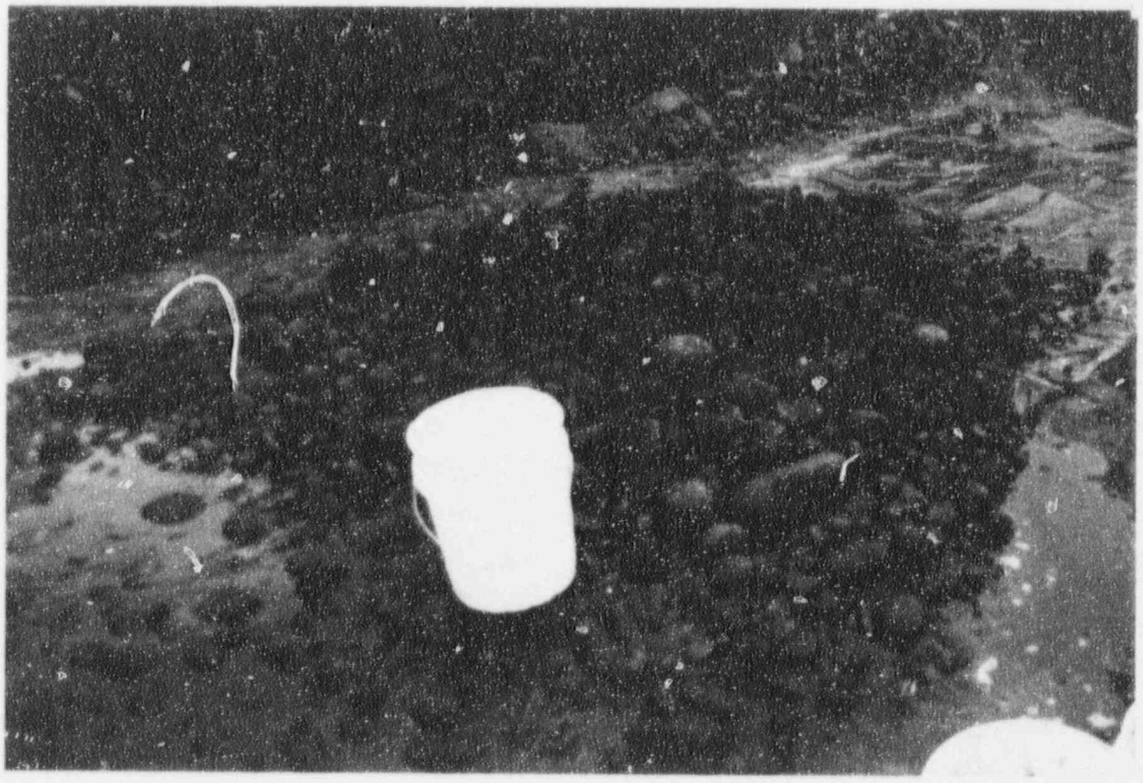
TP M-CF-19. Below 5 feet, the backhoe bucket encountered refusal on a cemented layer of gravels and cobbles.



TP M-CF-20. Beginning excavation. Note one inch of tailings on the surface.

TP M-CF-20. Bottom of test pit in sand, gravel and cobbles. Ground water encountered at a shallow depth.

TP M-CF-22. About 4-feet of road fill overlying the in-situ cobbles and gravels.



TP M-CF-22. Sample of cobbles and boulders with a carbonaceous coating.

TP M-CF-25. Unsuccessful attempt to dewater the pit to allow collection of samples below the water table.

TP M-CF-25. Sample obtained from below the water table (Note how fines have been removed by the flushing action of the water when the water drains out of the sample).

TP M-CF-26. Water encountered at the interface of the soil overburden and the underlying cobbles and gravels.

TP M-CF-26. Water level two hours after excavation.

TP M-CF-27. About 4 feet of fill and wood trash overlying tailings. Bottom of the test pit is in gravels and cobbles.

TP M-CF-28. Entire test pit in gravel, cobbles, and boulders. Black organic coating at 3 feet.

TP M-CF-29. Gravels, cobbles, and boulders overlying a clay layer. Water encountered near the interface.

TP M-CF-31. Sand gravel and cobbles in a background pit.

APPENDIX C

TEST PIT LOGS

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-01

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N25130E46890	11/30/93	11/30/93	5275.0	16.5	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
	SS-2242		**SILTY CLAY**, (CL), low to medium plasticity, brown, dry to moist, vertical roots.	24.0	2.2				
1	SS-2243			5.5	1.6				
2	SS-2244			4.3	1.8	10±1			FINES: Ra-226 (1,000 year) = 6.3 pCi/gr.
3	SS-2245		Some calcite casts and stringers at 2 to 4 feet.	2.5	1.1				
4	SS-2246			5.9	1.4				PVC pipe at 4 feet connecting two adjacent sumps.
5	SS-2247			1.9	1.8	3.8±0.8			FINES: Ra-226 (1,000 year) = 2.6 pCi/gr.
6	SS-2248			1.4	1.8				-Plan Exc. Depth at 6.0'.
7	SS-2249			1.7	1.7				
8	SS-2250		**CLAY-SILT**, (CL-ML), low plasticity, dark gray brown, moist, becoming more clayey with depth.	1.5	2.0				Heavy odor.
9	SS-2251			1.3	1.3				
10	SS-2252			2.0	1.5				
11	SS-2253			1.6	1.5				
12	SS-2254			0.9	1.6		9.5		
13	SS-2255		**ORGANIC CLAY**, (OL), dark gray to black, moist to saturated.	1.8	1.9	4.5±0.9			FINES: Ra-226 (1,000 year) = 2.7 pCi/gr. Strong odor.
14	SS-2256			2.0	1.6		9.6		
	SS-2257		**GRAVELS**, (GW), with cobbles to 12", well graded, approx. 30-35% fines, cobbles are	0.9	1.7				

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-[illegible]C	M-CF-01

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N25130E46890	11/30/93	11/30/93	5275.0	16.5	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
16	SS-2258		coated with a black organic stain.	1.0	1.4	0.9±0.4			FINES: Ra-226 (1,000 year) = 0.1 pCi/gr. Strong organic odor. Film of organic matter on top of ground water.
	SS-2259			0.9	1.6				
	SS-2260			1.3	1.4		9.0	▼	
17	SS-2261			0.9	1.2				
			BOTTOM OF TEST PIT AT 17.5'						COBBLES (Composite): Sample Depth 15' to 17'. Ra-226 Th-232 Th-230 Ra-226(1,000 yr) 1.1±0.6 1.1±0.4 FINES (Composite): Sample Depth 15' to 17'. Ra-226 Th-232 Th-230 Ra-226(1,000 yr) 4.6±1.1 3.1±0.7 +#4 sieve = 83.1% -#4 sieve = 16.9%

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-02

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY
GREEN	BACKHOE	N25130 E47190	12/2/93	12/2/93	5274.6	15.0	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
	SS-2492		**SILTY CLAY**, (CL), low plasticity, med. brown, slightly moist to dry, some roots.	2.2	1.3				Upper 6" frozen ground. Soil profile appears to represent several periods of deposition (Paleo Soils).
1	SS-2493			1.1	1.6				
2	SS-2494			1.9	2.6	1.0±0.4			FINES: Ra-226 (1,000 year) = 1.6 pCi/gr.
3	SS-2495			3.0	2.2				
4	SS-2496			1.0	1.8				
5	SS-2497			1.1	1.8				-Plan Exc. Depth at 5'.
6	SS-2498		**SILT**, (ML), low plasticity, reddish brown, moist, loose.	1.3	1.5				
7	SS-2499			2.3	1.6		9.2		
8	SS-2500		**SILTY CLAY**, (CL), low plasticity, gray to black, moist, abundant organic material (carbonaceous).	1.5	1.6				Strong aromatic odor.
9	SS-2501			1.4	1.2				
10	SS-2502			0.6	1.3				
11	SS-2503			1.3	1.7				
	SS-2504			1.7	1.3				
12	SS-2505		**PEAT**, organic material layer.	1.4	1.3		9.3		
	SS-2506		**GRAVELS**, (GM), 2.5" max., poorly graded, a	2.0	1.5				
13	SS-2507		silty matrix.	1.2	1.4				
	SS-2508			1.8	1.5				

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-02

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N25130 E47190	12/2/93	12/2/93	5274.6	15.0	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
	SS-2509			1.1	1.3				
	SS-2510			1.8	1.6				Film of organic matter on water surface (gas bubbling up to surface).
15	SS-2511		GRAVELS, (GP), with cobbles to 12", poorly graded in a sandy matrix (20-50%) cobbles average 3"-6" (30-35%).	1.1	1.5				
	SS-2512			1.4	1.3				
16	SS-2513			1.0	1.8				
	SS-2514			1.4	1.9				
17	SS-2515			1.1	1.4		9.2		
	SS-2516			1.6	1.5				
18	SS-2517			1.8	1.3				
	SS-2518		BOTTOM OF TEST PIT AT 18.0'	1.7	1.3				

COBBLES (Composite): Sample Depth 13' to 16'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
0.7±0.5		0.9±0.4	

FINES (Composite): Sample Depth 13' to 16'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
1.7±0.7		2.3±0.6	

+#4 sieve = 68.3%
-#4 sieve = 31.7%

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-03

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N25170 E47450	12/2/93	12/2/93	5278.4	21.0	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
1			**POND SEDIMENT**, silt in a CaCO3 matrix, buff colored with a surface covering of 2"-3" of yellowish slimy sand.						
2	SS-2519		**SILTY CLAY**, (CL), low plasticity, light brown, dry, roots (trace).	1.4	1.5		5.7		
3	SS-2520			2.0	1.5	4.1±0.8			FINES: Ra-226 (1,000 year) = 2.7 pCi/gr.
4	SS-2521			2.0	1.7		8.8		
5	SS-2522		Sandy silt, light brown, dry.	9.8	1.6				Plan Exc. Depth at 5' to 6'.
6	SS-2523			1.5	1.3				
7	SS-2524		Silty-clay, low plasticity, med. brown, slightly moist.	1.1	1.5				
8	SS-2525			1.4	1.4		8.8		
9	SS-2526			1.3	1.3		8.8		
10	SS-2527			1.3	1.5				
11	SS-2528		**CLAY**, (CL), med. to low plasticity, brown, moist, 4" to 6" thick layers.	1.2	1.4				
12	SS-2529			1.4	1.4				
13	SS-2530		Interlayered seams of sand and silt.	0.9	1.4				
14	SS-2531			1.2	1.3				

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-03

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N25170 E47450	12/2/93	12/2/93	5278.4	21.0	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
16	SS-2532			1.1	1.6				
	SS-2533			1.6	1.4		9.0		
17	SS-2534			1.0	1.7				
18	SS-2535		GRAVELS, (GP), with cobbles and boulders, coated with black carbonaceous material.	1.7	1.3				Strong aromatic (organic) odor.
	SS-2536			0.9	0.6				
19	SS-2537			0.9	1.2				
	SS-2538			1.6	2.1				
20	SS-2539			0.9	1.0		8.2		
	SS-2540			0.9	1.2			▼	
21									Film of organic matter on water surface (Gas bubbles coming up through the water).
22									
			BOTTOM OF TEST PIT AT 22.5'						

COBBLES (Composite): Sample Depth 18' to 21'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
1.7±0.7		0.5±0.3	

FINES (Composite): Sample Depth 18' to 21'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
1.9±0.7		5.7±1.0	

+#4 sieve = 70.4%
-#4 sieve = 29.6%

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-04

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24890 E46900	11/30/93	11/30/93	5274.5	16.5	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
1			TAILINGS, (ML-SP), silty sand, gray to reddish brown, moist, yellowish-brown seam (1.0 ft thick).						
2							5.45		pH Depth: 1'-4'.
3			Color changed to gray with brown spots.						
4									
5	SS-2267		CLAY, (CL), low plasticity, (TOPSOIL), brown, moist to wet.	85.0	3.7				Vegetation visible at interface.
6	SS-2268			92.0	4.0	32±2.0			FINES: Ra-226 (1,000 year) = 71.0 pCi/gr.
7	SS-2269			1.2					
8	SS-2270		Saturated (Perched water?).	44.0					
9	SS-2271		Gypsum stringers.	1.6	1.4				
10	SS-2272			13.0	1.9	7.6±1.1			FINES: Ra-226 (1,000 year) = 11.1 pCi/gr.
11	SS-2273			12.0	1.8				
12			SILTY GRAVEL, (GM), aromatic organic odor, some organic coating.				8.1		
13	SS-2274		GRAVELS, (GW-GP), with cobbles and boulders to 16".	2.7	1.6				-Plan Excav. Depth 13'.
14	SS-2275			2.1	1.5				
	SS-2276			* 10.0	1.8				
	SS-2277			* 14.0	1.8				

MORRISON KNUDSEN CORPORATION
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SHEET	TEST PIT NO.
1 OF 2	M-CF-04

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-04

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24890 E46900	11/30/93	11/30/93	5274.5	16.5	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
	SS-2278			2.7	1.6				
	SS-2279			3.2	1.2			▼	
16	SS-2280			* 11.0	1.3				
	SS-2281			* 10.0	1.4				
17	SS-2282			* 28.0	2.4				
	SS-2283			* 51.0	2.5				
18	SS-2284			* 15.0	1.7		7.8		* Possible cross contamination.
19			BOTTOM OF TEST PIT AT 19.0'						

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-04A

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24890 E46900	11/30/93	11/30/93	5274.5	16.5	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-230 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
1–10			Not Logged See Test Pit M-CF-04. This test pit was dug to collect uncontaminated samples between 11' and 17'.						
11	SS-2463		SILTY GRAVEL, (GM), aromatic organic odor, some organic coating.	8.5	1.6				
	SS-2464			11.0	2.0	9.3±1.2			FINES: Ra-226 (1,000 year) = 10.4 pCi/gr.
12	SS-2465			17.0	2.0		8.1		
	SS-2466		GRAVELS, (GW-GP), with cobbles and boulders to 16".	17.0	1.5				
13	SS-2467			9.2	1.9				-Plan Excav. Depth 13'.
	SS-2468			11.0	1.4				
14	SS-2469			3.2	1.5				
	SS-2470			4.2	1.5				

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-04A

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24890 E46900	11/30/93	11/30/93	5274.5	16.5	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
16	SS-2471			1.9	1.5				
	SS-2472			2.4	1.6				
	SS-2473			2.4	1.1				
	SS-2474			2.1	1.2				
17									
18									
19			BOTTOM OF TEST PIT AT 19.0'						

COBBLES (Composite): Sample depth 11' to 16'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
0.6±0.5		0.7±0.3	

FINES (Composite): Sample depth 11' to 16'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
7.4±1.4		6.6±1.0	

+#4 sieve = 76.1%
-#4 sieve = 23.9%

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-05

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24890 E47140	11/30/93	11/30/93	5273.7	18.0	J.CERCONE/G. LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
1			**TAILINGS**, (SM), silty sand, gray, moist to saturated, with interbedded 6" to 8" thick layers of slimes.						
2							5.0		pH Depth: 1'-6'.
3									
4									
5									
6			5.5'-6.0' Slime layer lavender color, saturated.						
7									
8									
9			**CLAY**, (CL), low plasticity, brown, moist, dry vegetation and roots.						Vegetation visible at interface.
10							4.9		
11	SS-2295			3.0	1.8				
12	SS-2296		**SANDY SILT**, (ML), dark brown, with some roots.	1.3	1.8	1.2±0.5	7.4		FINES: Ra-226 (1,000 year) = 1.3 pCi/gr.
13	SS-2297		**CLAY**, (CL), black, moist to saturated, carbonaceous.	1.8	1.6				-Plan Exc. Depth at 13'.
14	SS-2298			1.1	1.9				
15	SS-2300		Silty clay, light brown, thinly bedded.	1.1	1.6				
16	SS-2301		**GRAVELS**, (GP), with cobbles to 6'.	1.6	1.2		7.2		COBBLES (Composite): Sample Depth 16' to 21'.
17	SS-2302			5.5	1.3				Ra-226 Th-232 Th-230 Ra-226 (1,000 yr)
	SS-2304			5.7	1.3				1.4±0.6 0.3±0.2
18	SS-2305			1.1	1.1			▼	FINES (Composite): Sample Depth 16' to 21'.
	SS-2306			1.3	1.1				Ra-226 Th-232 Th-230 Ra-226 (1,000 yr)
19	SS-2307			4.1	1.2				2.5±0.8 2.3±0.6
	SS-2308			3.6	1.4				+#4 sieve = 77.6%
20	SS-2309			3.1	1.1				-#4 sieve = 22.4%
			BOTTOM OF TEST PIT AT 20.0'						

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SHEET	TEST PIT NO.
1 OF 1	M-CF-05

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-06

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24890 E47380	11/30/93	11/30/93	5276.8	18.8	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
1			**TAILINGS**, (SM), silty sand, gray, moist, loose, several seams and pockets of green slimes.						
2									
3									
4							5.0		pH Depth: 1'-8'.
5									
6									
7			Becoming pale yellow.						
8									
9									
10									Tailings were caving into the pit during the excavation. Consequently, no cobbles to fines samples were taken.
11									
12							5.0		pH Depth: 8'-15'.
13			Original ground surface.						
14	SS-2310		**SANDY CLAY**, (CL), brown, moist.	2.3	1.4	1.6±0.5			FINES: Ra-226 (1,000 year) = 2.1 pCi/gr.

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ENVIRONMENTAL SERVICES DIVISION

SHEET 1 OF 2

TEST PIT NO. M-CF-06

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-06

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24890 E47380	11/30/93	11/30/93	5276.8	18.8	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
16									-Plan Exc. Depth 16'.
17			**GRAVELS**, (GP), with cobbles to 6', sand matrix of 30%-40% fines, average size cobble is 3" 4", max. cobble size is 8".						
18									
19								▼	Water rose to this level after pit was excavated. (Free water was not encountered during excavation to 25').
20									
21							6.5		pH Depth: 20'-25'.
22									
23									
24	SS-2313			* 85 0	3.0		6.5		
25	SS-2314			* 41.0	2.5				* Possible Cross Contamination.
			BOTTOM OF TEST PIT AT 25.0'						COBBLES (Composite): Sample Depth 18' to 22'. Ra-226 3.3±0.9 Th-232 Th-230 1.6±0.5 Ra-226 (1,000 yr)

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-07

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24850 E47500	12/2/93	12/2/93	5277.9	Not Encountered	G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
1			**TAILINGS**, (SM) silty sand, fine, gray.						
			Reddish brown color from 1'-5'.						
5			Turning to purple color.						
6			Clayey slimes.						
10			Very wet, possibly perched water.						Perched water in tailings and equipment vibration cause severe caving and possible cross contamination.
14	SS-2541		**CLAY**, (CL), silty, dark gray, carbonaceous.	1.5	1.6		4.9		-Plan Exc. Depth at 14'.
15	SS-2542			3.0	1.4	1.8±0.5	4.9		FINES: Ra-226 (1,000 year) = 2.6 pCi/gr.
16	SS-2543			2.0	1.2				
	SS-2544		**GRAVELS**, (GP), with cobbles to 12".	5.9	1.3	4.2±0.8			FINES: Ra-226 (1,000 year) = 5.3 pCi/gr.
17	SS-2545			8.2	1.3				* Possible Cross Contamination.
	SS-2546			* 17.0	1.5				COBBLES (Composite): Sample Depth 17'-21'.
18	SS-2547			* 20.0	1.5				Ra-226 Th-232 Th-230 Ra-226 (1,000 yr)
									2.0±0.7 1.7±0.5
19									FINES (Composite): Sample Depth 17'-21'.
20									Ra-226 Th-232 Th-230 Ra-226 (1,000 yr)
									220±10 120±4
21									+#4 sieve = 73.1%.
			BOTTOM OF TEST PIT AT 21.0'						-#4 sieve = 26.9%

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

SHEET	TEST PIT NO.
1 OF 1	M-CF-07

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-11

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24700 E47670	12/2/93	12/2/93	5268.0	10.0	G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
1			TAILINGS, (ML), silt, light gray with red brown oxidized yellow slimes.						
2			CLAY, (CL), silty, dark brown, moist.						
3	SS-2437			0.9	1.3	1.2±0.5	6.6		FINES: Ra-226 (1,000 year) = 1.0 pCi/gr.
4	SS-2438			16.0	2.2		8.5		
			Silty clay, carbonaceous.						
5	SS-2439			6.5	1.5		8.2		-Plan Exc. Depth at 5'.
6	SS-2440		GRAVELS, (GP), with cobbles to 12", black, carbonaceous.	2.4	1.7	7.7±1.1			FINES: Ra-226 (1,000 year) = 4.3 pCi/gr.
	SS-2441			2.5	1.2				
7	SS-2442			3.2	1.3	22±2			FINES: Ra-226 (1,000 year) = 9.8 pCi/gr.
	SS-2443			3.6	1.0				
8	SS-2444			2.0	1.1				
	SS-2445			2.2	1.1				
9	SS-2446			7.1	1.3	25±2	8.8		FINES: Ra-226 (1,000 year) = 16.3 pCi/gr.
	SS-2447			7.1	1.2			▼	
10									
11			Partly Cemented Conglomerate (Refusal to backhoe).						
12			BOTTOM OF TEST PIT AT 12.0'						COBBLES (Composite): Sample Depth 6' to 10'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 0.8±0.5 0.4±0.3 FINES (Composite): Sample Depth 6' to 10'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 4.2±1.1 8.9±1.2 +#4 sieve = 76.4%. -#4 sieve = 23.6%.

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SHEET	TEST PIT NO.
1 OF 1	M-CF-11

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-15

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24410 E47825	12/1/93	12/1/93	5267.2	10.5	G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
	SS-2448		SILT, (ML), clayey, dark brown, pond sediments with oxidized seams.	167.0	3.3				
1	SS-2449		(FILL) per field staff.	555.0	10.0				
2	SS-2450		TAILINGS, (ML), silt, light gray.	471.0	9.2				
3	SS-2451		CLAY, (CL), silty, med. to low plasticity, dark brown, moist.	128.0	2.5				
4	SS-2452			8.6	1.6	12±1.0			FINES: Ra-226 (1,000 year) = 9.8 pCi/gr.
5	SS-2453			3.5	1.3	5.0±4.0			FINES: Ra-226 (1,000 year) = 4.0 pCi/gr. -Plan Exc. Depth at 5'.
6	SS-2454			1.9	1.2				
7	SS-2455		CLAY, (CL), silty, low plasticity, dark brown, moist to saturated.	1.1	1.2		8.8		
8	SS-2456			16.0	1.3	23±2.0			FINES: Ra-226 (1,000 year) = 18.5 pCi/gr. COBBLES (Composite): Sample Depth 10' to 13'.
9	SS-2457			11.0	1.1				Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 0.9±0.5 0.8±0.4 FINES (Composite): Sample Depth 10' to 13'.
10	SS-2458		GRAVELS, (GW), with cobbles to 5", dark gray to black, carbonaceous.	2.0	1.3			▼	Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 6.3±1.4 13±1 +#4 sieve = 74.2%. -#4 sieve = 25.8%.
11	SS-2460		Cemented below 11.0'.	7.9	1.2	8.8±1.2			FINES: Ra-226 (1,000 year) = 8.2 pCi/gr.
	SS-2461			2.8	1.2				
12	SS-2459			2.2	1.0				
	SS-2462		Refusal to Backhoe bucket.	2.6	1.2				
13			BOTTOM OF TEST PIT AT 13.0'						
			Note: Pit located in the bottom of a gypsum pond.						

MORRISON KNUDSEN CORPORATION
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SHEET 1 OF 1

TEST PIT NO. M-CF-15

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-19

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24160 E47900	12/1/93	12/1/93	5267.1	not encountered	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
0	SS-2428		SAND, (SM), silty, light brown, moist.	41.0	1.8		6.9		
1	SS-2430			2.1	1.6	4.8±0.9	7.1		FINES Ra-226 (1,000 year) = 3.0 pCi/gr.
2	SS-2429		ALLUVIUM	2.0	1.9				
3									
4	SS-2431		GRAVELS, (GP), with cobbles in a sand matrix, iron oxide and calcite cementation.	7.3	1.5		9.2		
	SS-2432			7.1	1.5	44±3.0			FINES Ra-226 (1,000 year) = 20 pCi/gr.
	SS-2433			9.5	1.5				
5	SS-2434		Hard digging with backhoe bucket below 5 feet.	10.0	1.9				
	SS-2435		Cemented with CaCO3.	5.9	1.6	19±2.0			FINES Ra-226 (1,000 year) = 10.5 pCi/gr.
6	SS-2436		Refusal to Backhoe.	6.0	1.7				-Plan Exc. Depth 6'.
			BOTTOM OF TEST PIT AT 6.7'.				9.1		
			Note: Pit located in the bottom of a gypsum pond.						COBBLES (Composite): Sample Depth 3.5' to 5.5'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 0.8±0.5 0.7±0.3 FINES (Composite): Sample Depth 3.5' to 5.5'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 6.5±1.3 16±2 +#4 sieve = 76.3%. -#4 sieve = 23.7%.

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-20

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N23900 E46900	12/1/93	12/1/93	5262.0	4.8	G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
0			GRAVELS, (GP), with cobbles to 12", light brown.						1 inch of tailings on the surface.
1	SS-2353			1.3	1.3				
	SS-2354			2.1	1.5	2.7±0.7			FINES: Ra-226 (1,000 year) = 2.3 pCi/gr.
2	SS-2355			2.7	1.2				
	SS-2356			2.0	1.4				
3	SS-2357			1.7	1.2	0.6±0.4			FINES: Ra-226 (1,000 year) = 1.3 pCi/gr.
	SS-2358			1.6	1.1				
4	SS-2359			8.6	1.4		7.4		
	SS-2360			9.0	1.1	16±2.0		▼	FINES: Ra-226 (1,000 year) = 11.2 pCi/gr. -Plan Exc. Depth at 5'.
5									
6									
7			BOTTOM OF TEST PIT AT 7.0'						

COBBLES (Composite): Sample Depth 4' to 7'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
0.5±0.4		7.8±0.4	

FINES (Composite): Sample Depth 4' to 7'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
8.6±1.5		17±2	

+#4 sieve = 84.4%.
-#4 sieve = 15.6%.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

SHEET 1 OF 1

TEST PIT NO. M-CF-20

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-21

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N23900 E47180	12/1/93	12/1/93	5261.4	4.5	G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
0	SS-2361		COBBLES, (GP), to 12", some sand and gravel.	4.7	1.3	5.7±0.9			FINES: Ra-226 (1,000 year) = 5.1 pCi/gr. 1 inch of tailings on the surface.
1	SS-2362			17.0	1.4				
	SS-2363			16.0	1.5				
2	SS-2364			12.0	1.7		8.4		
	SS-2365			13.0	1.9				
3	SS-2366			25.0	1.7				
	SS-2367			28.0	1.7				
4	SS-2368			11.0	1.2			▼	
	SS-2369			9.5	1.2	12±1.0			FINES: Ra-226 (1,000 year) = 10.4 pCi/gr. +#4 sieve = 81.8%. -#4 sieve = 18.2%. -Plan Exc. Depth 5'.
5									
6			BOTTOM OF TEST PIT AT 6.0'						

COBBLES (Composite): Sample Depth 2' to 6'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
1.6±0.7		1.2±0.4	

FINES (Composite): Sample Depth 2' to 6'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
32±3		55±3	

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

SHEET 1 OF 1

TEST PIT NO. M-CF-21

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-22

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N23900 E47430	12/1/93	12/1/93	5262.9	6.0	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
1			FILL, gravels and cobbles in a silty sand matrix.						
2									COBBLES (Composite): Sample Depth 4' to 8'.
3									Ra-226 Th-232 Th-230 Ra-226 (1,000 yr)
4									0.9±0.5 0.9±0.4
5			COBBLES, (GP), with boulders, black, carbonaceous, little sand and gravel.						FINES (Composite): Sample Depth 4' to 8'.
6	SS-2388			2.6	1.0	1.9±0.6		▼	Ra-226 Th-232 Th-230 Ra-226 (1,000 yr)
7	SS-2389			3.3	1.2		7.3		2.4±0.8 2.5±0.6
8			BOTTOM OF TEST PIT AT 8.0'						+#4 sieve = 79.3%.
									-#4 sieve = 20.7%.
									FINES: Ra-226 (1,000 year) = 2.4 pCi/gr.
									-Plan Exc. Depth at 6'.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

SHEET 1 OF 1

TEST PIT NO. M-CF-22

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-24

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N23700 E46915	12/1/93	12/1/93	5259.2	2.8	G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
	SS-2390		COBBLES, to 4" with sand.	1.6	0.8				
1	SS-2391			1.1	1.6				
2	SS-2392		GRAVELS (GP), with cobbles.	1.8	1.0	1.9±0.6			FINES: Ra-226 (1,000 year) = 1.8 pCi/gr.
	SS-2393			1.7	1.0		7.9	▼	
3	SS-2394			2.7	1.2				
	SS-2395			3.0	1.3				
4	SS-2396			1.8	0.8				-Plan Exc. Depth at 4'.
	SS-2397			2.0	1.3				
5			BOTTOM OF TEST PIT AT 5.0'						

COBBLES (Composite): Sample Depth 2' to 5'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
0.9±0.5		0.7±0.4	

FINES (Composite): Sample Depth 2' to 5'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
2.6±0.8		3.6±0.8	

+#4 sieve = 64.8%.
-#4 sieve = 35.2%.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

SHEET 1 OF 1

TEST PIT NO. M-CF-24

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-25

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N23640 E47180	12/1/93	12/1/93	5263.2	8.0	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
0	SS-2311		**SILTY CLAY**, (CL), med. plasticity, dark brown, moist to saturated.	10.0	1.6				
1	SS-2312			1.5	1.6	1.2±0.5			FINES: Ra-226 (1,000 year) = 1.4 pCi/gr.
2	SS-2315		(Fill?)	1.1	1.0				
3	SS-2316		Very moist.	1.0	1.1		7.5		
4	SS-2317		Organic seam.	1.4	1.0				
5	SS-2319		**CLAYEY SILT**, (ML), reddish brown-probably from oxidation.	1.0	1.0				
6	SS-2318			6.7	1.4	5.2±0.9			FINES: Ra-226 (1,000 year) = 6.2 pCi/gr. -Plan Exc. Depth at 6'.
7	SS-2320		**COBBLES**, (GW-GP), to 12", with sand and gravel, clean material.	0.9	1.4		7.0		
	SS-2321			1.5	1.2				
8	SS-2322			0.6	1.0			▼	Note: Attempted to dewater the pit with a 300 gpm pump. Unable to obtain a representative sample below the water table.
	SS-2323			1.1	1.0				
9	SS-2398			12.0	1.4				
	SS-2399			8.5	1.5				
10			BOTTOM OF TEST PIT AT 10.0'						

COBBLES (Composite): Sample Depth 6.5' to 8.5'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
0.8±0.5		1.3±0.5	

FINES (Composite): Sample Depth 6.5' to 8.5'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
5.4±1.2		4.1±0.8	

+#4 sieve = 78.5%.
-#4 sieve = 21.5%.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-26

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N23640 E47480	12/1/93	12/1/93	5263.5	7.5	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
0	SS-2324		FILL, dark brown, fine grained, with a lot of debris.	11.0	1.8				
1	SS-2325			7.1	1.5	8.1±1.1			FINES: Ra-226 (1,000 year) = 7.5 pCi/gr. Debris and fill to 3 feet on north side of the pit.
2	SS-2326		SAND, (SP), little silt, gray to brown, med. dense.	6.8	1.6		7.5		
3	SS-2327			0.9	1.5				
4	SS-2328			1.0	1.2	0.6±0.4			FINES: Ra-226 (1,000 year) = 0.9 pCi/gr.
5	SS-2329		Oxidized seam.	1.2	0.8		7.6		
6	SS-2330			1.0	0.9		7.1 7.0		-Plan Exc. Depth at 6'.
7	SS-2331			7.6	1.0	15±2.0	7.1	▼	FINES: Ra-226 (1,000 year) = 10.2 pCi/gr.
8	SS-2400		GRAVELS, (GP), with cobbles to 6".	2.0	0.8	2.6±0.7			FINES: Ra-226 (1,000 year) = 2.2 pCi/gr.
9			BOTTOM OF TEST PIT AT 9.5'						COBBLES (Composite): Sample Depth 8' to 9.5'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 0.7±0.5 0.5±0.3 FINES (Composite): Sample Depth 8' to 9.5'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 1.9±0.7 1.4±0.5 +#4 sieve = 65.5%. -#4 sieve = 34.5%.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

SHEET	TEST PIT NO.
1 OF 1	M-CF-26

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-27

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N23640 E47725	12/1/93	12/1/93	5267.0	11.0	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
0	SS-2332		FILL, mixed soil with tailings, wood.	281.0	8.3				
1	SS-2333			336.0	5.2				
2	SS-2334			370.0	7.8				
3	SS-2335		Oxidized zone at 3 to 4 feet.	349.0	7.1				
4	SS-2336		TAILINGS, (CL-ML), reddish brown with orange seams (3").	364.0	8.7		6.8		
5	SS-2337			150.0	4.5				
6	SS-2338		Slimes, gray, saturated.	1103.0	44.0				-Plan Exc. Depth at 6'.
7	SS-2339			2792.0	64.0		6.9		
8	SS-2340		SILTY CLAY, (CL), dark brown, some roots.	9.0	1.5				
9	SS-2345		GRAVELS, (GP), with cobbles to 12".	9.4	1.8	7.3±1.1	8.2		FINES: Ra-226 (1,000 year) = 8.7 pCi/gr.
10	SS-2346			10.0	1.7				
	SS-2341			2.3	1.0				
11	SS-2342			2.3	1.0			▼	
	SS-2343		BOTTOM OF TEST PIT AT 11.0'	7.8	1.3				COBBLES (Composite): Sample Depth 9.5' to 11.0'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 0.8±0.5 0.8±0.4 FINES (Composite): Sample Depth 9.5' to 11.0'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 3.2±0.9 1.4±0.5 +#4 sieve = 85.0%. -#4 sieve = 15.0%.
	SS-2344			7.6	1.3				

MORRISON KNUDSEN CORPORATION
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SHEET 1 OF 1

TEST PIT NO. M-CF-27

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-28

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N23400 E46900	12/1/93	12/1/93	5258.0	2.0	G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
	SS-2401		COBBLES, (GP), to 12", with black organic silt.	10.4	1.8	38±2.0			FINES: Ra-226 (1,000 year) = 20.1 pCi/gr.
1	SS-2402			13.0	1.2	40±2.0			FINES: Ra-226 (1,000 year) = 22.5 pCi/gr.
	SS-2403			12.0	1.0				
2	SS-2404			6.9	1.1		6.5	▼	-Plan Exc. Depth at 2'.
	SS-2405			7.2	1.3	30±2.0			FINES: Ra-226 (1,000 year) = 15.2 pCi/gr.
3									
4									
			BOTTOM OF TEST PIT AT 4.5'						

COBBLES (Composite): Sample Depth 0' to 4.5'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
0.8±0.5		0.5±0.3	

FINES (Composite): Sample Depth 0' to 4.5'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
4.2±1.0		11±1	

+#4 sieve = 90.4%.
-#4 sieve = 9.6%.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

SHEET	TEST PIT NO.
1 OF 1	M-CF-28

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-29

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N23450 E47130	12/1/93	12/1/93	5262.2	3.8	G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
1	SS-2406		FILL, mixed sand, gravel and cobbles to 12", dark brown.	186.0	5.4				
	SS-2407			178.0	4.5				
	SS-2408			99.0	3.0				
2	SS-2409			96.0	3.1				
	SS-2410			115.0	3.7	290±10			Ra-226 (1,000 yr) = 176.0 pCi/gr.
	SS-2411			131.0	3.4				
3									-Plan Exc. Depth at 3'.
4								▼	Perched water table?
5			SILTY CLAY, (CL), med. plasticity, black, with carbonized roots. Med. gray seam at 4.5' - 5.0'.						
6							6.9		
			BOTTOM OF TEST PIT AT 6.5'						COBBLES (Composite): Sample Depth 0' to 4'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 2.1±0.8 2.3±0.6 FINES (Composite): Sample Depth 0' to 4'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 110±10 230±10 +#4 sieve = 78.2%. -#4 sieve = 21.8%.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

SHEET 1 OF 1

TEST PIT NO. M-CF-29

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-30

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N23400 E47265	12/1/93	12/1/93	5262.2	8.3	J.CERCONE

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
0	SS-2412		**FILL**, silty gravel, poorly graded, brown, moist, low plasticity.	34.0	2.5				
1	SS-2413			11.0	1.5				
2	SS-2414			236.0	4.3		7.3		
3	SS-2417			142.0	3.5				
4			**SILTY SAND**, (SM), gray, moist.						Tailings?
	SS-2418		**CLAY**, (CL), low to med. plasticity, black, moist to saturated, organic.	9.8	1.4				
	SS-2419		**GRAVELS**, (GW), with cobbles, well graded, cobbles to 8" max., fines are med. to coarse sand.	13.0	1.5	32±2.0			FINES: Ra-226 (1,000 year) = 19.7 pCi/gr.
5	SS-2420			16.0	1.4				
	SS-2421			12.0	1.1				
6	SS-2422			30.0	1.5				Plan Excavation Depth at 6'.
	SS-2423			30.0	1.5				
7	SS-2424			4.4	1.2	22±2.0			FINES: Ra-226 (1,000 year) = 10.6 pCi/gr.
	SS-2425			6.0	1.1				
8	SS-2426			* 52.0	2.7			▼	
	SS-2427			* 47.0	1.8				
9			BOTTOM OF TEST PIT AT 9.0'						

* Possible Cross Contamination.

COBBLES (Composite): Sample Depth 4.5' to 7.5'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
1.2±0.6		0.6±0.4	

FINES (Composite): Sample Depth 4.5' to 7.5'.

Ra-226	Th-232	Th-230	Ra-226 (1,000 yr)
3.0±0.9		6.9±1.0	

+#4 sieve = 79.4%.
-#4 sieve = 20.6%.

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-31

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N25252 E49005	12/3/93	12/3/93	5272.8	8.5	J.CERCONE/G.LINDSEY

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
0	SS-2475		CLAY, (CL), light brown, slightly moist, some roots.	1.6	1.9				
1	SS-2476			1.1	2.3				
2	SS-2477			1.5	2.8				
3	SS-2478		SANDY SILT, (ML), to SILTY SAND, (SM), dark brown, moist, loose.	1.5					
4	SS-2479			1.8	2.0				
5	SS-2480			0.6	1.5				
6	SS-2481			0.8	1.5				
7	SS-2482		GRAVELS, (GP-GW), with cobbles to 4", matrix of fine sand.	0.9	1.6				
	SS-2483			1.3	1.5				
8	SS-2484			0.8	1.4			▼	
	SS-2485		GRAVELS, (GP-GW), with cobbles to 6", matrix of coarse sand.	1.3	1.3				
9	SS-2486			0.7	1.0				COBBLES (Composite): Sample Depth 8.5' to 11.5'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 0.9±0.5 0.7±0.4
	SS-2487			0.7	1.1				
10	SS-2488			0.8	1.2				FINES (Composite): Sample Depth 8.5' to 11.5'. Ra-226 Th-232 Th-230 Ra-226 (1,000 yr) 1.8±0.8 2.2±0.6
	SS-2489			1.0	1.2				
11	SS-2490			0.6	1.2				+#4 sieve = 78.2%.
	SS-2491			1.0	1.1				-#4 sieve = 21.8%.
12			BOTTOM OF TEST PIT AT 12.0'						
			(BACKGROUND PIT LOCATED AT NORTHEAST CORNER OF NEW RIFLE SITE).						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-32

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24648 E51357	12/2/93	12/2/93	5271.5	3.0	J.CERCONE

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
0	SS-2370		GRAVELS, (GP), with cobbles to 12", poorly graded, with coarse sand, slightly moist, all gravels and cobbles appear clean and fresh.	1.3	1.0				
	SS-2371			1.2	1.3				
1	SS-2372			0.9	1.0				
	SS-2374			1.5	1.1				
2	SS-2373			1.4	1.4				COBBLES (Composite): Sample Depth 0'to 4.0'. Ra-226 1.8±0.7; Th-232; Th-230 1.1±0.4; Ra-226 (1,000 yr)
	SS-2375			1.3	1.3			▼	
3	SS-2376			1.1	1.0				FINES (Composite): Sample Depth 0'to 4.0'. Ra-226 1.7±0.7; Th-232; Th-230 0.9±0.4; Ra-226 (1,000 yr)
	SS-2377			1.0	1.0				+#4 sieve = 80.8%.
4	SS-2378			1.2	1.2				-#4 sieve = 19.2%.
	SS-2479			0.8	1.0				
5			BOTTOM OF TEST PIT AT 5.0'. (BACKGROUND PIT LOCATED IN CON SY INC. GRAVEL PIT).						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

SHEET	TEST PIT NO.
1 OF 1	M-CF-32

TEST PIT LOG

PROJECT	SITE	LOCATION	JOB NO.	TEST PIT NO.
UMTRA	RIFLE	NEW RIFLE, COLORADO	3885-70	M-CF-33

CONTRACTOR	EXCAVATION METHOD	COORDINATES	BEGUN	COMPLETED	GROUND ELEV.	GROUND WATER DEPTH (FT)	LOGGED BY:
GREEN	BACKHOE	N24877 E51355	12/2/93	12/2/93	5275.2	7.2	J.CERCONE

DEPTH (FT)	SAMPLE NO.	GRAPHIC LOG	MATERIAL DESCRIPTION AND CLASSIFICATION	Ra-226 pCi/gr	Th-232 pCi/gr	Th-230 pCi/gr	pH	WATER DATA	REMARKS PHOTOGRAPH
0			CLAY, (CL), (TOP SOIL), some roots.						
1			SILT, (ML), light brown, moist.						
2									
3			CLAY, (CH), med. to high plasticity, black, saturated, organic .						
4									
5									
6	SS-2380		GRAVELS, (GW), with cobbles to 4", well graded, black to gray, organic coating.	1.3	1.1				COBBLES (Composite): Sample Depth 7.0' to 9.0'. Ra-226 1.6±0.7; Th-232; Th-230 0.5±0.3; Ra-226 (1,000 yr)
	SS-2381			1.1	1.3				
7	SS-2382			1.0	1.2			▼	FINES (Composite): Sample Depth 7.0' to 9.0'. Ra-226 1.6±0.7; Th-232; Th-230 1.3±0.5; Ra-226 (1,000 yr)
	SS-2383			0.9	0.9				+#4 sieve = 81.9%.
8	SS-2384			0.7	0.8				-#4 sieve = 18.1%.
	SS-2385			1.0	1.3				
9			BOTTOM OF TEST PIT AT 9.0'. (BACKGROUND PIT LOCATED IN CON SY INC. GRAVEL PIT).						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES DIVISION

SHEET	TEST PIT NO.
1 OF 1	M-CF-33

APPENDIX D

MASS PARTITION FUNCTIONS
(COBBLES-TO-FINES RATIOS)

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

INTER-OFFICE CORRESPONDENCE

DATE December 13, 1993

TO Grant Cherrington

FROM David Farr

LOCATION San Francisco

LOCATION Rifle, CO 3050

SUBJECT Cobbles to Fines Test Result

As requested, we have performed particle size analyses on New Rifle site subpile material test pit samples obtained by TAC, MKES and DOE representatives during recent test pit investigations. Enclosed are the results.

As discussed during initial test pit examination, the cobble to fine analyses were performed on composite bulk samples ranging in weight from 1000 to 1500 pounds each. The larger sized samples were required due to concerns about the smaller samples originally specified being representative. To expedite this process, the bulk samples were reduced to manageable proportions in accordance with the ASTM C-136 practice of sample reduction. An explanation of this practice has been provided in the attached calculation sheet (Attachment 1).

The dry weight of the +1" and +#4 fractions was calculated using an assumed 1.5% moisture as recommended by ASTM C-136. A representative sample of the +1", including a proportionate amount of the -1" to +#4 material, was collected for radium and thorium analysis. These samples were then given to site H.P. personnel to be sent out for analysis.

It should be noted that a few of the calculation sheets do not indicate the depth of the sample as this data was not provided to us.

Should you require further information, please advise.

File: 4.15 w/ enclosure

cc: Randy Withee w/o enclosure
QC File w/ enclosure

TFarr

ATTACHMENT 1
CALCULATIONS

1. A representative sample of between 1000 to 1500 pounds of material was split on the 1" sieve and weights of each fraction were obtained. The +1" fraction was corrected assuming a 1.5% moisture and the -1" fraction corrected by actual moisture content. Dry weights were calculated and added together to determine the total sample weight.

2. The -1" fraction was reduced to a manageable sized representative sample of approximately 50 pounds, split on the #4 sieve and weights were obtained for each fraction. A moisture sample was obtained from the -#4 material for correction and the +#4 fraction was corrected using an assumed moisture content of 1.5%. Dry weights were calculated. Percentages of the +#4 and -#4 were then calculated.

3. The percentages of +#4 and -#4 obtained from the reduced -1" fraction were then adjusted back to a whole sample basis by multiplying by the original dry weight of the whole -1" fraction. This weight was then added to the +1" fraction to determine the +#4 weight on a whole sample basis.

4. The weight of the +#4 and -#4 (cobbles and fines) is then expressed as a percentage of the total sample weight.

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #1

DATE TESTED: 12-6-93

DEPTH: 15.0' - 17.0'

TECHNICIAN: [signature]

CHECKED BY: [signature]

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	836.28 lbs.	-1" WET WEIGHT	381.92 lbs.
% MOIST	1.5 %	% MOIST	11.6 %
DRY WEIGHT	823.92 lbs.	DRY WEIGHT	342.22 lbs.

TOTAL SAMPLE WEIGHT 1166.14 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	24.01 lbs.	-#4 WET WEIGHT	35.12 lbs.
% MOIST	1.5 %	% MOIST	9.6 %
DRY WEIGHT	23.66 lbs.	DRY WEIGHT	32.04 lbs.

REDUCED SAMPLE WEIGHT 55.70 lbs.

% +#4 IN REDUCED SAMPLE 42.5 %

%-#4 IN REDUCED SAMPLE 57.5 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	145.44 lbs.
+ DRY WT. OF +1" IN BULK SAMPLE	823.92 lbs.
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	969.36 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	652.6 g	488.9 g
DRY WEIGHT	585.0 g	446.0 g
WT. OF WATER	67.6 g	42.9 g
% MOISTURE	11.6 %	9.6 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4	969.36 lbs.
TOTAL SAMPLE WEIGHT	1166.14 lbs.

% +#4 (COBBLES) 83.1 %

%-#4 (FINES) 16.9 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #2

DATE TESTED: 12-6-93

DEPTH: 13.0' - 16.0'

TECHNICIAN: [signature]

CHECKED BY: [signature]

BULK SAMPLE WEIGHTS

+ 1" WET WEIGHT	667.73 lbs	-1" WET WEIGHT	553.67 lbs
% MOIST	1.5 %	% MOIST	10.5 %
DRY WEIGHT	657.86 lbs.	DRY WEIGHT	501.06 lbs.

TOTAL SAMPLE WEIGHT 1158.92 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+ #4 WET WEIGHT	12.60 lbs	-#4 WET WEIGHT	37.18 lbs.
% MOIST	1.5 %	% MOIST	9.2 %
DRY WEIGHT	12.41 lbs.	DRY WEIGHT	34.05 lbs

REDUCED SAMPLE WEIGHT 46.46 lbs.

% + #4 IN REDUCED SAMPLE 26.7 %

%-#4 IN REDUCED SAMPLE 73.3 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% + #4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	133.78 lbs.
+ DRY WT. OF + 1" IN BULK SAMPLE	657.86 lbs.
= TOTAL DRY WEIGHT OF + #4 IN BULK SAMPLE	791.64 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	572.9 g	472.6 g
DRY WEIGHT	518.6 g	432.7 g
WT. OF WATER	54.3 g	39.9 g
% MOISTURE	10.5 %	9.2 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF + #4 791.64 lbs

TOTAL SAMPLE WEIGHT 1158.92 lbs

% + #4 (COBBLES) 68.3 %

%-#4 (FINES) 31.7 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #3

DEPTH: 18.0' - 21.0'

DATE TESTED: 12-7-93

TECHNICIAN: David Hazen

CHECKED BY: Steve Wilk

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	706.30 lbs	-1" WET WEIGHT	561.82 lbs
% MOIST	1.5 %	% MOIST	14.3 %
DRY WEIGHT	695.86 lbs	DRY WEIGHT	491.53 lbs

TOTAL SAMPLE WEIGHT 1187.39 lbs

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	15.83 lbs	-#4 WET WEIGHT	44.75 lbs
% MOIST	1.5 %	% MOIST	13.7 %
DRY WEIGHT	15.60 lbs	DRY WEIGHT	39.36 lbs

REDUCED SAMPLE WEIGHT 54.96 lbs

% +#4 IN REDUCED SAMPLE 28.4 %

%-#4 IN REDUCED SAMPLE 71.6 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE 139.59 lbs

\+ DRY WT. OF +1" IN BULK SAMPLE 695.86 lbs.

= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE 835.45 lbs

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	497.9 g	523.1 g
DRY WEIGHT	435.7 g	460.0 g
WT. OF WATER	62.2 g	63.1 g
% MOISTURE	14.3 %	13.7 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4 835.45 lbs

TOTAL SAMPLE WEIGHT 1187.39 lbs

% +#4 (COBBLES) 70.4 %

%-#4 (FINES) 29.6 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #4 DATE TESTED: 12-7-93

DEPTH: 11.0'-16.0' TECHNICIAN: David Mann

CHECKED BY: Steve Wilds

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	781.77 lbs.	-1" WET WEIGHT	458.61 lbs
% MOIST	1.5 %	% MOIST	5.4 %
DRY WEIGHT	770.22 lbs	DRY WEIGHT	435.11 lbs

TOTAL SAMPLE WEIGHT 1205.33 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	21.04 lbs	-#4 WET WEIGHT	~~45~~ 42.57 lbs (SW 12-14-93)
% MOIST	1.5 %	% MOIST	5.1 %
DRY WEIGHT	20.73 lbs	DRY WEIGHT	40.50 lbs

REDUCED SAMPLE WEIGHT 61.23 lbs

% +#4 IN REDUCED SAMPLE 33.9 %

%-#4 IN REDUCED SAMPLE 66.1 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	147.50 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	770.22 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	917.72 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	558.8 g	464.3 g
DRY WEIGHT	530.2 g	441.7 g
WT. OF WATER	28.6 g	22.6 g
% MOISTURE	5.4 %	5.1 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4	917.72 lbs
TOTAL SAMPLE WEIGHT	1205.33 lbs

% +#4 (COBBLES) 76.1 %

%-#4 (FINES) 23.9 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #5

DATE TESTED: 12-7-93

DEPTH: 16.0' - 21.0'

TECHNICIAN: David [illegible]

CHECKED BY: [illegible] Wills

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	692.10 lbs	-1" WET WEIGHT	525.88 lbs
% MOIST	1.5 %	% MOIST	7.2 %
DRY WEIGHT	681.87 lbs	DRY WEIGHT	490.56 lbs

TOTAL SAMPLE WEIGHT 1172.43 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	24.34 lbs	-#4 WET WEIGHT	30.99 lbs
% MOIST	1.5 %	% MOIST	12.0 %
DRY WEIGHT	23.98 lbs	DRY WEIGHT	27.67 lbs

REDUCED SAMPLE WEIGHT 51.65 lbs.

% +#4 IN REDUCED SAMPLE 46.4 %

%-#4 IN REDUCED SAMPLE 53.6 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	227.62 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	681.87 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	909.49 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	526.3 g	547.7 g
DRY WEIGHT	491.0 g	488.9 g
WT. OF WATER	35.3 g	58.8 g
% MOISTURE	7.2 %	12.0 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4 909.49 lbs

TOTAL SAMPLE WEIGHT 1172.43 lbs

% +#4 (COBBLES) 77.6 %

%-#4 (FINES) 22.4 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #7

DEPTH: 17.0'-21.0'

DATE TESTED: 12-7-93

TECHNICIAN: David Mann

CHECKED BY: Stan Wells

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	700.77 lbs	-1" WET WEIGHT	501.88 lbs
% MOIST	1.5 %	% MOIST	11.5 %
DRY WEIGHT	690.41 lbs	DRY WEIGHT	450.12 lbs

TOTAL SAMPLE WEIGHT 1140.53 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	18.12 lbs	-#4 WET WEIGHT	42.51 lbs
% MOIST	1.5 %	% MOIST	11.2 %
DRY WEIGHT	17.85 lbs	DRY WEIGHT	38.23 lbs

REDUCED SAMPLE WEIGHT 56.08 lbs

% +#4 IN REDUCED SAMPLE 31.8 %
%-#4 IN REDUCED SAMPLE 68.2 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE 143.14 lbs
+ DRY WT. OF +1" IN BULK SAMPLE 690.41 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE 833.55 lbs

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	530.1 g	531.8 g
DRY WEIGHT	475.5 g	478.3 g
WT. OF WATER	54.6 g	53.5 g
% MOISTURE	11.5 %	11.2 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4 833.55 lbs
TOTAL SAMPLE WEIGHT 1140.53 lbs

% +#4 (COBBLES) 73.1 %

%-#4 (FINES) 26.9 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #11 DATE TESTED: 12-7-93

DEPTH: 6.0'-10.0' TECHNICIAN: David A Farr

CHECKED BY: Stan Wells

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	1031.55 lbs	-1" WET WEIGHT	574.17 lbs
% MOIST	1.5 %	% MOIST	13.9 %
DRY WEIGHT	1016.11 lbs	DRY WEIGHT	504.10 lbs

TOTAL SAMPLE WEIGHT 1520.21 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	15.62 lbs	-#4 WET WEIGHT	41.74 lbs
% MOIST	1.5 %	% MOIST	10.2 %
DRY WEIGHT	15.39 lbs	DRY WEIGHT	37.88 lbs

REDUCED SAMPLE WEIGHT 53.27 lbs.

% +#4 IN REDUCED SAMPLE ~~145.68~~ D 12-14-93 28.9 %

%-#4 IN REDUCED SAMPLE 71.1 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	145.68 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	1016.11 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	1161.79 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	526.0 g	459.1 g
DRY WEIGHT	461.8 g	416.5 g
WT. OF WATER	64.2 g	42.6 g
% MOISTURE	13.9 %	10.2 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4	1161.79 lbs
TOTAL SAMPLE WEIGHT	1520.21 lbs

% +#4 (COBBLES) 76.4 %

%-#4 (FINES) 23.6 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #15

DEPTH: 10.0' - 13.0'

DATE TESTED: 12/6/93

TECHNICIAN: David Mass

CHECKED BY: Jhm Wells

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	650.45 lbs	-1" WET WEIGHT	586.97 lbs
% MOIST	1.5 %	% MOIST	11.2 %
DRY WEIGHT	640.84 lbs	DRY WEIGHT	527.85 lbs

TOTAL SAMPLE WEIGHT 1168.69 lbs

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	22.30 lbs	-#4 WET WEIGHT	31.60 lbs
% MOIST	1.5 %	% MOIST	8.2 %
DRY WEIGHT	21.97 lbs	DRY WEIGHT	29.21 lbs

REDUCED SAMPLE WEIGHT 51.18 lbs

% +#4 IN REDUCED SAMPLE 42.9 %
%-#4 IN REDUCED SAMPLE 57.1 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	226.45
+ DRY WT. OF +1" IN BULK SAMPLE	640.84
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	876.29 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	603.4 g	568.6 g
DRY WEIGHT	542.6 g	525.3 g
WT. OF WATER	60.8 g	43.3 g
% MOISTURE	11.2 %	8.2 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4	867.29 lbs
TOTAL SAMPLE WEIGHT	1168.69 lbs

% +#4 (COBBLES) 74.2 %

%-#4 (FINES) 25.8 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #19

DATE TESTED: 12-3-93

DEPTH: 3.5' - 5.5'

TECHNICIAN: [signature]

CHECKED BY: [signature]

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	717.17 lbs	-1" WET WEIGHT	480.03 lbs
% MOIST	1.5 %	% MOIST	7.3 %
DRY WEIGHT	706.57 lbs	DRY WEIGHT	447.37 lbs

TOTAL SAMPLE WEIGHT 1153.94 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	19.02 lbs	-#4 WET WEIGHT	31.94 lbs
% MOIST	1.5 %	% MOIST	7.9 %
DRY WEIGHT	18.74 lbs	DRY WEIGHT	29.60 lbs

REDUCED SAMPLE WEIGHT 48.34 lbs.

%+#4 IN REDUCED SAMPLE 38.8 %

%-#4 IN REDUCED SAMPLE 61.2 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

%+#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	173.58 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	706.57 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	880.15 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	600.0 g	492.1 g
DRY WEIGHT	559.1 g	455.9 g
WT. OF WATER	40.9 g	36.2 g
% MOISTURE	7.3 %	7.9 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4 880.15 lbs

TOTAL SAMPLE WEIGHT 1153.94 lbs

%+#4 (COBBLES) 76.3 %

%-#4 (FINES) 23.7 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #20

DATE TESTED: 12-3-93

DEPTH: 4 ½ to 7

TECHNICIAN: David M Farr

CHECKED BY: Steve Webb

BULK SAMPLE WEIGHTS

+ 1" WET WEIGHT	845.63 lbs	-1" WET WEIGHT	348.28 lbs
% MOIST	1.5 %	% MOIST	7.2 %
DRY WEIGHT	833.13 lbs	DRY WEIGHT	324.89 lbs

TOTAL SAMPLE WEIGHT 1158.02 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+ #4 WET WEIGHT	28.43 lbs	-#4 WET WEIGHT	37.41 lbs
% MOIST	1.5 %	% MOIST	7.2 %
DRY WEIGHT	28.01 lbs	DRY WEIGHT	34.90 lbs

REDUCED SAMPLE WEIGHT 62.91 lbs.

% + #4 IN REDUCED SAMPLE 44.5 %
%-#4 IN REDUCED SAMPLE 55.5 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% + #4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	144.58 lbs
+ DRY WT. OF + 1" IN BULK SAMPLE	833.13 lbs
= TOTAL DRY WEIGHT OF + #4 IN BULK SAMPLE	977.71 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	693.8 g	536.1 g
DRY WEIGHT	647.4 g	500.2 g
WT. OF WATER	46.4 g	35.9 g
% MOISTURE	7.2 %	7.2 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF + #4 977.71 lbs
TOTAL SAMPLE WEIGHT 1158.02 lbs

% + #4 (COBBLES) 84.4 %

%-#4 (FINES) 15.6 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #21 DATE TESTED: 12-3-93

DEPTH: 2'-6' TECHNICIAN: David M Jam

CHECKED BY: Jim Wilt

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	833.19 lbs	-1" WET WEIGHT	402.59 lbs
% MOIST	1.5 %	% MOIST	9.9 %
DRY WEIGHT	820.88 lbs	DRY WEIGHT	366.32 lbs

TOTAL SAMPLE WEIGHT 1187.20 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	19.88 lbs	-#4 WET WEIGHT	30.68 lbs
% MOIST	1.5 %	% MOIST	8.7 %
DRY WEIGHT	19.59 lbs	DRY WEIGHT	28.22 lbs

REDUCED SAMPLE WEIGHT 47.81 lbs.

% +#4 IN REDUCED SAMPLE 41.0 %
%-#4 IN REDUCED SAMPLE 59.0 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	150.19 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	820.88 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	971.07 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	711.0 g	495.1 g
DRY WEIGHT	647.0 g	455.3 g
WT. OF WATER	64.0 g	39.8 g
% MOISTURE	9.9 %	8.7 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4	971.07 lbs
TOTAL SAMPLE WEIGHT	1187.20 lbs

% +#4 (COBBLES) 81.8 %

%-#4 (FINES) 18.2 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #22

DEPTH: 5' - 6'

DATE TESTED: 12-1-93

TECHNICIAN: David M Tom

CHECKED BY: Steve Wells

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	847.35 lbs	-1" WET WEIGHT	471.52 lbs
% MOIST	1.5 %	% MOIST	13.4 %
DRY WEIGHT	834.83 lbs	DRY WEIGHT	415.80 lbs

TOTAL SAMPLE WEIGHT 1250.63 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	20.68 lbs	-#4 WET WEIGHT	38.41 lbs
% MOIST	1.5 %	% MOIST	13.8 %
DRY WEIGHT	20.37 lbs	DRY WEIGHT	33.75 lbs

REDUCED SAMPLE WEIGHT 54.12 lbs

%+#4 IN REDUCED SAMPLE 37.6 %

%-#4 IN REDUCED SAMPLE 62.4 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

%+#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE 156.34 lbs

\+ DRY WT. OF +1" IN BULK SAMPLE 834.83 lbs

= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE 991.17 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	734.2 g	661.6 g
DRY WEIGHT	647.3 g	581.5 g
WT. OF WATER	86.9 g	80.1 g
% MOISTURE	13.4 %	13.8 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4 991.17 lbs

TOTAL SAMPLE WEIGHT 1250.63 lbs

%+#4 (COBBLES) 79.3 %

%-#4 (FINES) 20.7 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #24 DATE TESTED: 12-2-93

DEPTH: 2-5' TECHNICIAN: David M Tam

CHECKED BY: Stan Mills

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	617.88 lbs	-1" WET WEIGHT	600.51 lbs
% MOIST	1.5 %	% MOIST	15.0 %
DRY WEIGHT	608.75 lbs	DRY WEIGHT	522.18 lbs

TOTAL SAMPLE WEIGHT 1130.93 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	12.92 lbs	-#4 WET WEIGHT	44.87 lbs
% MOIST	1.5 %	% MOIST	9.2 %
DRY WEIGHT	12.73 lbs	DRY WEIGHT	41.09 lbs

REDUCED SAMPLE WEIGHT 53.82 lbs

% +#4 IN REDUCED SAMPLE 23.7 %

%-#4 IN REDUCED SAMPLE 76.3 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	123.76 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	608.75 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	732.51 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	698.0 g	539.9 g
DRY WEIGHT	607.1 g	494.6 g
WT. OF WATER	90.9 g	45.3 g
% MOISTURE	15.0 %	9.2 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4	732.51 lbs
TOTAL SAMPLE WEIGHT	1130.93 lbs

% +#4 (COBBLES) 64.8 %

%-#4 (FINES) 35.2 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #25

DEPTH: 6.5'-8.5'

DATE TESTED: 12/1-93

TECHNICIAN: David Mitchell

CHECKED BY: Steve White

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	739.64 lbs	-1" WET WEIGHT	576.66 lbs
% MOIST	1.5 %	% MOIST	10.8 %
DRY WEIGHT	728.71 lbs	DRY WEIGHT	466.30 lbs

TOTAL SAMPLE WEIGHT 1195.01 lbs

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	34.01 lbs	-#4 WET WEIGHT	45.98 lbs
% MOIST	1.5 %	% MOIST	11.4 %
DRY WEIGHT	33.51 lbs	DRY WEIGHT	41.27 lbs

REDUCED SAMPLE WEIGHT 74.78 lbs.

% +#4 IN REDUCED SAMPLE	44.8 %
%-#4 IN REDUCED SAMPLE	55.2 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	208.90 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	728.71 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	937.61 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	855.5 g	648.9 g
DRY WEIGHT	771.8 g	582.4 g
WT. OF WATER	83.7 g	66.5 g
% MOISTURE	10.8 %	11.4 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4	937.61 lbs
TOTAL SAMPLE WEIGHT	1195.01 lbs

% +#4 (COBBLES) 78.5 %

%-#4 (FINES) 21.5 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #26

DEPTH: 8.0'-9.5'

DATE TESTED: 12-6-93

TECHNICIAN: [signature]

CHECKED BY: [signature]

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	675.65 lbs	-1" WET WEIGHT	624.43 lbs
% MOIST	1.5 %	% MOIST	6.4 %
DRY WEIGHT	665.67 lbs	DRY WEIGHT	586.87 lbs

TOTAL SAMPLE WEIGHT 1252.54 lbs

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	14.66 lbs	-#4 WET WEIGHT	42.90 lbs
% MOIST	1.5 %	% MOIST	6.0 %
DRY WEIGHT	14.44 lbs	DRY WEIGHT	40.47 lbs

REDUCED SAMPLE WEIGHT 54.91 lbs.

% +#4 IN REDUCED SAMPLE 26.3 %
%-#4 IN REDUCED SAMPLE 73.7 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE 154.35 lbs
+ DRY WT. OF +1" IN BULK SAMPLE 665.67 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE 820.02 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	551.0 g	557.1 g
DRY WEIGHT	518.1 g	525.5 g
WT. OF WATER	32.9 g	31.6 g
% MOISTURE	6.4 %	6.0 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4 820.02 lbs
TOTAL SAMPLE WEIGHT 1252.54 lbs

% +#4 (COBBLES) 65.5 %

%-#4 (FINES) 34.5 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #27

DEPTH: 9.5'-11.0'

DATE TESTED: 12-3-93

TECHNICIAN: [signature]

CHECKED BY: [signature]

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	900.36 lbs	-1" WET WEIGHT	319.62 lbs
% MOIST	1.5 %	% MOIST	11.0 %
DRY WEIGHT	887.05 lbs	DRY WEIGHT	287.95 lbs

TOTAL SAMPLE WEIGHT 1175.00 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	21.64 lbs	-#4 WET WEIGHT	37.10 lbs
% MOIST	1.5 %	% MOIST	11.0 %
DRY WEIGHT	21.32 lbs	DRY WEIGHT	33.42 lbs

REDUCED SAMPLE WEIGHT 54.74 lbs.

%+#4 IN REDUCED SAMPLE 38.9 %

%-#4 IN REDUCED SAMPLE 61.1 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

%+#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	112.01 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	887.05 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	999.06 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	705.3 g	646.8 g
DRY WEIGHT	635.5 g	582.5 g
WT. OF WATER	69.8 g	64.3 g
% MOISTURE	11.0 %	11.0 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4 999.06 lbs

TOTAL SAMPLE WEIGHT 1175.00 lbs

%+#4 (COBBLES) 85.0%

%-#4 (FINES) 15.0%

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #28

DEPTH: 0.0' - 4.5'

DATE TESTED: 12-3-93

TECHNICIAN: David M Jones

CHECKED BY: Steve Wells

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	938.47 lbs	-1" WET WEIGHT	161.34 lbs
% MOIST	1.5 %	% MOIST	21.5 %
DRY WEIGHT	924.60 lbs	DRY WEIGHT	132.79 lbs

TOTAL SAMPLE WEIGHT 1057.39 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	13.87 lbs	-#4 WET WEIGHT	48.77 lbs
% MOIST	1.5 %	% MOIST	9.5 %
DRY WEIGHT	13.67 lbs	DRY WEIGHT	44.54 lbs

REDUCED SAMPLE WEIGHT 58.21 lbs

% +#4 IN REDUCED SAMPLE 23.5 %

%-#4 IN REDUCED SAMPLE 76.5 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	31.21 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	924.60 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	955.81 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	876.5 g	515.5 g
DRY WEIGHT	721.2 g	470.7 g
WT. OF WATER	155.3 g	44.8 g
% MOISTURE	21.5 %	9.5 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4	955.81 lbs
TOTAL SAMPLE WEIGHT	1057.39 lbs

% +#4 (COBBLES) 90.4 %

%-#4 (FINES) 9.6 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #30

DEPTH: 4.5'-7.5'

DATE TESTED: 12-6-93

TECHNICIAN: [signature]

CHECKED BY: [signature]

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	874.78 lbs	-1" WET WEIGHT	502.99 lbs
% MOIST	1.5 %	% MOIST	6.6 %
DRY WEIGHT	861.85 lbs	DRY WEIGHT	471.85 lbs

TOTAL SAMPLE WEIGHT 1333.70 lbs

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	21.41 lbs	-#4 WET WEIGHT	30.74 lbs
% MOIST	1.5 %	% MOIST	4.3 %
DRY WEIGHT	21.09 lbs	DRY WEIGHT	29.47 lbs

REDUCED SAMPLE WEIGHT 50.56 lbs.

%+#4 IN REDUCED SAMPLE 41.7 %

%-#4 IN REDUCED SAMPLE 58.3 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

%+#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	196.76 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	861.85 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	1058.61 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	649.0 g	528.9 g
DRY WEIGHT	609.0 g	507.0 g
WT. OF WATER	40.0 g	21.9 g
% MOISTURE	6.6 %	4.3 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4 1058.61 lbs

TOTAL SAMPLE WEIGHT 1333.70 lbs

%+#4 (COBBLES) 79.4 %

%-#4 (FINES) 20.6 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: BACKROUND PIT (ON-SITE) #31 DATE TESTED: 12-7-93

DEPTH: 3.5 - 11.5 TECHNICIAN: [signature]

CHECKED BY: [signature]

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	786.00 lbs.	-1" WET WEIGHT	454.95 lbs
% MOIST	1.5 %	% MOIST	10.7 %
DRY WEIGHT	774.38 lbs	DRY WEIGHT	410.98 lbs

TOTAL SAMPLE WEIGHT 1185.36 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	20.31 lbs	-#4 WET WEIGHT	37.92 lbs
% MOIST	1.5 %	% MOIST	11.2 %
DRY WEIGHT	20.01 lbs	DRY WEIGHT	34.10 lbs

REDUCED SAMPLE WEIGHT 54.11 lbs.

% + #4 IN REDUCED SAMPLE 37.0 %

%-#4 IN REDUCED SAMPLE 63.0 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% + #4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	152.06 lbs
+ DRY WT. OF + 1" IN BULK SAMPLE	774.38 lbs
= TOTAL DRY WEIGHT OF + #4 IN BULK SAMPLE	926.44 lbs

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	639.4 g	515.6 g
DRY WEIGHT	577.8 g	463.8 g
WT. OF WATER	61.6 g	51.8 g
% MOISTURE	10.7 %	11.2 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF + #4 926.44 lbs

TOTAL SAMPLE WEIGHT 1185.36 lbs

% + #4 (COBBLES) 78.2 %

%-#4 (FINES) 21.8 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #32

DEPTH: 0.0' - 4.0'

DATE TESTED: 12-8-93

TECHNICIAN: David Moore

CHECKED BY: Steve Wilk

BULK SAMPLE WEIGHTS

+1" WET WEIGHT	909.88 lbs	-1" WET WEIGHT	492.38 lbs
% MOIST	1.5 %	% MOIST	3.7 %
DRY WEIGHT	896.43 lbs	DRY WEIGHT	474.81 lbs

TOTAL SAMPLE WEIGHT 1371.24 lbs

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+#4 WET WEIGHT	33.73 lbs	-#4 WET WEIGHT	42.64 lbs
% MOIST	1.5 %	% MOIST	3.1 %
DRY WEIGHT	33.23 lbs	DRY WEIGHT	41.36 lbs

REDUCED SAMPLE WEIGHT 74.59 lbs.

% +#4 IN REDUCED SAMPLE 44.6 %
%-#4 IN REDUCED SAMPLE 55.4 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% +#4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE	211.77 lbs
+ DRY WT. OF +1" IN BULK SAMPLE	896.43 lbs
= TOTAL DRY WEIGHT OF +#4 IN BULK SAMPLE	1108.20 lbs.

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	655.9 g	413.5 g
DRY WEIGHT	632.5 g	401.2 g
WT. OF WATER	23.4 g	12.3 g
% MOISTURE	3.7 %	3.1 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF +#4	1108.20 lbs
TOTAL SAMPLE WEIGHT	1371.24 lbs

% +#4 (COBBLES) 80.8 %

%-#4 (FINES) 19.2 %

CALCULATIONS FOR COBBLES TO FINES RATIO

TEST PIT: #33
DATE TESTED: 12-8-93
DEPTH: 7.0' - 9.0'
TECHNICIAN: [signature]
CHECKED BY: [signature]

BULK SAMPLE WEIGHTS

+ 1" WET WEIGHT	923.26 lbs	-1" WET WEIGHT	413.68 lbs
% MOIST	1.5 %	% MOIST	9.0 %
DRY WEIGHT	909.62 lbs	DRY WEIGHT	379.52 lbs

TOTAL SAMPLE WEIGHT 1289.14 lbs.

REDUCED SAMPLE WEIGHTS (-1" FRACTION)

+ #4 WET WEIGHT	26.16 lbs	-#4 WET WEIGHT	44.09 lbs
% MOIST	1.5 %	% MOIST	6.9 %
DRY WEIGHT	25.77 lbs	DRY WEIGHT	41.24 lbs

REDUCED SAMPLE WEIGHT 67.02 lbs.

% + #4 IN REDUCED SAMPLE 38.5 %
%-#4 IN REDUCED SAMPLE 61.5 %

CONVERSION OF REDUCED SAMPLE PERCENTAGES TO WHOLE SAMPLE WEIGHTS

% + #4 IN REDUCED SAMPLE X DRY WT. OF -1" IN BULK SAMPLE 146.12 lbs
+ DRY WT. OF + 1" IN BULK SAMPLE 909.62 lbs
= TOTAL DRY WEIGHT OF + #4 IN BULK SAMPLE 1055.74 lbs

MOISTURE CORRECTIONS

	BULK SAMPLE -1" FRACTION	REDUCED SAMPLE -#4
WET WEIGHT	535.1 g	525.2 g
DRY WEIGHT	491.1 g	491.4 g
WT. OF WATER	44.0 g	33.8 g
% MOISTURE	9.0 %	6.9 %

COBBLES TO FINES RATIO

TOTAL DRY WEIGHT OF + #4 1055.74 lbs
TOTAL SAMPLE WEIGHT 1289.14 lbs

% + #4 (COBBLES) 81.9 %

%-#4 (FINES) 18.1 %

APPENDIX E

LABORATORY RADIOLOGICAL TEST RESULTS

VENDOR LABORATORY RADIOLOGICAL
MEASUREMENTS: COMPOSITE SOIL SAMPLES >#4
MESH SIEVE

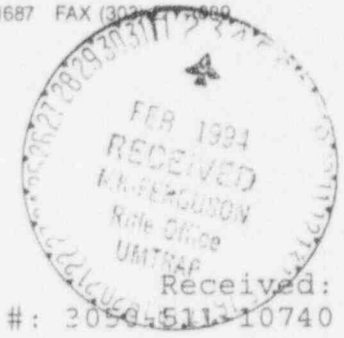
FOR INFORMATION ONLY

BARRINGER LABORATORIES INC.

15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1909

31-Jan-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650



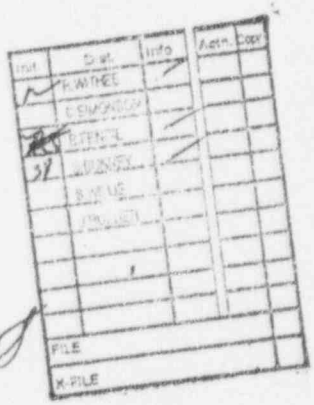
Attn:
Project: Rifle

Received: 21-Dec-93 11:38
PO #: 2050-511-10740 #338

Job: 939351E

Status: Final

ANALYTICAL REPORT PACKAGE



a copy was forwarded to Grand Junction

FOR INFORMATION ONLY

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

31-Jan-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Attn:
Project: Rifle

Received: 21-Dec-93 11:38
PO #: 3050-511-10740 #338

Job: 939351E

Status: Final

CASE NARRATIVE

A total of 23 Soil samples were received on 21-Dec-93. All were properly preserved and in good condition. As stated in the chain of custody, the samples were run for the following analyses: Ra-226 and Th-230. Our procedures are summarized on the Quality Control Data Sheet. All samples were extracted and analyzed within the proper holding times.

Quality control standards for organic and inorganic analyses followed the appropriate SW-846 or EPA methodology. For radiochemistry, the acceptance criteria for spikes and laboratory control standards is fifteen percent, plus the counting error. Duplicates will pass if the Replicate Error Ratio (RER) is 1.00 or less. The RER is defined as follows:

$$RER = \frac{ABS(R2 - R1)}{SQRT(ERROR1^2 + ERROR2^2)}$$

where: R1/R2 = original/duplicate sample result
ERROR1/ERROR2 = total 2 sigma uncertainty of R1/R2

All QC checks, including duplicates, spikes, and blanks, passed.

Signed: Steve L. Sincoff

Steven L. Sincoff, Ph.D.
Director of Operations

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

FOR INFORMATION ONLY

MK-FERGUSON (Rifle)

Analyte: Ra-226
Fraction: Total
Method: SM-705
Units: pCi/g

Project: Rifle
Date Analyzed: 01/25-01/31
LLD: 0.3

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ
939351-1	30-Nov-93	Soil	RFL-SS-2649-01-CTF	1.1±0.6
939351-2	6-Dec-93	Soil	RFL-SS-2650-02-CTF	0.7±0.5
939351-3	7-Dec-93	Soil	RFL-SS-2651-03-CTF	1.7±0.7
939351-4	7-Dec-93	Soil	RFL-SS-2652-04-CTF	0.6±0.5
939351-5	7-Dec-93	Soil	RFL-SS-2653-05-CTF	1.4±0.6
939351-6	30-Nov-93	Soil	RFL-SS-2654-06-CTF	3.3±0.9
939351-7	7-Dec-93	Soil	RFL-SS-2655-07-CTF	2.0±0.7
939351-8	7-Dec-93	Soil	RFL-SS-2656-11-CTF	0.8±0.5
939351-9	6-Dec-93	Soil	RFL-SS-2657-15-CTF	0.9±0.5
939351-10	3-Dec-93	Soil	RFL-SS-2658-19-CTF	0.8±0.5
939351-11	2-Dec-93	Soil	RFL-SS-2659-20-CTF	0.5±0.4
939351-12	2-Dec-93	Soil	RFL-SS-2660-21-CTF	1.6±0.7
939351-13	10-Dec-93	Soil	RFL-SS-2661-22-CTF	0.9±0.5
939351-14	2-Dec-93	Soil	RFL-SS-2662-24-CTF	0.9±0.5
939351-15	1-Dec-93	Soil	RFL-SS-2663-25-CTF	0.8±0.5
939351-16	6-Dec-93	Soil	RFL-SS-2664-26-CTF	0.7±0.5
939351-17	6-Dec-93	Soil	RFL-SS-2665-27-CTF	0.8±0.5
939351-18	3-Dec-93	Soil	RFL-SS-2666-28-CTF	0.8±0.5
939351-19	3-Dec-93	Soil	RFL-SS-2667-29-CTF	2.1±0.8
939351-20	6-Dec-93	Soil	RFL-SS-2668-30-CTF	1.2±0.6
939351-21	7-Dec-93	Soil	RFL-SS-2669-31-CTF	0.9±0.5
939351-22	9-Dec-93	Soil	RFL-SS-2670-32-CTF	1.8±0.7
939351-23	9-Dec-93	Soil	RFL-SS-2671-33-CTF	1.6±0.7

FOR INFORMATION ONLY

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

MK-FERGUSON (Rifle)

Analyte: Th-230
Fraction: Total
Method: USAEC
Units: pCi/g

Project: Rifle
Date Analyzed: 01/20-01/26
LLD: 0.4

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ
939351-1	30-Nov-93	Soil	RFL-SS-2649-01-CTF	1.1±0.4
939351-2	6-Dec-93	Soil	RFL-SS-2650-02-CTF	0.9±0.4
939351-3	7-Dec-93	Soil	RFL-SS-2651-03-CTF	0.5±0.3
939351-4	7-Dec-93	Soil	RFL-SS-2652-04-CTF	0.7±0.3
939351-5	7-Dec-93	Soil	RFL-SS-2653-05-CTF	0.3±0.2
939351-6	30-Nov-93	Soil	RFL-SS-2654-06-CTF	1.6±0.5
939351-7	7-Dec-93	Soil	RFL-SS-2655-07-CTF	1.7±0.5
939351-8	7-Dec-93	Soil	RFL-SS-2656-11-CTF	0.4±0.3
939351-9	6-Dec-93	Soil	RFL-SS-2657-15-CTF	0.8±0.4
939351-10	3-Dec-93	Soil	RFL-SS-2658-19-CTF	0.7±0.3
939351-11	2-Dec-93	Soil	RFL-SS-2659-20-CTF	0.8±0.4
939351-12	2-Dec-93	Soil	RFL-SS-2660-21-CTF	1.2±0.4
939351-13	10-Dec-93	Soil	RFL-SS-2661-22-CTF	0.9±0.4
939351-14	2-Dec-93	Soil	RFL-SS-2662-24-CTF	0.7±0.4
939351-15	1-Dec-93	Soil	RFL-SS-2663-25-CTF	1.3±0.5
939351-16	6-Dec-93	Soil	RFL-SS-2664-26-CTF	0.5±0.3
939351-17	6-Dec-93	Soil	RFL-SS-2665-27-CTF	0.8±0.4
939351-18	3-Dec-93	Soil	RFL-SS-2666-28-CTF	0.5±0.3
939351-19	3-Dec-93	Soil	RFL-SS-2667-29-CTF	2.3±0.6
939351-20	6-Dec-93	Soil	RFL-SS-2668-30-CTF	0.6±0.4
939351-21	7-Dec-93	Soil	RFL-SS-2669-31-CTF	0.7±0.4
939351-22	9-Dec-93	Soil	RFL-SS-2670-32-CTF	1.1±0.4
939351-23	9-Dec-93	Soil	RFL-SS-2671-33-CTF	0.5±0.3

FOR INFORMATION ONLY

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

31-Jan-94
Page: Q-1
Copy: 1 of 3
Status: Final

MK-FERGUSON (Rifle)

QUALITY CONTROL REPORT

Sample Id	Ra-226 Total pCi/g	± 2σ	Th-230 Total pCi/g	± 2σ
Duplicate	3.8	±1.0	0.7	±0.4
Duplicate	4.2	±1.0	0.4	±0.3
RER	0.18		0.46	
Std (found value)	80	±6	101	±7
Std (true value)	99		97	
Std % rec.	81		104	
Blank	0.0	±0.1	0.0	±0.1
Spike % rec.	96		77	

FOR INFORMATION ONLY

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

31-Jan-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Attn:
Project: Rifle

Received: 21-Dec-93 11:38
PO #: 3050-511-10740 #338

Job: 939351E Status: Final

Abbreviations:

Parameters:

Ra-226	: Radium-226
Th-230	: Thorium-230

Units:

pCi/g	: picoCuries per gram

FOR INFORMATION ONLY

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

31-Jan-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Page: Q-3
Copy: 1 of 3

Attn:
Project: Rifle

Received: 21-Dec-93 11:38
PO #: 3050-511-10740 #338

Job: 939351E

Status: Final

QUALITY CONTROL DATA SHEET

Received by: rc Via: Client

Sample Container Type: 5gal bucket
Additional Lab Preparation: None

Parameter	Method	Preservative	Analyst	Analysis Dates
Ra-226	SM-705	None	Lowrey	01/25-01/31
Th-230	USAEC	None	Kyle	01/20-01/26

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

FOR INFORMATION ONLY

31-Jan-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Page: Q-4
Copy: 1 of 3

Attn:
Project: Rifle

Received: 21-Dec-93 11:38
PO #: 3050-511-10740 #338

Job: 939351E

Status: Final

Signed: .....
Radiochemistry Manager

Barringer Laboratories, Inc. will return or dispose of your samples 30 days from the date your final report is mailed, unless otherwise specified by contract. Barringer Laboratories, Inc. reserves the right to return samples prior to the 30 days if radioactive levels exceed our license.

cc: Helene Langlois, MK-FERGUSON (Rifle)

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

FOR INFORMATION ONLY 9351

LABORATORY SERVICES AUTHORIZATION FORM

Robert Fencil
Requisitioner

12/20/93
Date

24 am 12/17/93
1/21/94
Need Date

Urgent

Priority

X
Standard

Rifle, CO
Location

3050-511-10740
P.O. Number

338
Request No.

ATTENTION LABORATORY:
All reports and invoices mus
Reference PO and Request Nos

Type of Sample: ____ Water X Soil ____ Environmental Air Sample
____ Occupational Air Sample ____ Vegetation

Type of Analysis: X Ra-226 X Th-230 ____ Nat U. ____ Gross Alp
____ Gross Beta ____ Solubility
____ Other (Specify under special instructions)

Special Instructions/Comments: ____

I.D. NO	DATE COLLECTED	VOLUME	DESCRIPTION
RFL-SS-2649-01-CTF	11/30/93	~63 lbs	Test Pit #1 Cobbles
RFL-SS-2650-02-CTF	12/6/93		Test Pit #2 Cobbles
RFL-SS-2651-03-CTF	12/7/93		Test Pit #3 Cobbles
RFL-SS-2652-04-CTF	12/7/93		Test Pit #4 Cobbles
RFL-SS-2653-05-CTF	12/7/93		Test Pit #5 Cobbles
RFL-SS-2654-06-CTF	11/30/93		Test Pit #6 Cobbles
RFL-SS-2655-07-CTF	12/7/93		Test Pit #7 Cobbles
RFL-SS-2656-11-CTF	12/7/93		Test Pit #11 Cobbles
RFL-SS-2657-15-CTF	12/6/93		Test Pit #15 Cobbles
RFL-SS-2658-19-CTF	12/3/93		Test Pit #19 Cobbles

CHAIN-OF-CUSTODY

Relinquished by (Site Representative Signature): James Stadelman	Date/Time 12-21-93 0700
Carrier: Daniel Franck	Date/Time 12-21-93 0700
Received at Lab by (Lab Representative Signature):* Daniel Franck	Date/Time 12-21-93 1138

*Barringer Chain-of-Custody as per contract will be attached

MK-F/CWMFES USE ONLY:

MK-F Site Manager

Health Physics Site Manager

Technical Review: ____ Date: ____

Ship to: Approved Vendor
For Radioanalytical Services

Copy to: HPP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

FOR INFORMATION ONLY 9551

LABORATORY SERVICES AUTHORIZATION FORM
(CONTINUATION PAGE)

3050-511-10740/ 33
P.O. Number/Request Numb

I.D. NO	DATE COLLECTED	VOLUME	DESCRIPTION
RFL-SS-2659-20-CTF	12/2/93	~68 lbs	Test Pit #20 Cobble
RFL-SS-2660-21-CTF	12/2/93		Test Pit #21 Cobble
RFL-SS-2661-22-CTF	12/10/93		Test Pit #22 Cobbles
RFL-SS-2662-24-CTF	12/2/93		Test Pit #24 Cobble
RFL-SS-2663-25-CTF	12/1/93		Test Pit #25 Cobble
RFL-SS-2664-26-CTF	12/6/93		Test Pit #26 Cobbles
RFL-SS-2665-27-CTF	12/6/93		Test Pit #27 Cobble
RFL-SS-2666-28-CTF	12/3/93		Test Pit #28 Cobble
RFL-SS-2667-29-CTF	12/3/93		Test Pit #29 Cobbles
RFL-SS-2668-30-CTF	12/6/93		Test Pit #30 Cobble
RFL-SS-2669-31-CTF	12/7/93		Test Pit #31 Cobble
RFL-SS-2670-32-CTF	12/9/93		Test Pit #32 Cobble
RFL-SS-2671-33-CTF	12/9/93		Test Pit #33 Cobble

ENGINEERS
AND
CONSTRUCTORS

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

HEADQUARTERS OFFICE
ONE ERIEVIEW PLAZA
CLEVELAND, OHIO, U.S.A. 44114
PHONE (216) 523-5600 TELEX 985542

FOR INFORMATION ONLY

*Rich C — please file in folder
Thanks
Jim

REPLY TO: MK-FERGUSON COMPANY
REMEDIAL ACTIONS
CONTRACTOR/MTRA PROJECT
P.O. BOX 9130
ALBUQUERQUE, NEW MEXICO U.S.A. 87119

January 5, 1994

Barringer Laboratories
15000 West 6th Avenue, Suite 300
Golden, Colorado 80401
Attn: June Brennan

Subject: Job No. 9351 - Rifle Site

Dear Ms. Brennan:

As per discussions today with Jim Turner, Barringer Laboratories is authorized to subcontract sample preparation work for samples containing large stone and cobbles for the subject Job Number.

Please contact Jim Turner at (505) 845-5868, if you have any questions.

Sincerely,

MK-Ferguson Company

D.L. Blasdel

Don L. Blasdel
Procurement Manager

DLB/JBT/jmg

Fax 94-35
Date 1-5-94 4:19 p.m.
Delivered to June

Received by Vera
BARRINGER LABORATORIES, INC.

*Subbed to SKYLINE for prep' - Girdon

BARRINGER LABORATORIES, INC.

Chain-of-Custody Record

15000 West 6th Ave. Suite #300, Golden, Colorado 80401
(303) 277-1687 Toll Free 1-800-654-0506 FAX (303) 277-1689

Client: Barringer Labs   Contact: June Brennan
Address: 15000 W 6th Ave Suite 300
Golden CO 80401
Phone (303) 277-1687   Fax ( )
Project ID / Description
P.O. Number

☐ STANDARD TAT   ☒ RUSH TAT (specify TAT): 3 day

ANALYSES REQUIRED

Indicate Parameters / Methods / Volumes / Preservatives

Vol
Pres

FOR INFORMATION ONLY

BLI ID #	Date Collected	Time Collected	Client Sample Identification	Matrix	No. of Bottles	Filtered	Unfiltered	Dry, crush, pulverize to 120-150 mesh
			9351-1, 2, 3, 4, 5, 6	rock	23			
			-7, 8, 9, 10, 11, 12	↓				
			-13, 14, 15, 16, 17					
			-18, 19, 20, 21, 22, 23					

FOR BLI USE ONLY

BLI #

SAMPLES WERE: (circle)
1. Shipped / Hand delivered
2. Ambient / Chilled
3. In good condition Y N
4. Properly preserved Y N
5. Within holding times Y N

COC TAPE WAS: (circle)
1. Present on outer pkg. Y N
2. Unbroken on outer pkg Y N
3. Present on sample Y N
4. Unbroken on sample Y N
5. Sample labels/COC record in agreement? Y N

IF the answer to any of the above qu[estions] is NO, please see attached Call Report

Comments

Comments / Special Instructions

* please call JUNE Brennan when Ready *

* (this is Logged)

Relinquished by	Date/Time	Received by	Date/Time
[illegible]	1-6-94	[illegible signature]	1-6-94 0900
[signature]	1-11-94 15:13	[signature]	1-11-94 1513

BARRINGER LABORATORIES, INC.

Internal Chain-of-Custody Record

00351

DEC93 PM LabData11 CUSTODY

BLI Job #93 9351 Rec'd Date 12-21-93

(circle one) Disposal / Return / Empty Date

Sign-off Date

BULK DRY

Sample Type Soil

Comments

Sample #'s 23

Location Buckets on Floor

Date	Time Out	Time In	Samp #'s	Initials

BULK COLD

Sample Type

Comments

FOR INFORMATION ONLY

Sample #'s

Location

Date	Time Out	Time In	Samp #'s	Initials

PREPPED DRY

Type SOIL Analyst

Start 12/21/93 Complete 1/11/94

Comments Prepped by Skyline rec'd 1/11/94

Sample #'s 1-23

Location Soil Prep Shelf

Date	Time Out	Time In	Samp #'s	Initials
1/20	0920	1230	1-23	DM
1/24/94	0910	1000	1, 2	BB
1/25/94	0207	0333	3-23	BB

PREPPED COLD

Type Analyst

Start Complete

Comments

Sample #'s

Location

Date	Time Out	Time In	Samp #'s	Initials

VENDOR LABORATORY RADIOLOGICAL
MEASUREMENTS: COMPOSITE SOIL SAMPLES <#4
MESH SIEVE

FOR INFORMATION ONLY

Rec'd. 3/14/94

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

9-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

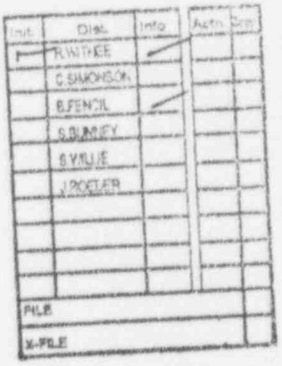
Attn:
Project: Rifle

Received: 28-Feb-94 09:20
PO #: 3050-511-10740 #356

Job: 941417E

Status: Final

ANALYTICAL REPORT PACKAGE



FOR INFORMATION ONLY

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

9-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Attn:
Project: Rifle

Received: 28-Feb-94 09:20
PO #: 3050-511-10740 #356

Job: 941417E

Status: Final

CASE NARRATIVE

A total of 22 Soil samples were received on 28-Feb-94. All were properly preserved and in good condition. As stated in the chain of custody, the samples were run for the following analyses: Ra-226 and Th-230. Our procedures are summarized on the Quality Control Data Sheet. All samples were extracted and analyzed within the proper holding times.

Quality control standards for organic and inorganic analyses followed the appropriate SW-846 or EPA methodology. For radiochemistry, the acceptance criteria for spikes and laboratory control standards is fifteen percent, plus the counting error. Duplicates will pass if the Replicate Error Ratio (RER) is 1.00 or less. The RER is defined as follows:

$$RER = \frac{ABS(R2 - R1)}{SQRT(ERROR1^2 + ERROR2^2)}$$

where: R1/R2 = original/duplicate sample result
ERROR1/ERROR2 = total 2 sigma uncertainty of R1/R2

All QC checks, including duplicates, spikes, and blanks, passed.

Signed: Steven L. Sincoff

Steven L. Sincoff, Ph.D.
Director of Operations

FOR INFORMATION ONLY

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

MK-FERGUSON (Rifle)

Analyte: Ra-226
Fraction: Total
Method: SM-705
Units: pCi/g

Project: Rifle
Date Analyzed: 03/04-03/08
LLD: 0.3

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ
941417-1	6-Dec-93	Soil	RFL-SS-2596-TP-1-CTF	4.6±1.1
941417-2	6-Dec-93	Soil	RFL-SS-2598-TP-2-CTF	1.7±0.7
941417-3	7-Dec-93	Soil	RFL-SS-2600-TP-3-CTF	1.9±0.7
941417-4	7-Dec-93	Soil	RFL-SS-2602-TP-4-CTF	7.4±1.4
941417-5	7-Dec-93	Soil	RFL-SS-2604-TP-5-CTF	2.5±0.8
941417-6	7-Dec-93	Soil	RFL-SS-2606-TP-7-CTF	220±10
941417-7	7-Dec-93	Soil	RFL-SS-2608-TP-11-CTF	4.2±1.1
941417-8	6-Dec-93	Soil	RFL-SS-2610-TP-15-CTF	6.3±1.4
941417-9	2-Dec-93	Soil	RFL-SS-2612-TP-19-CTF	6.5±1.3
941417-10	2-Dec-93	Soil	RFL-SS-2614-TP-20-CTF	8.6±1.5
941417-11	6-Dec-93	Soil	RFL-SS-2616-TP-21-CTF	32±3
941417-12	6-Dec-93	Soil	RFL-SS-2618-TP-22-CTF	2.4±0.8
941417-13	1-Dec-93	Soil	RFL-SS-2620-TP-24-CTF	2.6±0.8
941417-14	1-Dec-93	Soil	RFL-SS-2622-TP-25-CTF	5.4±1.2
941417-15	6-Dec-93	Soil	RFL-SS-2624-TP-26-CTF	1.9±0.7
941417-16	3-Dec-93	Soil	RFL-SS-2626-TP-27-CTF	3.2±0.9
941417-17	9-Dec-93	Soil	RFL-SS-2628-TP-28-CTF	4.2±1.0
941417-18	6-Dec-93	Soil	RFL-SS-2630-TP-29-CTF	110±10
941417-19	6-Dec-93	Soil	RFL-SS-2632-TP-30-CTF	3.0±0.9
941417-20	9-Dec-93	Soil	RFL-SS-2634-TP-32-CTF	1.7±0.7
941417-21	9-Dec-93	Soil	RFL-SS-2636-TP-33-CTF	1.6±0.7
941417-22	7-Dec-93	Soil	RFL-SS-2638-TP-BKG-CTF	1.8±0.8

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

FOR INFORMATION ONLY

MK-FERGUSON (Rifle)

Analyte: Th-230
Fraction: Total
Method: USAEC
Units: pCi/g

Project: Rifle
Date Analyzed: 03/03-03/08
LLD: 0.4

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ
941417-1	6-Dec-93	Soil	RFL-SS-2596-TP-1-CTF	3.1±0.7
941417-2	6-Dec-93	Soil	RFL-SS-2598-TP-2-CTF	2.3±0.6
941417-3	7-Dec-93	Soil	RFL-SS-2600-TP-3-CTF	5.7±1.0
941417-4	7-Dec-93	Soil	RFL-SS-2602-TP-4-CTF	6.6±1.0
941417-5	7-Dec-93	Soil	RFL-SS-2604-TP-5-CTF	2.3±0.6
941417-6	7-Dec-93	Soil	RFL-SS-2606-TP-7-CTF	120±4
941417-7	7-Dec-93	Soil	RFL-SS-2608-TP-11-CTF	8.9±1.2
941417-8	6-Dec-93	Soil	RFL-SS-2610-TP-15-CTF	13±1
941417-9	2-Dec-93	Soil	RFL-SS-2612-TP-19-CTF	16±2
941417-10	2-Dec-93	Soil	RFL-SS-2614-TP-20-CTF	17±2
941417-11	6-Dec-93	Soil	RFL-SS-2616-TP-21-CTF	55±3
941417-12	6-Dec-93	Soil	RFL-SS-2618-TP-22-CTF	2.5±0.6
941417-13	1-Dec-93	Soil	RFL-SS-2620-TP-24-CTF	3.6±0.8
941417-14	1-Dec-93	Soil	RFL-SS-2622-TP-25-CTF	4.1±0.8
941417-15	6-Dec-93	Soil	RFL-SS-2624-TP-26-CTF	1.4±0.5
941417-16	3-Dec-93	Soil	RFL-SS-2626-TP-27-CTF	1.4±0.5
941417-17	9-Dec-93	Soil	RFL-SS-2628-TP-28-CTF	11±1
941417-18	6-Dec-93	Soil	RFL-SS-2630-TP-29-CTF	230±10
941417-19	6-Dec-93	Soil	RFL-SS-2632-TP-30-CTF	6.9±1.0
941417-20	9-Dec-93	Soil	RFL-SS-2634-TP-32-CTF	0.9±0.4
941417-21	9-Dec-93	Soil	RFL-SS-2636-TP-33-CTF	1.3±0.5
941417-22	7-Dec-93	Soil	RFL-SS-2638-TP-BKG-CTF	2.2±0.6

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

FOR INFORMATION ONLY

MK-FERGUSON (Rifle)

QUALITY CONTROL REPORT

Sample Id	Ra-226 Total pCi/g	± 2σ	Th-230 Total pCi/g	± 2σ
Duplicate	0.0	±0.2	16	±2
Duplicate	0.3	±0.4	16	±2
RER	0.58		0.00	
Std (found value)	91	±6	311	±12
Std (true value)	99		305	
Std % rec.	91		102	
Blank	0.0	±0.1	0.2	±0.2
Spike % rec.	92		94	

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

FOR INFORMATION ONLY

9-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Page: Q-2
Copy: 1 of 3

Attn:
Project: Rifle

Received: 28-Feb-94 09:20
PO #: 3050-511-10740 #356

Job: 941417E

Status: Final

Abbreviations:

Parameters:

Ra-226	: Radium-226
Th-230	: Thorium-230

Units:

pCi/g	: picoCuries per gram

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

FOR INFORMATION ONLY

9-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Attn:
Project: Rifle

Received: 28-Feb-94 09:20
PO #: 3050-511-10740 #356

Job: 941417E

Status: Final

QUALITY CONTROL DATA SHEET

Received by: rc Via: UPS

Sample Container Type: 500g can
Additional Lab Preparation: 100 mesh

Parameter	Method	Preservative	Analyst	Analysis Dates
Ra-226	SM-705	None	Lowrey	03/04-03/08
Th-230	USAEC	None	Melcher	03/03-03/08

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

FOR INFORMATION ONLY

9-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Page: Q-4
Copy: 1 of 3

Attn:
Project: Rifle

Received: 28-Feb-94 09:20
PO #: 3050-511-10740 #356

Job: 941417E

Status: Final

Signed: .....
Radiochemistry Manager

Barringer Laboratories, Inc. will return or dispose of your samples 30 days from the date your final report is mailed, unless otherwise specified by contract. Barringer Laboratories, Inc. reserves the right to return samples prior to the 30 days if radioactive levels exceed our license.

cc: Helene Langlois, MK-FERGUSON (Rifle)

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

941417

LABORATORY SERVICES AUTHORIZATION FORM

Robert Fencil — Requisitioner
2/25/94 — Date

3/14/94 — Need Date
FOR INFORMATION ONLY
✓ Priority
Urgent
Standard

Rifle, CO — Location
3050-511-10740 — P.O. Number
356 — Request No.

ATTENTION LABORATORY: All reports and invoices must Reference PO and Request Nos.

Type of Sample: ___ Water ✓ Soil ___ Environmental Air Sample ___ Occupational Air Sample ___ Vegetation

Type of Analysis: ✓ Ra-226 ✓ Th-230 ___ Nat U. ___ Gross Alpha ___ Gross Beta ___ Solubility ___ Other (Specify under special instructions)

Special Instructions/Comments: Final, composite

I.D. NO	DATE COLLECTED	VOLUME	DESCRIPTION
FL-SS-2596-TP-1-CTF	12/6/93	453g	TP-1 15-17'
FL-SS-2598-TP-2-CTF	12/6/93	473g	TP-2 13-16'
FL-SS-2600-TP-3-CTF	12/7/93	450g	TP-3 18-21'
FL-SS-2602-TP-4-CTF	12/7/93	453g	TP-4 11-16'
FL-SS-2604-TP-5-CTF	12/7/93	452g	TP-5 16-21'
FL-SS-2606-TP-7-CTF	12/7/93	432g	TP-7 11-21' 340/904
FL-SS-2608-TP-11-CTF	12/7/93	423g	TP-11 6-10'
FL-SS-2610-TP-15-CTF	12/6/93	460g	TP-15 10-13'
FL-SS-2612-TP-19-CTF	12/2/93	450g	TP-19 3.5-5.5'
FL-SS-2614-TP-20-CTF	12/2/93	520g	TP-20 1-5'

CHAIN-OF-CUSTODY

Relinquished by (Site Representative Signature): Bobbie V. Hickey
Date/Time: 2/25/94 @ 1047

Carrier: UPS Pickup Record # 272 076 087
Date/Time:

Received at Lab by (Lab Representative Signature):* R. Cantrell
Date/Time: 02/28/94 0920

*Barringer Chain-of-Custody as per contract will be attached

MK-F/CWMFES USE ONLY:

Scott B — MK-F Site Manager
Robert Fencil — Health Physics Site Manager

Technical Review: ___ Date: ___

Ship to: Approved Vendor For Radioanalytical Services

Copy to: HPP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

941417

LABORATORY SERVICES AUTHORIZATION FORM
(CONTINUATION PAGE)

FOR INFORMATION ONLY

3050-511-10740
P.O. Number/Request Num

I.D. NO	DATE COLLECTED	VOLUME	DESCRIPTION
FEL-SS-2616-TP-21-CTF	12/6/93	502 g	TP-21 1-5'
FEL-SS-2618-TP-22-CTF	12/6/93	634 g	TP-22 4-7'
FEL-SS-2620-TP-24-CTF	12/1/93	509 g	TP-24 2.5-5'
FEL-SS-2622-TP-25-CTF	12/1/93	487 g	TP-25 6.5-8.5'
FEL-SS-2624-TP-26-CTF	12/6/93	508 g	TP-26 8-9.5'
FEL-SS-2626-TP27-CTF	12/3/93	520 g	TP-27 9.5-11'
FEL-SS-2628-TP-28-CTF	12/9/93	510 g	TP-28 0-15'
FEL-SS-2630-TP-29-CTF	12/6/93	458 g	TP-29 0-3' 350/65
FEL-SS-2632-TP-30-CTF	12/6/93	518 g	TP-30 4.5-7.5'
FEL-SS-2634-TP-32-CTF	12/9/93	469 g	TP-32 0-4'
FEL-SS-2636-TP-33-CTF	12/9/93	454 g	TP-33 0-4'
FEL-SS-2638-TP-BKg-CTF	12/7/93	471 g	TP-BKg 7-12'

BARRINGER LABORATORIES, INC.

Internal Chain-of-Custody Record 00417

DEC93 PM LabData11:CUSTODY

BLI Job #94 1417 | Rec'd by [illegible] | Rec'd date 3-28-94

How Disposed (circle one) Return / Waste / Sewer

Sign-off Date

BULK DRY

Sample Type Soils

Comments

Sample #'s 22

Location Safe

Date	Samp #'s	Time Out	Initials	Time In	Initials
3/1/94	6	0750	BS	0920	BS
3/1/94	1-22	3:30	DW	4:30	DW

BULK COLD

Sample Type

Comments

Sample #'s

Location

Date	Samp #'s	Time Out	Initials	Time In	Initials

PREPPED DRY

Type Soil Analyst DW

Start 3/1/94 Complete 3/3/94

Comments

Sample #'s 1-22

Location Soil Prep Shelf Y6

Date	Samp #'s	Time Out	Initials	Time In	Initials
3/3	2310 1-22		DM	2350	DM
3/4	1-15	0312	[illegible]	0345	[illegible]
3/7	16 22	0028	[illegible]	0057	[illegible]

PREPPED COLD

Type Analyst

Start Complete

Comments

Sample #'s

Location

Date	Samp #'s	Time Out	Initials	Time In	Initials

VENDOR LABORATORY TH-230 MEASUREMENTS OF
1-FT DEPTH INCREMENT SOIL SAMPLES <#4 MESH

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

1-Feb-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

FOR INFORMATION ONLY

Attn:
Project: Rifle

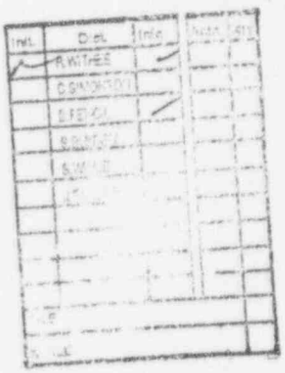
Received: 30-Dec-93 09:30
PO #: 3050-511-10740 #341

Job: 939420E

Status: Final

ANALYTICAL REPORT PACKAGE

OK
RS



BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

1-Feb-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

FOR INFORMATION ONLY

Attn:
Project: Rifle

Received: 30-Dec-93 09:30
PO #: 3050-511-10740 #341

Job: 939420E

Status: Final

CASE NARRATIVE

A total of 30 Soil samples were received on 30-Dec-93. All were properly preserved and in good condition. As stated in the chain of custody, the samples were run for the following analysis: Th-230. Our procedures are summarized on the Quality Control Data Sheet. All samples were extracted and analyzed within the proper holding times.

Quality control standards for organic and inorganic analyses followed the appropriate SW-846 or EPA methodology. For radiochemistry, the acceptance criteria for spikes and laboratory control standards is fifteen percent, plus the counting error. Duplicates will pass if the Replicate Error Ratio (RER) is 1.00 or less. The RER is defined as follows:

$$RER = \frac{ABS(R2 - R1)}{SQRT(ERROR1^2 + ERROR2^2)}$$

where: R1/R2 = original/duplicate sample result
ERROR1/ERROR2 = total 2 sigma uncertainty of R1/R2

All QC checks, including duplicates, spikes, and blanks, passed.

Signed: .....
Steven L. Sincoff, Ph.D
Director of Operations

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

MK-FERGUSON (Rifle)

FOR INFORMATION ONLY

Analyte: Th-230
Fraction: Total
Method: USAEC
Units: pCi/g

Project: Rifle
Date Analyzed: 01/28-01/02
LLD: 0.4

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ
939420-1	1-Dec-93	Soil	RFL-SS-2360	16±2
939420-2	1-Dec-93	Soil	RFL-SS-2354	2.7±0.7
939420-3	1-Dec-93	Soil	RFL-SS-2312	1.2±0.5
939420-4	1-Dec-93	Soil	RFL-SS-2392	1.9±0.6
939420-5	1-Dec-93	Soil	RFL-SS-2419	32±2
939420-6	1-Dec-93	Soil	RFL-SS-2402	40±2
939420-7	1-Dec-93	Soil	RFL-SS-2331	15±2
939420-8	1-Dec-93	Soil	RFL-SS-2345	7.3±1.1
939420-9	1-Dec-93	Soil	RFL-SS-2388	1.9±0.6
939420-10	3-Dec-93	Soil	RFL-SS-2464	9.3±1.2
939420-11	2-Dec-93	Soil	RFL-SS-2452	12±1
939420-12	2-Dec-93	Soil	RFL-SS-2460	8.8±1.2
939420-13	2-Dec-93	Soil	RFL-SS-2437	1.2±0.5
939420-14	2-Dec-93	Soil	RFL-SS-2494	1.0±0.4
939420-15	30-Nov-93	Soil	RFL-SS-2268	32±2
939420-16	30-Nov-93	Soil	RFL-SS-2247	3.8±0.8
939420-17	30-Nov-93	Soil	RFL-SS-2258	0.9±0.4
939420-18	30-Nov-93	Soil	RFL-SS-2244	10±1
939420-19	30-Nov-93	Soil	RFL-SS-2255	4.5±0.9
939420-20	2-Dec-93	Soil	RFL-SS-2520	4.1±0.8
939420-21	1-Dec-93	Soil	RFL-SS-2435	19±2
939420-22	1-Dec-93	Soil	RFL-SS-2361	5.7±0.9
939420-23	2-Dec-93	Soil	RFL-SS-2542	1.8±0.5
939420-24	2-Dec-93	Soil	RFL-SS-2440	7.7±1.1
939420-25	2-Dec-93	Soil	RFL-SS-2544	4.2±0.8
939420-26	30-Nov-93	Soil	RFL-SS-2310	1.6±0.5
939420-27	30-Nov-93	Soil	RFL-SS-2296	1.2±0.5
939420-28	1-Dec-93	Soil	RFL-SS-2325	8.1±1.1
939420-29	1-Dec-93	Soil	RFL-SS-2369	12±1
939420-30	1-Dec-93	Soil	RFL-SS-2318	5.2±0.9

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

MK-FERGUSON (Rifle)

QUALITY CONTROL REPORT

Sample Id	Th-230 Total pCi/g	± 2σ
Duplicate	5.2	±0.9
Duplicate	4.6	±0.9
RER	0.24	
Std (found value)	292	±12
Std (true value)	305	
Std % rec.	96	
Blank	0.1	±0.2
Spike % rec.	101	

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

1-Feb-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

FOR INFORMATION ONLY

Attn:
Project: Rifle

Received: 30-Dec-93 09:30
PO #: 3050-511-10740 #341

Job: 939420E

Status: Final

Abbreviations:

Parameters:

Th-230	: Thorium-230

Units:

pCi/g	: picoCuries per gram

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

1-Feb-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

FOR INFORMATION ONLY

Attn:
Project: Rifle

Received: 30-Dec-93 09:30
PO #: 3050-511-10740 #341

Job: 939420E

Status: Final

QUALITY CONTROL REPORT

QUALITY CONTROL DATA SHEET

Received by: rc Via: UPS

Sample Container Type: 500g can
Additional Lab Preparation: 100 mesh

Parameter	Method	Preservative	Analyst	Analysis Dates
Th-230	USAEC	None	Ortiz	01/28-02/01

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM F[illegible]ral Environmental Services, Inc.

9420

LABORATORY SERVICES AUTHORIZATION FORM

Page 1 of 2

Robert Fencil
Requisitioner

12/29/93
Date

4 pm 12/29/93

2/1/93
Need Date

Urgent

Priority

X
Standard

Rifle, CO
Location

3050-511-10740
P.O. Number

341
Request No.

ATTENTION LABORATORY:
All reports and invoices m
Reference PO and Request Nos

FOR INFORMATION ONLY

Type of Sample: ____ Water X Soil ____ Environmental Air Sample
____ Occupational Air Sample ____ Vegetation

Type of Analysis: ____ Ra-226 X Th-230 ____ Nat U. ____ Gross Al
____ Gross Beta ____ Solubility
____ Other (Specify under special instructions)

Special Instructions/Comments:

I.D. NO	DATE COLLECTED	VOLUME	DESCRIPTION
RFL-SS-2360	12-1-93	696 gms	TP # 20 DUP
RFL-SS-2354	12-1-93	567 gms	TP # 20 DUP
L-SS-2312	12-1-93	419 gms	TP # 25
RFL-SS-2392	12-1-93	664 gms	TP # 24
RFL-SS-2419	12-1-93	510 gms	TP # 30
RFL-SS-2402	12-1-93	607 gms	TP # 28
RFL-SS-2331	12-1-93	592 gms	TP # 26
RFL-SS-2345	12-1-93	669 gms	TP # 27
RFL-SS-2388	12-1-93	632 gms	TP # 22
RFL-SS-2464	12-3-93	636 gms	TP # 4A DUP

CHAIN-OF-CUSTODY

Relinquished by (Site Representative Signature): Bonnie S. McCord
Date/Time: 12/29/93 1000

Carrier: UPS Pickup Record # 2P2076058
Date/Time:

Received at Lab by (Lab Representative Signature):* R.C. Barringer
Date/Time: 12/30/93 0530

*Barringer Chain-of-Custody as per contract will be attached

MK-F/CWMFES USE ONLY:

MK-F Site Manager

Robert K. Fencil
Health Physics Site Manager

Technical Review:

Date:

Ship to: Approved Vendor
For Radioanalytical Services

Copy to: HPP Manager

F2-RP-006-4 ICN-01

MK-PERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

9420

LABORATORY SERVICES AUTHORIZATION FORM
(CONTINUATION PAGE)

FOR INFORMATION ONLY

3050-511-10740/ 341
P.O. Number/Request Numb

	I.D. NO	DATE COLLECTED	VOLUME	DESCRIPTION
	RFL-SS-2452	12-2-93	513 gm	TP # 15
	RFL-SS-2460	12-2-93	675 gm	TP # 15
	RFL-SS-2437	12-2-93	468 gm	TP # 11
	RFL-SS-2494	12-2-93	378 gm	TP # 2
	RFL-SS-2268 490/160	11-30-93	487 gm	TP # 4
	RFL-SS-2247	11-30-93	460 gm	TP # 1
	RFL-SS-2258	11-30-93	653 gm	TP # 1
	RFL-SS-2241	11-30-93	472 gm	TP # 1
	RFL-SS-2255	11-30-93	550 gm	TP # 1
20	RFL-SS-2520	12-2-93	401 gm	TP # 3
	RFL-SS-2435	12-1-93	581 gm	TP # 19
	RFL-SS-2361	12-1-93	525 gm	TP # 21
	RFL-SS-2542	12-2-93	449 gm	TP # 7
	RFL-SS-2440	12-2-93	644 gm	TP # 11
	RFL-SS-2544	12-2-93	617 gm	TP # 7
	RFL-SS-2310	11-30-93	517 gm	TP # 6
	RFL-SS-2296	11-30-93	612 gm	TP # 5
	RFL-SS-2325	12-1-93	487 gm	TP # 26
	RFL-SS-2369	12-1-93	600 gm	TP # 21
	RFL-SS-2318	12-1-93	502 gm	TP # 25
			N A	

BLI Job #93 9420 Rec'd Date 12-30-93

(circle one) Disposal / Return / Empty Date

Sign-off Date

Internal Chain-of-Custody Record 0420

DEC93.PM:LabData11:CUSTODY

BULK DRY

Sample Type Soil

Comments

Sample #'s 30

Location Safe

Date	Time Out	Time In	Samp #'s	Initials
12/29/93	1530	1600	15	BS
1/4/94	0353	3.50	1-30	DAT

BULK COLD

Sample Type

Comments FOR INFORMATION ONLY

Sample #'s

Location

Date	Time Out	Time In	Samp #'s	Initials

PREPPED DRY

Type Soil Analyst DAT

Start 1/14/94 Complete 1/21/94

Comments

Sample #'s 1-30

Location Soil prep shelf

Date	Time Out	Time In	Samp #'s	Initials
1-28-94	0219	0445	1-30	JO

PREPPED COLD

Type Analyst

Start Complete

Comments

Sample #'s

Location

Date	Time Out	Time In	Samp #'s	Initials

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

9-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Attn:
Project: Rifle

Received: 15-Feb-94 09:30
PO #: 3050-511-10740 #353

Job: 941337E

Status: Final

ANALYTICAL REPORT PACKAGE

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

9-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Attn:
Project: Rifle

Received: 15-Feb-94 09:30
PO #: 3050-511-10740 #353

Job: 941337E

Status: Final

CASE NARRATIVE

A total of 5 Soil samples were received on 15-Feb-94. All were properly preserved and in good condition. As stated in the chain of custody, the samples were run for the following analysis: Th-230. Our procedures are summarized on the Quality Control Data Sheet. All samples were extracted and analyzed within the proper holding times.

Quality control standards for organic and inorganic analyses followed the appropriate SW-846 or EPA methodology. For radiochemistry, the acceptance criteria for spikes and laboratory control standards is fifteen percent, plus the counting error. Duplicates will pass if the Replicate Error Ratio (RER) is 1.00 or less. The RER is defined as follows:

$$RER = \frac{ABS(R2 - R1)}{SQRT(ERROR1^2 + ERROR2^2)}$$

where: R1/R2 = original/duplicate sample result
ERROR1/ERROR2 = total 2 sigma uncertainty of R1/R2

All QC checks, including duplicates, spikes, and blanks, passed.

Signed: Steven L. Sincoff

Steven L. Sincoff, Ph.D.
Director of Operations

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

MK-FERGUSON (Rifle)

Analyte: Th-230
Fraction: Total
Method: USAEC
Units: pCi/g

Project: Rifle
Date Analyzed: 03/07-03/09
LLD: 0.4

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ
941337-1	1-Dec-93	Soil	RFL-SS-2405-TP28-CTF	30±2
941337-2	1-Dec-93	Soil	RFL-SS-2410-TP29-CTF	290±10
941337-3	1-Dec-93	Soil	RFL-SS-2424-TP30-CTF	22±2
941337-4	2-Dec-93	Soil	RFL-SS-2442-TP11-CTF	22±2
941337-5	2-Dec-93	Soil	RFL-SS-2446-TP11-CTF	25±2

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

9-Mar-94
Page: Q-1
Copy: 1 of 3
Status: Final

MK-FERGUSON (Rifle)

QUALITY CONTROL REPORT

Sample Id	Th-230 Total pCi/g	± 2σ
Duplicate	25	±2
Duplicate	28	±2
RER	0.35	
Std (found value)	103	±8
Std (true value)	97	
Std % rec.	106	
Blank	0.1	±0.3
Spike % rec.	121	

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

9-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

FOR INFORMATION ONLY

Attn:
Project: Rifle

Received: 15-Feb-94 09:30
PO #: 3050-511-10740 #353

Job: 941337E

Status: Final

Abbreviations:

Parameters:

Th-230	: Thorium-230

Units:

pCi/g	: picoCuries per gram

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

FOR INFORMATION 9-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Page: Q-3
Copy: 1 of 3

Attn:
Project: Rifle

Received: 15-Feb-94 09:30
PO #: 3050-511-10740 #353

Job: 941337E

Status: Final

QUALITY CONTROL DATA SHEET

Received by: rc Via: UPS

Sample Container Type: 500g can
Additional Lab Preparation: 100 mesh

Parameter	Method	Preservative	Analyst	Analysis Dates
Th-230	USAEC	None	Ortiz	03/07-03/09

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

9-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

FOR INFORMATION ONLY

Page: Q-4
Copy: 1 of 3

Attn:
Project: Rifle

Received: 15-Feb-94 09:30
PO #: 3050-511-10740 #353

Job: 941337E

Status: Final

Signed: .....
Radiochemistry Manager

Barringer Laboratories, Inc. will return or dispose of your samples 30 days from the date your final report is mailed, unless otherwise specified by contract. Barringer Laboratories, Inc. reserves the right to return samples prior to the 30 days if radioactive levels exceed our license.

cc: Helene Langlois, MK-FERGUSON (Rifle)

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

1337

LABORATORY SERVICES AUTHORIZATION FORM

...ert Fencil Requisitioner	2/11/94 Date	3/16/94 Need Date Priority: ✓ Standard / Urgent
Rifle, CO Location	3050-511-10740 P.O. Number	353 Request No.

FOR INFORMATION ONLY

ATTENTION LABORATORY: All reports and invoices must Reference PO and Request Nos.

Type of Sample: ____ Water ✓ Soil ____ Environmental Air Sample ____ Occupational Air Sample ____ Vegetation

Type of Analysis: ____ Ra-226 ✓ Th-230 ____ Nat U. ____ Gross Alph ____ Gross Beta ____ Solubility ____ Other (Specify under special instructions)

Special Instructions/Comments:

I.D. NO	DATE COLLECTED	VOLUME	DESCRIPTION
FL-SS-2405-TP28-CTF	12/1/93	608 g	TP#28 2-3'
FL-SS-240-TP29-CTF	12/1/93	651 g	TP#29 2-3' 240...
FL-SS-2424-TP30-CTF	12/1/93	602 g	TP#30 7-8'
F SS-2442-TP11-CTF	12/2/93	624 g	TP#11 7-8'
FL-SS-2446-TP11-CTF	12/2/93	669 g	TP#11 9-10'
		N/A	

CHAIN-OF-CUSTODY

Relinquished by (Site Representative Signature): Bobbie V. Hickey	Date/Time: 2/11/94 @ 1600
Carrier: UPS Pickup Record # 272076082	Date/Time: 2/14/94
Received at Lab by (Lab Representative Signature):* R. C. [illegible]	Date/Time: 02/15/94 0530

*Barringer Chain-of-Custody as per contract will be attached

MK-F/CWMFES USE ONLY:

[signature] MK-F Site Manager

[signature] Health Physics Site Manager

Technical Review: ____ Date: ____

Ship to: Approved Vendor For Radioanalytical Services

Copy to: HPP Manager

BARRINGER LABORATORIES INC
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1688

24-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

FOR INFORMATION ONLY

Attn:
Project: Rifle

Received: 16-Mar-94 09:25
PO #: 3050-511-10740 #360

Job: 941524E

Status: Final

ANALYTICAL REPORT PACKAGE

specials New Rifle CTF
OK RS 3-29-94

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

24-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

FOR INFORMATION ONLY

Attn:
Project: Rifle

Received: 16-Mar-94 09:25
PO #: 3050-511-10740 #360

Job: 941524E

Status: Final

CASE NARRATIVE

A total of 9 Soil samples were received on 16-Mar-94. All were properly preserved and in good condition. As stated in the chain of custody, the samples were run for the following analysis: Th-230. Our procedures are summarized on the Quality Control Data Sheet. All samples were extracted and analyzed within the proper holding times.

Quality control standards for organic and inorganic analyses followed the appropriate SW-846 or EPA methodology. For radiochemistry, the acceptance criteria for spikes and laboratory control standards is fifteen percent, plus the counting error. Duplicates will pass if the Replicate Error Ratio (RER) is 1.00 or less. The RER is defined as follows:

$$RER = \frac{ABS(R2 - R1)}{SQRT(ERROR1^2 + ERROR2^2)}$$

where: R1/R2 = original/duplicate sample result
ERROR1/ERROR2 = total 2 sigma uncertainty of R1/R2

All QC checks, including duplicates, spikes, and blanks, passed.

Signed: .....S. L. Sincoff.....
Steven L. Sincoff, Ph.D.
Director of Operations

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

MK-FERGUSON (Rifle)

Analyte: Th-230
Fraction: Total
Method: USAEC
Units: pCi/g

Project: Rifle
Date Analyzed: 03/21-03/22
LLD: 0.4

Lab Id	Date Sampled	Matrix	Sample Id	Concentration± 2σ
941524-1	30-Nov-93	Soil	RFL-SS-2272-CTF	7.6±1.1
941524-2	1-Dec-93	Soil	RFL-SS-2328-CTF	0.6±0.4
941524-3	1-Dec-93	Soil	RFL-SS-2357-CTF	0.6±0.4
941524-4	1-Dec-93	Soil	RFL-SS-2400-CTF	2.6±0.7
941524-5	1-Dec-93	Soil	RFL-SS-2401-CTF	38±2
941524-6	1-Dec-93	Soil	RFL-SS-2430-CTF	4.8±0.9
941524-7	1-Dec-93	Soil	RFL-SS-2432-CTF	44±3
941524-8	2-Dec-93	Soil	RFL-SS-2453-CTF	5.0±0.9
941524-9	2-Dec-93	Soil	RFL-SS-2456-CTF	23±2

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

24-Mar-94
Page: Q-1
Copy: 1 of 3
Status: Final

MK-FERGUSON (Rifle)

QUALITY CONTROL REPORT

FOR INFORMATION ONLY

Sample Id	Th-230 Total pCi/g	± 2σ
Duplicate	23	±2
Duplicate	21	±2
RER	0.28	
Std (found value)	327	±13
Std (true value)	305	
Std % rec.	107	
Blank	0.0	±0.2
Spike % rec.	90	

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

24-Mar-94

FOR INFORMATION ONLY

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

Attn:
Project: Rifle

Received: 16-Mar-94 09:25
PO #: 3050-511-10740 #360

Job: 941524E

Status: Final

Abbreviations:

Parameters:

Th-230	: Thorium-230

Units:

pCi/g	: picoCuries per gram

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

24-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

FOR INFORMATION ONLY

Page: Q-3
Copy: 1 of 3

Attn:
Project: Rifle

Received: 16-Mar-94 09:25
PO #: 3050-511-10740 #360

Job: 941524E

Status: Final

QUALITY CONTROL DATA SHEET

Received by: cs Via: UPS

Sample Container Type: 500g can
Additional Lab Preparation: 100 mesh

Parameter	Method	Preservative	Analyst	Analysis Dates
Th-230	USAEC	None	Ortiz	03/21-03/22

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

24-Mar-94

ATTN: Site Manager
MK-FERGUSON (Rifle)
P.O. Box 151
Rifle, CO 81650

FOR INFORMATION ONLY

Page: Q-4
Copy: 1 of 3

Attn:
Project: Rifle

Received: 16-Mar-94 09:25
PO #: 3050-511-10740 #360

Job: 941524E

Status: Final

Signed: .....
Radiochemistry Manager

Barringer Laboratories, Inc. will return or dispose of your samples 30 days from the date your final report is mailed, unless otherwise specified by contract. Barringer Laboratories, Inc. reserves the right to return samples prior to the 30 days if radioactive levels exceed our license.

cc: Helene Langlois, MK-FERGUSON (Rifle)

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

1524

LABORATORY SERVICES AUTHORIZATION FORM

Page 1 of 1

Robert Fencil — Requisitioner
3/14/94 — Date

4/18/94 — Need Date
Priority ✓
Urgent
Standard

Rifle, CO — Location
3050-511-10740 — P.O. Number
FOR INFORMATION ONLY
360 — Request No.

ATTENTION LABORATORY: All reports and invoices must Reference PO and Request Nos.

Type of Sample: Water ✓ Soil Environmental Air Sample
Occupational Air Sample Vegetation

Type of Analysis: Ra-226 ✓ Th-230 Nat U. Gross Alph
Gross Beta Solubility
Other (Specify under special instructions)

Special Instructions/Comments:

I.D. NO	DATE COLLECTED	VOLUME	DESCRIPTION
PFL-SS-2272-CTF	11-30-93	627	Tp #4
-SS-2328-CTF	12-01-93	517	Tp #26
FL-SS-2357-CTF	12-01-93	582	Tp #20
PFL-SS-2400-CTF	12-01-93	648	Tp #26
PFL-SS-2401-CTF	12-01-93	610	Tp #28
PFL-SS-2430-CTF	12-01-93	531	Tp #19
PFL-SS-2432-CTF	12-01-93	534	Tp #19
PFL-SS-2453-CTF	12-02-93	537	Tp #15
FL-SS-2456-CTF	12-02-93	531	Tp #15

CHAIN-OF-CUSTODY

Relinquished by (Site Representative Signature): Bobbie McCoy — Date/Time 3/14/94 1605

Carrier: UPS Pickup Record # 272 076 097 — Date/Time 3/15/94

Received at Lab by (Lab Representative Signature):* S. Stephenson — Date/Time 3-16-94/925

Barringer Chain-of-Custody as per contract will be attached

MK-F/CWMFES USE ONLY:

F Site Manager

Health Physics Site Manager

Technical Review: Date:

to: Approved Vendor For Radiological Services

Copy to: HPP Manager

BARRINGER LABORATORIES, INC.

Internal Chain-of-Custody Record

00024

DEC93:PM:LabData11:CUSTODY

BLI Job #94 1524

Rec'd by [illegible]

Rec'd date 3-16-94

How Disposed, (circle one) Return / Waste / Sewer

Sign-off [illegible] Date 3-25-94

BULK DRY

Sample Type Soil

Comments

Sample #'s 9

Location E3 Out

Date	Samp #'s	Time Out	Initials	Time In	Initials
3/16/94	1-9	3:00	QW	3:10	QW

BULK COLD

Sample Type

Comments

Sample #'s

Location

Date	Samp #'s	Time Out	Initials	Time In	Initials

PREPPED DRY

Type Soil Analyst QW

Start 3/16/94 Complete 3/17/94

Comments

Sample #'s 1-9

Location Soil Prep Shelf

Date	Samp #'s	Time Out	Initials	Time In	Initials
3/21/94	1-9	0332	fo	0357	fo

PREPPED COLD

Type Analyst

Start Complete

Comments

Sample #'s

Location

Date	Samp #'s	Time Out	Initials	Time In	Initials

ON-SITE RADIOLOGICAL MEASUREMENTS OF 1-FT
DEPTH INCREMENT SOIL SAMPLES <#4 MESH SIEVE

WIK-FINCH JSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

FOR INFORMATION ONLY

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
11-20-93	RFL-SS-2237			400	512.1	853.3	406	1.3	2.1	✓	PV	@ Surface
12-13-93	-001	11-19-93	11-22-93	566	502.1	537.0	363	1.4	1.5		[illegible]	Main. Yard @ E.G. 601 cptm
11-20-93	RFL-SS-2238			500	274.7	795.9	401	0.69	2.0	✓	PV	@ Surface
12-13-93	-002	11-19-93	11-22-93	468	459.2	722.7	350	1.3	2.1		[illegible]	Main. Yard @ E.G. 573 cptm
11-20-93	RFL-SS-2239			402	636.3	522.4	336	1.9	1.6	✓	PV	@ Surface
12-13-93	-003	11-19-93	11-22-93	568	550.1	709.6	291	1.9	2.4		[illegible]	Main. Yard @ E.G. 546 cptm
11-22-93	RFL-SS-2240			510	345.9	1132	522	0.66	2.2		PV	@ 18"
12-14-93	493	11-20-93	11-23-93	454	4838	1480	502	9.6	2.9	✓	[illegible]	10+65, 6+20 Lt.
11-22-93	RFL-SS-2241			412	10283	888.2	568	18.	1.6		PV	@ 4'
12-14-93	493	11-20-93	11-23-93	548	14439	1419	515	28	2.5	✓	[illegible]	10+65, 4+80 Lt.
11/30/93	RFL-SS-2242			426	5374	1141	519	10.4	2.2		[illegible]	TP#1
12/21/93	TP#1	11/30/93	12/1/93	430	11559	1115	452	24	2.3	✓	[illegible]	0-1'
11/30/93	RFL-SS-2243			526	1737	882.2	550	3.2	1.6		[illegible]	TP#1
12/21/93	TP#1	11/30/93	12/1/93	528	2841	1189	513	5.5	2.3	✓	[illegible]	1-2'
11/30/93	RFL-SS-2244			428	1187	896.9	503	2.4	1.8		[illegible]	TP#1
12/21/93	TP#1	11/30/93	12/1/93	530	2011	1132	472	4.3	2.4	✓	[illegible]	2-3'
11/30/93	RFL-SS-2245			528	949.6	516.6	497	1.9	1.1		[illegible]	TP#1
12/21/93	TP#1	11/30/93	12/1/93	434	1118	1001	456	2.5	2.2	✓	[illegible]	3-4'
11/30/93	RFL-SS-2246			432	1896	879.5	608	3.1	1.4		[illegible]	TP#1
12/23/93	TP#1	11/30/93	12/3/93	532	3570	1247	523	5.9	2.4	✓	DEC	4-5'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature] Site HP Manager

MK-FE JSON COMPANY
A MORRI ANUDSEN COMPANY

CWM Federal Environmental ices, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE / INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g INITIAL/CORR / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
11/30/93	RFL-SS-2247			532	803.	613.7	509	1.6	1.2 7.8		KB	TP#1
12-21-93	TP #1	11/30/93	12-1-93	532	885	1084	460	1.9	2.4	✓	KB	5-6'
11/30/93	RFL-SS-2248			434	527.7	896.9	495	1.1	1.8		KB	TP #1
12/21/93	TP#1	11/30/93	12-1-93	534	613	1132	450	1.4	2.5	✓	KB	6-7'
11/30/93	RFL-SS-2249			534	815.8	SEE 2.1	501	1.7	1.7		KB	TP#1
12/21/93	TP#1	11/30/93	12-1-93	436	806	984	467	1.7	2.1	✓	KB	7-8'
11/30/93	RFL-SS-2250			436	560.3	1106	566	0.99	2.0		KB	TP#1
12/22/93	TP#1	11/30/93	12/2/93	440	781.7	1001	516	1.5	1.9	✓	KB	8-9'
11/30/93	RFL-SS-2251			536	588.6	738.4	553	1.1	1.3		KB	TP#1
12/21/93	TP#1	11/30/93	12-1-93	438	685	975	508	1.3	1.9	✓	KB	9-10'
11/30/93	RFL-SS-2252			438	709.8	870.7	599	1.2	1.5		KB	TP#1
12/22/93	TP#1	11/30/93	12/2/93	540	1055	863.0	535	2.0	1.6	✓	KB	10-11'
11/30/93	RFL-SS-2253			538	1130	805.5	548	2.1	1.5		KB	TP#1
12/21/93	TP#1	11/30/93	12-1-93	536	802	1141	506	1.6	2.3	✓	KB	11-12'
11/30/93	RFL-SS-2254			440	763.4	914.3	585	1.3	1.6		PU	TP#1
12/21/93	TP#1	11-30-93	12-1-93	538	491	969	541	.91	1.8	✓	KB	12'-13'
11/30/93	RFL-SS-2255			540	607.7	1151	607	1.0	1.9		PU	TP#1
12/21/93	TP#1	11-30-93	12-1-93	440	986	1028	550	1.8	1.9	✓	KB	13'-14'
11-30-93	RFL-SS-2256			442	740.2	1045	649	1.1	1.6		PU	TP#1
12/21/93	TP#1	11-30-93	12-1-93	552	1193	873	602	2.0	1.5	✓	KB	14'-15' Screened #4

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: R. L. McFarland
Site HP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-228 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
11-30-93	RFL-SS-2257			542	750.2	1122	679	1.1	1.7		PU	TP#1
12-28-93	TP#1 - DUP	11-30-93	12-2-93	454	541.5	914.3	537	0.92	1.6	✓	DRC	14'-15' Screened#4
11-30-93	RFL-SS-2258			444	481.5	966.5	696	0.69	1.4		PU	TP#1
12-21-93	TP#1	11-30-93	12-1-93	454	679	1176	653	1.0	1.8	✓	B	15'-16' Screened#4
11-30-93	RFL-SS-2259			544	652.1	1074	668	0.98	1.6		PU	TP#1
12-28-93	TP#1 - DUP	11-30-93	12-2-93	452	543.1	1036	592	0.92	1.8	✓	DRC	15'-16' Screened#4
11-30-93	RFL-SS-2260			446	528.7	1010	732	0.72	1.4		PU	TP#1
12/22/93	TP#1	11-30-93	12/2/93	442	798.4	1062	601	1.3	1.8	✓	B	16'-17' Screened#4
11-30-93	RFL-SS-2261			546	906.8	911.0	770	1.2	1.2		PU	TP#1
12-28-93	TP#1-DUP	11-30-93	12/2/93	453	522	809.8	611	0.85	1.3	✓	DRC	16'-17' Screened#4
11-30-93	RFL-SS-2262			454	261040	8890	550	475	16.2		PU	TP#4
12-21-93	TP#4	11-30-93	12-1-93	554	382540	17635	505	758	35	✓	B	0-1'
11-30-93	RFL-SS-2263			554	266440	11824	573	465	21		PU	TP#4
12-21-93	TP#4	11-30-93	12-1-93	456	349720	11990	527	664	23	✓	B	1'-2'
11-30-93	RFL-SS-2264			456	282280	10736	581	486	18		PU	TP#4
12-21-93	TP#4	11-30-93	12-1-93	556	414310	20857	514	?:6	41	✓	B	2'-3'
11-30-93	RFL-SS-2265			556	881530	46594	650	1356 1356#2#93 PU	72		PU	TP#4
12/22/93	TP#4	11-30-93	12/2/93	542	977900	46697	495	1980	125	✓	B	3'-4'
11-30-93	RFL-SS-2266			458	856970	29892	604	1419	49		PU	TP#4
12-27-93	TP#4	11-30-93	12/2/93	400	959760	32792	453	2119	72	✓	DRC	4'-5'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: Robert K Ferrell
Site HP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

SITE NAME RIFLE, CO.

FOR INFORMATION ONLY

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL	OCS # 20 DAY	Bi-214 pCi INITIAL	Bi-214 pCi 20 DAY	Tl-208 pCi INITIAL	Tl-208 pCi 20 DAY	MASS (grams) WET	MASS (grams) DRY	Ra-226 pCi/g INITIAL/CORR.	Ra-226 pCi/g 20 DAY	Th-232 pCi/g INITIAL	Th-232 pCi/g 20 DAY	DEPTH <15cm	DEPTH >15cm	TECH INITIAL	TECH 20 DAY	COMMENTS
11-30-93	RFL-SS-2267	11-30-93	12/1/93	558		34629		2129		580		60		3.7				PV		TP #4
12-21-93	TP#4	+0#5"			458		44658		2595		525		8.5		4.9	✓				5'-6'
11-30-93	RFL-SS-2268			460		35265		2133		534		66		4.0				PV		TP#4
12-21-93	TP#4	11-30-93	12/1/93	558		44725		2503		487		92		5.1		✓				6'-7'
11-30-93	RFL-SS-2269			560		750.3		767.1		553		1.4		1.4				PV		TP #4
12-21-93	TP#4	11-30-93	12/1/93	460		601		949		499		1.2		1.9		✓				7'-8'
11-30-93	RFL-SS-2270			462		18151		1289		595		31		2.2				PV		TP#4
12-21-93	TP#4	11-30-93	12/1/93	560		23625		1812		539		44		3.4		✓				8'-9'
11-30-93	RFL-SS-2271			562		677.1		757.6		541		1.3		1.4				PV		TP#4
12-21-93	TP#4	11-30-93	12/1/93	462		832		801		516		1.6		1.6		✓				9'-10'
11-30-93	RFL-SS-2272			464		6445		1324		701		9.2		1.9				PV		TP#4
12-21-93	TP#4	11-30-93	12/1/93	562		8385		1237		627		13		2.0		✓				10'-11' Screened 4
11-30-93	RFL-SS-2273			564		5435		1208		690		7.9		1.8				PV		TP#4
12-28-93	TP#4-DUP.	11-30-93	12-2-93	546		6570		1266		552		12.		2.3		✓		DRC		10'-11' Screend 4
11-30-93	RFL-SS-2274			466		1337		1062		645		2.1		1.6				PV		TP#4
12-21-93	TP#4	11-30-93	12/1/93	464		1614		1132		601		2.7		1.9		✓				13'-14' Screened 4
11-30-93	RFL-SS-2275			566		1121		958.9		639		1.8		1.5				PV		TP#4
12-28-93	TP#4-DUP.	11-30-93	12/2/93	552		1195		1160		572		2.1		2.0		✓		DRC		13'-14' Screened 4
11-30-93	RFL-SS-2276			472		5091		1080		586		8.7		1.8				PV		TP#4
12-21-93	TP#4	11-30-93	12/1/93	466		5615		853		552		10		1.5		✓				14'-15' Screened 4

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature]
Site HP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

FOR INFORMATION ONLY

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
11-30-93	RFL-SS-2277			573	6129	1103	620	9.9	1.8		PV	TP#4
12-28-93	TP#4-DUP	11-30-93	12-2-93	554	8020	1117	572	14	1.9	✓	DRC	14'-15' Screened 4
11-30-93	RFL-SS-2278			474	1255	1167	734	1.7	1.6		PV	TP#4
12-21-93	TP#4	11-30-93	12/1/93	564	1550	988	572	2.7	1.7	✓	[illegible]	15'-16' Screened 4
11-30-93	RFL-SS-2279			575	1797	901.4	768	2.3	1.2		PV	TP#4
12-28-93	TP#4-DUP	11-30-93	12/2/93	550	2166	1170	671	3.2	1.7	✓	DRC	15'-16' Screened 4
12/1/93	RFL-SS-2280			400	6602	1115	877	7.5	1.3		[illegible]	TP#4
12/27/93	TP#4	11/30/93	12/2/93	402	8611	1202	776	11	1.5	✓	DRC	16-17' screened 4
12/1/93	RFL-SS-2281			500	6324	1180	824	7.7	1.4		[illegible]	TP#4
12/28/93	TP#4-DUP	11/30/93	12/2/93	460	7105	1054	709	10	1.5	✓	DRC	16-17' Screened 4
12-1-93	RFL-SS-2282			502	15940	1889	798	20	2.4		PV	TP#4
12-27-93	TP#4	11-30-93	12-2-93	406	19325	1411	697	28	2.0	✓	DRC	17'-18' Screened 4
12-1-93	RFL-SS-2283			402	25979	1959	790	33	2.5		PV	TP#4
12-28-93	TP#4-DUP	11-30-93	12-2-93	556	34033	1927	664	51	2.9	✓	DRC	17'-18' Screened 4
12-1-93	RFL-SS-2284			504	8549	1295	775	11	1.7		PV	TP#4
12-27-93	TP#4	11-30-93	12-2-93	404	10678	1010	702	15	1.4	✓	DRC	18'-19'
12-1-93	RFL-SS-2285			404	287060	11067	559	514	20		PV	TP#5
12/22/93	TP#5	11-30-93	12/2/93	512	423670	22276	561	848	44	✓	[illegible]	0'-1'
12-1-93	RFL-SS-2286			506	315560	15084	554	570	27		PV	TP#5
12/22/93	TP#5	11-30-93	12/2/93	414	435870	15430	494	882	31	✓	[illegible]	1-2'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature]
Site HP Manager

MK-FE A MORRIS ... ISON COMPANY ...NUDSEN COMPANY

CWM Federal Environmental S... ...ices, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-228 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12-1-93	RFL-SS-2237			406	393840	10745	608	482	18		PU	TP #5
12/22/93	TP #5	11-30-93	12/2/93	514	425510	22650	540	788	42	✓	B	2'-3'
12-1-93	RFL-SS-2238			508	376150	18450	601	626	31		PU	TP #5
12/22/93	TP #5	11-30-93	12/2/93	416	469560	15177	528	889	29	✓	B	3'-4'
12-1-93	RFL-SS-2289			408	504400	18782	538	938	35		PU	TP #5
12/22/93	TP #5	11-30-93	12/2/93	516	704490	39076	464	1518	84	✓	B	4'-5'
12-1-93	RFL-SS-2290			510	620950	33745	639	972	53		PU	TP #5
12/22/93	TP #5	11-30-93	12/2/93	418	783690	23527	552	1329	43	✓	B	5'-6'
12/1/93	RFL-SS-2291			410	622290	23667	653	959	36		B	TP #5
12/22/93	TP #5	11/30/93	12/2/93	518	862430	51379	574	1502	90	✓	B	~~7-8~~ B 12/1/93 6-7'
12/1/93	RFL-SS-2292			512	546950	31129	533	1026	57		B	TP #5
12/22/93	TP #5	11/30/93	12/2/93	420	723750	24137	467	1550	52	✓	B	7-8'
12/1/93	RFL-SS-2293			412	419030	12085	612	783	30		B	TP #5
12/22/93	TP # 5	11/30/93	12/2/93	520	688400	39661	539	1277	74	✓	B	9-10'
12/1/93	RFL-SS-2294			514	629550	~~3444~~ 35960 B 12/1/93	540	1166	67		B	TP #5
12/22/93	TP #5	11/30/93	12/2/93	422	736020	24842	472	1559	53	✓	B	10-11'
12/1/93	RFL-SS-2295			414	1391	992.6	540	3.5	1.8		B	TP #5
12/22/93	TP #5	11/30/93	12/2/93	522	1443	1180	482	3.0	2.4	✓	B	11-12'
12/1/93	RFL-SS-2296			516	2581	1285	716	3.6	1.8		B	TP #5
12/22/93	TP #5	11/30/93	12/2/93	424	776.7	827.2	612	1.3	1.4	✓	B	12-13'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental S...

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12/1/93	RFL-SS- 2297	11/30/93	12/2/93	416	668.8	101.9	618	1.1	1.6		B	TP # 5
12/22/93	TP#5			524	985.7	901.4	550	1.8	1.6	✓	B	13-14'
12/1/93	RFL-SS- 2298	11/30/93	12/2/93	518	613.7	1314	707	0.87	1.9		B	TP # 5
12/22/93	TP#5			536	723.1	783.1	636	1.1	1.2	✓	B	14-15'
12/1/93	RFL-SS- 2299	11/30/93	12/2/93	418	48909.0	18172	501	976.2	36.3		B	TP #5
12/22/93	TP#5			526	70826.0	44801	410	1727	109	✓	B	8-9'
12/1/93	RFL-SS- 2300	11/30/93	12/2/93	520	772.6	1132	720	1.1	1.6		B	TP#5
12/22/93	TP#5			428	726.4	1028	639	1.1	1.6	✓	B	15-16'
12/1/93	RFL-SS- 2301	11/30/93	12/2/93	420	1880	821.2	697	2.7	1.2		B	TP#5
12/22/93	TP#5	~~12/1/93~~ 11/30/93		528	931.4	1036	599	1.6	1.7	✓	B	16-17'
12/1/93	RFL-SS- 2302	11/30/93	12/2/93	522	3241	1026	771	4.2	1.3		B	TP#5
12/22/93	TP#5			430	3731	1028	675	5.5	1.5	✓	B	16-17' SCREENED 4
12/1/93	RFL-SS- 2303	12/1/93	12/2/93	422	4408	914.3	722	6.1	1.3		B	TP #25
12/22/93	TP#25			530	4667	930.2	595	7.8	1.6	✓	B	@ 10'
12/1/93	RFL-SS- 2304	11/30/93	12/2/93	524	3575	1045	809	4.4	1.3		B	TP#5
12/28/93	TP#5-Dup	~~12/1/93~~ 12/1/93		462	3672	1289	649	5.7	2.0	✓	DRC	16-17' SCREENED 4
12/1/93	RFL-SS- 2305	11/30/93	12/2/93	424	683.8	951.8	837	0.82	1.1		B	TP#5
12/28/93	TP#5			530	773.0	930.2	692	1.1	1.3	✓	DRC	17-18' SCREENED 4
12/1/93	RFL-SS- 2306	11/30/93	12/2/93	526	683.3	834.3	786	0.87	1.1		B	TP#5
12/28/93	TP#5-Dup			548	862.3	815.1	637	1.3	1.3	✓	DRC	17-18 SCREENED 4

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

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Site HP Manager

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CWM Federal Environmental Services, Inc.

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

FOR INFORMATION ONLY

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12/1/93	RFL-SS- 2307			436	1794	870.7	757	2.4	1.2	TP	B	TP#5
12/22/93	TP#5	11/30/93	12/2/93	432	2743	1036	661	4.1	1.6	✓	B	18-19' screened
12/1/93	RFL-SS- 2308			528	1552	1093	760	2.0	1.4		B	TP#5
12/28/93	TP#5-DUP	11/30/93	12/2/93	456	2236	855.9	636	3.6	1.3	✓	DRC	18-19' screened
12/1/93	RFL-SS-2309			428	2231	810.7	789	2.8	1.1		B	TP#5
12-28-93	TP#5	11/30/93	12-3-93	526	2490	733.4	670	3.7	1.1	✓	DRC	19-20'
12/1/93	RFL-SS- 2310			530	875.0	786.3	576	1.5	1.4		B	TP#6
12/22/93	TP#6	11/30/93	12/2/93	532	1190	652.1	517	2.3	1.3	✓	B	14-15'
12/1/93	RFL-SS- 2311			430	2804	801.1	501	5.6	1.6		B	TP#25
12/22/93	TP#25	11/30/93	12/2/93	434	4692	792.4	465	10.0	1.7	✓	B	0-1'
12/1/93	RFL-SS- 2312			532	870.9	834.3	531	1.5	1.6		B	TP#25
12/27/93	TP#25	11/30/93	12/3/93	510	6413.0	872.6	419	1.5	2.1	✓	DRC	1-2'
12/1/93	RFL-SS- 2313			432	5131	2551	837	61.0	3.0		B	TP#6
12-28-93	TP#6	11/30/93	12-3-93	536	12733	2656	759	8.5	3.6	✓	DRC	24-25'
12/1/93	RFL-SS- 2314			534	28096	2206	883	32	2.5		B	TP#6
12/22/93	TP#6	11/30/93	12/2/93	534	33553	5254	826	41	2.7	✓	B	24-25'
12/1/93	RFL-SS- 2315			434	752.6	653.1	648	1.2	1.0		B	TP#25
12/28/93	TP#25	11/30/93	12/3/93	438	534.3	801.1	517	1.1	1.5	✓	DRC	2-3'
12/1/93	RFL-SS- 2316			536	751.8	680.8	631	1.2	1.1		B	TP#25
12-28-93	TP#25	11/30/93	12/3/93	534	526.1	949.3	503	1.0	1.9	✓	DRC	3-4'

Site Correction Factor = 1.8

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Site HP Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL	OCS # 20 DAY	Bi-214 pCi INITIAL	Bi-214 pCi 20 DAY	Tl-208 pCi INITIAL	Tl-208 pCi 20 DAY	MASS (grams) WET	MASS (grams) DRY	Ra-226 pCi/g INITIAL/CORR.	Ra-226 pCi/g 20 DAY	Th-232 pCi/g INITIAL	Th-232 pCi/g 20 DAY	DEPTH <15cm	DEPTH >15cm	TECH INITIAL	TECH 20 DAY	COMMENTS
12-1-93	RFL-SS-2317			436		1054		705.3		725		1.5		0.97				PU		TP#25
12-28-93	TP#25	12-1-93	12-3-93	432		845.2		905.6		550		1.9		1.5		✓		DRC		4'-5'
12-1-93	RFL-SS-2318			538		1875		882.2		615		3.0		1.4				PU		TP#25
12-27-93	TP#25	12-1-93	12-3-93	459		3358		853.3		502		6.7		1.7		✓		DRC		6'-7'
12-1-93	RFL-SS-2319			438		841.8		651		722		1.2		0.90				PU		TP#25
12/22/93	TP#25	12-1-93	12/2/93	2		588.9		766.3		618		0.95		1.2		✓		KL		5'-6'
12-1-93	RFL-SS-2320			540		318.2		1064		759		.42		1.4				PU		TP#25
12-28-93	TP#25	12-1-93	12-3-93	540		542.3		1237		609		.89		2.0		✓		DRC		7'-8' Sleeve
12-1-93	RFL-SS-2321			440		730.9		846.9		712		.95		1.2				PU		TP#25
12-28-93	TP#25-Dup	12-1-93	12-3-93	500		914.9		920.6		622		1.5		1.5		✓		DRC		7'-8' Sleeve
12-1-93	RFL-SS-2322			542		608.5		796.9		764		.79		1.0				PU		TP#25
12-28-93	TP#25	12-1-93	12-3-93	525		322.7		901.4		634		.57		1.9		✓		DRC		8'-9' Sleeve
12-1-93	RFL-SS-2323			442		660.9		801.1		792		.83		1.0				PU		TP#25
12-28-93	TP 25-Dup	12-1-93	12-3-93	518		703.0		719.2		657		1.1		1.1		✓		DRC		8'-9' Sleeve
12-1-93	RFL-SS-2324			544		3305		930.2		524		6.3		1.8				PU		Tp#26
12/22/93	Tp 26	12-1-93	12/2/93	536		5072		1285		475		11.		2.7		✓		KL		0'-1'
12-1-93	RFL-SS-2325			444		2149		801.1		529		4.1		1.5				PU		TPH 26
12/22/93	TP#26	12-1-93	12/2/93	438		3457		1010		487		7.1		2.1		✓		KL		1'-2'
12-1-93	RFL-SS-2326			546		1805		911.5		582		3.1		1.6				PU		TP#26
12/22/93	TP#26	12-1-93	12/2/93	538		3577		1064		529		6.8		2.0		✓		KL		2'-3

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

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Site HP Manager

MK-FE JSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-1-93	RFL-SS-2327 TP #26	12-1-93	12-3-93	446	744.3	914.3	668	1.2	1.5	✓	PU	TP #26
12-28-93				442	502.7	627.1	559	.91	2.8	✓	DRC	3'-4'
12-1-93	RFL-SS-2328 TP #26	12-1-93	12/3/93	548	344.0	632.9	547	.73	1.2	✓	PU	TP #26
12/29/93				408	501.8	792.4	517	.97	1.5	✓	B	4'-5'
12-1-93	RFL-SS-2329 TP #26	12-1-93	12/3/93	448	545.8	692.1	759	.72	.78	✓	PU	TP #26
12/29/93				410	701.8	748.8	600	1.2	1.2	✓	B	5'-6'
12-1-93	RFL-SS-2330 TP #26	12-1-93	12/3/93	550	589.7	661.7	757	.78	.87	✓	PU	TP #26
12/29/93				408	657.3	705.3	632	1.0	1.1	✓	B	6'-7'
12-1-93	RFL-SS-2331 TP #26	12-1-93	12-3-93	450	2612	687.9	715	3.7	.96	✓	PU	TP #26
12-28-93				406	4481	862.0	592	7.6	1.5	✓	DRC	7'-8'
12-1-93	RFL-SS-2332 TP #27	12-1-93	12-2-93	552	85,557	4612	554	16.0	8.3	✓	PU	TP #27
12-28-93				560	14060	5154	501	251	11	✓	DRC	0'-1'
12-1-93	RFL-SS-2333 TP #27	12-1-93	12-2-93	452	84,813	3039	557	144.5	5.2	✓	PU	TP #27
12-28-93				466	179200	6452	534	354	12	✓	DRC	1'-2'
12-1-93	RFL-SS-2334 TP #27	12-1-93	12/3/93	554	93640	4881	629	148.2	7.8	✓	PU	TP #27
12/29/93				510	199460	8554	539	370	16	✓	B	2'-3'
12-1-93	RFL-SS-2335 TP #27	12-1-93	12-2-93	454	96,750	4197	589	164	7.1	✓	PU	TP #27
12-28-93				464	186460	6543	535	349	12	✓	DRC	3'-4'
12-1-93	RFL-SS-2336 TP #27	12-1-93	12-2-93	556	100050	4852	556	180	8.7	✓	PU	TP #27
12-28-93				558	179730	6895	491	364	14	✓	DRC	4'-5'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

MK-FE JSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-228 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-1-93	RFL-SS-2337	12-1-93	12-2-93	456	56241	2665	589	99	4.5		RU	TP #27
12-28-93	TP #27			468	81496	3596	545	150	6.7	✓	DRC	5'-6'
12-1-93	RFL-SS-2338	12-1-93	12-2-93	558	473860	24,932	564	840	44		RU	TP #27
12-28-93	TP #27			562	564650	25766	512	1103	50	✓	DRC	6'-7'
12-1-93	RFL-SS-2339	12-1-93	12-3-93	458	1044900	37868	550	1753	64		RU	TP #27
12-27-93	TP # 27			454	[illegible]	34281	392	2792	87	✓	DRC	7'-8'
12-1-93	RFL-SS-2340	12-1-93	12/3/93	560	4668	853.4	556	8.4	1.5		RU	TP #27
12/29/93	TP #27			412	3996	809.8	442	9.0	1.8	✓	B	8'-9'
12-1-93	RFL-SS-2341	12-1-93	12-3-93	466	1099	818.5	790	1.4	1.0		RU	TP #27
12-28-93	TP # 27			436	1437	748.3	634	2.3	1.2	✓	DRC	10'-11' Screened
12-1-93	RFL-SS-2342	12-1-93	12-3-93	562	1414	843.9	821	1.8	1.0		RU	TP #27
12-28-93	TP #27-Dup			412	1533	862.0	674	2.3	1.3	✓	DRC	10'-11' Screened
12-1-93	RFL-SS-2343	12-1-93	12-2-93	3707	3707	1045	790	4.7	1.3		RU	TP #27
12-28-93	TP #27			470	5068	914.3	696	7.9	1.4	✓	DRC	11'-12 Screened
12-1-93	RFL-SS-2344	12-1-93	12-2-93	564	3892	1017	769	5.1	1.3		RU	TP #27
12-28-93	TP 27-Dup			568	4861	911.0	637	7.6	1.4	✓	DRC	11'-12' Screened
12-1-93	RFL-SS-~~2344~~ 2345 RS	12-1-93	12-3-93	464	4699	1480	819	5.7	1.8		RU	TP #27
12-28-93	TP #27			500	6267	1312	669	9.4	2.7	✓	DRC	9'-10' Screened
12-1-93	RFL-SS-2346	12-1-93	12/3/93	566	5932	1381	829	7.2	1.7		RU	TP #27
12/29/93	TP #27-Dup			506	6822	1256	684	10.	1.8	✓	B	9'-10' Screened

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

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Site HP Manager

F5-IN-001-1, ICN-01

MK-FL JSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-2-93	RFL-SS-2347			400	768.6	896.9	576	1.3	1.6		PU	TP#19 (Composite
1/11/94	TP#19	12-1-93	12/3/93	426	781.7	1001	571	1.4	1.8	✓	[illegible]	5.5' - 6.5'
12-2-93	RFL-SS-2348			500	387.5	1026	407.9	0.95	2.5		PU	TP#1 (Composite
2-11-94	TP#1	11-30-93	12/2/93	508	402.2	931.6	407.9	0.99	2.3	✓	WLW	14' - 17'
12-2-93	RFL-SS-2349			502	1226	911.0	489.4	2.5	1.9		PU	TP#4 (Composite
2-11-94	TP#4	11-30-93	12/2/93	502	1027	1055	489.4	2.1	2.2	✓	WLW	15' - 16.5'
12-2-93	RFL-SS-2350			402	3512	775.0	375.2	9.4	2.1		PU	TP#4 (Composite
2-11-94	TP#4	11-30-93	12/2/93	500	4637	1007	375.2	12.4	2.7	✓	WLW	11.5' - 15.0'
12-2-93	RFL-SS-2351			504	979.5	824.7	398.4	2.5	2.1		PU	TP#5 (Composite
2-11-94	TP#5	11-30-93	12/2/93	504	804.7	901.4	398.4	2.0	2.3	✓	WLW	16.5' - 18.0'
12-2-93	RFL-SS-2352			404	2645	1001	406.1	6.5	2.5		PU	TP#5 (Composite
2/11/94	TP#5	11-30-93	12/2/93	402	3881	801.1	406.1	9.6	2.0	✓	WLW	18' - 19'
12-2-93	RFL-SS-2353			506	891.8	815.1	608	1.5	1.3		PU	TP#20
12-27-93	TP#20	12-1-93	12-3-93	566	748.3	920.6	517	1.3	1.6	✓	ORC	1' - 2'
12-2-93	RFL-SS-2354			406	1131	914.3	603	1.9	1.5		PU	TP#20
12-27-93	TP#20-DUP	12-1-93	12-3-93	564	1197	965.8	567	2.1	1.0	✓	ORC	1' - 2'
12-2-93	RFL-SS-2355			508	1156	767.1	645	1.8	1.2		PU	TP#20
12-27-93	TP#20	12-1-93	12-3-93	431	1633	731.4	604	2.7	1.2	✓	ORC	2' - 3'
12-2-93	RFL-SS-2356			408	1367	844.6	622	2.2	1.4		PU	TP#20
12/29/93	TP#20-DUP.	12-1-93	12/3/93	406	1136	705.3	580	2.0	1.2	✓	[illegible]	2' - 3'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site PI Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12-2-93	RFL-SS-2357			510	772.0	767.1	618	1.2	1.2		PU	TP#20
12-27-93	TP#20	12-1-93	12-3-93	457	1007	670.5	592	1.7	1.2	✓	DRC	3'-4'
12-2-93	RFL-SS-2358			410	6985	600.8	547	1.3	1.1		PU	TP#20
12-28-93	TP#20-DUP	12-1-93	12-3-93	520	796.9	805.5	509	1.6	1.6	✓	DRC	3'-4'
12-2-93	RFL-SS-2359			512	3170	872.6	627	5.1	1.4		PU	TP#20
12-28-93	TP#20	12-1-93	12-3-93	446	4580	818.5	534	5.6	1.5	✓	DRC	4'-5'
12-2-93	RFL-SS-2360			412	3817	879.5	798	4.8	1.1		PU	TP#20
12-27-93	TP#20-DUP	12-1-93	12-3-93	453	6385	1019	690	9.0	1.5	✓	DRC	4'-5'
12-2-93	RFL-SS-2361			514	1976	700.0	551	3.6	1.3		PU	TP#21
12-27-93	TP#21	12-1-93	12-3-93	415	2444	731.4	525	4.7	1.4	✓	DRC	0'-1'
12/2/93	RFL-SS-2362			414	6076	827.2	597	10 10.2	1.4		B	TP#21
12/27/93	TP#21	12/1/93	12-3-93	558	9385	1151	567	17	2.0	✓	DRC	1-2' Screened
12/2/93	RFL-SS-2363			516	5997	901.4	601	10.0	1.5		B	TP#21
12-28-93	TP#21-Dup	12/1/93	12-3-93	474	9144	1306	572	16	2.3	✓	DRC	1-2' Screened
12/2/93	RFL-SS-2364			416	4476	1080	648	6.9	1.7		B	TP#21
12/27/93	TP#21	12/1/93	12/3/93	419	7311	949.1	610	12	1.6	✓	DRC	2-3' Screened
12/2/93	RFL-SS-2365			518	3696	1103	566	6.5	1.9		B	TP#21
12-28-93	TP#21	12/1/93	12/3/93	566	6808	901.4	530	13	1.7	✓	DRC	2-3' Screened
12/2/93	RFL-SS-2366			418	8513	1158	673	13 ~~12.6~~	1.7		B	TP#21
12/27/93	TP#21	12/1/93	12/3/93	456	15666	1189	622	25	1.9	✓	DRC	3-4' Screened

556

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

F5-IN-001-1, ICN-01

MK-FE JSON COMPANY
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CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE / INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # / INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12/2/93	RFL-SS-2367			520	847.6	930.2	542	16 ~~15.6~~	1.7		[illegible]	TP#21
12-28-93	TP#21-Dup	12/1/93	12-3-93	564	1312	1199	497	23	2.4	✓	DRC	3-4' Screened
12/2/93	RFL-SS-2368			420	280.9	696.6	604	4.7	1.2		[illegible]	TP#21
12/27/93	TP#21	12/1/93	12/3/93	441	575.1	838.7	535	11	1.7	✓	DRC	4-5' Screened
12/2/93	RFL-SS-2369			522	312.9	805.5	671	4.7	1.2		[illegible]	TP#21
12/27/93	TP#21-Dup	12/1/93	12/3/93	562	511.2	872.6	600	9.5	1.5	✓	DRC	4-5' Screened
12/2/93	RFL-SS-2370			422	414.4	618.2	616	0.67	1.0		[illegible]	TP#32 BKg
12/27/93	TP#32	12/2/93	12/3/93	417	745.2	635.6	579	1.3	1.1	✓	DRC	0-1' Screened
12/2/93	RFL-SS-2371			524	22[illegible]	853.4	655	1.0	1.3		[illegible]	TP#32 BKg
12/27/93	TP#32	12/2/93	12/3/93	408	701	636	609	1.2	1.0	✓	DRC	0-1' Screened
12/2/93	RFL-SS-2372			424	383.8	635.6	639	0.60	0.99		[illegible]	TP#32 BKg
12/27/93	TP#32	12/2/93	12/3/93	414	562	653	595	0.94	1.10	✓	DRC	1-2' Screened
12/2/93	RFL-SS-2373			526	465.9	920.6	661	0.70	1.4		[illegible]	TP#32 BKg
12/27/93	TP#32	12/2/93	12/3/93	429	861.5	746.3	596	1.4	1.3	✓	DRC	2-3' Screened
12/2/93	RFL-SS-2374			426	432.2	696.6	631	0.68	1.1		[illegible]	TP#32 BKg
12/27/93	TP#32	12/2/93	12/3/93	425	814.4	714.0	591	1.5	1.2	✓	DRC	1-2' Screened
12/2/93	RFL-SS-2375			528	649.5	863.0	644g	1.0	1.3		[illegible]	TP#32 BKg
12/30/93	TP#32	12/2/93	12/6/93	400	773.9	687.9	579	1.3	1.2	✓	[illegible]	2-3' Screened
12/2/93	RFL-SS-2376			428	420.1	705.3	709	0.59	0.99		[illegible]	TP#32 BKg
12/27/93	TP#32	12/2/93	12/3/93	439	666.0	879.5	607	1.1	1.4	✓	DRC	3-4' Screened

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE / INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # / INITIAL / 20 DAY	Bi-214 pCi INITIAL	20 DAY	Tl-208 pCi INITIAL	20 DAY	MASS (grams) WET	DRY	Ra-226 pCi/g INITIAL/CORR.	20 DAY	Th-232 pCi/g INITIAL	20 DAY	DEPTH <15cm	>15cm	TECH INITIAL	20 DAY	COMMENTS
12/2/93	RFL-SS-2377			530	757.8		680.8		702		1.1		0.97				~~LB~~		TP #32 BKg
12/27/93	TP #32	12/2/93	12/3/93	412	588		557		598		.98		.93		✓		DRC		3-4' Screened
12/2/93	RFL-SS-2378			430	197.5		888.2		759		0.26		1.2				~~LB~~		TP# 32 BKg
12/27/93	TP #32	12/2/93	12/3/93	564	771.5		611.3		659		1.2		1.0		✓		DRC		4-5' Screened
12/2/93	RFL-SS-2379			532	720.6		757.6		800		0.90		0.95				~~LB~~		TP# 32 BKg
12/27/93	TP #32	12/2/93	12/3/93	410	564		766		703		.80		1.1		✓		DRC		4-5' Screened
12/2/93	RFL-SS-2380			432	197.0		782.4		687		0.29		1.1				~~LB~~		TP# 33 BKg
12/27/93	TP #~~32~~ 33	12/2/93	12/3/93	423	797.6		661.8		602		1.3		1.1		✓		DRC		6-7' Screened
12/2/93	RFL-SS-2381			534	462.5		968.5		754		0.61		1.3				~~LB~~		TP# 33 BKg
12/27/93	TP #~~33~~ 32	12/2/93	12/3/93	421	695.5		749.8		647		1.1		1.2		✓		DRC		6-7' Screened
12-2-93	RFL-SS-2382			434	721.3		853.3		716		1.0		1.2				PU		TP #33 BKg
12-28-93	TP #33	12-2-93	12-3-93	544	615.8		805.5		607		1.0		1.3		✓		DRC		7'-8' Screened
12-2-93	RFL-SS-2383			536	435.8		728.8		774		0.56		0.94				PU		TP #33 BKg
12-27-93	TP #33	12-2-93	12/3/93	437	557.1		862.0		652		0.85		1.3		✓		DRC		7'-8' Screened
12-2-93	RFL-SS-2384			436	546.4		600.8		748		0.73		0.80				PU		TP#33 BKg
12-27-93	TP #33	12-2-93	12-3-93	435	438.3		992.6		613		0.72		1.6		✓		DRC		8'-9' Screened
12-2-93	RFL-SS-2385			538	307.3		930.2		728		0.42		1.3				PU		TP#33 BKg
12-27-93	TP#33	12-2-93	12-3-93	449	615.8		933.2		623		0.98		1.4		✓		DRC		8'-9' Screened
12-2-93	RFL-SS-2386-			438	3865		1228		695		5.6 ~~5.56~~ 2.8 PU		1.8				PU		S.W. Corner
12-28-93	493	12-2-93	12-3-93	450	5537		1010		632		8.8		1.6		✓		DRC		

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

FOR INFORMATION ONLY

OCS SAMPLE LOG

SITE NAME RIFLE, CO.

COUNT DATE / INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # / INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-228 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12-2-93	RFL-SS-2387	12-2-93	12-3-93	540	687.8	104.5	769	8.9	1.4		YW	S.W. Corner
12-28-93	-493			448	1132.4	110.6	665	17	1.7	✓	DRC	
12-2-93	RFL-SS-2388	12-1-93	12-6-93	440	150.1	74.8.8	754	2.0	0.99		YW	TP#22
12-28-93	TP#22			408	161.2	705.3	632	2.6	1.1	✓	DRC	6'-7' Screened
12-2-93	RFL-SS-2389	12-1-93	12-3-93	542	100.4	94.9.3	798	1.3	1.2		YW	TP#22
12-28-93	TP#22-DUP			514	225.3	719.2	679	3.3	1.1	✓	DRC	6'-7' Screened
12-2-93	RFL-SS-2390	12-1-93	12-3-93	442	985.1	522.4	685	1.4	.76		YW	TP#24
12-28-93	TP#24			512	1014	591.8	654	1.6	1.4	✓	DRC	0-1'
12-2-93	RFL-SS-2391	12-1-93	12-3-93	544	415.5	1103	689	.66	1.6		YW	TP#24
12-28-93	TP#24			434	706.6	626.9	634	1.1	.99	✓	DRC	1-2'
12-2-93	RFL-SS-2392	12-1-93	12-3-93	444	867.2	757.5	779	1.1	.97		YW	TP#24
12-28-93	TP#24			400	1189	827.2	664	1.8	1.2	✓	DRC	2-3' SCREENED
12-2-93	RFL-SS-2393	12-1-93	12-3-93	546	744.6	786.3	787	.95	1.0		YW	TP#24
12-28-93	TP#24 DUP			410	1177	644.4	680	1.7	0.95	✓	DRC	2-3' SCREENED
12-2-93	RFL-SS-2394	12-1-93	12-3-93	446	1649	975.2	794	2.1	1.2		YW	TP#24
12-28-93	TP#24			440	1835	827.2	697	2.7	1.2	✓	DRC	3-4' SCREENED
12-2-93	RFL-SS-2395	12-1-93	12-3-93	548	1506	1064	809	1.9	1.3		YW	TP#24
12/29/93	TP#24 DUP			401	2065	955.3	696	3.0	1.2	✓	[illegible]	3-4' SCREENED
12-2-93	RFL-SS-2396	12-1-93	12-3-93	448	1560	626.9	778	1.7	.81		YW	TP#24
12-28-93	TP#24			538	1172	1141	655	1.8	1.7	✓	DRC	4-5' Screened

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

MK-FE JSON COMPANY
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CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-2-93	RFL-SS-2397	12-1-93	12/5/93	550	1249	1017	741	1.6	1.3		PW	Tp #24 Screened
12/29/93	Tp #24			502	1541	1257	665	2.0	1.8	✓	[illegible]	4-5 Dup
12-2-93	RFL-SS-2398	12-1-93	12-3-93	450	566	975.2	651	8.3	1.4		PW	Tp #25
12-29-93	Tp #25			404	6798	1010	575	12	1.8	✓	DRC	9-10 Screened
12-2-93	RFL-SS-2399	12-1-93	12-3-93	552	4659	1151	759	6.1	1.5		PW	Tp #25 Screened
12-28-93	Tp #25			472	5452	975.2	658	8.5	1.5	✓	DRC	9-10 Dup
12-2-93	RFL-SS-2400	12-1-93	1 12-6-93 (New 2-11-94)	452	1700	600.8	776	2.2	.77		PW	Tp #26
2-11-94	Tp #26			506	1288	786.3	648	2.0	1.2	✓	WLW	8.-9.5
12-2-93	RFL-SS-2401	12-1-93	12/3/93	554	3698	1218	665	5.6	1.8		PW	Tp #28
12/29/93	Tp #28			512	6348	939.8	610	10.4	1.5	✓	[illegible]	0-1
12-2-93	RFL-SS-2402	12-1-93	12/3/93	556	5404	911.1	732	.74	1.2		PW	TP #28
12-28-93	TP #28			404	7855	975.2	607	13	1.6	✓	DRC	1-2' SCREENED
12-2-93	RFL-SS-2403	12-1-93	12-3-93	454	4606	731.4	735	6.3	1.0		PW	TP #28 DUP
12-28-93	TP #28 DUP			476	7042	1149	611	12	1.9	✓	DRC	1-2' SCREENED
12-2-93	RFL-SS-2404	12-1-93	12/3/93	558	2593	1160	728	3.6	1.6		PW	TP #28
12/29/93	TP #28			414	4077	983.9	592	6.9	1.7	✓	[illegible]	2-3' SCREENED
12-2-93	RFL-SS-2405	12-1-93	12/3/93	456	2415	966.5	740	3.3	1.3		PW	TP #28 DUP
12/29/93	TP 28			500	4348	930.2	608	7.2	1.5	✓	[illegible]	2'-3' SCREENED
12-2-93	RFL-SS-2406	12-1-93	12/3/93	560	60753	3347	618	98	5.4		PW	TP 29
12/29/93	TP 29			508	103280	4229	555	186	7.6	✓	[illegible]	0-1' SCREENED

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-2-93	RFL-SS-2407	12-1-93	12/3/93	458	6766	3344	740	91	4.5		PV	TP 29 DUP
12/29/93	TP 29 DUP			482	114990	4789	641	178	7.4	✓	[illegible]	0-1' SCREENED
12-2-93	RFL-SS-2408	12-1-93	12/3/93	562	35228	2100	690	51	3.0		PV	TP 29
12/29/93	TP 29			514	60950	3174	618	99	5.1	✓	[illegible]	1-2' SCREENED
12-2-93	RFL-SS-2409	12-1-93	12/3/93	460	32065	2064	662	48	3.1		PV	TP 29 DUP
12/29/93	TP 29			504	57491	3397	596	96	4.0	✓	[illegible]	1-2' SCREENED
12-2-93	RFL-SS-2410	12-1-93	12/3/93	564	41989	2608	705	60	3.7		PV	TP 29
12/29/93	TP 29			416	74697	3344	651	115	5.1	✓	[illegible]	2-3' SCREENED
12-2-93	RFL-SS-2411	12-1-93	12/3/93	462	47500	2438	721	66	3.4		PV	TP 29 DUP
12/29/93	TP 29 DUP			516	82409	3519	639	131	5.5	✓	[illegible]	2-3' SCREENED
12-2-93	RFL-SS-2412	12-1-93	12-3-93	566	9550	1410	557	17	2.5		PV	TP 30
12-27-93	TP 30			455	17684	1132	516	34	2.2	✓	DRC	0-1'
12-2-93	RFL-SS-2413	12-1-93	12-3-93	464	2586	870.7	567	4.6	1.5		PV	TP 30
12-27-93	TP 30			568	6150	1130	543	11	2.2	✓	DRC	1-2'
12-2-93	RFL-SS-2414	12-1-93	12-3-93	568	34583	2014	468	74	4.3		PV	TP 30
12-27-93	TP 30			560	63312	2603	292	236	8.9	✓	DRC	2-3'
12-2-93	RFL-SS-~~2411~~ 2415 TP25 2S 12-2	12-1-93		466	518.5	853.3	340	1.3	2.2		PV	TP 25 COMPOSITE
										✓		6.5-7.5'
12-2-93	RFL-SS-2416	12-1-93	12-2-13	570	2615	815.1	419	6.2	1.9		PV	TP 27 COMPOSITE
2-11-94	TP 27			407	3114	714.0	419	9.3	1.7	✓	WW	9-12'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.6

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-3-93	RFL-SS-2417			400	3150	2020	572	55	3.5		PV	Tp #30
12/30/93	Tp #30	12-1-93	12/6/93	500	5468	2417	384	142	6.3	✓	LE	3-4'
12-3-93	RFL-SS-2418			500	2244	795.4	565	4.0	1.4		PV	Tp #30
12/30/93	Tp #30	12-1-93	12/6/93	402	4914	992.6	501	9.3	2.0	✓	LE	4-5' Screened
12-3-93	RFL-SS-2419			402	2878	870.1	574	5.0	1.5		PV	Tp #30 Dup.
12-28-93	Tp #30	12-1-93	12-6-93	407	6879	696.6	510	13	1.4	✓	DRC	4-5 Screened
12-3-93	RFL-SS-2420			502	2829	836.0	626	4.5	1.4		PV	Tp #30
12/30/93	Tp #30	12-1-93	12/6/93	502	8360	834.3	533	16.0	4.6	✓	LE	5-6' Screened
12-3-93	RFL-SS-2421			409	2400	731.4	651	3.7	1.1		PV	Tp #30
12/28/93	Tp #30	12-1-93	12-6-93	418	6679	731.4	558	12	1.3	✓	DRC	5-6' Dup Screened
12-3-93	RFL-SS-2422			509	7290	1036	686	11	1.5		PV	Tp #30
12/30/93	Tp #30	12-1-93	12/6/93	404	17045	1628	564	30	2.9	✓	LE	6-7' Screened
12-3-93	RFL-SS-2423			406	6232	~~4953.4~~ 4539	647	9.6	1.5		PV	Tp #30
12-28-93	Tp #30	12-1-93	12-6-93	529	16410	1247	542	30	2.3	✓	DRC	6-7' Dup Screened
12-3-93	RFL-SS-2424			506	2129	991.8	729	2.9	1.2		PV	Tp #30
12/30/93	Tp #30	12-1-93	12/6/93	504	2240	853.4	602	4.4	1.4	✓	LE	7-8' Screened
12-3-93	RFL-SS-2425			409	2244	757.5	687	3.3	1.1		PV	Tp #30 Screened
12-28-93	Tp #30	12-1-93	12-6-93	420	3430	624.2	569	6.0	1.2	✓	DRC	7-8' Dup
12-3-93	RFL-SS-2426			508	17004	1793	676	25	2.7		PV	〃
12/30/93	Tp #30	12-1-93	12/6/93	406	26641	1715	513	52	3.3	✓	LE	8-9' Screened

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: Robert K. Ferrell
Site HP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

FOR INFORMATION ONLY

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS [grams] WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-3-93	RFL-SS-2427	12-1-93	12-6-93	410	16055	1223	681	2.4	1.9		PU	Tp #30 Screened
12-23-93	Tp #30			510	24590	1477	521	47	2.3	✓	DRC	8'-9' Dup.
12-3-93	RFL-SS-2428	12-1-93	12/6/93	510	7341	1045	580	13	1.9		PU	Tp #19
12/30/93	Tp # 19			506	19013	1467	460	41	3.2	✓	KB	0'-1'
12-3-93	RFL-SS-2429	12-1-93	12/6/93	412	532.1	1158	606	.88	1.9		PU	Tp #19 *
12/30/93	Tp #19			408	1087	1106	549	2.0	2.0	✓	KB	2'-3'
12-3-93	RFL-SS-2430	12-1-93	12/6/93	512	6890	815.1	509	1.4	1.5		PU	Tp #19
12/30/93	Tp #19			508	1126	661.7	531	2.1	1.2	✓	KB	1'-2'
12-3-93	RFL-SS-2431	12-1-93	12/6/93	414	2174	957.8	643	3.4	1.5		PU	Tp #19
12/30/93	Tp #19			410	4017	1132	550	7.3	2.1	✓	KB	3½ - 4½
12-3-93	RFL-SS-2432	12-1-93	12-6-93	514	1550	949.3	630	3.0	1.5		PU	Tp #19
12-28-93	Tp #19			430	3738	1019	534	7.1	1.9	✓	DRC	3½ - 4½ Dup
12-3-93	RFL-SS-2433	12-1-93	12/6/93	416	2604	844.6	572	4.6	1.5		PU	Tp #19
12/30/93	Tp #19			510	4870	843.9	513	9.5	1.6	✓	KB	4½ - 5½
12-3-93	RFL-SS-2434	12-1-93	12-6-93	516	2459	1036	553	4.4	1.9		PU	Tp #19
12-28-93	Tp #19			522	4954	632.7	493	10	1.3	✓	DRC	4½ - 5½ Dup
12-3-93	RFL-SS-2435	12-1-93	12-6-93	418	1602	1036	658	2.4	1.6		PU	Tp #19
12-27-93	Tp #19			445	3471	1123	589	5.9	1.9	✓	DRC	5½ - 6½
12-3-93	RFL-SS-2436	12-1-93	12-6-93	518	1915	1112	661	2.9	1.7		PU	Tp #19
12-28-93	Tp #19			428	3525	835.9	592	6.0	1.4	✓	DRC	5½ - 6½ Dup

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

MK-FE[illegible]JSON COMPANY
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CWM Federal Environmental S[illegible]vices, Inc.

OCS SAMPLE LOG

SITE NAME RIFLE, CO.

[illegible]FORMATION ONLY

COUNT DATE INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH ≤15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12-3-93	RFL-SS-2437			420	719.7	731.4	553	1.3	1.3		RU	Tp # 11
12-27-93	Tp # 11	12-2-93	12-6-93	443	4353	1036	468	0.93	2.2	✓	DRC	3'-4'
12-3-93	RFL-SS-2438			520	4922	1486	666	7.4	2.2		RU	Tp # 11
12/30/93	Tp # 11	12-2-93	12/6/93	412	8584	1176	535	16.0	2.2	✓	[illegible]	4'-5'
12-3-93	RFL-SS-2439			422	1856	949.1	650	2.9	1.5		RU	Tp # 11
12/30/93	Tp # 11	12-2-93	12/6/93	512	3309	882.2	507	6.5	1.7	✓	[illegible]	5'-6'
12-3-93	RFL-SS-2440			522	9258	1323	782	1.2	1.7		RU	Tp # 11 screened
12-27-93	Tp # 11	12-2-93	12-6-93	447	1527	1356	644	2.4	2.1	✓	DRC	6'-7'
12-3-93	RFL-SS-2441			424	1283	905.6	753	1.7	1.2		RU	Tp # 11 screened
12-28-93	Tp # 11	12-2-93	12-6-93	422	1715	1055	614	2.5	1.7	✓	DRC	6'-7' Dup
12-3-93	RFL-SS-2442			524	1030	997.3	761	1.4	1.3		RU	Tp # 11 screened
12/30/93	Tp # 11	12-2-93	12/6/93	414	1980	1297	624	3.2	2.1	✓	[illegible]	7'-8'
12-3-93	RFL-SS-2443			426	1738	792.4	762	2.3	1.0		RU	Tp # 11 screened
12/30/93	Tp # 11	12-2-93	12/6/93	514	2233	1017	621	3.6	1.6	✓	[illegible]	7-8' Dup
12-3-93	RFL-SS-2444			526	733.0	911.0	830	.88	1.1		RU	Tp # 11 screened
12/30/93	Tp # 11	12-2-93	12/6/93	416	1408	1080	692	2.0	1.6	✓	[illegible]	8'-9'
12-3-93	RFL-SS-2445			428	1141	870.7	812	1.4	1.1		RU	Tp # 11 screened
12-28-93	Tp # 11	12-2-93	12-6-93	514	1457	930.2	677	2.2	1.3	✓	DRC	8-9 Dup
12-3-93	RFL-SS-2446			528	3010	1036	795	3.8	1.3		RU	Tp # 11 screened
12/30/93	TP # 11	12-2-93	12/6/93	516	4737	815.1	669	7.1	1.2	✓	[illegible]	9-10

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

MK-FER[illegible]ON COMPANY
A MORRISON [illegible]JDSEN COMPANY

CWM Federal Environmental Se[illegible]es, Inc.

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

FOR INFORMATION ONLY

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-3-93	RFL-SS-2447	12-2-93	12-6-93	430	2593	555.2	727	3.5	1.2		PU	Tp # 11 Screened
12-28-93	Tp # 11			512	4350	949.3	613	7.1	1.5	✓	DRC	9-10' Dup
12-3-93	RFL-SS-2448	12-2-93	12/6/93	530	37026	2215	666	56	3.3		PU	Tp # 15
12/30/93	Tp # 15			418	83688	4049	500	167	8.1	✓	[illegible]	0-1'
12-3-93	RFL-SS-2449	12-2-93	12/6/93	432	33650	6017	588	236	10		PU	Tp # 15
12/30/93	Tp # 15			518	268600	11191	484	555	23	✓	[illegible]	1-2'
12-3-93	RFL-SS-2450	12-2-93	12/6/93	532	120090	5399	587	205	9.2		PU	Tp # 15
12/30/93	Tp # 15			420	232430	9639	494	471	20.	✓	[illegible]	2-3'
12-3-93	RFL-SS-2451	12-2-93	12/6/93	434	27267	1393	565	48	2.5		PU	TP 15
12/30/93	TP 15			520	59645	2791	467	128	6.0	✓	[illegible]	3-4'
12-3-93	RFL-SS-2452	12-2-93	12-6-93	539	1484	1064	661	2.2	1.6		PU	TP 15
12-27-93	TP 15			548	4433	815.1	513	8.6	1.6	✓	DRC	4-5'
12-3-93	RFL-SS-2453	12-2-93	12/6/93	436	1441	896.9	708	2.0	1.3		PU	TP 15
12/30/93	TP 15			422	1900	940.4	531	3.5	1.8	✓	[illegible]	5-6'
12-3-93	RFL-SS-2454	12-2-93	12/6/93	536	666.3	891.8	763	.87	1.2		PU	TP 15
12/30/93	TP 15			522	1114	786.3	583	1.9	1.3	✓	[illegible]	6-7'
12-3-93	RFL-SS-2455	12-2-93	12/6/93	438	492.0	535.9	688	.72	1.2		PU	TP 15
12/30/93	TP 15			424	561.4	775.0	516	1.1	1.5	✓	[illegible]	7-8'
12-3-93	RFL-SS-2456	12-2-93	12/6/93	538	4958	853.4	651	7.3	1.3		PU	TP 15
12/30/93	TP 15			524	8433	843.9	531	16.	1.6	✓	[illegible]	8-9'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

EF-IN-001.1-ICN-01

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

FOR INFORMATION ONLY

COUNT DATE (INITIAL) 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # (INITIAL) 20 DAY	Bi-214 pCi (INITIAL) 20 DAY	Tl-208 pCi (INITIAL) 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g (INITIAL/CORR) 20 DAY	Th-232 pCi/g (INITIAL) 20 DAY	DEPTH <15cm / >15cm	TECH (INITIAL) 20 DAY	COMMENTS
12-3-93	RFL-SS-2457 TP15	12-2-93		440	403.7	553.3	747	5.4	1.1		PV	TP15
12/30/93			12/6/93	426	665.0	126.3	612	11	2.1	✓	[illegible]	9-10'
12-3-93	RFL-SS-2458 TP15	12-2-93		540	731.1	542.2	663	1.1	1.3		PV	TP15
12/30/93			12/6/93	526	1061	959.8	533	2.0	1.8	✓	[illegible]	10-11'
12-3-93	RFL-SS-2459			442	973.4	809.8	799	1.2	1.0		PV	TP#15
12/30/93	TP#15	12-2-93	12/6/93	428	1452	1071	674	2.2	1.6	✓	[illegible]	12'-13' Screened #4
12-3-93	RFL-SS-2460			542	3050	997.3	831	3.7	1.3		PV	TP#15, 11'-12' #3 12'-13' #5 Screened #4
12-27-93	TP#15	12-2-93	12-6-93	546	5323	871.8	675	7.9	1.3	✓	DRC	
12-3-93	RFL-SS-2461			444	796.2	931.7	767	1.0	1.2		PV	TP#15, 11'-12' 12'-13' Screened #4
12-28-93	TP#15-DUP	12-2-93	12-6-93	520	1926	1007	623	2.5	1.6	✓	DRC	
12-3-93	RFL-SS-2462			544	1474	939.8	808	1.8	1.2		PV	TP#15
12-28-93	TP#15 DUP	12-2-93	12-6-93	426	1796	705.3	633	2.4	1.6	✓	DRC	12'-13' Screened #4
12-3-93	RFL-SS-2463A			446	437.2	1228	775	5.6	1.6		PV	TP#4
12/29/93	TP#4	12-3-93	12/6/93	418	542.0	849.5	635	8.5	1.4	✓	[illegible]	11'-12' Screened
12-3-93	RFL-SS-2464			546	502.7	153.4	771	6.5	2.0		PV	TP#4
12-28-93	TP#4 DUP	12-3-93	12-6-93	502	697.7	119.9	636	11	1.9	✓	DRC	11'-12' Screened
12-3-93	RFL-SS-2465A			448	848.2	1358	694	12	2.0		PV	TP#4
12/29/93	TP#4	12-3-93	12/6/93	518	1082.3	1122	619	17	1.8	✓	[illegible]	12'-13' Screened
12-3-93	RFL-SS-2466A			548	856.3	1026	673	13	1.5		PV	TP#4
12-28-93	TP#4 - DUP	12-3-93	12-6-93	424	1008.8	1010	600	17	1.7	✓	DRC	12'-13' Screened

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature]
Site HP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

TE NAME RIFLE, CO.

OCS SAMPLE LOG

FOR INFORMATION ONLY

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
2-3-93	RFL-SS-2467A			450	3259	1219	654	6.1	1.9		PW	TP#4
2/29/93	TP#4	12-3-93	12/6/93	420	5282	896.9	574	9.2	1.6	✓	[illegible]	13'-14' Screened
2-3-93	RFL-SS-2468A			550	5132	1036	731	7.0	1.4		PW	TP#4
2-28-93	TP#4-DUP	12-3-93	12-6-93	414	7071	923.0	642	11	1.4	✓	DEC	13'-14' Screened
2-3-93	RFL-SS-2469A			452	1143	905.6	611	1.9	1.5		PW	TP#4
2/29/93	TP#4	12-3-93	12/6/93	520	1815	767.1	565	3.2	1.4	✓	[illegible]	14'-15' Screened
2-3-93	RFL-SS-2470A			552	1651	1064	729	2.3	1.5		PW	TP#4
2-28-93	TP#4-DUP	12-3-93	12-6-93	416	2466	775.0	581	4.2	1.3	✓	DEC	14'-15' Screened
2-3-93	RFL-SS-2471A			454	9[illegible]2.1	1045	718	1.3	1.5		PW	TP#4
2/29/93	TP#4	12-3-93	12/6/93	422	1264	722.7	651	1.9	1.1	✓	[illegible]	15'-16' Screened
2-3-93	RFL-SS-2472A			554	1071	1055	669	1.6	1.6		PW	TP#4
12-28-93	TP#4-DUP	12-3-93	12-6-93	516	1500	1343	633	2.4	2.1	✓	DEC	15'-16' Screened
12-3-93	RFL-SS-2473A			456	979.5	923.0	823	1.2	1.1		PW	Tp#4
2/29/93	Tp#4	12-3-93	12/6/93	522	1668	738.4	697	2.4	1.1	✓	[illegible]	16-17' Screened
12-3-93	RFL-SS-2474A			556	968.4	1045	854	1.1	1.2		PW	Tp#4,
12-28-93	Tp#4-Dup	12-3-93	12-6-93	508	1519	960.0	719	2.1	1.3	✓	DEC	16-17' Screened
12-3-93	RFL-SS-2475			458	633.6	966.5	519	1.2	1.9		PW	Tp#31 Background
12/30/93	Tp#31	12-3-93	12/6/93	528	707.9	690.4	456	1.6	1.5	✓	[illegible]	0-1'
12-3-93	RFL-SS-2476			558	514.5	1024	471	1.1	2.3		PW	TP#31
12/30/93	Tp#31	12-3-93	12/6/93	430	445.7	1097	409	1.1	2.7	✓	[illegible]	1'-2' Background

Site Correction Factor = 1.8

HP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature]
Site HP Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-3-93	RFL-SS-2477	12-3-93	12/6/93	460	117.6	116.7	421	.42	2.9		PU	Tp #31
12/30/93	TP #31			530	515.8	911.0	353	1.5	2.6 cs-12-3-93	✓	[illegible]	2'-3' Background
12-3-93	RFL-SS-2478	12-3-93	12/6/93	560	249.4	1026	450	.65	2.3		PU	Tp #31
12/30/93	Tp #31			432	606.7	844.6	392	1.5	2.2	✓	[illegible]	3'-4' Background
12-3-93	RFL-SS-2479	12-3-93	12/6/93	462	350.0	1012	541	.70	2.0		PU	Tp #31
12/30/93	Tp #31			532	847.8	719.2	481	1.8	1.5	✓	[illegible]	4'-5' Background
12-3-93	RFL-SS-2480	12-3-93	12/6/93	562	675.6	1007	691	.99	1.5		PU	Tp #31
12/30/93	Tp #31			434	377.2	1019	617	.62	1.7	✓	[illegible]	5-6' Background
12-3-93	RFL-SS-2481	12-3-93	12/6/93	464	301.2	923.0	605	.50	1.5		PU	Tp #31
12/30/93	Tp #31			534	412.8	876.8	544	0.76	1.62	✓	[illegible]	6-7' Background
12-3-93	RFL-SS-2482	12-3-93	12/6/93	564	635.9	1141	716	.89	1.6		PU	Tp #31 screened
12/30/93	Tp #31			436	604.1	1097	667	0.91	1.6	✓	[illegible]	7-8' Background
12-3-93	RFL-SS-2483	12-3-93	12/6/93	466	562.1	1036	695	.82	1.5		PU	Tp #31 screened
12/29/93	Tp #31-Dup			436	832.8	681.2	636	1.3	0.97	✓	[illegible]	7-8' Background
12-3-93	RFL-SS-2484	12-3-93	12/6/93	566	512.0	1132	806	.64	1.4	cs-12-3-93 ✓	PU	Tp #31 screened
12/30/93	Tp #31			536	556.7	968.5	727	0.77	1.3	✓	[illegible]	8-9' Background
12-3-93	RFL-SS-2485	12-3-93	12/6/93	468	626.1	1045	929	.75	1.3		PU	Tp #31 screened
2-11-94	Tp #31-Dup			404	981.2	949.1	750	1.3	1.3	✓	WLW	8-9' Background
12-3-93	RFL-SS-2486	12-3-93	12/6/93	568	744.6	786.3	780	.95	1.0		PU	Tp #31 screened
12/30/93	Tp #31-~~Dup~~ cs-12-3-93			438	385.4	853.2	593	0.65	1.4	✓	cs-12-3-93	~~8-9'~~ 9-10' Background

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature]
Site HP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12-3-93	RFL-SS-2487	12-3-93	12/6/93	470	533.4	858.2	828	.64	1.1		[initials]	Tp#31 Screened
12/29/93	Tp#31 - Dup			424	501.3	687.9	708	0.71	0.97	✓	[initials]	9'-10' Background
12-3-93	RFL-SS-2488	12-3-93	12/6/93	570	771.8	853.4	701	1.1	1.2		[initials]	Tp#31 screened
12/30/93	Tp#31			538	489.6	767.1	598	0.82	1.3	✓	[initials]	10'-11' Background
12-3-93	RFL-SS-2489	12-3-93	12/6/93	472	758.8	844.6	691	1.1	1.2		[initials]	Tp#31 Screened
12/30/93	Tp#31 - Dup			440	592.8	923	605	0.98	1.5	✓	[initials]	10'-11' Background
12-3-93	RFL-SS-2490	12-3-93	12/6/93	572	474.7	939.8	800	.59	1.2		[initials]	Tp#31 screened
12/30/93	Tp#31 ~~Dup~~			540	918.1	1045	688	.61	1.5	✓	[initials]	11'-12' Background
12-3-93	RFL-SS-2491	12-3-93	12/6/93	474	940.9	818.5	777	1.2	1.1		[initials]	Tp#31 screened
12/30/93	Tp#31 - Dup			442	684.9	975.2	683	1.0	1.4	✓	[initials]	11'-12' Background
12-3-93	RFL-SS-2492	12-2-93	12/6/93	574	802.2	604.1	450	1.8	1.3		[initials]	Tp#2
12/29/93	Tp#2			524	938.6	527.4	423	2.2	1.2	✓	[initials]	0'-1'
12-3-93	RFL-SS-2493	12-2-93	12/6/93	476	773.1	966.5	605	1.3	1.6		[initials]	Tp#2
12/29/93	Tp#2			426	634.9	888.2	563	1.1	1.6	✓	[initials]	1'-2'
12-3-93	RFL-SS-2494	12-2-93	12-6-93	576	910.3	1132	415	2.2	~~2.2~~ 2.7 B 12/13/93		[initials]	Tp#2
12-27-93	Tp#2			433	2074	931.7	328	1.9	2.5	✓	OCC	2'-3'
12-3-93	RFL-SS-2495	12-2-93	12/6/93	478	555.4	835.9	383	1.5	2.2		[initials]	Tp#2
12/29/93	Tp#2			526	1056	700.0	353	3.0	2.0	✓	[initials]	3'-4'
12-3-93	RFL-SS-2496	12-2-93	12/6/93	578	549.1	786.3	439	1.3	1.8		[initials]	Tp#2
12/30/93	Tp#2			542	394.6	883.2	412	0.97	2.2	✓	[initials]	4'-5'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

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REVIEWED BY: [signature]
Site HP Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-3-93	RFL-SS-2497			480	466.6	931.7	521	.90	1.5		LB	Tp#2.
12/30/93	Tp #2	12-2-93	12/6/93	444	529.7	931.7	462	1.1	2.0	✓	LB	5'-6'
12-3-93	RFL-SS-2498			580	315.3	939.8	616	.51	1.5		LB	Tp#2.
12/29/93	Tp #2	12-2-93	12/6/93	498	546.3	696.6	555	0.98	1.3	✓	LB	6'-7'
12-3-93	RFL-SS-2499			482	463.7	883.2	556	.83	1.6		LB	Tp#2
12/29/93	Tp #2	12-2-93	12/6/93	528	1139	556.2	505	2.3	1.1	✓	LB	7'-8'
12-3-93	RFL-SS-2500			582	665.5	832.2	556	1.2	1.6		LB	Tp#2
12/29/93	Tp #2	12-2-93	12/6/93	430	745.1	781.4	507	1.5	1.4	✓	LB	8'-9'
12-3-93	RFL-SS-2501			484	618.7	819.5	708	.96	1.2		LB	Tp#2
12/29/93	Tp #2	12-2-93	12/6/93	530	878.5	652.1	637	1.4	1.0	✓	LB	9'-10'
12-3-93	RFL-SS-2502			554	583.8	767.1	586	1.0	1.3		LB	Tp#2
12/30/93	Tp #2	12-2-93	12/6/93	544	385.5	920.6	564	0.59	1.6	✓	LB	10'-11'
12-3-93	RFL-SS-2503			486	696.9	1158	693	1.0	1.7		LB	Tp#2
12/29/93	Tp #2	12-2-93	12/6/93	432	857.9	905.6	644	1.3	1.4	✓	LB	11'-12' Screened
12-3-93	RFL-SS-2504			536	532.3	853.4	648	.82	1.3		LB	Tp#2
2-11-94	Tp #2-Dup	12-2-93	12/6/93	406	1039	966.5	604	1.7	1.6	✓	WW	11-12' Screened
12-6-93	RFL-SS-2505			400	520.3	783.7	608	.86	1.3		PW	TP#2
12/29/93	TP#2	12-2-93	12/6/93 12/7/93	536	806.2	920.6	574	1.4	1.6	✓	LB	12'-13' Screened
12-6-93	RFL-SS-2506			500	620.3	949.3	613	1.0	1.5		PW	TP#2
12/~~29~~ 12/29/93	TP#2-DUP	12-2-93	12/7/93	534	1132	938.4	577	2.0	1.3	✓	LB	12'-13' Screened

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

F5-IN-001-1, ICN-01

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

INFORMATION ONLY

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-6-93	RFL-SS-2507			402	803.7	949.1	673	1.2	1.4		PU	TP#2
12/29/93	TP#2	12-2-93	12/7/93	438	747.8	870.7	619	1.2	1.4	✓	[illegible]	13'-14' Screened
12-6-93	RFL-SS-2508			502	571.7	1064	691	.83	1.5		PU	TP#2
12/29/93	TP#2-DUP	12-2-93	12/7/93	538	1132	834.3	642	1.8	1.3	✓	[illegible]	13'-14' Screened
12-6-93	RFL-SS-2509			404	844.6	896.9	673	1.3	1.3		PU	TP#2
12/29/93	TP#2	12-2-93	12/7/93	440	707.3	1123	618	1.1	1.8	✓	[illegible]	14'-15' Screened
12-6-93	RFL-SS-2510			504	744.9	968.5	607	1.2	1.6		PU	TP#2
12/29/93	TP#2-DUP	12-2-93	12/7/93	540	971.9	911.0	553	1.8	1.6	✓	[illegible]	14'-15' Screened
12-6-93	RFL-SS-2511			406	716.6	975.2	631	1.1	1.5		PU	TP#2
12/29/93	TP#2	12-2-93	12/7/93	442	641.2	888.2	573	1.1	1.6	✓	[illegible]	15'-16' Screened
12-6-93	RFL-SS-2512			506	845.0	8632	672	1.3	1.3		PU	TP#2
12/29/93	TP#2-DUP	12-2-93	12/7/93	542	867.4	1227	616	1.4	2.0	✓	[illegible]	15'-16' Screened
12-6-93	RFL-SS-2513			408	582.7	1045	597	1.0	1.8		RMC	TP#2
12/29/93	TP#2	12-2-93	12/7/93	444	571.9	818.5	523	1.0	1.6	✓	[illegible]	16'-17' screened
12-6-93	RFL-SS-2514			508	521.5	891.8	468	1.1	1.9		RMC	TP#2
12/29/93	TP#2-DUP	12-2-93	12/7/93	544	561.0	843.9	410	1.4	2.1	✓	[illegible]	16'-17' screened
12-6-93	RFL-SS-2515			410	726.9	1036	730	1.0	1.4		RMC	TP#2
12/29/93	TP#2	12-2-93	12/7/93	446	732.1	1115	647	1.1	1.7	✓	[illegible]	17'-18' screened
12-6-93	RFL-SS-2516			510	428.6	997.3	660	.65	1.5		RMC	TP#2
12/29/93	TP#2-DUP	12-2-93	12/7/93	546	919.7	891.8	582	1.6	1.5	✓	[illegible]	17'-18' screened

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature] Site HP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

SITE NAME RIFLE, CO.

FOR INFORMATION ONLY

COUNT DATE INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-228 pCi/g INITIAL/L. AR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12-6-93	RFL-SS-2517			412	678.7	879.5	240	.92	1.2		RWC	TP#2
12/29/93	TP#2	12-2-93	12/7/93	448	1092	992.6	601	1.8	1.7	✓	B	18'-19' screened
12-6-93	RFL-SS-2518			512	438.9	767.1	586	.75	1.3		RWC	TP#2
12/29/93	TP#2-DUP	12-2-93	12/7/93	548	760.4	891.8	457	1.7	2.0	✓	B	18'-19' screened
12-6-93	RFL-SS-2519			414	701.3	740.1	500	1.4	1.5		RWC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	450	601.6	766.3	444	1.4	1.7	✓	B	2'-3'
12-6-93	RFL-SS-2520			514	750.5	680.8	465	1.6	1.5		RWC	TP#3
12-27-93	TP#3 ~~DUP~~ RWC	12-2-93	12-7-93	427	814.4	531.2	401	2.C	1.3	✓	B	3'-4'
12-6-93	RFL-SS-2521			416	859.7	740.1	438	2.0	1.7		RWC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	550	791.1	824.7	393	2.0	2.1	✓	B	RWC 12-6-93 ~~3'-4'~~ 4'-5'
12-6-93	RFL-SS-2522			516	1944	805.5	506	3.8	1.6		RWC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	452	4532	766.2	463	9.8	1.7	✓	B	5'-6'
12-6-93	RFL-SS-2523			418	433.9	722.7	492	.88	1.5		RWC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	552	656.5	949.3	445	1.5	2.1	✓	B	7'-8'
12-6-93	RFL-SS-2524			518	772.0	767.1	601	1.3	1.3		RWC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	454	615.6	853.3	547	1.1	1.6	✓	B	6'-7'
12-6-93	RFL-SS-2525			420	629.7	905.6	651	.97	1.4		RWC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	554	831.5	786.3	593	1.4	1.3	✓	B	RWC 12-6-93 ~~7'-8'~~ 8'-9'
12-6-93	RFL-SS-2526			520	871.6	834.3	636	1.4	1.3		RWC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	456	766.3	866.0	570	1.3	1.5	✓	B	RWC 12-6-93 ~~8'-9'~~ 9'-10'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature]
Site HP Manager

F5-IN-001-1, ICN-01

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

FOR INFORMATION ONLY

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-6-93	RFL-SS-2527			422	628.4	983.9	647	.97	1.5		RwC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	556	681.2	719.2	576	1.2	1.2	✓	[illegible]	10'-11'
12-6-93	RFL-SS-2528			522	535.7	978.1	685	.78	1.4		RwC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	458	723.7	797.4	592	1.2	1.3	✓	[illegible]	11'-12'
12-6-93	RFL-SS-2529			424	659.1	870.7	619	1.1	1.4		RwC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	558	783.2	815.1	543	1.4	1.5	✓	[illegible]	12'-13'
12-6-93	RFL-SS-2530			524	695.5	805.5	586	1.2	1.4		RwC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	460	431.2	1167	509	0.85	2.3	✓	[illegible]	13'-14'
12-6-93	RFL-SS-2531			426	643.6	827.2	663	.97	1.3		RwC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	560	719.3	920.6	598	1.2	1.5	✓	[illegible]	14'-15'
12-6-93	RFL-SS-2532			526	507.3	1074	664	.76	1.6		RwC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	462	684.7	870.7	549	1.1	1.6	✓	[illegible]	15'-16'
12-6-93	RFL-SS-2533			428	680.0	1028	724	.94	1.4		RwC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	562	1029	719.2	642	1.6	1.1	✓	[illegible]	16'-17'
12-6-93	RFL-SS-2534			528	608.1	978.1	591	1.0	1.7		RwC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	464	505.2	844.6	527	0.96	1.6	✓	[illegible]	17'-18
12-6-93	RFL-SS-2535			430	539.4	888.2	661	.82	1.3		RwC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	564	101.2	872.6	592	1.7	1.5	✓	[illegible]	18'-19' screened
12-6-93	RFL-SS-2536			530	529.2	387.7	697	.76	.56		RwC	TP#3
12/29/93	TP#3 DUP	12-2-93	12/7/93	434	534.7	809.8	624	0.86	1.3	✓	[illegible]	18'-19' screened

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

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REVIEWED BY: [signature] Site HP Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

OCS SAMPLE LOG

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

COUNT DATE INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-228 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH ≤15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12-6-93	RFL-SS-2537			432	224.7	1001	820	.88	1.2		RMC	TP#3
12/27/93	TP#3	12-2-93	12/7/93	466	690.1	957.8	746	0.93	1.3	✓	[illegible]	19'-20' screened
12-6-93	RFL-SS-2538			532	474.8	1208	870	~~.55~~ ~~.83~~	~~2.1~~ 1.4		RMC	TP#3
12/29/93	TP#3 DUP	12-2-93	12/6/93	532	1330	863	785	1.6	1.1	✓	[illegible]	DUP 19'-20' screened
12-6-93	RFL-SS-2539			434	548.6	231.4	754	.23	.97		RMC	TP#3
12/29/93	TP#3	12-2-93	12/7/93	467	690.1	957.8	746	0.93	1.3	✓	[illegible]	20'-21' screened
12-6-93	RFL-SS-2540			534	636.5	882.2	731	.87	1.2		RMC	TP#3
12/29/93	TP#3 DUP	12-2-93	12/7/93	468	534.0	896.9	616	0.87	1.5	✓	[illegible]	DUP 20'-21' screened
12-6-93	RFL-SS-2541			436	324.4	696.6	440	2.0	1.6		RMC	TP#7
12/30/93	TP#7	12-2-93	12/7/93	446	546.8	801.1	353	1.5	2.3	✓	[illegible]	14'-15
12-6-93	RFL-SS-2542			536	860.8	815.1	577	1.5	1.4		RMC	TP#7
12-27-93	TP#7	12-2-93	12-7-93	~~536~~ 556	1344	939.8	449	3.0	2.1	✓	[illegible]	15'-16' screened
12-6-93	RFL-SS-2543			438	670.1	748.8	618	1.1	1.2		RMC	TP#7
12/29/93	TP#7 DUP	12-2-93	12/7/93	568	943.5	738.4	481	2.0	1.5	✓	[illegible]	DUP 15'-16' screened
12-6-93	RFL-SS-2544			538	3378	930.2	735	4.6	1.3		RMC	TP#7
12-27-93	TP#7	12-2-93	12-7-93	552	3667	743.0	617	5.9	1.2	✓	[illegible]	16'-17' screened
12-6-93	RFL-SS-2545			440	3893	975.2	756	5.1	1.3		RMC	TP#7
12/29/93	TP#7 DUP	12-2-93	12/7/93	470	5222	1237	638	8.2	1.9	✓	[illegible]	DUP 16'-17' screened
12-6-93	RFL-SS-2546			540	9549	1218	801	12	1.5		RMC	TP#7
12/30/93	TP#7	12-2-93	12/7/93	546	11601	1160	686	17.	1.7	✓	[illegible]	17'-18' screened

Site Correction Factor = 1.8

HP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature]
Site HP Manager

F5-IN-001-1, ICN-01

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

FOR INFORMATION ONLY

COUNT DATE / INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # / INITIAL / 20 DAY	Bi-214 pCi/g INITIAL / 20 DAY	Tl-208 pCi/g INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12-6-93	RFL-SS-2547			442	11519	1280	809	14	1.6		LB	TP#7 screened
12/29/93	TP#7 DUP	12-2-93	12/7/93	570	14405	1112	693	20.	1.6	✓	LB	17'-18' DUP
12-6-93	RFL-SS-2548 TP#6	11/30/93		448	73263	3030	465	158	6.5	✓	LB	TP#6 Composite 20-25'
12-6-93	RFL-SS-2549 TP#19	12/3/93		548	1001	1084	559	1.8	1.9	✓	LB	TP#19 Composite 3.5'-5.5'
12-6-93	RFL-SS-2550 TP#20	12-3-93		450	1957	653.1	648	3.0	1.0		LB	TP#20 Composite
12-6-93	RFL-SS-2551 12-6-93 KC TP#20 20	12-1-93		550	2243	863.0	561	4.0	1.5	✓	LB	TP#20 Composite 1'-5'
12-6-93	RFL-SS-2552 TP#21	12-1-93		452	980.4	548.6	637	1.5	.86	✓	LB	TP#21 Composite 1'-5'
12-6-93	RFL-SS-2553 TP#21	12-3-93		552	12270	1458	648	19	2.3		LB	TP#21 Composite
12-6-93	RFL-SS-2554 TP#22	12/3/93		454	452.8	518.5	648	.70	1.3		LB	TP22 Composite
12-6-93	RFL-SS-2555 TP#24	12/3/93		554	4293	9206	608	1.5	1.5		LB	TP#24 Composite
12-6-93	RFL-SS-2556 TP#25	12/3/93		456	787.9	1193	772	1.0	1.5	✓	LB	TP#25 Composite 6.5'-8.5'

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: Robert W. Ferrick
Site HP Manager

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.

TE NAME RIFLE, CO.

OCS SAMPLE LOG

FOR INFORMATION ONLY

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
2-6-93	RFL-SS-2557			556	810.7	1064	524	1.5	2.0		[illegible]	TP#25 Composite
	TP#25	12-1-93								✓		7.5'-8.5'
2-6-93	RFL-SS-2558			458	1234	844.6	538	2.3	1.6		[illegible]	TP#25 Composite
	TP#25	12-1-93								✓		9'-10'
2-6-93	RFL-SS-2559			558	1229	955.9	635	1.9	1.5		[illegible]	TP#27 Composite
	TP#27	12-3-93								✓		9.5'-11'
2-6-93	RFL-SS-2560			460	9576	879.5	678	1.4	1.3		[illegible]	TP#28 Composite
	TP#28	12-3-93										
2-6-93	RFL-SS-2561			560	97855	2014	410	92.1	4.9		[illegible]	TP#29 Composite
	TP#29	12-3-93										
2-6-93	RFL-SS-2562			572	14255	1117	732	19	1.5		[illegible]	
12/30/93	493	12-6-93	12/7/93	448	2018.4	1811	676	31	2.7	✓	[illegible]	
~~12-7-93~~ 12-6-93 RWC	RFL-SS-2563	12-6-93 RWC 12-6-93 RWC		464	2747	905.6	519	0.53	1.7		RWC	TP#2
	TP#2									✓		13'-16' Composite
12-7-93	RFL-SS-2564	12-6-93 RWC 12-6-93 RWC		564	450.4	997.3	556	0.77	1.7		RWC	TP#1
	TP#1									✓		15'-17' Composite
12-7-93	RFL-SS-2565			466	628.4	953.9	543	1.2	1.8		RWC	TP#15
	TP#15	12-6-93								RWC 12-7-93		Composite
12-7-93	RFL-SS-2566			566	327.2	728.8	519	0.63	1.4		RWC	TP#26
	TP#26	12-6-93										Composite

Site Correction Factor = 1.8

HP Correction Factor (if applicable) = 2.0

Count Time = 500 sec. ____, unless otherwise noted

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Site HP Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

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OCS SAMPLE LOG

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-7-93	RFL-SS-2567			468	1932	807.8	604	3.0	1.3		RWC	TP#30
	TP#30	12-6-93								✓		4.5'-7.5' Composite
12-8-93	RFL-SS-2568			424	489.7	801.1	578.3	0.85	1.4		RWC	Composite
	BKG Pit	12-7-93								✓		BKG Pit
12-8-93	RFL-SS-2569			524	926.9	6233	530.7	1.8	1.2		RWC	TP#4
	TP#4	12-7-93								✓		Composite
12-8-93	RFL-SS-2570			426	555.1	539.9	436.2	1.3	1.2		RWC	TP#3
	TP#3	12-7-93								✓		Composite
12-8-93	RFL-SS-2571			526	309.3	776.7	491.3	.63	1.6		RWC	TP#5
	TP#5	12-7-93								✓		Composite
12-8-93	RFL-SS-2572			428	579.2	618.2	462.0	1.3	1.3		RWC	TP#11
	TP#11	12-7-93								✓		Composite
12-8-93	RFL-SS-2573			528	2599.1	3433	476.0	160	7.2		RWC	TP#7
	TP#7	12-7-93								✓		Composite
12/9/93	RFL-SS-2574			400	1372	636.9	446	3.1	1.4		RB	TP#1 -4 MOIST
12/30/93	TP#1	12/6/93	12/9/93	450	1528	870.7	446	3.4	2.0	✓	RB	15-17' Composite
12/9/93	RFL-SS-2575			500	521.2	978.1	433	1.2	2.3		RB	TP#2 -4 moist
12/30/93	TP#2	12/6/93	12/9/93	550	42.8	89.8	433	0.95	2.1	✓	RB	13-16' Composite
12/9/93	RFL-SS-2576			402	921.0	609.5	460	2.0	1.3		RB	TP#3 18-21' -4 moist
1-3-94	TP#3	12/7/93	12/9/93	500	624.7	1093	460	1.4	2.4	✓	RB	Composite

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

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Site HP Manager

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CWM Federal Environmental Services, Inc.

FOR INFORMATION ONLY

OCS SAMPLE LOG

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH ≤15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
2/9/93	RFL-SS-2577			502	2337	805.2	442	5.3	1.8		LB	TP#4 -4 Moist
1/3/94	TP#4	12/7/93	12/9/93	518	2948	1074	442	6.7	2.4	✓	LB	11-16' Composite
2/9/93	RFL-SS-2578			404	885.8	653.1	427	2.1	1.5		LB	TP#5 -4 Moist
1-3-94	TP#5	12/7/93	12/9/93	400	1172	757.5	427	2.7	1.8	✓	LB	16-21' Composite
2/9/93	RFL-SS-2579			504	73891	5260	419	154.3	6.8		LB	TP#7 -4 Moist
1/3/94	TP#7	12/7/93	12/9/93	402	100310	4476	479	209.4	9.3	✓	LB	11-21' Composite
2/9/93	RFL-SS-2580			406	1061	809.8	417	2.5	1.9		LB	TP#11 -4 Moist
1/3/94	TP#11	12/7/93	12/9/93	502	1072	978.1	417	2.6	2.3	✓	LB	6-10' Composite
2/9/93	RFL-SS-2581			506	1563	786.3	525	3.0	1.5		LB	TP#15 -4 Moist
1/3/94	TP#15	12/6/93	12/9/93	504	2978	911.0	525	5.7	1.7	✓	LB	10-13' Composite
2/9/93	RFL-SS-2582			408	1698	757.5	456	3.7	1.7		LB	TP#19 -4 Moist
1/3/94	TP#19	12/2/93	12/9/93	404	3612	949.1	456	7.9	2.1	✓	LB	3.5'-5.5' Composite
12/9/93	RFL-SS-2583			508	2974	949.5	500	5.9	1.9		LB	TP#20 -4 Moist
1/3/94	TP#20	12/2/93	12/9/93	506	5162	968.5	500	10.3	1.9	✓	LB	Composite
12/9/93	RFL-SS-2584			410	10557	940.4	456	23	2.1		LB	TP#21 -4 Moist
1/3/94	TP#21	12/6/93	12/9/93	406	18350	1724	456	40	3.8	✓	LB	Composite
12/9/93	RFL-SS-2585			510	838.3	958.9	582	1.4	1.6		LB	TP#22 -4 Moist
1/3/94	TP#22	12/6/93	12/9/93	508	1020	872.6	582	1.8	1.5	✓	LB	Composite
12/9/93	RFL-SS-2586			412	565.3	696.7	495	1.1	1.4		LB	TP#24 -4 Moist
1/3/94	TP#24	12/1/93	12/9/93	408	1214	1115	495	2.5	2.3	✓	LB	Composite

Site Correction Factor = 1.8

HP Correction Factor (if applicable) = 2.0

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Site HP Manager

F5-IN-001-1, ICN-01

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.
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OCS SAMPLE LOG

SITE NAME RIFLE, CO.

COUNT DATE / INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # / INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12/9/93	RFL-SS-2587			512	1218	997.3	553	2.2	1.8		B	TP#25 -4 Mois
1/3/94	TP#25	12/1/93	12/9/93	410	2232	975.2	553	4.0	1.8	✓	B	Composite
12/9/93	RFL-SS-2588			444	799.3	687.9	526	1.5	1.3		B	TP#26 -4 Mois
1/3/94	TP#26	12/6/93	12/9/93	510	1106	863.0	526	2.1	1.6	✓	B	8.0-9.5' Composi
12/9/93	RFL-SS-2589			514	658.5	795.9	583	1.1	1.4		B	TP#27 -4 Mois
1/3/94	TP#27	12/6/93	12/9/93	512	899.6	911.0	583	1.5	1.6	✓	B	9.5'-11.0' Compos
12/9/93	RFL-SS-2590			416	3456	2020	417	8.3	4.8		B	TP#29 -4 Mois
1/3/94	TP#29	12/6/93	12/9/93	412	6206	3100	417	14.9	7.4	✓	B	Composite
12/9/93	RFL-SS-2591			516	730.1	786.3	507	1.4	1.6		B	TP#30 -4 Mois
1/3/94	TP#30	12/6/93	12/9/93	514	1117	1007	507	2.2	2.0	✓	B	4.5-7.5' Compos
12/9/93	RFL-SS-2592			418	859.7	740.1	633	1.4	1.2		B	TP#32 Consy
1/3/94	TP#32	12/8/93	12/9/93	414	819.3	896.9	633	1.3	1.4	✓	B	Composite
12/9/93	RFL-SS-2593			518	559.1	642.5	492	1.1	1.3		B	TP#33 Consy
1/3/94	TP#33	12/8/93	12/9/93	516	511.3	767.1	492	1.0	1.6	✓	B	Composite
12/9/93	RFL-SS-2594			420	794.6	809.8	464	1.7	1.7		B	TP# BKG -4 Mois
1/3/94	TP# BKG	12/7/93	12/9/93	416	790.7	1237	464	1.7	2.7	✓	B	Composite
12/9/93	RFL-SS-2595			426	1237	783.7	490	2.5	1.6		B	TP#1 1 of 2
1/3/94	TP#1	12/6/93	12/13/93	418	2096	1228	448	4.7	2.7	✓	B	15-17' Rust Comp.
12/9/93	RFL-SS-2596			526	1416	853.4	494	2.9	1.7		B	TP#1 2 of 2
1/3/94	TP#1	12/6/93	12/13/93	420	2077	748.8	453	4.6	1.7	✓	B	15-17' Rust Comp.

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: Robert K. Fencil
Site HP Manager

MK-FERGUSON COMPANY
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CWM Federal Environmental Services, Inc.

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OCS SAMPLE LOG

ITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12/9/93	RFL-SS-2597			428	503.0	809.8	495	1.0	1.6		LB	TP#2 1 of 2
1/3/94	TP#2	12/6/93	12/13/93	520	566.5	911.0	452	1.3	2.0	✓	LB	13-16' Rust Comp.
12/9/93	RFL-SS-2598			528	583.7	767.1	515	1.1	1.5		LB	TP#2 2 of 2
1/3/94	TP#2	12/6/93	12/13/93	524	789.1	709.6	473	1.7	1.5	✓	LB	13-16' Rust Comp.
12/9/93	RFL-SS-2599			430	965.2	801.1	488	2.0	1.6		LB	TP#3 1 of 2
1/3/94	TP#3	12/7/93	12/13/93	424	1036	714.0	437	2.4	1.7	✓	LB	18-21' Rust Comp.
12/9/93	RFL-SS-2600			531	698.8	757.6	511	1.4	1.5		LB	TP#3 2 of 2
1/3/94	TP#3	12/7/93	12/13/93	426	1285	748.8	450	2.9	1.7	✓	LB	18-21' Rust Comp
12/9/93	RFL-SS-2601			432	2593	975.2	484	5.4 5.0 12/21	2.0		LB	TP#4 1 of 2
1/3/94	TP#4	12/7/93	12/13/93	526	4244	537.0	463	9.2	1.2	✓	LB	11-16' Rust Comp
12/9/93	RFL-SS-2602			532	3101	642.5	479	6.5	1.3		LB	TP#4 2 of 2
1/3/94	TP#4	12/7/93	12/13/93	428	4287	809.8	453	9.5	1.8	✓	LB	11-16' Rust Comp
12-9-93	RFL-SS-2603			438	747.2	957.8	528	1.4	1.8		PW	TP#5 1 of 2
1/3/94	TP#5	12-7-93	12/13/93	528	869.3	805.5	476	1.8	1.7	✓	LB	16'-21' Rust Comp.
12-9-93	RFL-SS-2604			538	699.0	671.3	503	1.4	1.3		PW	TP#5 2 of 2
1/3/94	TP#5	12-7-93	12/13/93	430	1238	705.3	452	2.7	1.6	✓	LB	16'-21' Rust Comp.
12-9-93	RFL-SS-2605			440	73019	4058	539	135	7.5		PW	TP#7 1 of 2
1/3/94	TP#7	12-7-93	12/13/93	530	10052	4306	485	207	8.9	✓	LB	17'-21' Rust Comp.
12-9-93	RFL-SS-2606			540	73183	3280	527	139	6.2		PW	TP#7 2 of 2
1/3/94	TP#7	12-7-93	12/13/93	432	9635	3527	474	210	7.4	✓	LB	17'-21' Rust Comp.

Site Correction Factor = 1.8

HP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: John K Tencel
Site HP Manager

F5-IN-001-1, ICN-01

MK-FERGUSON COMPANY
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OCS SAMPLE LOG

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COUNT DATE INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g INITIAL/CORR 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-9-93	RFL-SS-2607			442	9981	222.7	486	2.1	1.5		RMC	TP#11 1 of 2
1/3/94	TP# 11	12-7-93	12/13/93	532	1227	930.2	443	2.8	2.1	✓	[illegible]	6'-10' Rust Comp
12-9-93	RFL-SS-2608			542	1084	776.7	465	2.3	1.7		RMC	TP#11 2 of 2
1/3/94	TP# 11	12-7-93	12/13/93	434	1401	975.2	423	3.3	2.3	✓	[illegible]	6'-10' Rust Comp
12-9-93	RFL-SS-2609			444	1440	792.4	553	2.6	1.4		RMC	TP#15 1 of 2
1/3/94	TP# 15	12-6-93	12/13/93	534	2753	901.4	507	5.4	1.8	✓	[illegible]	10'-13' Rust Comp
12-9-93	RFL-SS-2610			544	1706	671.3	501	3.4	1.3		RMC	TP#15 2 of 2
1/3/94	TP# 15	12-6-93	12/13/93	436	2880	714.0	460	6.3	1.6	✓	[illegible]	10'-13' Rust Comp.
12-9-93	RFL-SS-2611			446	2058	844.6	493	4.2	1.7		RMC	TP#19 1 of 2
1/3/94	TP# 19	12-2-93	12/13/93	536	3158	815.1	459	6.9	1.8	✓	[illegible]	3.5'-5.5' Rust Comp
12-9-93	RFL-SS-2612			546	1965	834.3	483	4.1	1.7		RMC	TP#19 2 of 2
1/3/94	TP# 19	12-2-93	12/13/93	542	2698	939.8	450	6.0	2.1	✓	[illegible]	3.5-5.5' Rust Comp
12-9-93	RFL-SS-2613			448	3779	592.1	522	7.2	1.1		RMC	TP#20 1 of 2
1/3/94	TP# 20	12-2-93	12/13/93	544	4898	1087	489	10.0	2.1	✓	[illegible]	1'-5' Rust Comp.
12-9-93	RFL-SS-2614			548	3957	748.0	557	7.1	1.3		RMC	TP#20 2 of 2
1/3/94	TP# 20	12-2-93	12/13/93	444	4875	870.7	520	9.4	1.7	✓	[illegible]	1'-5' Rust Comp.
12-9-93	RFL-SS-2615			450	11532	1280	540	21	2.4		RMC	TP#21 1 of 2
1/3/94	TP#21	12-6-93	12/13/93	446	19101	1376	498	38	2.8	✓	[illegible]	1'-5' Rust Comp
12-9-93	RFL-SS-2616			550	12220	1017	541	23	1.9		RMC	TP#21 2 of 2
1/3/94	TP#21	12-6-93	12/13/93	546	19679	1381	502	39	2.8	✓	[illegible]	1'-5' Rust Comp

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec. , unless otherwise noted

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Site HP Manager

MK-FERGUSON COMPANY
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CCS SAMPLE LOG

SITE NAME RIFLE, CO.

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-9-93	RFL-SS-2617			452	936.3	844.6	623	1.5	1.4		RMC	TP#22 1 of 2
1/3/94	TP#22	12-6-93	12/13/93	448	1066	801.1	548	1.9	1.5	✓	R	4'-7' Rust Comp.
12-9-93	RFL-SS-2618			552	1330	680.8	719	1.8	.95		RMC	TP#22 2 of 2
1/3/94	TP#22	12-6-93	12/13/93	548	1382	786.3	634	2.2	1.2	✓	R	4'-7' Rust Comp.
12-9-93	RFL-SS-2619			454	1131	626.9	548	2.1	1.1		RMC	TP#24 1 of 2
1/3/94	TP#24	12-1-93	12/13/93	450	1454	819.5	505	2.9	1.6	✓	R	2.5'-5' Rust Comp.
12-9-93	RFL-SS-2620			554	1007	632.9	554	1.8	1.1		RMC	TP#24 2 of 2
1/3/94	TP#24	12-1-93	12/13/93	550	1384	632.9	509	2.7	1.2	✓	R	2.5'-5' Rust Comp.
12-9-93	RFL-SS-2621			456	1430	731.4	634	2.3	1.2		RMC	TP#25 1 of 2
1/3/94	TP#25	12-1-93	12/13/93	552	2160	738.4	571	3.8	1.3	✓	R	6.5'-8.5' Rust Comp.
12-9-93	RFL-SS-2622			556	938.7	1036	539	1.7	1.9		RMC	TP#25 2 of 2
1/3/94	TP#25	12-1-93	12/13/93	452	2110	862.0	487	4.3	1.8	✓	R	6.5'-8.5' Rust Comp.
12-9-93	RFL-SS-2623			458	618.4	635.6	544	1.1	1.2		RMC	TP#26 1 of 2
1/3/94	TP#26	12-6-93	12/13/93	554	1086	709.6	514	2.1	1.4	✓	R	8'-9.5' Rust Comp.
12-9-93	RFL-SS-2624			558	902.6	680.8	537	1.7	1.3		RMC	TP#26 2 of 2
1/3/94	TP#26	12-6-93	12/13/93	454	1086	896.9	508	2.1	1.8	✓	R	8'-9.5' Rust Comp.
12-9-93	RFL-SS-2625			460	1008	679.2	637	1.6	1.1		RMC	TP#27 1 of 2
1/3/94	TP#27	12-3-93	12/13/93	556	1122	795.9	572	2.0	1.4	✓	R	9.5'-11' Rust Comp.
12-9-93	RFL-SS-2626			560	627.5	949.3	579	1.1	1.6		RMC	TP#27 2 of 2
1/3/94	TP#27	12-3-93	12/13/93	456	798.5	870.7	520	1.5	1.7	✓	R	9.5'-11' Rust Comp.

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature]
Site HP Manager

FS-IN-001-1, ICN-01

MK-FERGUSON COMPANY
A MORRISON KNUDSEN COMPANY

CWM Federal Environmental Services, Inc.
FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	GMSS (grams) WET TARE	Ra-226 pCi/g INITIAL/CORR. 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-9-93	RFL-SS-2627			462	1285	748.8	462	2.7	1.6		RMC	TP#28 1 of 2
1/3/94	TP#28	12-9-93	12/13/93	558	2269	824.7	442	5.1	1.9	✓	LB	0'-4.5' Rust Com
12-9-93	RFL-SS-2628			562	1962	978.1	557	3.5	1.8		RMC	TP#28 2 of 2
1/3/94	TP#28	12-9-93	12/13/93	458	2189	1207	510	4.3	2.4	✓	LB	0'-4.5' Rust Com
12-9-93	RFL-SS-2629			464	39354	2064	498	77	4.1		RMC	TP#29 1 of 2
1/3/94	TP#29	12-6-93	12/13/93	470	64696	2699	460	141	5.9	✓	LB	0'-3' Rust Com
12-9-93	RFL-SS-2630			564	40956	1841	493	83	3.7		RMC	TP#29 2 of 2
1/3/94	TP#29	12-6-93	12/13/93	570	67840	3030	458	148	6.6	✓	LB	0'-3' Rust Com
12-9-93	RFL-SS-2631			466	1209	548.6	590	2.1	.93		RMC	TP#30 1 of 2
1/3/94	TP#30	12-6-93	12/13/93	572	1238	795.9	566	2.2	1.4	✓	LB	4.5'-7.5' Rust Com
12-9-93	RFL-SS-2632			566	892.2	891.8	540	1.8	1.2		RMC	TP#3 2 of 2
1/3/94	TP#30	12-6-93	12/13/93	472	1481	879.5	518	2.9	1.7	✓	LB	4.5'-7.5' Rust Com
12-9-93	RFL-SS-2633			468	667.9	714.0	473	1.4	1.5		RMC	TP#32 1 of 2
1/3/94	TP#32	12-9-93	12/13/93	574	536.9	546.6	460	1.2	1.2	✓	LB	0'-' Rust Com
12-9-93	RFL-SS-2634			568	302.1	776.7	482	.62	1.6		RMC	TP#32 2 of 2
1/3/94	TP#32	12-9-93	12/13/93	474	510.4	827.2	469	1.1	1.8	✓	LB	0'-4' Rust Com
12-9-93	RFL-SS-2635			470	530.7	748.8	521	1.0	1.4		RMC	TP#33, 1 of 2
1/3/94	TP#33	12-9-93	12/13/93	576	631.0	546.6	488	1.3	1.1	✓	LB	7-9 0'-4.5' 12/28/94 Rust Com
12-9-93	RFL-SS-2636			570	470.4	709.6	486	.97	1.5		RMC	TP#33 7-9' 2 of 2
1/3/94	TP#33	12-9-93	12/13/93	476	421.3	626.9	454	0.93	1.4	✓	LB	0'-4.5' 12/28/94 Rust Com

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: Robert K. Stencil
Site RI Manager

FS-IN.001.1, ICN-01

FOR INFORMATION ONLY

SITE NAME RIFLE, CO.

OCS SAMPLE LOG

COUNT DATE INITIAL 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS-2 INITIAL 20 DAY	Bi-214 pCi INITIAL 20 DAY	Tl-208 pCi INITIAL 20 DAY	MASS (grams) WET DRY	Ra-226 pCi/g INITIAL/CORR 20 DAY	Th-232 pCi/g INITIAL 20 DAY	DEPTH <15cm >15cm	TECH INITIAL 20 DAY	COMMENTS
12-9-93	RFL-SS-2637		93	472	561.2	827.2	483	1.2	1.7		RME	TP# BKG 1 of 2
1/3/94	TP# BKG	12-7-93	12-13-~~94~~	578	706.1	757.6	436	1.6	1.7	✓	B	7-12' Rust Comp
12-9-93	RFL-SS-2638		WLW 1-3-94	572	862.6	901.4	522	1.7 RME 12-9-93 ~~26~~	1.7		RME	TP# BKG 2 of 2
1/3/94	TP# BKG	12-7-93	12-13-93	478	1039	862.0	471	2.2	1.8	✓	B	7-12' Rust Comp
12/10/93	RFL-SS-2639			406	34378	2055	505	68	4.1		B	TP# 29 0-1'
1/10/94	TP# 29	12/1/93	12-13-93	554	56401	2532	505	112	5.0	✓	B	TAC Sample
12/10/93	RFL-SS-2640			506	11247	1074	561	20.	1.9		B	TP# 29 1-2'
1/10/94	TP#29	12/1/93	12-13-93	454	20115	1768	561	36	3.2	✓	B	TAC Sample
12/10/93	RFL-SS-2641			408	32618	1698	554	59.0	3.1		B	TP#29 2-3'
1/10/94	TP#29	12/1/93	12-13-93	558	55305	2503	554	100	4.5	✓	B	TAC Sample
12/10/93	RFL-SS-2642			422	1672	844.6	471	3.5	1.8		B	TP#28 0-15'
1/3/94	TP#28	12/9/93	12/10/93	480	2434	766.3	471	5.4	1.6	✓	B	Composite
12/10/93	RFL-SS-2643			522	434.5	623.3	401	1.1	1.6		B	TP#32
1/3/94	TP#32	12/9/93	12/10/93	580	710.9	460.3	401	1.8	1.1	✓	B	Con-sy Composite
12/10/93	RFL-SS-2644			424	451.1	792.4	491	0.92	1.6		B	TP#33
1/3/94	TP# 33	12/9/93	12/10/93	582	593.2	527.4	491	1.2	1.1	✓	B	Con-sy Composite
12/15/93	RFL-SS-2645			400	19091	1315	803	34.0	1.6		B	TP#4
1/5/94	TP# 4	12/15/93	12/16/93	446	26094	1881	803	32.0 (WLW 1-5-94)	2.3	✓	B	17-18' TAC
12/15/93	RFL-SS-2646			500	190560	8534	805	337.0	10.6		B	TP#6
1/5/94	TP# 6	12/15/93	12/16/93	448	218120	7480	805	271	9.3	✓	B	24-25' TAC

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature]
Site MP Manager

MK-FER[illegible]SON COMPANY
A MORRISO[illegible]UDSEN COMPANY

CWM Federal Environmental Se[illegible]ces, Inc.

FOR INFORMATION ONLY

OCS SAMPLE LOG

SITE NAME RIFLE, CO.

COUNT DATE INITIAL / 20 DAY	SAMPLE ID & LOCATION	DATE SAMPLED	DATE SEALED	OCS # INITIAL / 20 DAY	Bi-214 pCi INITIAL / 20 DAY	Tl-208 pCi INITIAL / 20 DAY	MASS (grams) WET / DRY	Ra-226 pCi/g INITIAL/CORR. / 20 DAY	Th-232 pCi/g INITIAL / 20 DAY	DEPTH <15cm / >15cm	TECH INITIAL / 20 DAY	COMMENTS
12/15/93	RFL-SS-2647	12/15/93	12/16/93	402	6780	827.2	755	9.0	1.1		[illegible]	17-18'
1/5/94	TP # 7			546	9534	937.8	755	13	1.2	✓	[illegible]	TP # 7 TAC
12/15/93	RFL-SS-2648	12/15/93	12/16/93	50.3	17120	1611	809	21.2	20		[illegible]	8-9'
1/5/94	TP # 30			548	45157	2206	809	56	2.7	✓	[illegible]	TP # 30 TAC
12-16-93	RFL-SS-2649A*	12-15-93	12/17/93	400	1767	853.3	498	3.5	1.7		PU	A-914 CPTM
1/6/94				514	3664	1064	466	7.9	2.3	✓	[illegible]	B-N.W.
12-16-93	RFL-SS-2650A	12-15-93	12/17/93	500	883.0	7959 [illegible]	522	1.7	1.5		PU	Δ 1040 CPTM
1/6/94				508	697.4	1007	480	1.5	2.1	✓	[illegible]	Area B-Fence Line
12-16-93	RFL-SS-2651A	12-15-93	12/17/93	402	1656	801.1	430	3.9	1.9		DRC	B.NW
1/6/94				408	4240	661.8	363	12	1.8	✓	[illegible]	Δ 1350 CPTm
12-16-93	RFL-SS-2652A	12-15-93	12/17/93	502	587.4	901.4	498	1.2	1.8		DRC	B.NW
1/6/94				510	715.9	700.0	464	1.5	1.5	✓	[illegible]	Δ 812 CPTm
12-16-93	RFL-SS-2653A	12-15-93	12/16/93	404	2631	879.5	452	5.8	1.9		DRC	B-NW
1-10-94				458	4819	983.9	452	11	2.2	✓	[illegible]	Δ-1610 CPTm
12-16-93	RFL-SS-2654A	12-15-93	12/17/93	504	773.9	968.5	517	1.5	1.9		DRC	B-W Fence
1/6/94				410	970.6	496.3	459	2.1	1.1	✓	[illegible]	Δ-1040 CPTm
12-16-93	RFL-SS-2655A	12-15-93	12/17/93	406	639.6	766.3	595	1.1	1.3		DRC	B-NW
1/6/94				512	352.6	863.0	573	0.62	1.5	✓	[illegible]	Δ 550 CPTm
12-16-93	RFL-SS-2656A	12-15-93	12/17/93	506	747.0	1084	493	1.5	2.2		DRC	B-NW
1/6/94				412	423.5	757.5	463	0.91	1.6	✓	[illegible]	Δ-712 CPTm

Site Correction Factor = 1.8

VP Correction Factor (if applicable) = 2.0

Count Time = 500 sec., unless otherwise noted

REVIEWED BY: [signature] [illegible] 12/17/93
Site HP Manager

* The "A" was add'd to the sample ID # for 2649 - 2656 to avoid confusion with duplicate sample # ID numbers assign[illegible]