APPENDIX C
BORROW AREA SAMPLING RESULTS

MWH

BUILDING A BETTER WORLD

TECHNICAL MEMORANDUM

TO: *Mr. Lance Hauer, GE*

DATE: *February 17, 2012*

FROM: *Eileen Dornfest, Clint Strachan, MWH, Inc.*
Stephen Dwyer, Dwyer Engineering, LLC

REFERENCE: *1012151*

SUBJECT: *Potential Borrow Areas and Borrow Characterization Plan, Northeast Church Rock Millsite*

Cover Construction Materials

As requested by GE, available cover materials from select potential borrow areas on the NECR site were evaluated for geotechnical characteristics and estimated volume. Five potential areas containing borrow source material have been identified within the United Nuclear Corporation property at the Northeast Church Rock Millsite. These potential borrow sources are Borrow Areas 1, 2, D-N, D-S, and Dilco Hill. Limited investigations have been conducted within Borrow Areas 1 and 2. The remaining borrow areas have not yet been sampled or characterized. The potential borrow areas are shown on Figure BA-1. A stockpile of topsoil material available for cover construction is also shown on Figure BA-1.

Estimated quantities of soil material required for cover construction range from approximately 160,000 cubic yards (cy) to over 350,000 cy, depending on the capacity and configuration of the mine waste repository. In addition, the Engineering Evaluation/Cost Analysis (EPA, 2009) indicates that approximately 200,000 cy of borrow material may be required to restore the mine site.

Borrow Areas 1 and 2

Borrow Areas 1 and 2 were sampled in 2008 with an excavator. Thirteen test pits were excavated within Borrow Area 1, with depths ranging from 8.0 feet to greater than 12.0 feet. The depths of the test pits excavated in Borrow Area 1 were generally limited by the reach of the excavator. Twelve test pits were excavated within Borrow Area 2, with depths ranging from 3.9 to 12.0 feet. The test pit identification numbers, GPS coordinates, and depths are provided in Tables 1 and 2 for Borrow Areas 1 and 2, respectively. The approximate locations of the test pits in Borrow Areas 1 and 2 are shown in Figure BA-2.

Table 1. Borrow Area 1 Test Pit Depths and Locations

Test Pit ID	GPS Location (latitude/longitude)	Depth
NTP-01	N 35º 38.734´/ W 108º 29.668´	9.5 ft Rock[1]
NTP-02	N 35º 38.733´/ W 108º 29.692´	>12.0 ft
NTP-03	N 35º 38.734´/ W 108º 29.720´	>12.0 ft
NTP-04	N 35º 38.709´/ W 108º 29.662´	>12.0 ft
NTP-05	N 35º 38.702´/ W 108º 29.692´	>12.0 ft
NTP-06	N 35º 38.700´/ W 108º 29.726´	8.0 ft Rock[1]
NTP-07	N 35º 38.673´/ W 108º 29.662´	>12.0 ft
NTP-08	N 35º 38.674´/ W 108º 29.692´	>12.0 ft
NTP-09	N 35º 38.678´/ W 108º 29.725´	8.5ft Shale[1]
NTP-10	N 35º 38.643´/ W 108º 29.664´	>12.0 ft
NTP-11	N 35º 38.644´/ W 108º 29.693´	>12.0 ft
NTP-12	N 35º 38.647´/ W 108º 29.732´	>12.0 ft
NTP-13	N 35º 38.?´/ W 108º 29.?´	>12.0 ft

Notes: 1. The test pits were terminated shallower than 12 ft due to refusal as a result of rock or shale.

Table 2. Borrow Area 2 Test Pit Depths and Locations

Test Pit ID	GPS Location (latitude/longitude)	Depth
STP-01	N 35º 38.439´/ W 108º 30.262´	3.9 ft
STP-02	N 35º 38.460´/ W 108º 30.264´	4.0 ft
STP-03	N 35º 38.456´/ W 108º 30.267´	9.9 ft
STP-04	N 35º 38.444´/ W 108º 30.279´	9.5 ft
STP-05	N 35º 38.434´/ W 108º 30.286´	3.1 ft
STP-06	N 35º 38.478´/ W 108º 30.300´	8.6 ft
STP-07	N 35º 38.471´/ W 108º 30.311´	8.5 ft
STP-08	N 35º 38.458´/ W 108º 30.329´	11.8 ft
STP-09	N 35º 38.456´/ W 108º 30.333´	4.9 ft
STP-10	N 35º 38.505´/ W 108º 30.336´	10.3 ft
STP-11	N 35º 38.498´/ W 108º 30.345´	12.0 ft
STP-12	N 35º 38.487´/ W 108º 30.360´	11.1 ft

Estimates of available borrow material volume from Borrow Areas 1 and 2 are provided below. Estimates are based on the depth of borrow material encountered in test pits, as well as assumptions about geometry of the borrow pit excavations.

- Borrow Area 1 – 204,000 cy (assumes an average excavation depth of 12 ft, and 5:1 (horizontal:vertical) slopes along the excavation perimeter).
- Borrow Area 2 – 143,000 cy (assumes an average excavation depth of 8 ft, with 5:1 slopes along the excavation perimeter).

AMEC collected samples from both Borrow Areas 1 and 2 and tested them for limited geotechnical properties in 2008. The results of the laboratory testing and the material types are provided in Table 3 below (Dwyer, 2012).

Table 3. Laboratory Test Results for Borrow Areas 1 and 2

Sample	Ksat (cm/sec)	% Sand	% Silt	% Clay	USDA Classification
Borrow Area 1	1.41E-04	35.8	31.9	33.6	Clay Loam
Borrow Area 2	4.19E-04	46.2	24.1	29.6	Sandy Clay Loam

Dilco Hill Borrow Area

The area designated as Dilco Hill is shown on Figure BA-1. No exploration or characterization of this potential borrow source has been conducted, but the material is assumed to be composed predominately of shale with siltstone and sandstone. Estimates of the volume of material available from the Dilco Hill Borrow Area are based on an assumed depth and lateral extent of excavation, as shown on Figure BA-3. The estimated volume of material available from Dilco Hill is approximately 337,000 CY.

Borrow Areas D-N and D-S

The areas designated as potential Borrow Areas D-N and D-S are located in drainages north of the Church Rock tailings facility, as shown in Figure BA-1. No exploration or characterization of these potential borrow sources has been conducted, and no estimates of available borrow material have been developed. If these borrow sources are determined to be necessary for cover construction, these borrow areas will be sampled and characterized as a portion of the pre-design data collection activities.

Topsoil Stockpile

A topsoil stockpile containing approximately 34,000 CY of material exists on UNC property north of Highway 566 and west of the UNC offices. The location of the topsoil stockpile is shown on Figure BA-1. AMEC tested one sample from the topsoil stockpile for limited geotechnical properties in 2008. The results of the laboratory testing are provided in Table 4 below (Dwyer, 2012).

Table 4. Laboratory Test Results for Topsoil Stockpile Material

Sample	Ksat (cm/sec)	% Sand	% Silt	% Clay	USDA Classification
Topsoil Stockpile	1.27E-04	34.5	31.9	33.6	Clay Loam

Further characterization of these borrow materials will be necessary to determine suitability of the proposed material for soil cover construction, as well as to develop geotechnical parameters for final design. The proposed borrow soil investigation is discussed below.

Erosion Protection Materials

Erosion protection materials (basalt rock) are also currently stockpiled on site (personal communication with UNC personnel). These rock sizes and stockpile volumes are provided in Table 5 below. These erosion protection materials are surplus materials from previous construction at the site and have already been tested and characterized. Therefore, they should not require any additional geotechnical sampling or testing.

Table 5. Volume of Materials Stockpiled on Site

D_{50} Diameter (in)	Volume Stockpiled on Site (cubic yards)
0.02 (crusher fines)	822
0.35 (base coarse)	325
1.5	4,469
3.0	600
6.0	143
10.0	314

Future Borrow Soil investigation

The borrow sources described above will require sampling and laboratory testing to measure applicable geotechnical and hydraulic properties. The sample frequency and laboratory testing program will be specified as part of the pre-design data collection task. The laboratory test results will be used to help determine the applicability of the different soils for use in a final cover system. An adequate number of trenches and/or borings will need to be excavated and sampled to adequately characterize the full extent of the borrow sources. If the borrow soil investigation results indicate the material volumes or properties are inadequate for cover construction, investigation of additional borrow sources may be warranted.

A preliminary summary of the laboratory testing to be performed on samples from the borrow areas is provided in Table 6. The tests will be performed as specified during the pre-design data collection task.

Table 6. Soil Tests and Methods for Additional Borrow Material Characterization

Test	Test Method
Saturated hydraulic conductivity	(Rigid Wall - ASTM D2434M) or flexible wall depending on soil texture flexible wall
Dry bulk density	ASTM D7263
Moisture Content	ASTM D7263
Calculated total porosity	ASTM D7263
Moisture Characteristics (5-7pts. min): other test methods such as centrifuge is to be approved prior to their use	
Hanging Column Method	ASTM D6836
Pressure Plate Method	ASTM D6836
Water Potential (Dewpoint Potentiometer)	ASTM D6836
Relative Humidity (Box)	Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays. SSA Journal 46:1321-1325; Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods. Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity:	ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991
Specific Gravity Fine	ASTM D854
Specific Gravity Coarse	ASTM C127
Particle size analysis (Wet) Standard Sieves with Wash & Hydrometer	ASTM D422
USDA Classification	ASTM D422, USDA Soil Textural Triangle
Atterberg Limits:	ASTM D4318
Standard Proctor Compaction	ASTM D698

References

US Environmental Protection Agency Region 9. 2009. *Engineering Evaluation /Cost Analysis Northeast Church Rock (NECR) Mine Site, Gallup New Mexico.* May 30.

Dwyer, Steve. 2012. *Memo: Summary of NECR Geotechnical Data Available to Date.* January 3.

cc: Randall McAlister, GE
Toby Leeson, MWH

Attachments:

Figure BA-1: Potential Borrow Area Locations
Figure BA-2: Test Pit Locations in Borrow Area 1
Figure BA-3: Dilco Hill Borrow Area

FIGURES

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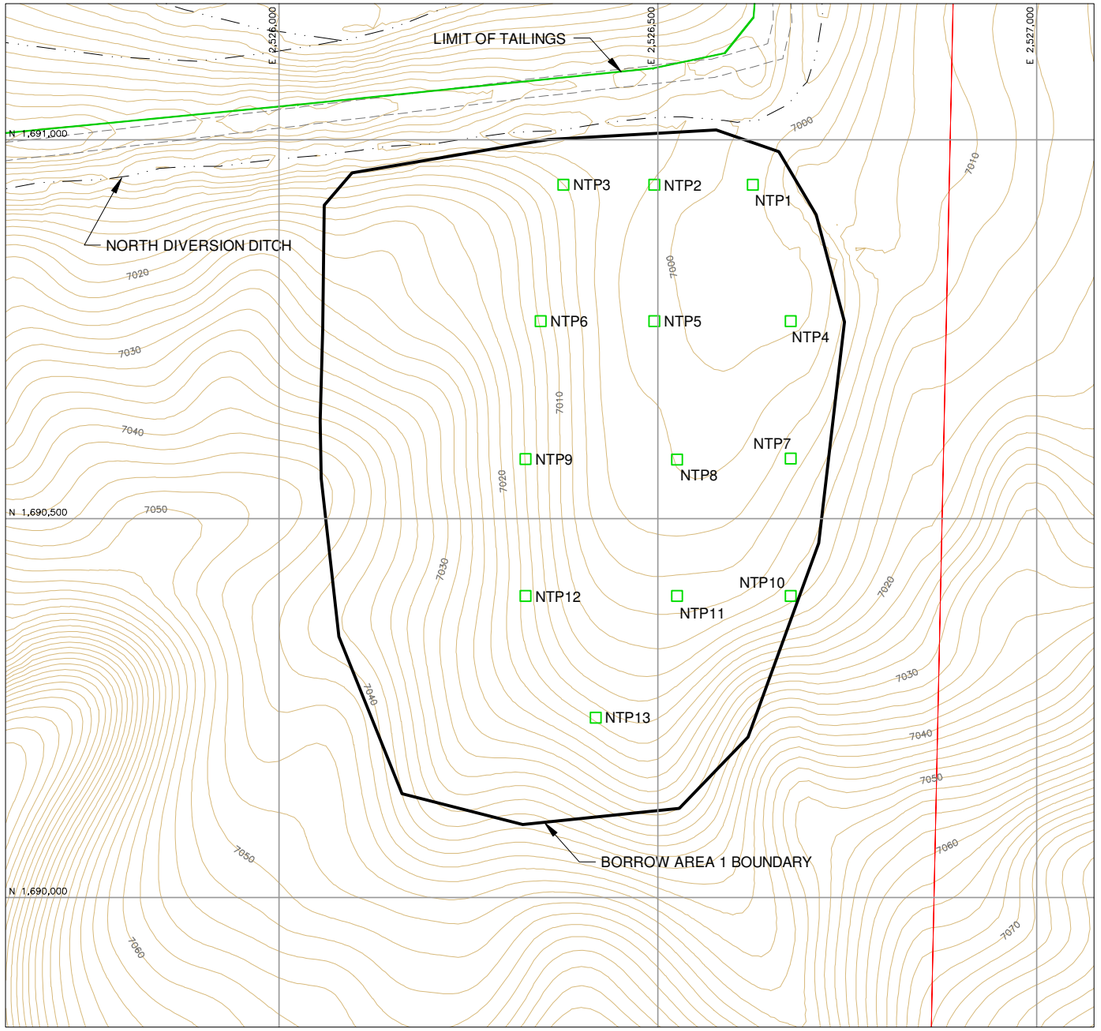
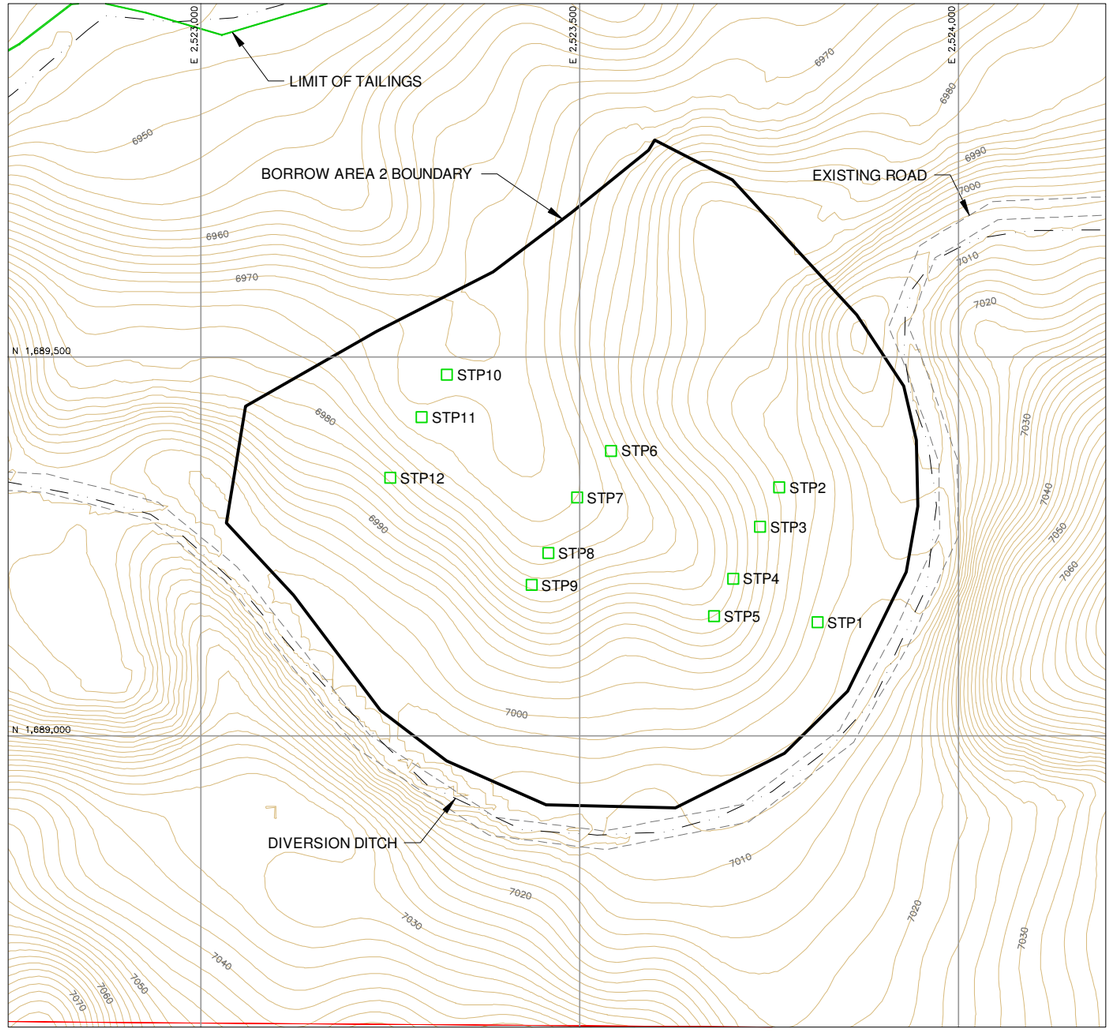
P.O. BOX 3077
Gallup, New Mexico 87305-3077

PROJECT LOCATION: McKINLEY COUNTY, NEW MEXICO
PROJECT: NECR REMOVAL ACTION
TITLE: POTENTIAL BORROW AREA LOCATIONS
FIGURE: BA-1
DATE: FEB 2012
FILE NAME: 1012217D008

MWH



BORROW AREA 1 TEST PIT LOCATIONS



BORROW AREA 2 TEST PIT LOCATIONS

LEGEND:

- NECR CELL BOUNDARY
- PLSS SECTION LINE
- NTP13 APPROXIMATE BORROW TEST PIT LOCATION

SCALE
100' 0 100' 200'

P.O. BOX 3077
Gallup, New Mexico 87305-3077

PROJECT LOCATION: McKINLEY COUNTY, NEW MEXICO
PROJECT: NECR REMOVAL ACTION
TITLE: BORROW AREA TEST PIT LOCATION MAP
FIGURE: BA-2
DATE: JAN 2012
FILE NAME: 1012217D010

MWH

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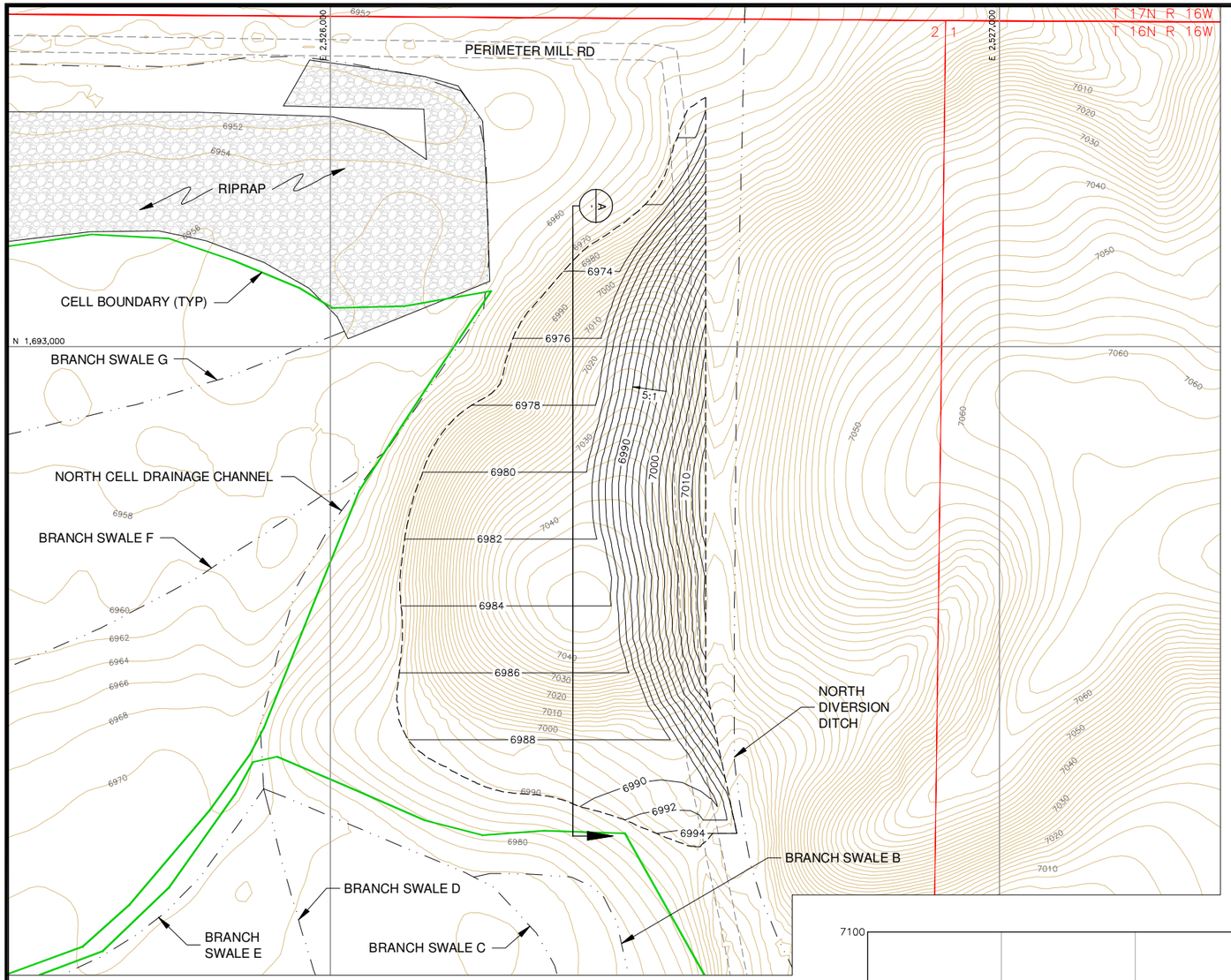


PLAN

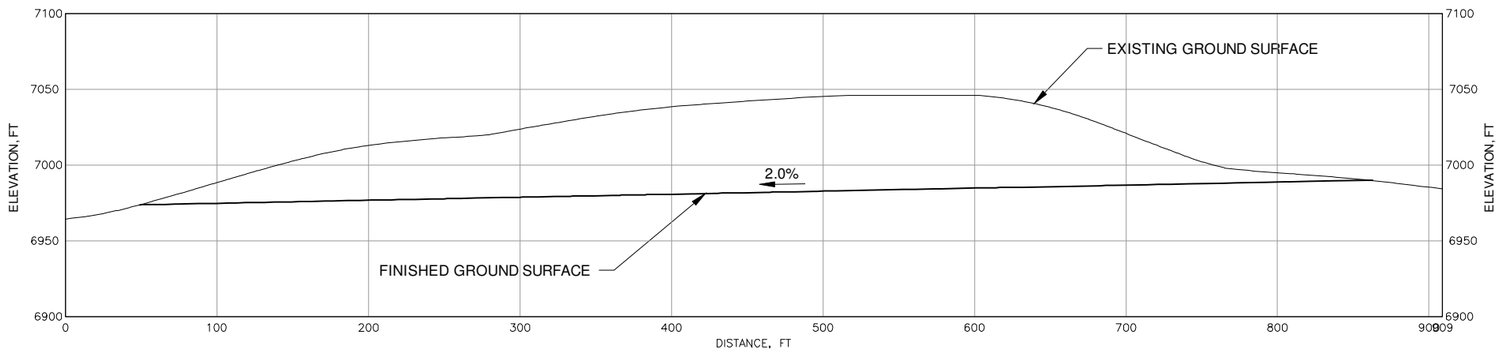
SCALE

100' 0 100' 200'

CONTOUR INTERVAL = 2 FEET

LEGEND:

- 6980 — EXISTING GROUND SURFACE CONTOUR ELEVATION, FT
- 6980 — FINISHED GROUND SURFACE CONTOUR, FT
- EXISTING ROADS
- PLSS SECTION LINE



SECTION A

SCALE

50' 0 50' 100'

P.O. BOX 3077
Gallup, New Mexico 87305-3077

PROJECT LOCATION: McKINLEY COUNTY, NEW MEXICO

PROJECT: NECR REMOVAL ACTION

TITLE: DILCO HILL BORROW AREA

MWH

FIGURE: BA-3

DATE: JAN 2012

FILE NAME: 1012217D009

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MEMORANDUM

DATE: **July 31, 2009**

SUBJECT: Statistical Evaluation of Radium-226 in Soils and Rock from IRA Borrow Source Area

This memorandum provides a summary of a statistical data evaluation of soil analytical data collected during the borrow source evaluation for the Northeast Church Rock Interim Removal Action (IRA). The objective of the statistical evaluation was to determine whether the Ra-226 concentrations in soil collected from borrow source test pits statistically exceed the field screening level of 2.24 pCi/g. A total of 15 soil samples were collected from five test pits. Samples were obtained from the top (T), middle (M), and bottom (B) of each test pit. The samples ranged in depth from the near surface to 21 feet below ground surface (bgs). The test pits numbers, sample identification numbers, sample depths, radium-226 concentrations (reported, maximum and minimums based on the total propagated uncertainty [TPU]) are shown on Table 1. Also shown on this table is whether the sample was collected from alluvial material or shale rock material.

Table 1
Borrow Source Sample Locations

Sample ID	Ra-226 Concentration (pCi/g)	+/- 2 s TPU[1]	Ra-226 Concentration Maximum (pCi/g)	Ra-226 Concentration Minimum (pCi/g)	Lithology[2]
PRB1-08-T	1.32	0.30	1.62	1.02	alluvium
PRB1-08-M	1.97	0.43	2.40	1.54	alluvium
PRB1-08-B	0.81	0.23	1.04	0.58	alluvium
PRB1-20+8W-T	1.86	0.37	2.23	1.49	alluvium
PRB1-20+8W-M	0.97	0.29	1.26	0.68	alluvium
PRB1-20+8W-B	1.24	0.32	1.56	0.92	rock
PRB-1-21-T	1.22	0.32	1.54	0.90	alluvium
PRB-1-21-M	1.01	0.31	1.32	0.70	alluvium
PRB-1-21-B	0.91	0.30	1.21	0.61	rock
PRB-1-17-T	1.21	0.30	1.51	0.91	alluvium
PRB-1-17-M	0.74	0.25	0.99	0.49	alluvium
PRB-1-17-B	1.15	0.30	1.45	0.85	rock
PRB1-24+48E-T	1.69	0.38	2.07	1.31	rock
PRB1-24+48E-M	1.34	0.32	1.66	1.02	rock
PRB1-24+48E-B	1.51	0.34	1.85	1.17	rock

Notes:
[1]TPU - total propagated uncertainty
[2]Lithology was assumed based on a general test pit log information

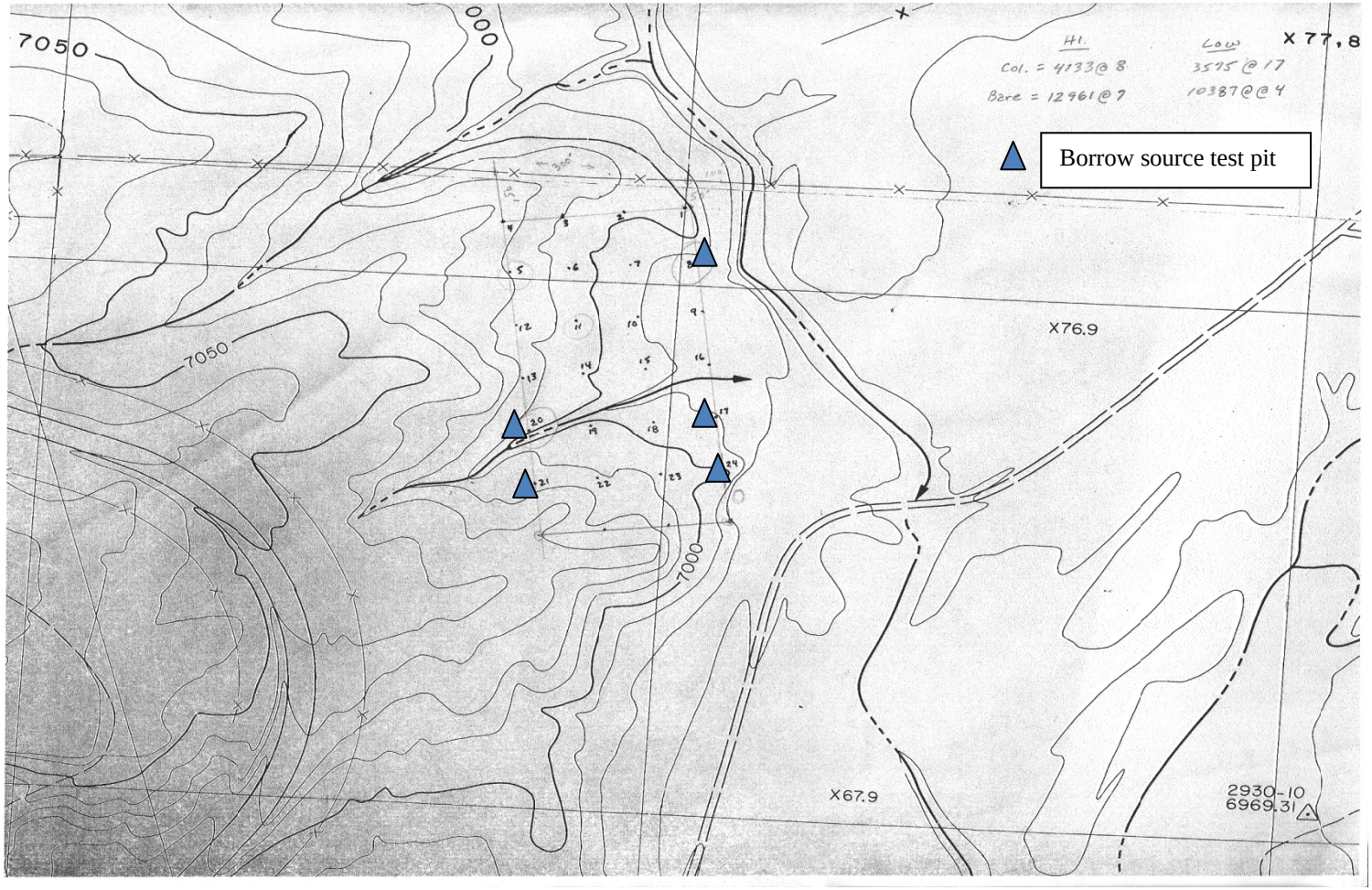

FIGURE 1 – BORROW SOURCE SAMPLE LOCATIONS

Statistical Methods Background

The data were statistically analyzed using standard EPA methods included in the ProUCL 4.0 software. ProUCL contains statistical methods to address various environmental issues, as discussed in detail in the *ProUCL Version 4.0 Technical Guide* (EPA, 2007) and *Statistical Methods for Evaluating the Attainment of Cleanup Standards* (EPA, 1994). ProUCL was used to statistically evaluate the borrow source data set. Simple statistics (e.g., maximum, minimum, mean, median and upper confidence levels (UCL)) were used to evaluate the data set. The UCL is a tool for acknowledging uncertainties and variability within an environmental data set without presenting an unacceptable risk to human health or the environment. In environmental studies, the uncertainties are commonly due to limited sampling data. The 95% UCL defines a value that equals or exceeds the true mean 95% of the time. Statistics were evaluated for several scenarios as described below.

Statistical Evaluation

The data set was divided into two types, alluvial and rock, based on the borrow source test pit data as shown on Table 1. Of the 15 samples, nine (9) samples were characterized as alluvium and six (6) were characterized as rock. For each scenario, the data sets were evaluated for the entire data set as well as for each sample type (alluvial versus rock). Each of these scenarios is described below.

Scenario 1a: Compared laboratory reported Ra-226 concentrations for entire data set
Scenario 1b: Compared laboratory reported Ra-226 concentrations for alluvial data set
Scenario 1c: Compared laboratory reported Ra-226 concentrations for rock data set

Scenario 2a: Compared maximum reported Ra-226 concentrations (+ 2 s TPU) for entire data set
Scenario 2b: Compared maximum reported Ra-226 concentrations (+ 2 s TPU) for alluvial data set
Scenario 2c: Compared maximum reported Ra-226 concentrations (+ 2 s TPU) for rock data set

Scenario 2a: Compared minimum reported Ra-226 concentrations (- 2 s TPU) for entire data set
Scenario 2b: Compared minimum reported Ra-226 concentrations (- 2 s TPU) for alluvial data set
Scenario 2c: Compared minimum reported Ra-226 concentrations (- 2 s TPU) for rock data set

Sample numbers and a summary of sample statistics for each scenario are provided in Table 2.

Table 2 Summary of Statistics										
Scenario	**Description**	**NumObs**	**Minimum**	**Maximum**	**Mean**	**Median**	**Variance**	SD	**Potential UCL to use**	**95% UCL**
Scenario 1a	All data	15	0.74	1.97	1.26	1.22	0.13	0.37	95% Student's-t UCL	1.43
Scenario 1b	Alluvium	9	0.74	1.97	1.23	1.21	0.19	0.43	95% Student's-t UCL	1.50
Scenario 1c	Rock	6	0.91	1.69	1.31	1.29	0.08	0.27	95% Student's-t UCL	1.53
Scenario 2a	Maximum All data	15	0.99	2.40	1.58	1.54	0.17	0.41	95% Student's-t UCL	1.77
Scenario 2b	Maximum Alluvium	9	0.99	2.40	1.55	1.51	0.24	0.49	95% Student's-t UCL	1.85
Scenario 2c	Maximum Rock	6	1.21	2.07	1.63	1.61	0.09	0.30	95% Student's-t UCL	1.88
Scenario 3a	Minimum All data	15	0.49	1.54	0.95	0.91	0.10	0.32	95% Student's-t UCL	1.09
Scenario 3b	Minimum Alluvium	9	0.49	1.54	0.92	0.90	0.14	0.38	95% Student's-t UCL	1.16
Scenario 3c	Minimum Rock	6	0.61	1.31	0.98	0.97	0.06	0.25	95% Student's-t UCL	1.18
Notes: Units in pCi/g										

It must be noted that nine (9) and six (6) samples may be too few data to computer meaningful and reliable test statistics and estimate as indicated by the ProUCL warning for these data sets

Data Sets

See Table 1

ProUCL Output

See worksheets in Attachment 1

Results

The statistical data evaluation indicated two primary results 1) the 95% UCL statistic on the average, maximum, and minimum Ra-226 concentrations were below 2.24 pCi/g for every scenario, and 2) any differences between the rock and alluvial data sets were generally statistically insignificant.

References

U.S. Environmental Protection Agency (EPA). *ProUCL Version 4.0 Technical Guide*, EPA/600/R-07/041, April 2007, www.epa.gov.

ATTACHMENT 1
SCENARIO DATA AND PROUCL OUTPUT

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MEMORANDUM

SCENARIO 1

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\lmwolf\Desktop\radium concentrations.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ra-226 Concentration

General Statistics

Number of Valid Observations	15	Number of Distinct Observations	15

Raw Statistics

Minimum	0.74
Maximum	1.97
Mean	1.263
Median	1.22
SD	0.366
Coefficient of Variation	0.29
Skewness	0.561

Log-transformed Statistics

Minimum of Log Data	-0.301
Maximum of Log Data	0.678
Mean of log Data	0.195
SD of log Data	0.289

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.952
Shapiro Wilk Critical Value	0.881

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1.43

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	1.434
95% Modified-t UCL	1.432

Gamma Distribution Test

k star (bias corrected)	10.47
Theta Star	0.121
nu star	314.1
Approximate Chi Square Value (.05)	274
Adjusted Level of Significance	0.0324
Adjusted Chi Square Value	269.4
Anderson-Darling Test Statistic	0.196
Anderson-Darling 5% Critical Value	0.737
Kolmogorov-Smirnov Test Statistic	0.113
Kolmogorov-Smirnov 5% Critical Value	0.221

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	1.448
95% Adjusted Gamma UCL	1.473

Potential UCL to Use

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.975
Shapiro Wilk Critical Value	0.881

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	1.464
95% Chebyshev (MVUE) UCL	1.679
97.5% Chebyshev (MVUE) UCL	1.858
99% Chebyshev (MVUE) UCL	2.212

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	1.419
95% Jackknife UCL	1.43
95% Standard Bootstrap UCL	1.413
95% Bootstrap-t UCL	1.452
95% Hall's Bootstrap UCL	1.433
95% Percentile Bootstrap UCL	1.414
95% BCA Bootstrap UCL	1.433
95% Chebyshev(Mean, Sd) UCL	1.676
97.5% Chebyshev(Mean, Sd) UCL	1.854
99% Chebyshev(Mean, Sd) UCL	2.205

Use 95% Student's-t UCL 1.43

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\lmwolf\Desktop\radium concentrations.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ra-226 Concentration (alluvium)

General Statistics

Number of Valid Observations 9

Number of Distinct Observations 9

Raw Statistics

Minimum	0.74
Maximum	1.97
Mean	1.234
Median	1.21
SD	0.431
Coefficient of Variation	0.349
Skewness	0.836

Log-transformed Statistics

Minimum of Log Data	-0.301
Maximum of Log Data	0.678
Mean of log Data	0.159
SD of log Data	0.336

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.896
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.945
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1.502

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	1.513
95% Modified-t UCL	1.508

Assuming Lognormal Distribution

95% H-UCL	1.584
95% Chebyshev (MVUE) UCL	1.84
97.5% Chebyshev (MVUE) UCL	2.102
99% Chebyshev (MVUE) UCL	2.618

Gamma Distribution Test

k star (bias corrected)	6.674
Theta Star	0.185
nu star	120.1
Approximate Chi Square Value (.05)	95.82
Adjusted Level of Significance	0.0231
Adjusted Chi Square Value	91.25
Anderson-Darling Test Statistic	0.322
Anderson-Darling 5% Critical Value	0.722
Kolmogorov-Smirnov Test Statistic	0.154

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	1.471
95% Jackknife UCL	1.502
95% Standard Bootstrap UCL	1.452
95% Bootstrap-t UCL	1.63
95% Hall's Bootstrap UCL	1.846
95% Percentile Bootstrap UCL	1.467

53				Kolmogorov-Smirnov 5% Critical Value	0.279				95% BCA Bootstrap UCL	1.497		
54			**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	1.861		
55									97.5% Chebyshev(Mean, Sd) UCL	2.131		
56			**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	2.664		
57				95% Approximate Gamma UCL	1.548							
58				95% Adjusted Gamma UCL	1.625							
59												
60			**Potential UCL to Use**						Use 95% Student's-t UCL	1.502		
61												
62												
63	**Ra-226 Concentration (rock)**											
64												
65						**General Statistics**						
66				Number of Valid Observations	6				Number of Distinct Observations	6		
67												
68			**Raw Statistics**						**Log-transformed Statistics**			
69				Minimum	0.91				Minimum of Log Data	-0.0943		
70				Maximum	1.69				Maximum of Log Data	0.525		
71				Mean	1.307				Mean of log Data	0.248		
72				Median	1.29				SD of log Data	0.217		
73				SD	0.274							
74				Coefficient of Variation	0.21							
75				Skewness	-0.026							
76												
77												
78			**Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!**									
79												
80			**It is suggested to collect at least 8 to 10 observations using these statistical methods!**									
81			**If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**									
82												
83												
84						**Warning: There are only 6 Values in this data**							
85						**Note: It should be noted that even though bootstrap methods may be performed on this data set,**							
86						**the resulting calculations may not be reliable enough to draw conclusions**							
87												
88						**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**							
89												
90						**Relevant UCL Statistics**							
91			**Normal Distribution Test**						**Lognormal Distribution Test**			
92				Shapiro Wilk Test Statistic	0.995				Shapiro Wilk Test Statistic	0.984		
93				Shapiro Wilk Critical Value	0.788				Shapiro Wilk Critical Value	0.788		
94			**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**			
95												
96			**Assuming Normal Distribution**						**Assuming Lognormal Distribution**			
97				95% Student's-t UCL	1.532				95% H-UCL	1.608		
98			**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL	1.812		
99				95% Adjusted-CLT UCL	1.489				97.5% Chebyshev (MVUE) UCL	2.03		
100				95% Modified-t UCL	1.532				99% Chebyshev (MVUE) UCL	2.46		
101												
102			**Gamma Distribution Test**						**Data Distribution**			
103				k star (bias corrected)	13.26				**Data appear Normal at 5% Significance Level**			
104				Theta Star	0.0985							

105					nu star	159.1						
106				Approximate Chi Square Value (.05)		131			**Nonparametric Statistics**			
107				Adjusted Level of Significance		0.0122				95% CLT UCL	1.491	
108				Adjusted Chi Square Value		121.7				95% Jackknife UCL	1.532	
109										95% Standard Bootstrap UCL	1.475	
110				Anderson-Darling Test Statistic		0.157				95% Bootstrap-t UCL	1.56	
111				Anderson-Darling 5% Critical Value		0.697				95% Hall's Bootstrap UCL	1.543	
112				Kolmogorov-Smirnov Test Statistic		0.128				95% Percentile Bootstrap UCL	1.468	
113				Kolmogorov-Smirnov 5% Critical Value		0.332				95% BCA Bootstrap UCL	1.467	
114			**Data appear Gamma Distributed at 5% Significance Level**							95% Chebyshev(Mean, Sd) UCL	1.794	
115										97.5% Chebyshev(Mean, Sd) UCL	2.006	
116			**Assuming Gamma Distribution**							99% Chebyshev(Mean, Sd) UCL	2.42	
117				95% Approximate Gamma UCL		1.588						
118				95% Adjusted Gamma UCL		1.708						
119												
120			**Potential UCL to Use**							Use 95% Student's-t UCL	1.532	
121												

MWH

BUILDING A BETTER WORLD

MEMORANDUM

SCENARIO 2

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\lmwolf\Desktop\pro ucl\radium_concentrations_proucl.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ra-226 Concentration Max

General Statistics

Number of Valid Observations	15	Number of Distinct Observations	15

Raw Statistics

Minimum	0.99
Maximum	2.4
Mean	1.581
Median	1.54
SD	0.413
Coefficient of Variation	0.261
Skewness	0.577

Log-transformed Statistics

Minimum of Log Data	-0.0101
Maximum of Log Data	0.875
Mean of log Data	0.427
SD of log Data	0.259

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.953
Shapiro Wilk Critical Value	0.881

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1.768

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	1.773
95% Modified-t UCL	1.771

Gamma Distribution Test

k star (bias corrected)	12.95
Theta Star	0.122
nu star	388.6
Approximate Chi Square Value (.05)	343.9
Adjusted Level of Significance	0.0324
Adjusted Chi Square Value	338.7
Anderson-Darling Test Statistic	0.202
Anderson-Darling 5% Critical Value	0.736
Kolmogorov-Smirnov Test Statistic	0.123
Kolmogorov-Smirnov 5% Critical Value	0.221

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	1.786
95% Adjusted Gamma UCL	1.813

Potential UCL to Use

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.975
Shapiro Wilk Critical Value	0.881

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	1.801
95% Chebyshev (MVUE) UCL	2.045
97.5% Chebyshev (MVUE) UCL	2.246
99% Chebyshev (MVUE) UCL	2.641

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	1.756
95% Jackknife UCL	1.768
95% Standard Bootstrap UCL	1.748
95% Bootstrap-t UCL	1.791
95% Hall's Bootstrap UCL	1.769
95% Percentile Bootstrap UCL	1.751
95% BCA Bootstrap UCL	1.757
95% Chebyshev(Mean, Sd) UCL	2.045
97.5% Chebyshev(Mean, Sd) UCL	2.246
99% Chebyshev(Mean, Sd) UCL	2.641

Use 95% Student's-t UCL 1.768

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\lmwolf\Desktop\pro ucl\radium_concentrations_proucl.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ra-226 Concentration Max (alluvium)

General Statistics

Number of Valid Observations	9	Number of Distinct Observations	9

Raw Statistics		Log-transformed Statistics	
Minimum	0.99	Minimum of Log Data	-0.0101
Maximum	2.4	Maximum of Log Data	0.875
Mean	1.546	Mean of log Data	0.394
Median	1.51	SD of log Data	0.304
SD	0.488		
Coefficient of Variation	0.315		
Skewness	0.845		

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.9	Shapiro Wilk Test Statistic	0.942
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1.848	95% H-UCL	1.927
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.229
95% Adjusted-CLT UCL	1.862	97.5% Chebyshev (MVUE) UCL	2.525
95% Modified-t UCL	1.855	99% Chebyshev (MVUE) UCL	3.107

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	8.146	**Data appear Normal at 5% Significance Level**	
Theta Star	0.19		
nu star	146.6		
Approximate Chi Square Value (.05)	119.7	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0231	95% CLT UCL	1.813
Adjusted Chi Square Value	114.5	95% Jackknife UCL	1.848
		95% Standard Bootstrap UCL	1.794
Anderson-Darling Test Statistic	0.326	95% Bootstrap-t UCL	2.025
Anderson-Darling 5% Critical Value	0.722	95% Hall's Bootstrap UCL	2.327
Kolmogorov-Smirnov Test Statistic	0.175	95% Percentile Bootstrap UCL	1.813
Kolmogorov-Smirnov 5% Critical Value	0.279	95% BCA Bootstrap UCL	1.858

54				Data appear Gamma Distributed at 5% Significance Level					95% Chebyshev(Mean, Sd) UCL	2.254		
55									97.5% Chebyshev(Mean, Sd) UCL	2.561		
56				Assuming Gamma Distribution					99% Chebyshev(Mean, Sd) UCL	3.163		
57				95% Approximate Gamma UCL	1.894							
58				95% Adjusted Gamma UCL	1.979							
59												
60				Potential UCL to Use					Use 95% Student's-t UCL	1.848		
61												
62												
63	Ra-226 Concentration Max (rock)											
64												
65					General Statistics							
66				Number of Valid Observations	6				Number of Distinct Observations	6		
67												
68				Raw Statistics					Log-transformed Statistics			
69				Minimum	1.21				Minimum of Log Data	0.191		
70				Maximum	2.07				Maximum of Log Data	0.728		
71				Mean	1.633				Mean of log Data	0.476		
72				Median	1.61				SD of log Data	0.188		
73				SD	0.302							
74				Coefficient of Variation	0.185							
75				Skewness	0.12							
76												
77												
78				Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!								
79												
80				It is suggested to collect at least 8 to 10 observations using these statistical methods!								
81				If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.								
82												
83												
84				Warning: There are only 6 Values in this data								
85				Note: It should be noted that even though bootstrap methods may be performed on this data set,								
86				the resulting calculations may not be reliable enough to draw conclusions								
87												
88				The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.								
89												
90					Relevant UCL Statistics							
91				Normal Distribution Test					Lognormal Distribution Test			
92				Shapiro Wilk Test Statistic	0.995				Shapiro Wilk Test Statistic	0.993		
93				Shapiro Wilk Critical Value	0.788				Shapiro Wilk Critical Value	0.788		
94				Data appear Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level			
95												
96				Assuming Normal Distribution					Assuming Lognormal Distribution			
97				95% Student's-t UCL	1.882				95% H-UCL	1.947		
98				95% UCLs (Adjusted for Skewness)					95% Chebyshev (MVUE) UCL	2.18		
99				95% Adjusted-CLT UCL	1.843				97.5% Chebyshev (MVUE) UCL	2.417		
100				95% Modified-t UCL	1.883				99% Chebyshev (MVUE) UCL	2.882		
101												
102				Gamma Distribution Test					Data Distribution			
103				k star (bias corrected)	17.37				Data appear Normal at 5% Significance Level			
104				Theta Star	0.094							
105				nu star	208.5							
106				Approximate Chi Square Value (.05)	176.1				Nonparametric Statistics			

107				Adjusted Level of Significance	0.0122					95% CLT UCL	1.836	
108				Adjusted Chi Square Value	165.3					95% Jackknife UCL	1.882	
109										95% Standard Bootstrap UCL	1.815	
110				Anderson-Darling Test Statistic	0.146					95% Bootstrap-t UCL	1.914	
111				Anderson-Darling 5% Critical Value	0.697					95% Hall's Bootstrap UCL	1.949	
112				Kolmogorov-Smirnov Test Statistic	0.123					95% Percentile Bootstrap UCL	1.828	
113				Kolmogorov-Smirnov 5% Critical Value	0.332					95% BCA Bootstrap UCL	1.815	
114			**Data appear Gamma Distributed at 5% Significance Level**							95% Chebyshev(Mean, Sd) UCL	2.171	
115										97.5% Chebyshev(Mean, Sd) UCL	2.404	
116			**Assuming Gamma Distribution**							99% Chebyshev(Mean, Sd) UCL	2.861	
117				95% Approximate Gamma UCL	1.934							
118				95% Adjusted Gamma UCL	2.06							
119												
120			**Potential UCL to Use**							Use 95% Student's-t UCL	1.882	
121												

SCENARIO 3

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\lmwolf\Desktop\pro ucl\radium_concentrations_proucl.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ra-226 Concentration Min

General Statistics

Number of Valid Observations	15	Number of Distinct Observations	14

Raw Statistics

Minimum	0.49
Maximum	1.54
Mean	0.946
Median	0.91
SD	0.321
Coefficient of Variation	0.339
Skewness	0.534

Log-transformed Statistics

Minimum of Log Data	-0.713
Maximum of Log Data	0.432
Mean of log Data	-0.11
SD of log Data	0.343

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.945
Shapiro Wilk Critical Value	0.881

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1.092

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	1.095
95% Modified-t UCL	1.094

Gamma Distribution Test

k star (bias corrected)	7.579
Theta Star	0.125
nu star	227.4
Approximate Chi Square Value (.05)	193.5
Adjusted Level of Significance	0.0324
Adjusted Chi Square Value	189.6
Anderson-Darling Test Statistic	0.22
Anderson-Darling 5% Critical Value	0.738
Kolmogorov-Smirnov Test Statistic	0.112
Kolmogorov-Smirnov 5% Critical Value	0.222

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	1.112
95% Adjusted Gamma UCL	1.134

Potential UCL to Use

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.881

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	1.133
95% Chebyshev (MVUE) UCL	1.317
97.5% Chebyshev (MVUE) UCL	1.477
99% Chebyshev (MVUE) UCL	1.792

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	1.082
95% Jackknife UCL	1.092
95% Standard Bootstrap UCL	1.079
95% Bootstrap-t UCL	1.107
95% Hall's Bootstrap UCL	1.092
95% Percentile Bootstrap UCL	1.067
95% BCA Bootstrap UCL	1.091
95% Chebyshev(Mean, Sd) UCL	1.307
97.5% Chebyshev(Mean, Sd) UCL	1.463
99% Chebyshev(Mean, Sd) UCL	1.77

Use 95% Student's-t UCL	1.092

General UCL Statistics for Full Data Sets

User Selected Options

From File	C:\Documents and Settings\lmwolf\Desktop\pro ucl\radium_concentrations_proucl.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ra-226 Concentration Min (alluvium)

General Statistics

Number of Valid Observations	9	Number of Distinct Observations	9

Raw Statistics		Log-transformed Statistics	
Minimum	0.49	Minimum of Log Data	-0.713
Maximum	1.54	Maximum of Log Data	0.432
Mean	0.923	Mean of log Data	-0.15
Median	0.9	SD of log Data	0.394
SD	0.375		
Coefficient of Variation	0.406		
Skewness	0.821		

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.889	Shapiro Wilk Test Statistic	0.946
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1.156	95% H-UCL	1.252
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.455
95% Adjusted-CLT UCL	1.166	97.5% Chebyshev (MVUE) UCL	1.686
95% Modified-t UCL	1.162	99% Chebyshev (MVUE) UCL	2.14

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	4.931	**Data appear Normal at 5% Significance Level**	
Theta Star	0.187		
nu star	88.75		
Approximate Chi Square Value (.05)	68.03	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0231	95% CLT UCL	1.129
Adjusted Chi Square Value	64.22	95% Jackknife UCL	1.156
		95% Standard Bootstrap UCL	1.114
Anderson-Darling Test Statistic	0.326	95% Bootstrap-t UCL	1.289
Anderson-Darling 5% Critical Value	0.722	95% Hall's Bootstrap UCL	1.382
Kolmogorov-Smirnov Test Statistic	0.166	95% Percentile Bootstrap UCL	1.127
Kolmogorov-Smirnov 5% Critical Value	0.28	95% BCA Bootstrap UCL	1.161

54				Data appear Gamma Distributed at 5% Significance Level					95% Chebyshev(Mean, Sd) UCL	1.468		
55									97.5% Chebyshev(Mean, Sd) UCL	1.704		
56				Assuming Gamma Distribution					99% Chebyshev(Mean, Sd) UCL	2.168		
57				95% Approximate Gamma UCL	1.205							
58				95% Adjusted Gamma UCL	1.276							
59												
60				Potential UCL to Use					Use 95% Student's-t UCL	1.156		
61												
62												
63	Ra-226 Concentration Min (rock)											
64												
65					General Statistics							
66				Number of Valid Observations	6				Number of Distinct Observations	6		
67												
68				Raw Statistics					Log-transformed Statistics			
69				Minimum	0.61				Minimum of Log Data	-0.494		
70				Maximum	1.31				Maximum of Log Data	0.27		
71				Mean	0.98				Mean of log Data	-0.0489		
72				Median	0.97				SD of log Data	0.269		
73				SD	0.247							
74				Coefficient of Variation	0.252							
75				Skewness	-0.204							
76												
77												
78				Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!								
79												
80				It is suggested to collect at least 8 to 10 observations using these statistical methods!								
81				If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.								
82												
83												
84				Warning: There are only 6 Values in this data								
85				Note: It should be noted that even though bootstrap methods may be performed on this data set,								
86				the resulting calculations may not be reliable enough to draw conclusions								
87												
88				The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.								
89												
90					Relevant UCL Statistics							
91				Normal Distribution Test					Lognormal Distribution Test			
92				Shapiro Wilk Test Statistic	0.99				Shapiro Wilk Test Statistic	0.964		
93				Shapiro Wilk Critical Value	0.788				Shapiro Wilk Critical Value	0.788		
94				Data appear Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level			
95												
96				Assuming Normal Distribution					Assuming Lognormal Distribution			
97				95% Student's-t UCL	1.183				95% H-UCL	1.282		
98				95% UCLs (Adjusted for Skewness)					95% Chebyshev (MVUE) UCL	1.451		
99				95% Adjusted-CLT UCL	1.137				97.5% Chebyshev (MVUE) UCL	1.654		
100				95% Modified-t UCL	1.181				99% Chebyshev (MVUE) UCL	2.053		
101												
102				Gamma Distribution Test					Data Distribution			
103				k star (bias corrected)	8.907				Data appear Normal at 5% Significance Level			
104				Theta Star	0.11							
105				nu star	106.9							
106				Approximate Chi Square Value (.05)	84.03				Nonparametric Statistics			

107				Adjusted Level of Significance	0.0122					95% CLT UCL	1.146	
108				Adjusted Chi Square Value	76.72					95% Jackknife UCL	1.183	
109										95% Standard Bootstrap UCL	1.13	
110				Anderson-Darling Test Statistic	0.186					95% Bootstrap-t UCL	1.191	
111				Anderson-Darling 5% Critical Value	0.697					95% Hall's Bootstrap UCL	1.183	
112				Kolmogorov-Smirnov Test Statistic	0.141					95% Percentile Bootstrap UCL	1.133	
113				Kolmogorov-Smirnov 5% Critical Value	0.332					95% BCA Bootstrap UCL	1.125	
114			**Data appear Gamma Distributed at 5% Significance Level**							95% Chebyshev(Mean, Sd) UCL	1.419	
115										97.5% Chebyshev(Mean, Sd) UCL	1.609	
116			**Assuming Gamma Distribution**							99% Chebyshev(Mean, Sd) UCL	1.982	
117				95% Approximate Gamma UCL	1.247							
118				95% Adjusted Gamma UCL	1.365							
119												
120			**Potential UCL to Use**							Use 95% Student's-t UCL	1.183	
121												

MWH

BUILDING A BETTER WORLD

MEMORANDUM

TO:	Andrew Bain	DATE:	November 13, 2009
FROM:	James Thompson	REFERENCE:	1007552
SUBJECT:	Transmittal of Riprap Material Quality Data		

Pursuant to the revised Northeast Church Rock Interim Removal Action Construction Plan (Construction Plan), attached are material quality data for riprap and bedding materials from the General Rock Products quarry located near Thoreau, New Mexico. Material quality data in Attachment 1 meets the quality requirements presented in the Construction Plan (Construction Plan). The bedding material gradation included in Attachment 2 is slightly outside of the specification but is suitable for use. Gamma scan results are included in Attachment 3 and are below correlated action level based on the correlation in the Construction Plan. Preliminary laboratory analysis indicates that the material contains 0.51 pCi/g and is currently being validated. A laboratory data report will be provided once validation is complete. We anticipate importing and beginning to place bedding material and riprap the first week of December.

Attachments: 1 – Material Quality Results
2 – Gradation Data
3 – Gamma Scan Results

cc: Freida White, NNEPA – 4 copies
Lance Hauer, GE

ATTACHMENT 1

Western Technologies Inc.
The Quality People
Since 1955

400 South Lorena Avenue
Farmington, New Mexico 87401
(505) 327-4966 • fax 327-5293

PHYSICAL PROPERTIES OF AGGREGATES

Client **GENERAL ROCK PRODUCTS**
PO BOX 1496
COLORADO CITY, AZ 86021

Date of Report **06-24-09**
Job No. **3149JK027**
Event / Invoice No. **31490129**
Authorized by **ERNEST JESOP** — Lab No. **3715-17**
Sampled by **CLIENT** — Date **06-09-09**
Submitted by **CLIENT** — Date **06-09-09**

Project **THOREAU CRUSHER CONTROL**
Contractor **GENERAL ROCK PRODUCTS**
Type / Use of Material **AGGREGATE BASE COURSE (3 SAMPLES)**
Sample Source / Location **THOREAU PIT/BELT AT PIT**
Testing Authorized : **SPEC GRAV & ABSORP, LA RESIST, ORGANIC IMPUR, FRAC FACES, AGG INDEX, SOUNDNESS**
Special Instructions :

Location **THOREAU, NM**
Arch. / Engr. **N/A**
Supplier / Source **GENERAL ROCK PRODUCTS/THOREAU PIT**
Source / Location Desig. By **CLIENT** — Date **06-09-09**

TEST RESULTS

SIEVE ANALYSIS ☐ ASTM C136 ☐ AASHTO T27
FINER THAN #200 ☐ ASTM C117 ☐ AASHTO T11

SIEVE	ACCUMULATIVE % PASSING	SPECIFICATION

LIQUID LIMIT & PLASTIC PROPERTIES
☐ ASTM D4318 ☐ AASHTO T89 & T90
METHOD
SAMPLE AIR DRIED ☐ YES ☐ NO
ESTIMATED % RETAINED ON NO 40

	RESULTS	SPECS
LIQUID LIMIT →		
PLASTIC LIMIT →		
PLASTICITY INDEX →		

FINENESS MODULUS
☐ ASTM C125 →

ORGANIC IMPURITIES
☐ ASTM C40
☒ AASHTO T21 PLATE NO. → 1

CLEANNESS VALUE
☐ CA 227 →

PHYSICAL PROPERTIES		RESULTS	SPECS
UNIT WEIGHT & VOIDS ☐ ASTM C29 ☐ AASHTO T19 ☐ RODDING ☐ JIGGING ☐ LOOSE	FINE AGGREGATE — UNIT WEIGHT, PCF →		
	VOIDS, % →		
	COARSE AGGREGATE — UNIT WEIGHT, PCF →		
	VOIDS, % →		
SPECIFIC GRAVITY & ABSORPTION FINE AGGREGATE ☐ ASTM C128 ☐ AASHTO T84 AGGREGATE DRIED ☐ YES ☐ NO	BULK SPECIFIC GRAVITY →		
	BULK SPECIFIC GRAVITY (SSD) →		
	APPARENT SPECIFIC GRAVITY →		
	ABSORPTION, % →		
COARSE AGGREGATE ☐ ASTM C127 ☒ AASHTO T85 AGGREGATE DRIED ☒ YES ☐ NO	BULK SPECIFIC GRAVITY →	2.62	
	BULK SPECIFIC GRAVITY (SSD) →	2.66	
	APPARENT SPECIFIC GRAVITY →	2.72	
	ABSORPTION, % →	1.3	
SAND EQUIVALENT VALUE ☐ ASTM D2419 ☐ AASHTO T176	SE, % →		
RESISTANCE TO DEGRADATION SMALL COARSE AGGREGATE ☐ ASTM C131 ☒ AASHTO T96	GRADING 100 REV., %LOSS →		
	GRADING **B** 500 REV., %LOSS →	23	
LARGE COARSE AGGREGATE ☐ ASTM C535	GRADING 200 REV., %LOSS →		
	GRADING 1000 REV., %LOSS →		
LIGHTWEIGHT PIECES ☐ ASTM C123 ☐ AASHTO T113	FINE AGGREGATE, % →		
	COARSE AGGREGATE, % →		
CLAY LUMPS & FRIABLE PARTICLES ☐ ASTM C142 ☐ AASHTO T112	FINE AGGREGATE, % →		
	COARSE AGGREGATE, % →		
FRACTURED FACES OF COARSE AGGREGATES BY WEIGHT ☐ AZ 212 ☐ FLH T507 ☒ NMDOT FF=1	ONE OR MORE FACES, % →	100.0	
	TWO OR MORE FACES, % →	100.0	50 MIN
DURABILITY INDEX ☐ ASTM D3744 ☐ AASHTO T210 PROCEDURE : A ☐ COARSE B ☐ FINE C ☐ COARSE & FINE	D_c →		
	D_f →		
UNCOMPACTED VOID CONTENT ☐ AZ 247 ☐ ASTM C1252 METHOD	VC, % →		

Comments : **PAGE 1 OF 6**
AGGREGATE INDEX PER SECTION 910 = 13.5,SPEC-35 MAX

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GENERAL ROCK PRODUCTS - E. JESOP (EMAIL) (1)

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LABORATORY REPORT ON AGGREGATES

Client **GENERAL ROCK PRODUCTS**
PO BOX 1496
COLORADO CITY, AZ 86021

Date of Report **06-22-09**
Job No. **3149JK027**
Event / Invoice No. **31490129** Lab No. **3715-17A**
Authorized By **ERNEST JESOP** Date **06-09-09**
Sampled By **CLIENT** Date **06-09-09**
Submitted By **CLIENT** Date **06-09-09**

Project **THOREAU CRUSHER CONTROL** Location **THOREAU, NM**
Contractor **GENERAL ROCK PRODUCTS** Arch. / Engr. **N/A**
Type / Use of Aggregate **AGGREGATE BASE COURSE (3 SAMPLES)** Supplier / Source **GENERAL ROCK PRODUCTS/THOREAU PIT**
Sample Source / Location **THOREAU PIT/BELT AT PIT** Source / Location Desig. By **CLIENT** Date **06-09-09**
Reference: **SOUNDNESS:** ☐ **ASTM C88** ☒ **AASHTO T104** ☐ **SODIUM SULFATE** ☒ **MAGNESIUM SULFATE**
ABRASION RESISTANCE: ☐ **ASTM C131** ☒ **AASHTO T96** ☐ **ASTM C535**
Special Instructions:

TEST RESULTS

SIEVE SIZE	GRADING OF ORIGINAL SAMPLE %	WEIGHT OF TEST FRACTIONS BEFORE TEST GRAMS	PASSING DESIGNATED SIEVE AFTER TEST %	WEIGHTED PERCENTAGE LOSS	ALLOWABLE PERCENTAGE LOSS SODIUM	ALLOWABLE PERCENTAGE LOSS MAGNESIUM
SOUNDNESS TEST OF FINE AGGREGATE		SOLUTION CONDITION: ☐ NEW ☐ USED			NO. OF CYCLES	
MINUS NO. 100						
NO. 50 TO NO. 100						
NO. 30 TO NO. 50						
NO. 16 TO NO. 30						
NO. 8 TO NO. 16						
NO. 4 TO NO. 8						
3/8 IN. TO NO. 4						
TOTAL						
SOUNDNESS TEST OF COARSE AGGREGATE		SOLUTION CONDITION: ☒ NEW ☐ USED			NO. OF CYCLES **5**	
2 1/2 IN. TO 1 1/2 IN.						
1 1/2 IN. TO 3/4 IN.						
3/4 IN. TO 3/8 IN.	**57**	**1004.2**	**7.42**	**3.3**		
3/8 IN. TO NO. 4	**43**	**302.2**	**11.42**	**7.2**		
TOTAL	**100**	**1306.4**	**18.84**	**10.5**		

QUALITATIVE EXAMINATION OF COARSE SIZE PARTICLES EXHIBITING DISTRESS

SIEVE SIZE	SPLITTING NO.	SPLITTING %	CRUMBLING NO.	CRUMBLING %	CRACKING NO.	CRACKING %	FLAKING NO.	FLAKING %	TOTAL NO. PARTICLES BEFORE TEST
2 1/2 IN. TO 1 1/2 IN.									
1 1/2 IN. TO 3/4 IN.									

RESISTANCE TO DEGRADATION BY L.A. MACHINE		% LOSS	SPECIFICATION
SMALL COARSE AGGREGATE - GRADING **B**	100 REV. →		
	500 REV. →	**23**	
LARGE COARSE AGGREGATE - GRADING	200 REV. →		
	1000 REV. →		

Comments: **PAGE 2 OF 6**

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LABORATORY REPORT ON AGGREGATES

Client **GENERAL ROCK PRODUCTS**
PO BOX 1496
COLORADO CITY, AZ 86021

Date of Report **06-22-09**
Job No. **3149JK027**
Event / Invoice No. **31490129** Lab No. **3715-17B**
Authorized By **ERNEST JESOP** Date **06-09-09**
Sampled By **CLIENT** Date **06-09-09**
Submitted By **CLIENT** Date **06-09-09**

Project **THOREAU CRUSHER CONTROL** Location **THOREAU, NM**
Contractor **GENERAL ROCK PRODUCTS** Arch. / Engr. **N/A**
Type / Use of Aggregate **AGGREGATE BASE COURSE (3 SAMPLES)** Supplier / Source **GENERAL ROCK PRODUCTS/THOREAU PIT**
Sample Source / Location **THOREAU PIT/BELT AT PIT** Source / Location Desig. By **CLIENT** Date **06-09-09**
Reference: **SOUNDNESS:** ☐ **ASTM C88** ☒ **AASHTO T104** ☐ **SODIUM SULFATE** ☒ **MAGNESIUM SULFATE**
ABRASION RESISTANCE: ☐ **ASTM C131** ☒ **AASHTO T96** ☐ **ASTM C535**
Special Instructions:

TEST RESULTS

SIEVE SIZE	GRADING OF ORIGINAL SAMPLE %	WEIGHT OF TEST FRACTIONS BEFORE TEST GRAMS	PASSING DESIGNATED SIEVE AFTER TEST %	WEIGHTED PERCENTAGE LOSS	ALLOWABLE PERCENTAGE LOSS SODIUM	ALLOWABLE PERCENTAGE LOSS MAGNESIUM
SOUNDNESS TEST OF FINE AGGREGATE	SOLUTION CONDITION: ☐ NEW ☐ USED				NO. OF CYCLES	
MINUS NO. 100						
NO. 50 TO NO. 100						
NO. 30 TO NO. 50						
NO. 16 TO NO. 30						
NO. 8 TO NO. 16						
NO. 4 TO NO. 8						
3/8 IN. TO NO. 4						
TOTAL						
SOUNDNESS TEST OF COARSE AGGREGATE	SOLUTION CONDITION: ☒ NEW ☐ USED				NO. OF CYCLES 5	
2 1/2 IN. TO 1 1/2 IN.						
1 1/2 IN. TO 3/4 IN.						
3/4 IN. TO 3/8 IN.	57	1000.9	6.0	3.4		
3/8 IN. TO NO. 4	43	300.0	14.2	6.1		
TOTAL	100	1300.9	20.2	9.5		

QUALITATIVE EXAMINATION OF COARSE SIZE PARTICLES EXHIBITING DISTRESS

SIEVE SIZE	SPLITTING NO.	SPLITTING %	CRUMBLING NO.	CRUMBLING %	CRACKING NO.	CRACKING %	FLAKING NO.	FLAKING %	TOTAL NO. PARTICLES BEFORE TEST
2 1/2 IN. TO 1 1/2 IN.									
1 1/2 IN. TO 3/4 IN.									

RESISTANCE TO DEGRADATION BY L.A. MACHINE		% LOSS	SPECIFICATION
SMALL COARSE AGGREGATE – GRADING **B**	100 REV. →		
	500 REV. →	23	
LARGE COARSE AGGREGATE – GRADING	200 REV. →		
	1000 REV. →		

Comments: **PAGE 3 OF 6**

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LABORATORY REPORT ON AGGREGATES

Client **GENERAL ROCK PRODUCTS**
PO BOX 1496
COLORADO CITY, AZ 86021

Date of Report **06-22-09**
Job No. **3149JK027**
Event / Invoice No. **31490129** Lab No. **3715-17C**
Authorized By **ERNEST JESOP** Date **06-09-09**
Sampled By **CLIENT** Date **06-09-09**
Submitted By **CLIENT** Date **06-09-09**

Project **THOREAU CRUSHER CONTROL** Location **THOREAU, NM**
Contractor **GENERAL ROCK PRODUCTS** Arch. / Engr. **N/A**
Type / Use of Aggregate **AGGREGATE BASE COURSE (3 SAMPLES)** Supplier / Source **GENERAL ROCK PRODUCTS/THOREAU PIT**
Sample Source / Location **THOREAU PIT/BELT AT PIT** Source / Location Desig. By **CLIENT** Date **06-09-09**
Reference: **SOUNDNESS:** ☐ **ASTM C88** ☒ **AASHTO T104** ☐ **SODIUM SULFATE** ☒ **MAGNESIUM SULFATE**
ABRASION RESISTANCE: ☐ **ASTM C131** ☒ **AASHTO T96** ☐ **ASTM C535**
Special Instructions:

TEST RESULTS

SIEVE SIZE	GRADING OF ORIGINAL SAMPLE %	WEIGHT OF TEST FRACTIONS BEFORE TEST GRAMS	PASSING DESIGNATED SIEVE AFTER TEST %	WEIGHTED PERCENTAGE LOSS	ALLOWABLE PERCENTAGE LOSS SODIUM	ALLOWABLE PERCENTAGE LOSS MAGNESIUM
SOUNDNESS TEST OF FINE AGGREGATE	SOLUTION CONDITION: ☐ NEW ☐ USED				NO. OF CYCLES	
MINUS NO. 100						
NO. 50 TO NO. 100						
NO. 30 TO NO. 50						
NO. 16 TO NO. 30						
NO. 8 TO NO. 16						
NO. 4 TO NO. 8						
3/8 IN. TO NO. 4						
TOTAL						
SOUNDNESS TEST OF COARSE AGGREGATE	SOLUTION CONDITION: ☒ NEW ☐ USED				NO. OF CYCLES 5	
2 1/2 IN. TO 1 1/2 IN.						
1 1/2 IN. TO 3/4 IN.						
3/4 IN. TO 3/8 IN.	57	1001.6	6.7	3.8		
3/8 IN. TO NO. 4	43	300.5	9.6	4.3		
TOTAL	100	1302.1	16.3	8.1		

QUALITATIVE EXAMINATION OF COARSE SIZE PARTICLES EXHIBITING DISTRESS

SIEVE SIZE	SPLITTING NO.	SPLITTING %	CRUMBLING NO.	CRUMBLING %	CRACKING NO.	CRACKING %	FLAKING NO.	FLAKING %	TOTAL NO. PARTICLES BEFORE TEST
2 1/2 IN. TO 1 1/2 IN.									
1 1/2 IN. TO 3/4 IN.									

RESISTANCE TO DEGRADATION BY L.A. MACHINE		% LOSS	SPECIFICATION
SMALL COARSE AGGREGATE – GRADING **B**	100 REV. →		
	500 REV. →	23	
LARGE COARSE AGGREGATE – GRADING	200 REV. →		
	1000 REV. →		

Comments: **PAGE 4 OF 6**

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LABORATORY REPORT ON AGGREGATES

Client **GENERAL ROCK PRODUCTS**
PO BOX 1496
COLORADO CITY, AZ 86021

Date of Report **06-22-09**
Job No. **3149JK027**
Event / Invoice No. **31490129** Lab No. **3715-17D**
Authorized By **ERNEST JESOP** Date **06-09-09**
Sampled By **CLIENT** Date **06-09-09**
Submitted By **CLIENT** Date **06-09-09**

Project **THOREAU CRUSHER CONTROL** Location **THOREAU, NM**
Contractor **GENERAL ROCK PRODUCTS** Arch. / Engr. **N/A**
Type / Use of Aggregate **AGGREGATE BASE COURSE (3 SAMPLES)** Supplier / Source **GENERAL ROCK PRODUCTS/THOREAU PIT**
Sample Source / Location **THOREAU PIT/BELT AT PIT** Source / Location Desig. By **CLIENT** Date **06-09-09**
Reference: **SOUNDNESS:** ☐ **ASTM C88** ☒ **AASHTO T104** ☐ **SODIUM SULFATE** ☒ **MAGNESIUM SULFATE**
ABRASION RESISTANCE: ☐ **ASTM C131** ☒ **AASHTO T96** ☐ **ASTM C535**
Special Instructions:

TEST RESULTS

SIEVE SIZE	GRADING OF ORIGINAL SAMPLE %	WEIGHT OF TEST FRACTIONS BEFORE TEST GRAMS	PASSING DESIGNATED SIEVE AFTER TEST %	WEIGHTED PERCENTAGE LOSS	ALLOWABLE PERCENTAGE LOSS SODIUM	ALLOWABLE PERCENTAGE LOSS MAGNESIUM
SOUNDNESS TEST OF FINE AGGREGATE	SOLUTION CONDITION: ☐ NEW ☐ USED				NO. OF CYCLES	
MINUS NO. 100						
NO. 50 TO NO. 100						
NO. 30 TO NO. 50						
NO. 16 TO NO. 30						
NO. 8 TO NO. 16						
NO. 4 TO NO. 8						
3/8 IN. TO NO. 4						
TOTAL						
SOUNDNESS TEST OF COARSE AGGREGATE	SOLUTION CONDITION: ☒ NEW ☐ USED				NO. OF CYCLES 5	
2 1/2 IN. TO 1 1/2 IN.						
1 1/2 IN. TO 3/4 IN.						
3/4 IN. TO 3/8 IN.	57	1001.5	7.8	4.4		
3/8 IN. TO NO. 4	43	300.2	10.5	4.5		
TOTAL	100	1301.7	18.3	8.9		

QUALITATIVE EXAMINATION OF COARSE SIZE PARTICLES EXHIBITING DISTRESS

SIEVE SIZE	SPLITTING NO.	SPLITTING %	CRUMBLING NO.	CRUMBLING %	CRACKING NO.	CRACKING %	FLAKING NO.	FLAKING %	TOTAL NO. PARTICLES BEFORE TEST
2 1/2 IN. TO 1 1/2 IN.									
1 1/2 IN. TO 3/4 IN.									

RESISTANCE TO DEGRADATION BY L.A. MACHINE		% LOSS	SPECIFICATION
SMALL COARSE AGGREGATE – GRADING **B**	100 REV. →		
	500 REV. →	23	
LARGE COARSE AGGREGATE – GRADING	200 REV. →		
	1000 REV. →		

Comments: **PAGE 5 OF 6**

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LABORATORY REPORT ON AGGREGATES

Client **GENERAL ROCK PRODUCTS**
PO BOX 1496
COLORADO CITY, AZ 86021

Date of Report **06-22-09**
Job No. **3149JK027**
Event / Invoice No. **31490129** Lab No. **3715-17E**
Authorized By **ERNEST JESOP** Date **06-09-09**
Sampled By **CLIENT** Date **06-09-09**
Submitted By **CLIENT** Date **06-09-09**

Project **THOREAU CRUSHER CONTROL** Location **THOREAU, NM**
Contractor **GENERAL ROCK PRODUCTS** Arch. / Engr. **N/A**
Type / Use of Aggregate **AGGREGATE BASE COURSE (3 SAMPLES)** Supplier / Source **GENERAL ROCK PRODUCTS/THOREAU PIT**
Sample Source / Location **THOREAU PIT/BELT AT PIT** Source / Location Desig. By **CLIENT** Date **06-09-09**
Reference: **SOUNDNESS:** ☐ **ASTM C88** ☒ **AASHTO T104** ☐ **SODIUM SULFATE** ☒ **MAGNESIUM SULFATE**
ABRASION RESISTANCE: ☐ **ASTM C131** ☒ **AASHTO T96** ☐ **ASTM C535**
Special Instructions:

TEST RESULTS

SIEVE SIZE	GRADING OF ORIGINAL SAMPLE %	WEIGHT OF TEST FRACTIONS BEFORE TEST GRAMS	PASSING DESIGNATED SIEVE AFTER TEST %	WEIGHTED PERCENTAGE LOSS	ALLOWABLE PERCENTAGE LOSS SODIUM	ALLOWABLE PERCENTAGE LOSS MAGNESIUM
SOUNDNESS TEST OF FINE AGGREGATE		SOLUTION CONDITION: ☐ NEW ☐ USED			NO. OF CYCLES	
MINUS NO. 100						
NO. 50 TO NO. 100						
NO. 30 TO NO. 50						
NO. 16 TO NO. 30						
NO. 8 TO NO. 16						
NO. 4 TO NO. 8						
3/8 IN. TO NO. 4						
TOTAL						
SOUNDNESS TEST OF COARSE AGGREGATE		SOLUTION CONDITION: ☒ NEW ☐ USED			NO. OF CYCLES 5	
2 1/2 IN. TO 1 1/2 IN.						
1 1/2 IN. TO 3/4 IN.						
3/4 IN. TO 3/8 IN.	57	1001.1	6.5	3.7		
3/8 IN. TO NO. 4	43	300.6	12.8	5.5		
TOTAL	100	1301.7	19.3	9.2		

QUALITATIVE EXAMINATION OF COARSE SIZE PARTICLES EXHIBITING DISTRESS

SIEVE SIZE	SPLITTING NO.	SPLITTING %	CRUMBLING NO.	CRUMBLING %	CRACKING NO.	CRACKING %	FLAKING NO.	FLAKING %	TOTAL NO. PARTICLES BEFORE TEST
2 1/2 IN. TO 1 1/2 IN.									
1 1/2 IN. TO 3/4 IN.									

RESISTANCE TO DEGRADATION BY L.A. MACHINE		% LOSS	SPECIFICATION
SMALL COARSE AGGREGATE – GRADING **B**	100 REV. →		
	500 REV. →	23	
LARGE COARSE AGGREGATE – GRADING	200 REV. →		
	1000 REV. →		

Comments: **PAGE 6 OF 6**

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ATTACHMENT 2

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PHYSICAL PROPERTIES OF AGGREGATES

Client **GENERAL ROCK PRODUCTS**
PO BOX 1496
COLORADO CITY, AZ 86021

Date of Report **10-09-09**
Job No. **3149JK027**
Event / Invoice No. **31490220** Lab No. **4184A**
Authorized by **ERNEST JESOP** Date **10-06-09**
Sampled by **CLIENT** Date **10-06-09**
Submitted by **CLIENT** Date **10-06-09**

Project **THOREAU CRUSHER CONTROL**
Contractor **GENERAL ROCK PRODUCTS**
Type / Use of Material **FILTER AGGREGATE/FILTER AGGREGATE**
Sample Source / Location **THOREAU PIT/BELT AT PIT**
Testing Authorized : **SIEVE ANALYSIS**
Special Instructions :

Location **THOREAU, NM**
Arch. / Engr. **N/A**
Supplier / Source **GENERAL ROCK PRODUCTS/THOREAU PIT**
Source / Location Desig. By **CLIENT** Date **10-06-09**

TEST RESULTS

SIEVE ANALYSIS [X] ASTM C136 [ ] AASHTO T27
FINER THAN #200 [X] ASTM C117 [ ] AASHTO T11

SIEVE	ACCUMULATIVE % PASSING	SPECIFICATION
4		
3	100	100
2	95	
1-1/2"	90	95-100
1"	79	60-100
3/4"	66	
1/2"	43	
3/8"	28	
1/4"	10	
No.4	3	15-55
8	1	
10	1	0-15
16	1	
30	1	
40	1	
50	1	
100	1	
200	0.6	

LIQUID LIMIT & PLASTIC PROPERTIES
[ ] ASTM D4318 [ ] AASHTO T89 & T90
METHOD
SAMPLE AIR DRIED [ ] YES [ ] NO
ESTIMATED % RETAINED ON NO 40

	RESULTS	SPECS
LIQUID LIMIT →		
PLASTIC LIMIT →		
PLASTICITY INDEX →		

FINENESS MODULUS
[ ] ASTM C125 →

ORGANIC IMPURITIES
[ ] ASTM C40
[ ] AASHTO T21 PLATE NO. →

CLEANNESS VALUE
[ ] CA 227 →

PHYSICAL PROPERTIES		RESULTS	SPECS
UNIT WEIGHT & VOIDS	FINE AGGREGATE UNIT WEIGHT, KG/M³ → VOIDS, % → COARSE AGGREGATE UNIT WEIGHT, KG/M³ → VOIDS, % →		
	[ ] ASTM C29 [ ] AASHTO T19 [ ] RODDING [ ] JIGGING [ ] LOOSE		
SPECIFIC GRAVITY & ABSORPTION	FINE AGGREGATE [ ] ASTM C128 [ ] AASHTO T84 AGGREGATE DRIED [ ] YES [ ] NO BULK SPECIFIC GRAVITY → BULK SPECIFIC GRAVITY (SSD) → APPARENT SPECIFIC GRAVITY → ABSORPTION, % →		
	COARSE AGGREGATE [ ] ASTM C127 [ ] AASHTO T85 AGGREGATE DRIED [ ] YES [ ] NO BULK SPECIFIC GRAVITY → BULK SPECIFIC GRAVITY (SSD) → APPARENT SPECIFIC GRAVITY → ABSORPTION, % →		
SAND EQUIVALENT VALUE	[ ] ASTM D2419 [ ] AASHTO T176 SE, % →		
RESISTANCE TO DEGRADATION	SMALL COARSE AGGREGATE [ ] ASTM C131 [ ] AASHTO T96 GRADING 100 REV., %LOSS → GRADING 500 REV., %LOSS →		
	LARGE COARSE AGGREGATE [ ] ASTM C535 GRADING 200 REV., %LOSS → GRADING 1000 REV., %LOSS →		
LIGHTWEIGHT PIECES	[ ] ASTM C123 [ ] AASHTO T113 FINE AGGREGATE, % → COARSE AGGREGATE, % →		
CLAY LUMPS & FRIABLE PARTICLES	[ ] ASTM C142 [ ] AASHTO T112 FINE AGGREGATE, % → COARSE AGGREGATE, % →		
FRACTURED FACES OF COARSE AGGREGATES BY WEIGHT	[ ] AZ 212 [ ] FLH T507 [ ] FAA ONE OR MORE FACES, % → TWO OR MORE FACES, % →		
DURABILITY INDEX	[ ] ASTM D3744 [ ] AASHTO T210 PROCEDURE : A [ ] COARSE B [ ] FINE C [ ] COARSE & FINE D_c → D_f →		
UNCOMPACTED VOID CONTENT	[ ] AZ 247 [ ] ASTM C1252 METHOD VC, % →		

Comments :

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PHYSICAL PROPERTIES OF AGGREGATES

Client **GENERAL ROCK PRODUCTS**
PO BOX 1496
COLORADO CITY, AZ 86021

Date of Report **10-22-09**
Job No. **3149JK027**
Event / Invoice No. **31490220** Lab No. **4207**
Authorized by **ERNEST JESOP** Date **10-15-09**
Sampled by **CLIENT** Date **10-15-09**
Submitted by **CLIENT** Date **10-15-09**

Project **THOREAU CRUSHER CONTROL**
Contractor **GENERAL ROCK PRODUCTS**
Type / Use of Material **RIPRAP AGGREGATE/RIPRAP AGGREGATE**
Sample Source / Location **THOREAU PIT/BELT AT PIT**
Testing Authorized : **SIEVE ANALYSIS**
Special Instructions :

Location **THOREAU, NM**
Arch. / Engr. **N/A**
Supplier / Source **GENERAL ROCK PRODUCTS/THOREAU PIT**
Source / Location Desig. By **CLIENT** Date **10-15-09**

TEST RESULTS

SIEVE ANALYSIS [X] ASTM C136 [ ] AASHTO T27
FINER THAN #200 [X] ASTM C117 [ ] AASHTO T11

SIEVE	ACCUMULATIVE % PASSING	SPECIFICATION
11-1/2	100	75-100
8"	32	
7-1/2"	32	30-70
6"	25	
5"	6	
4"	6	0-25
3"	1	
2-1/2"	0	
2"	0	
1"	0	
No.4	0	
8	0	
10	0	
16	0	
30	0	
40	0	
50	0	
100	0	
200	0.0	

LIQUID LIMIT & PLASTIC PROPERTIES
[ ] ASTM D4318 [ ] AASHTO T89 & T90
METHOD
SAMPLE AIR DRIED [ ] YES [ ] NO
ESTIMATED % RETAINED ON NO 40

	RESULTS	SPECS
LIQUID LIMIT →		
PLASTIC LIMIT →		
PLASTICITY INDEX →		

FINENESS MODULUS
[ ] ASTM C125 →

ORGANIC IMPURITIES
[ ] ASTM C40
[ ] AASHTO T21
PLATE NO. →

CLEANNESS VALUE
[ ] CA 227 →

PHYSICAL PROPERTIES		RESULTS	SPECS
UNIT WEIGHT & VOIDS [ ] ASTM C29 [ ] AASHTO T19 [ ] RODDING [ ] JIGGING [ ] LOOSE	FINE AGGREGATE: UNIT WEIGHT, KG/M³ →		
	VOIDS, % →		
	COARSE AGGREGATE: UNIT WEIGHT, KG/M³ →		
	VOIDS, % →		
SPECIFIC GRAVITY & ABSORPTION FINE AGGREGATE [ ] ASTM C128 [ ] AASHTO T84 AGGREGATE DRIED [ ] YES [ ] NO	BULK SPECIFIC GRAVITY →		
	BULK SPECIFIC GRAVITY (SSD) →		
	APPARENT SPECIFIC GRAVITY →		
	ABSORPTION, % →		
COARSE AGGREGATE [ ] ASTM C127 [ ] AASHTO T85 AGGREGATE DRIED [ ] YES [ ] NO	BULK SPECIFIC GRAVITY →		
	BULK SPECIFIC GRAVITY (SSD) →		
	APPARENT SPECIFIC GRAVITY →		
	ABSORPTION, % →		
SAND EQUIVALENT VALUE [ ] ASTM D2419 [ ] AASHTO T176	SE, % →		
RESISTANCE TO DEGRADATION SMALL COARSE AGGREGATE [ ] ASTM C131 [ ] AASHTO T96	GRADING 100 REV., %LOSS →		
	GRADING 500 REV., %LOSS →		
LARGE COARSE AGGREGATE [ ] ASTM C535	GRADING 200 REV., %LOSS →		
	GRADING 1000 REV., %LOSS →		
LIGHTWEIGHT PIECES [ ] ASTM C123 [ ] AASHTO T113	FINE AGGREGATE, % →		
	COARSE AGGREGATE, % →		
CLAY LUMPS & FRIABLE PARTICLES [ ] ASTM C142 [ ] AASHTO T112	FINE AGGREGATE, % →		
	COARSE AGGREGATE, % →		
FRACTURED FACES OF COARSE AGGREGATES BY WEIGHT [ ] AZ 212 [ ] FLH T507 [ ] FAA	ONE OR MORE FACES, % →		
	TWO OR MORE FACES, % →		
DURABILITY INDEX [ ] ASTM D3744 [ ] AASHTO T210 PROCEDURE : A [ ] COARSE B [ ] FINE C [ ] COARSE & FINE	D_c →		
	D_f →		
UNCOMPACTED VOID CONTENT [ ] AZ 247 [ ] ASTM C1252 METHOD	VC, % →		

Comments :

Copies to : **CLIENT - (2)**
GENERAL ROCK PRODUCTS - E. JESOP (EMAIL) (1)

REVIEWED BY T Wrake

ATTACHMENT 3

Attachment C, SOP #RAD-03a
Gamma Radiation Survey @ UNC's NECR Mine Site

Static Gamma Radiation Survey Field Form

Instrumentation : Scaler/Ratemeter Lud 2221/254769, Detector Lud 44-10/PR27762

Instrument Calibration Date: 4-12-09, Instrument Daily Function Check Performed: Yes

2"x2" NaI Detector Collimated ✓ Yes or _____ No.

Survey Area/Unit Description General Rock Products - Rock Pit area located near Thoreau, NM

Survey Date/Time	Survey Point ID/Description	Survey Point Coordinate		Gamma Radiation Reading, CPM	Comments/Notes
		Northing	Easting		
9-25-09	Filter Rock Material				
1330	Pile :				
	East Side			1472	Bucket sample taken
	South Side			1740	or collected of filter
	West Side			1691	material.
	North Side			1663	
	Northeast Side			1687	
	Rip Rap Rock				
	material Pile :				
	East Side			1587	
	South Side			1646	
	West Side			1529	
"	North Side			1641	
	Northeast Side			1637	

Technician Signature Mark Chisholm Jr. Reviewed by Mark Chisholm Jr.