AREA 5 SITE CHARACTERIZATION PROJECT REPORT FY 1994

by

William Albright
Scott Tyler
Jenny Chapman
Mary Miller
Rocio Estrella

Water Resources Center
Desert Research Institute
University and Community College System of Nevada

prepared for
Nevada Operations Office
U.S. Department of Energy
Las Vegas, Nevada

September 1994

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

The work upon which this report is based was supported by the U.S. Department of Energy under Contract #DE-AC08-90NV10845.

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

CONTENTS

INTRODUCTION	1
Site Description	1
LABORATORY TESTING METHODS	1
Water Content Analysis	1
Soil Bulk Density	1
Soil Water Potential	3
Soil Water Extraction	4
Soil Water Extract Isotope Analysis	4
Oxygen Isotope Analysis	4
Hydrogen Isotope Analysis	4
¹³ C Analysis	4
¹⁴ C Analysis	4
REFERENCES	13
APPENDIX A	15
A.1. Physical and hydrologic data for RP-1.	16
A.1. Physical and hydrologic data for RP-2.	17
A.1. Physical and hydrologic data for AP-1.	18
A.1. Physical and hydrologic data for AP-2.	19
A.1. Physical and hydrologic data for NN-1 and NW-2.	20
APPENDIX B	22
B.1. Stable isotope data for boreholes.	23

FIGURES

1. Location of the Area 5 Radioactive Waste Management Site (RWMS) at the Nevada Test Site (NTS).	2
2. Location of recently completed and sampled boreholes in Area 5 of the NTS.	3
3. Depth profile of total soil water potential (KPa) for borehole AP-1.	5
4. Depth profile of volumetric water content for borehole AP-1.	5
5. Depth profile of total soil water potential (KPa) for borehole AP-2.	6
6. Depth profile of volumetric water content for borehole AP-2.	6
7. Depth profile of total soil water potential (KPa) for borehole RP-1.	7
8. Depth profile of volumetric water content for borehole RP-1.	7
9. Depth profile of total soil water potential (KPa) for borehole RP-2.	8
10. Depth profile of volumetric water content for borehole RP-2.	8

11. Depth profile of total soil water potential (KPa) for borehole NN.	9
12. Depth profile of volumetric water content for borehole NN.	9
13. Depth profile of total soil water potential (KPa) for borehole NW.	10
14. Depth profile of volumetric water content for borehole NW.	10

INTRODUCTION

The Area 5 Site Characterization Project is designed to determine the suitability of the Radioactive Waste Management Site (RWMS) for disposal of low-level waste (LLW), mixed waste (MW) and transuranic waste (TRU). The Desert Research Institute (DRI) has conducted this study for the Area 5 Site Characterization Project for the U.S. Department of Energy, Nevada Operations Office (DOE/NV), Waste Management Division (WMD). The purpose of DRI's Area 5 Site Characterization Project is to characterize important properties of the upper vadose zone which influence infiltration and redistribution of water and transport of solutes as well as to characterize the water quality and hydrologic conditions of the uppermost aquifer.

This report describes methods and presents a summary of all data and results from laboratory physical and chemical testing from borehole samples through September 1994. DRI laboratories performed soil water content, soil water potential, soil bulk density, and soil water extract isotope analyses.

Site Description

Area 5 is located in the southeast quarter of the Nevada Test Site (NTS) and is one of two areas at the NTS designated as Radioactive Waste Management Sites (RWMS) (Figure 1). The Area 5 RWMS encompasses 2.96 km² on an alluvial fan within the Frenchman Flat drainage basin. Area 5 averages 11.7 cm of precipitation annually, and the vadose zone is approximately 240 m thick (Winograd and Thordarson, 1975). In addition to the existing pilot wells and science trench boreholes, eight additional boreholes were recently completed: air permeability test boreholes (AP 1 and 2), random pumping test boreholes (RP 1 and 2), and neutron access boreholes (NN-1, NE-1, NS-1, and NW-1). Figure 2 shows the locations of these new boreholes.

LABORATORY TESTING METHODS

A brief description of the laboratory testing methods and references used to obtain the data contained in this report are presented here. Detailed methods can be found in DRI Quality Assurance Standard Operating Procedures (SOPs).

Water Content Analysis

Soil water content refers to the amount of water contained in a unit mass or volume of soil. The fractional content of water in the soil can be expressed in terms of either mass (kg kg⁻¹) or volume (m³ m⁻³). The traditional gravimetric method of measuring mass wetness consists of determining a sample's moist and dry weights. The moist weight is determined by weighing the sample at the time of sampling and the dry weight is obtained after drying the sample to a constant weight. The standard method of drying the soil consists of drying the samples in an oven at 105°C for 24 hours (Hillel, 1982). The mass wetness (w) or gravimetric wetness (θ_m) is the ratio of the weight loss in drying to the dry weight of the sample. If the bulk density of the sample is known, the volumetric water content (θ_v) can also be determined.

Soil Bulk Density

Soil bulk density, ρ_b , is the ratio of the mass of dry solids to the bulk volume of the soil. The mass is determined after drying to constant weight at 105°C, and the volume of the sample as taken

Figure 1. Location of the Area 5 Radioactive Waste Management Site (RWMS) at the Nevada Test Site (NTS).

Figure 2. Location of recently completed and sampled boreholes in Area 5 of the NTS.

in the field (Blake and Hartge, 1986). Bulk density was determined only on core samples with 100 percent recovery.

Soil Water Potential

Soil water can contain energy in different quantities and forms. The potential energy, caused by position or internal conditions, is of primary importance in determining the state and movement of water in the soil (Hillel, 1982). All forms of water transfer occur as a result of potential differences with movement from regions of higher to lower potential. The concept of soil water potential refers to the relationship between the retention of water by soil and the soil water energy level.

All methods for measuring water potential in soils require that some medium, whose water potential can be determined, be in equilibrium with soil water. The soil water potential is then found from the known water potential of the medium (Campbell and Gee, 1986). Soil water potential for the Area 5 Project is being determined via (1) filter paper and (2) a CX-2 water activity meter. For the first method, filter paper is used as a standard matrix and equilibrated with soil water to calculate soil water potential (Graecen et al., 1989). The CX-2 water activity meter uses a cooled mirror to

sense the dew point of water vapor in a closed chamber containing a soil sample. Dew-point-derived water activities are converted to total water potential using the Kelvin equation (Gee et al., 1992).

The CX-2 method was used on all samples below a water potential of -0.5 MPa. For the year ending September 1994, all soil water potential measurements were made with this method.

Soil Water Extraction

Azeotropic distillation with toluene is used to extract soil water for oxygen and hydrogen isotopic analysis. The method used by the DRI Environmental Isotope Laboratory in Las Vegas is a modification of the methods used by Revezs and Woods (1990) and Ingraham and Shadel (1992). The method is based on the fact that water and toluene form an azeotropic mixture at 84.1°C , but are immiscible at ambient temperature.

Soil Water Extract Isotope Analysis

Oxygen Isotope Analysis

Samples for oxygen isotope analysis are prepared using the guanidine hydrochloride method modified after Dugan et al. (1985). In this method, $10\ \mu\text{l}$ of water are frozen into a glass reaction tube containing excess guanidine hydrochloride. The tube is then sealed at the top by melting in a torch flame. Through a series of reactions, the water is quantitatively converted into CO_2 gas. This gas is purified and analyzed on a Finnigan Model Delta-E gas-ratio mass spectrometer.

Hydrogen Isotope Analysis

Samples for hydrogen isotope analysis are prepared using the zinc-reduction method modified after Kendall and Coplen (1985). In this method, $10\ \mu\text{l}$ of water are frozen and sealed into a 7 mm glass reaction tube containing 0.25 g of zinc metal shot. The water and zinc are reacted in a furnace at 450°C for one hour to produce hydrogen gas which is directly analyzed on a Nuclide Model 30/60/HD Mass Spectrometer (Gonfiantini, 1981).

^{13}C Analysis

Samples analyzed for ^{13}C were precipitated in the laboratory as strontium carbonate and prepared by the phosphoric acid method as described by McCrea (1950), and the resulting carbon dioxide gas was also analyzed in the Finnigan-Matt mass spectrometer for $^{13}\text{C}/^{12}\text{C}$ ratios.

^{14}C Analysis

^{14}C samples were sent to the Lawrence Livermore National Laboratory Center for accelerator mass spectrometry.

Figure 3. Depth profile of total soil water potential (KPa) for borehole AP-1.

Figure 4. Depth profile of volumetric water content for borehole AP-1.

Figure 5. Depth profile of total soil water potential (KPa) for borehole AP-2.

Figure 6. Depth profile of volumetric water content for borehole AP-2.

Figure 7. Depth profile of total soil water potential (KPa) for borehole RP-1.

Figure 8. Depth profile of volumetric water content for borehole RP-1.

Figure 9. Depth profile of total soil water potential (KPa) for borehole RP-2.

Figure 10. Depth profile of volumetric water content for borehole RP-2.

Figure 11. Depth profile of total soil water potential (KPa) for borehole NN.

Figure 12. Depth profile of volumetric water content for borehole NN.

Figure 13. Depth profile of total soil water potential (KPa) for borehole NW.

Figure 14. Depth profile of volumetric water content for borehole NW.

REFERENCES

- Allison, G.B., 1982, The Relationship Between ^{18}O and Deuterium in Water in Sand Columns Undergoing Evaporation. *Journal of Hydrology*, 55, 163–169.
- Blake, G.R. and K.H. Hartge. 1986. Bulk Density. p. 363–366. In: A. Klute (ed.). *Methods of Soil Analysis, Part 1*. 2nd. ed. American Society of Agronomy (ASA), Soil Science Society of America (SSSA), Madison, Wis.
- Campbell, G.S. and G.W. Gee. 1986. Water Potential: Miscellaneous Methods. p. 628–629. In: A. Klute (ed.). *Methods of Soil Analysis, Part 1*. 2nd. ed. American Society of Agronomy (ASA), Soil Science Society of America (SSSA), Madison, Wis.
- Dugan, J.P., J. Borthwich, R.S. Harmon, M.A. Gagnier, J.E. Glahn, E.P. Kinsel, S. MacLeod, J.A. Viglino and J.W. Hess, 1985. "Guanidine Hydrochloride Method for Determination of Water Oxygen Isotope Ratios and the Oxygen–18 Fractionation Between Carbon Dioxide and Water at 25°C," *Anal. Chem.* 57:1734–1736.
- Gee, G.W., M.D. Campbell, G.S. Campbell, and J.H. Campbell. 1992. "Rapid measurement of low soil water potentials using a water activity meter". *Soil Sci. Soc. Am. J.*, Vol. 56, p. 1068–1070.
- Gonfiantini, R., 1981. "The Del–Notation and the Mass Spectrometric Measurements Techniques", International Atomic Energy Agency, Technical Report Series No. 210, Chapter 4, pp 35–84.
- Graecen, E.L., G.R. Walker and P.G. Cook. 1989. Procedure for the Filter Paper Method of Measuring Soil Water Suction. Report 108, Division of Soil, CSIRO, Canberra, Australia.
- Hillel, D. 1982. *Introduction to Soil Physics*. Academic Press, Inc. San Diego, CA. pp. 57–60 and 64–67.
- Ingraham, N.L. and C. Shadel. 1992. A Comparison of the Toluene Distillation and Vacuum/Heat Methods for Extracting Soil Water for Stable Isotope Analysis. *J. Hydrol.*, 140:371–387.
- Kendall, C. and T.B. Coplen. 1985. "Multisample Conversion of Water to Hydrogen by Zinc for Stable Isotope Determination." *Anal. Chem.*, Vol. 57, pp 1437–1440.
- Reynolds Electrical & Engineering Company (REECo). 1993a. Hydrologic Data for Science Trench Boreholes at the Area 5 Radioactive Waste Management Site, Nye County, Nevada. Special Project Section, Environmental Division, Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV.
- Reynolds Electrical & Engineering Company (REECo). 1993b. Site Characterization and Monitoring Data from Area 5 Pilot Wells, Nevada Test Site, Nye County, Nevada. Special Project Section, Environmental Division, Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV.
- Revezs, K. and P.H. Woods. 1990. A Method to Extract Soil Water for Stable Isotope Analysis. *J. Hydrol.*, 115:397–406.
- Winograd, I.J. and W. Thordarson. 1975. Hydrologic and hydro–chemical framework, Southcentral Great Basin, Nevada–California, with special reference to the Nevada Test Site, *Geol. Survey Prof. Paper* 712–C.

APPENDIX A

TABLE A.1. Physical and hydrologic data for RP-1.

Sample ID	Site No.	Depth Interval (ft)	Total Potential CX-2 (KPa)	Grav. Water Content	Bulk Density (gr/cm ³)	Vol. Water Content
29643	RP-1	0.25-.050	-1702	0.055	1.62	0.089
29644	RP-1	6.25-6.5	-7581	0.043	1.44	0.062
29645	RP-1	9.25-9.5	-12832	0.030	1.68	0.050
29646	RP-1	10.75-11.0	-10108	0.016	2.27	0.037
29647	RP-1	14.0-14.25	-6654	0.047	1.41	0.066
29648	RP-1	15.5-15.75	-5733	0.041	1.40	0.058
29649	RP-1	19.25-19.5	-6228	0.039	1.56	0.061
29650	RP-1	20.25-20.5	-4679	0.040	1.55	0.062
29651	RP-1	23.0-23.25	-4959	0.042	1.59	0.067
29652	RP-1	25.25-25.5	-6441	0.039	1.56	0.061
29653	RP-1	29.25-29.5	-4679	0.053	1.33	0.070
29654	RP-1	31.0-31.25	-4260	0.041	1.35	0.055
29655	RP-1	44.25-44.5	-3148	0.054	1.72	0.092
29656	RP-1	50.75-51.0	-3148	0.035	1.61	0.057
29657	RP-1	69.5-69.75	-2457	0.035	1.98	0.070
29658	RP-1	80.75-81.0	-2044	0.046	1.87	0.086
29659	RP-1	89.25-89.5	-1702	0.066	1.70	0.111
29660	RP-1	100.5-100.75	-1565	0.055	1.69	0.093
29661	RP-1	119.25-119.5	-1359	0.062	1.78	0.111
29662	RP-1	139.5-139.75	-1428	0.053	1.82	0.096
29663	RP-1	151.5-151.75	-1359	0.047	1.85	0.087

*Sample 29646 contains one medium and one large (8x6x6 cm) rock.

TABLE A.1. Physical and hydrologic data for RP-2.

Sample ID	Site No.	Depth Interval (ft)	Total Potential CX-2 (KPa)	Grav. Water Content	Bulk Density (gr/cm ³)	Vol. Water Content
29724	RP-2	1.25-1.50	-7724	0.037	1.71	0.064
29725	RP-2	4.0-4.25	-6654	0.043	1.64	0.071
29726	RP-2	6.5-6.75	-7223	0.049	1.72	0.084
29727	RP-2	9.0-9.25	-8586	0.043	1.18	0.051
29728	RP-2	11.5-11.75	-8442	0.033	1.77	0.058
29729	RP-2	13.0-13.25	-7724	0.027	1.70	0.046
29730	RP-2	16.25-16.5	-6087	0.040	1.26	0.051
29731	RP-2	18.0-18.25	-5945	0.038	1.61	0.061
29732	RP-2	22.75-23.0	-6370	0.039	1.60	0.062
29733	RP-2	25.25-25.5	-6299	0.034	1.62	0.055
29734	RP-2	29.0-29.25	-4959	0.042	1.45	0.061
29735	RP-2	31.25-31.5	-5100	0.035	1.79	0.062
29736	RP-2	44.25-44.5	-3564	0.054	1.79	0.096
29737	RP-2	50.0-50.25	-3564	0.034	1.81	0.062
29738	RP-2	58.75-59.0	-2871	0.051	1.58	0.080
29739	RP-2	60.5-60.75	-2251	0.059	1.71	0.102
29740	RP-2	62.75-63.0	-1907	0.077	1.49	0.115
29741	RP-2	70.75-71.0	-1770	0.081	1.52	0.123
29742	RP-2	79.25-79.5	-1702	0.046	1.71	0.078
29743	RP-2	90.5-90.75	-1633	0.043	1.76	0.076
29744	RP-2	99.5-99.75	-1633	0.061	1.90	0.117
29745	RP-2	110.25-110.5	-3564	0.043	1.60	0.069
29746	RP-2	119.25-119.5	-1223	0.063	1.72	0.108
29747	RP-2	129.5-129.75	-1018	0.061	1.74	0.106
29748	RP-2	139.5-139.75	-1223	0.068	1.71	0.117
29749	RP-2	151.0-151.25	-1018	0.056	1.58	0.088

TABLE A.1. Physical and hydrologic data for AP-1.

Sample ID	Site No.	Depth Interval (ft)	Total Potential CX-2 (KPa)	Grav. Water Content	Bulk Density (gr/cm ³)	Vol. Water Content
29454	AP-1	0.0-0.25	-746	0.066	1.64	0.109
29455	AP-1	2.75-3.0	-1839	0.069	1.57	0.109
29456	AP-1	6.5-6.75	-3981	0.047	1.58	0.074
29457	AP-1	10.75-11.0	-7366	0.032	1.66	0.053
29458	AP-1	13.75-14.0	-8442	0.024	1.85	0.044
29459	AP-1	16.0-16.25	-6228	0.029	1.60	0.046
29460	AP-1	19.25-19.5	-5240	0.037	1.53	0.057
29461	AP-1	21.0-21.25	-5945	0.027	1.57	0.043
29462	AP-1	24.25-24.5	-4609	0.037	1.34	0.050
29463	AP-1	26.75-27.0	-5875	0.034	1.48	0.050
29464	AP-1	28.25-28.5	-6228	0.026	1.91	0.050
29465	AP-1	40.5-40.75	-3842	0.045	1.65	0.074
29466	AP-1	50.75-51.0	-3702	0.061	1.30	0.078
29467	AP-1	60.75-61.0	-3494	0.047	1.25	0.059
29468	AP-1	70.5-70.75	-2802	0.048	1.53	0.073
29469	AP-1	81.0-81.25	-2802	0.067	1.60	0.107
29470	AP-1	100.75-101.0	-2733	0.050	1.41	0.071
29471	AP-1	109.75-110.0	-1839	0.069	1.67	0.116
29472	AP-1	130.5-130.75	-1633	0.067	1.39	0.093
29473	AP-1	159.75-160.0	-1565	0.078	1.60	0.124
29474	AP-1	181.0-181.25	-2044	0.055	1.33	0.073
29475	AP-1	200.5-200.75	-1496	0.055	1.41	0.078
29476	AP-1	221.0-221.25	-1359	0.070	1.16	0.081
29477	AP-1	240.5-240.75	-746	0.060	1.49	0.090
29478	AP-1	259.5-259.75	-814	0.070	1.62	0.114
29479	AP-1	276.25-276.5	-3286	0.046	1.55	0.072

*Sample 29557 contained one large (8x5 cm) rock.

TABLE A.1. Physical and hydrologic data for AP-2.

Sample ID	Site No.	Depth Interval (ft)	Total Potential CX-2 (KPa)	Grav. Water Content	Bulk Density (gr/cm ³)	Vol. Water Content
29551	AP-2	0.5-0.75	-814	0.065	1.61	0.105
29552	AP-2	3.5-3.75	-1223	0.082	1.57	0.129
29553	AP-2	6.25-6.5	-2871	0.049	1.79	0.088
29554	AP-2	9-9.25	-3842	0.042	1.32	0.055
29555	AP-2	11-11.25	-8226	0.036	1.52	0.054
29556	AP-2	13.5-13.75	-6016	0.029	1.82	0.052
29557	AP-2	15.25-15.5	-6654	0.017	2.19	0.037
29558	AP-2	18-18.25	-4539	0.039	1.65	0.064
29559	AP-2	20.25-20.5	-5170	0.037	1.62	0.061
29560	AP-2	22.75-23	-5381	0.029	1.59	0.046
29561	AP-2	25.25-25.5	-4260	0.037	1.72	0.063
29562	AP-2	29.25-29.5	-4399	0.030	1.63	0.049
29563	AP-2	40.75-41	-3772	0.057	1.52	0.086
29564	AP-2	49.5-49.75	-2733	0.053	1.58	0.084
29565	AP-2	60.25-61	-3286	0.047	1.64	0.077
29566	AP-2	70-70.25	-2733	0.057	1.39	0.079
29567	AP-2	80.75-81	-2457	0.053	1.46	0.078
29568	AP-2	90.75-91	-2251	0.058	1.37	0.080
29569	AP-2	110.75-111	-1770	0.067	1.46	0.098
29570	AP-2	120.5-120.75	-1839	0.061	1.67	0.101
29571	AP-2	130.75-131	-1907	0.085	1.32	0.113
29572	AP-2	149.5-149.75	-1702	0.067	1.84	0.123
29573	AP-2	159.5-159.75	-1291	0.057	1.91	0.109
29574	AP-2	180.75-181	-1223	0.046	1.57	0.072
29575	AP-2	200.25-200.5	-1223	0.092	1.49	0.137
29576	AP-2	219.5-219.75	-746	0.053	1.74	0.091
29577	AP-2	241.0-240.25	-1018	0.051	1.59	0.081
29578	AP-2	259.25-259.5	-882	0.051	1.91	0.097
29579	AP-2	275.75-276.0	-814	0.052	1.80	0.093

TABLE A.1. Physical and hydrologic data for NN-1 and NW-2.

Sample ID	Site No.	Depth Interval (ft)	Total Potential CX-2 (KPa)	Grav. Water Content	Bulk Density (gr/cm ³)	Vol. Water Content
30619	NN-1	20.0-20.25	-9164	0.025	1.81	0.045
30620	NN-1	40.0-40.25	-6299	0.044	1.55	0.069
30621	NN-1	99.5-99.75	-1839	0.084	1.60	0.135
30622	NN-1	180.5-180.75	-1428	0.052	1.69	0.087
30623	NW-1	19.75-20.0	-5311	0.055	1.66	0.091
30624	NW-1	39.75-40.0	-3148	0.052	1.65	0.086
30625	NW-1	100.25-100.5	-1830	0.051	1.88	0.097
30626	NW-1	180.25-180.5	-1702	0.049	1.93	0.096

APPENDIX B

TABLE B.1. Stable isotope data for boreholes.

SITE #	DEPTH INTERVAL (ft)	VSMOW $\delta^{18}\text{O}$ (‰)	VSMOW δD (‰)
AP-2	0.25-0.50	-3.5	-92
	3.25-3.50	-2.3	-64
	6.50-6.75	-3.6	-76
	7.75-8.00	-4.1	-76
	13.25-13.50	-5.2	-80
	17.75-18.00	-4.6	-78
	21.50-21.75	-5.4	-85
	24.25-24.50	-4.9	-81
	39.25-39.50	-7.5	-94
	79.25-79.50	-10.9	-105
	129.25-129.50	-12.0, -11.9	-108
	181.00-181.250	-12.9	-111
	240.75-241.00	-13.0	-111
	275.50-275.75	-14.2	-116
RP-2	1.50-1.75	-8.4	-100
	4.25-4.50	-2.9	-74, -75
	6.75-7.00	-3.5	-73
	9.25-9.50	-4.2	-76
	11.25-11.50	-4.4	-75
	12.75-13.00	-5.1	-79
	17.75-18.00	-5.4	-82
	25.75-26.00	-6.7	-90
	45.0-45.25	-8.5	-96
	80.75-81.00	-12.5	-112
	150.75-151.00	-13.9	-121
NN-1	19.75-20.00	-6.6	-89
	39.75-40.00	-9.5	-108
	99.25-99.50	-13.3	-119, -120
	180.25-180.50	-14.6	-126
NW-1	19.50-19.75	-6.9	-81
	39.50-39.75	-7.6	-76
	100.0-100.25	-8.1	-71
	180.0-180.25	-7.6	-76

TABLE B2. Carbon Isotope Data.

Well	Depth (m)	$\delta^{13}\text{C}$ (‰ PDB)	Percent Modern Carbon	Percent Modern Carbon, Corrected*
ST-1	33.5	-7.0	23.04	18.9
ST-1	30.8	-6.9	19.33	17.2
PW-1	54	-8.0	26.69	24.5
PW-2	30.2	-6.2	13.71	12.6
PW-2	14.6	-5.2	25.59	19.4

*This number is the measured percent modern carbon minus the carbon added during the soil washing procedure.