TABLES

Table 1 Soil Analytical and Gamma Screening Results						
Location ID	Depth	Ra-226 901.1 Results		Static Gamma Survey		Comments
	(ft bgs)	pCi/g	TPU[1]	Sample	Reference[2]	
Subsurface Samples from Roadway[3]						
RW-SB-01	1.0[4]	1.3 J+	0.33	31,246	30,624	
	2.5	1.18	0.28	31,444	30,624	
	4.0			30,269	30,624	
RW-SB-02	1.0	1.21	0.3	20,152	20,064	
	2.5	0.94	0.3	19,752	20,064	
	4.0			na	20,064	
RW-SB-03	1.0	0.81 J+	0.28	17,615	17,879	
	2.5	1.61 J+	0.34	17,181	17,879	
	4.0			16,111	17,879	
RW-SB-04	1.0	1.4	0.29	17,286	18,464	
	2.5	1.11	0.27	17,002	18,464	
	4.0			17,156	18,464	
RW-SB-05	1.0	0.89	0.28	22,840	24,039	
	2.5			22,855	24,039	
	4.0			23,038	24,039	
	5.5	1.34 J+	0.33	24,647	24,039	
RW-SB-06	1.0	1.37 J+	0.34	20,589	20,865	
	2.5	1.33 J+	0.31	20,497	20,865	
	4.0			20,447	20,865	
RW-SB-07	1.0	1.27 J+	0.32	22,176	22,648	
	2.5	1.22 J+	0.31	21,113	22,648	
	4.0			21,432	22,648	
RW-SB-08	1.0	1.12 J+	0.29	19,234	19,762	
	2.5	1.31	0.3	19,659	19,762	
	4.0			19,065	19,762	
RW-SB-09	1.0	1.12	0.29	14,750	15,598	
	2.5	1.24	0.28	14,880	15,598	
	4.0			15,127	15,598	
RW-SB-10	1.0	2.09	0.4	15,994	15,412	
	2.5			15,678	15,412	
	4.0			15,855	15,412	
	5.5	1.73	0.34	15,357	15,412	
Surface and Subsurface Samples from 50-ft Buffers[5]						
Home-SS-428[6]	0	**9.2**	0.4			From Suppplemental RSE 4/08
Home-SS-429	0	**4.6**	0.3			From Suppplemental RSE 4/08
Home-SS-430	0	**2.9**	0.3			From Suppplemental RSE 4/08
Home-SS-431	0	**18.7**	0.6			From Suppplemental RSE 4/08
Home-SS-433	0	**28.5**	0.7			From Suppplemental RSE 4/08
Home-SS-434	0	**5.3**	0.4			From Suppplemental RSE 4/08
Home-SS-448	0	**17.1**	0.5			From Suppplemental RSE 4/08
RW-TP-11	0	**69.0**	8.2	44,751	31,213	
	1.0			31,306	31,213	
	2.0	1.49 J+	0.34	31,606	31,213	
	3.0	0.87 J+	0.29	31,285	31,213	
	4.0			31,460	31,213	
	5.0			31,414	31,213	
RW-TP-12	0	**15**	1.9	22,120	20,256	
	1.0	1	0.26	20,158	20,256	
	2.0			20,198	20,256	
	3.0	0.75	0.24	20,159	20,256	
RW-TP-13	1.0	1.28 J+	0.34	21,519	21,927	
	2.0			21,692	21,927	
	3.0	1.26	0.28	20,324	21,927	

Table 1 Soil Analytical and Gamma Screening Results						
Location ID	Depth	Ra-226 901.1 Results		Static Gamma Survey		Comments
	(ft bgs)	pCi/g	TPU[1]	Sample	Reference[2]	
RW-TP-14	1.0	**3.11**	0.48	22,302	22,347	
	2.0			21,589	22,347	
	3.0	**2.46 J+**	0.44	21,570	22,347	
RW-TP-15	0	**2.38**	0.39	21,236	21,244	
	1.0	**2.61**	0.44	21,561	21,244	
	2.0			20,495	21,244	
	3.0	1.51	0.3	20,107	21,244	
RW-TP-16	1.0			21,495	21,839	
	2.0	1.3	0.28	21,719	21,839	
	3.0	1.26	0.28	21,512	21,839	
RW-TP-17	0	**44.3**	5.3	26,552	19,837	
	1.0	2.03	0.37	20,576	19,837	
	2.0	1.18 J+	0.29	19,817	19,837	
	3.0			19,684	19,837	
RW-TP-18	1.0	1.24	0.29	17,014	17,170	
	2.0			16,597	17,170	
	3.0	1.41	0.31	17,132	17,170	
RW-TP-19	1.0	1.39	0.31	15,138	15,138	
	3.0			15,233	15,138	
	3.0			15,402	15,138	
	4.0	1.15	0.3	14,929	15,138	
RW-TP-20	1.0	2.02 J+	0.37	14,780	14,519	
	3.0	1.19	0.29	13,742	14,519	
	3.0			14,281	14,519	
RW-TP-21	0	**19.7**	2.4	16,923	14,519	
	2.0			14,796	14,519	
	3.0	1.06	0.28	14,733	14,519	
	3.0			14,754	14,519	
	4.0	1.11	0.29	14,377	14,519	
RW-TP-22	0	14	1.7	16,749	15,138	
	2.0	1.39	0.31	13,701	15,138	
	3.0			na	15,138	Bedrock @ ~2.5' bgs
RW-TP-23	1.0	1.23	0.29	17,391	17,170	
	2.0			16,776	17,170	Sample spooned off of sidewall
	3.0	1.21	0.29	16,716	17,170	
	3.0			16,785	17,170	
RW-TP-24	1.0	1.08	0.25	19,193	19,837	
	2.0			19,579	19,837	
	3.0	1.17	0.28	19,637	19,837	
RW-TP-25	0	**18.7**	2.3	24,416	21,839	
	1.0			21,639	21,839	
	2.0	1.2	0.29	21,901	21,839	
	3.0	1.02	0.29	21,740	21,839	
RW-TP-26	1.0	1.16	0.28	21,369	21,244	Road cut
	2.0			20,895	21,244	Road cut
	3.0	0.95	0.25	21,526	21,244	Road cut
	3.0			21,452	21,244	Road cut
	4.0			21,051	21,244	Road cut
RW-TP-27	0	**8.9**	1.2	23,074	22,347	
	1.0	1.25	0.28	21,156	22,347	
	2.0			21,439	22,347	
	3.0	1.71	0.34	21,391	22,347	
RW-TP-28	0	**10.3**	1.4	22,427	21,927	
	1.0	0.83	0.23	21,814	21,927	
	2.0			21,676	21,927	
	3.0	1.05	0.25	21,880	21,927	

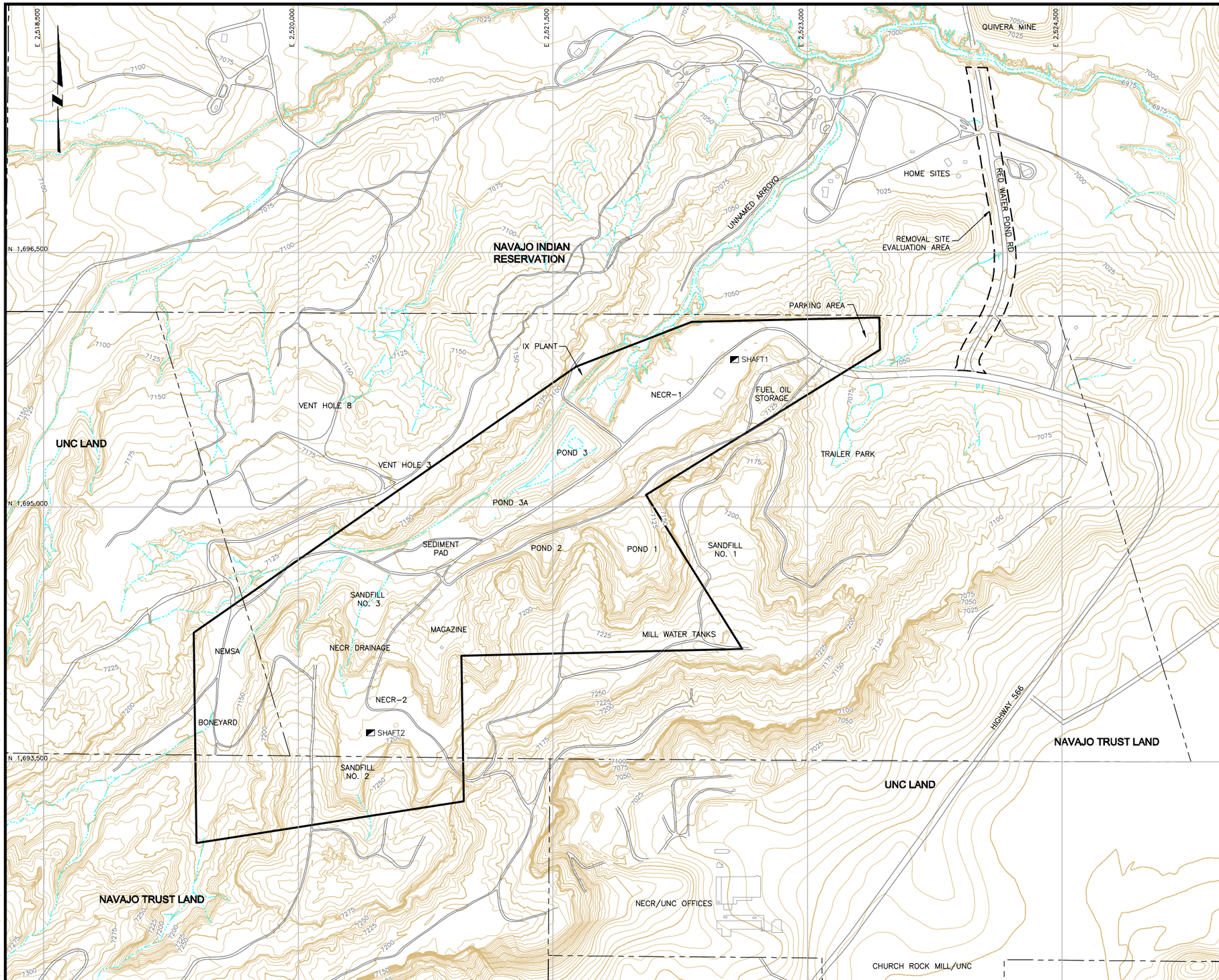
Table 1 Soil Analytical and Gamma Screening Results						
Location ID	**Depth**	**Ra-226 901.1 Results**		**Static Gamma Survey**		**Comments**
	(ft bgs)	**pCi/g**	**TPU[1]**	**Sample**	**Reference[2]**	
RW-TP-29	1.0	**4.31**	0.62	20,503	20,256	
	2.0			19,807	20,256	
	3.0	0.84	0.25	19,945	20,256	
RW-TP-30	1.0	**30.8**	3.7	36,338	31,213	Former drainage
	2.0			32,574	31,213	
	3.0	**6.26**	0.87	31,937	31,213	
	4.0			31,881	31,213	
	5.0			31,729	31,213	
	6.0	1.14 J+	0.3	31,324	31,213	
	7.0			31,742	31,213	
	8.0			31,590	31,213	

Notes:

1. TPU = Total Propagated Uncertainty at 2 standard deviations (s).
2. Reference material from borrow source and contains Ra-226 at 1.9 pCi/g.
3. Samples collected from boreholes using an auger drilling rig and an 18-inch split-spoon sampler.
4. Samples from18-inch split-spoon samplers analyzed over total interval recovered.
5. Samples collected from test pits using and excavator as grab samples.
6. Surface soil samples collected in April 2008 for Supplemental RSE.
7. Cells shaded and with bold values indicate exceedance of 2.24 pCi/g.

J+ = estimated biased high by laboratory due to density differences between sample and calibration standard.
n/a = not applicable

DRAWINGS



LEGEND:

- 7040 — EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
- NECR MINE SITE PERMIT BOUNDARY
- APPROXIMATE OWNERSHIP BOUNDARY
- ROADS
- NATURAL DRAINAGE
- PHYSICAL STRUCTURE
- SHAFT LOCATION

SCALE
300 0 300 600 FEET
CONTOUR INTERVAL = 5 FEET

REV	DESCRIPTION	TECH	ENG	DATE
0	ISSUED FOR FINAL	CHF	RTL	01/14/10
A	DRAFT	CHF	RTL	12/22/09

ISSUE

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DRAWING REFERENCE(S):
SURFACE TOPOGRAPHY GENERATED FROM AERIAL PHOTOGRAPHS DATED MAY 2007 BY COOPER AERIAL SURVEYS CO. AND USGS 10m DIGITAL ELEVATION MODELS (DEM).

PROJECTION:
STATE PLANE COORADINATES

ZONE:
NEW MEXICO WEST

DATUM:
NAD 83

UNITS:
US FEET

DESIGNED BY	T LEESON	01/14/10
DRAWN BY	C FOWLER	01/14/10
CHECKED BY	T LEESON	01/14/10
APPROVED BY	T LEESON	01/14/10
PROJECT MANAGER	T LEESON	01/14/10
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

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

PROJECT LOCATION
NORTHEAST CHURCH ROCK MINE

PROJECT
REMOVAL SITE EVALUATION
RED WATER POND ROAD

TITLE
SITE MAP

MWH

DRAWING 1 of 4
REVISION 0
FILE NAME 1007552D010

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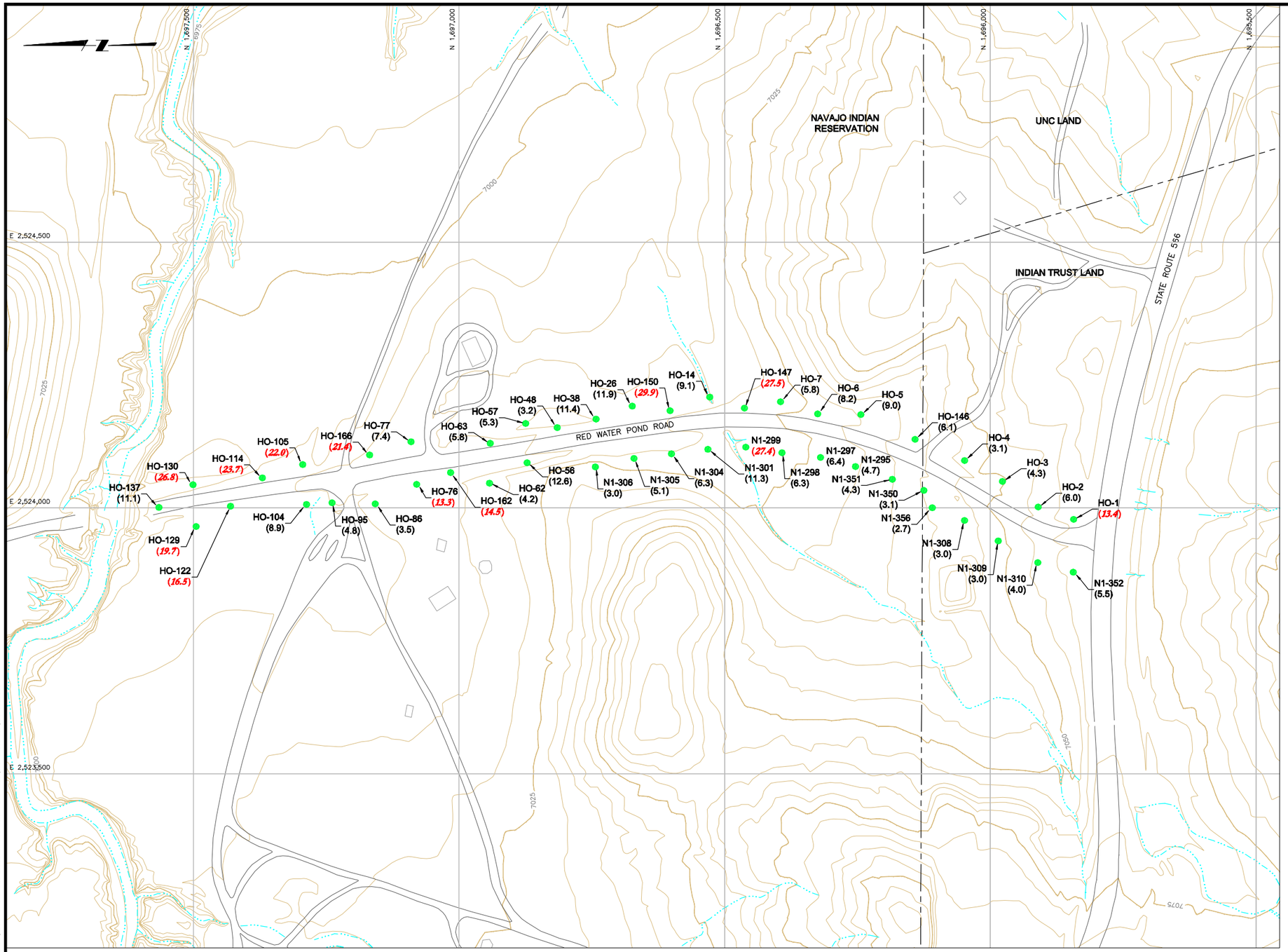

LEGEND:

- 7040 — EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
- APPROXIMATE OWNERSHIP BOUNDARY
- ROADS
- NATURAL DRAINAGE
- PHYSICAL STRUCTURE
- GAMMA SAMPLE LOCATION
- HO-5 — LOCATION ID; (9.0) — Ra-226 (pCi/g) EQUIVALENT
- (13.4) — MEASUREMENTS WITHIN UPPER 25% OF VALUES (>13.3 pCi/g)

NOTE:

GAMMA MEASUREMENTS COLLECTED IN NOVEMBER 2007 AS PART OF THE SUPPLEMENTAL REMOVAL SITE EVALUATION.

PLAN

SCALE

100 0 100 200 FEET

CONTOUR INTERVAL = 5 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
0	ISSUED FOR FINAL	CHF	RTL	01/14/10
A	DRAFT	CHF	RTL	12/22/09

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SURFACE TOPOGRAPHY GENERATED FROM AERIAL PHOTOGRAPHS DATED MAY 2007 BY COOPER AERIAL SURVEYS CO. AND USGS 10m DIGITAL ELEVATION MODELS (DEM).

PROJECTION:
STATE PLANE COORADINATES

ZONE:
NEW MEXICO WEST

DATUM:
NAD 83

UNITS:
US FEET

DESIGNED BY	T LEESON	01/14/10
DRAWN BY	C FOWLER	01/14/10
CHECKED BY	T LEESON	01/14/10
APPROVED BY	T LEESON	01/14/10
PROJECT MANAGER	T LEESON	01/14/10
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

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

PROJECT LOCATION
NORTHEAST CHURCH ROCK MINE

PROJECT
REMOVAL SITE EVALUATION
RED WATER POND ROAD

TITLE
SRSE STATIC GAMMA MEASUREMENTS

MWH

DRAWING 2 of 4

REVISION 0

FILE NAME 1007552D009

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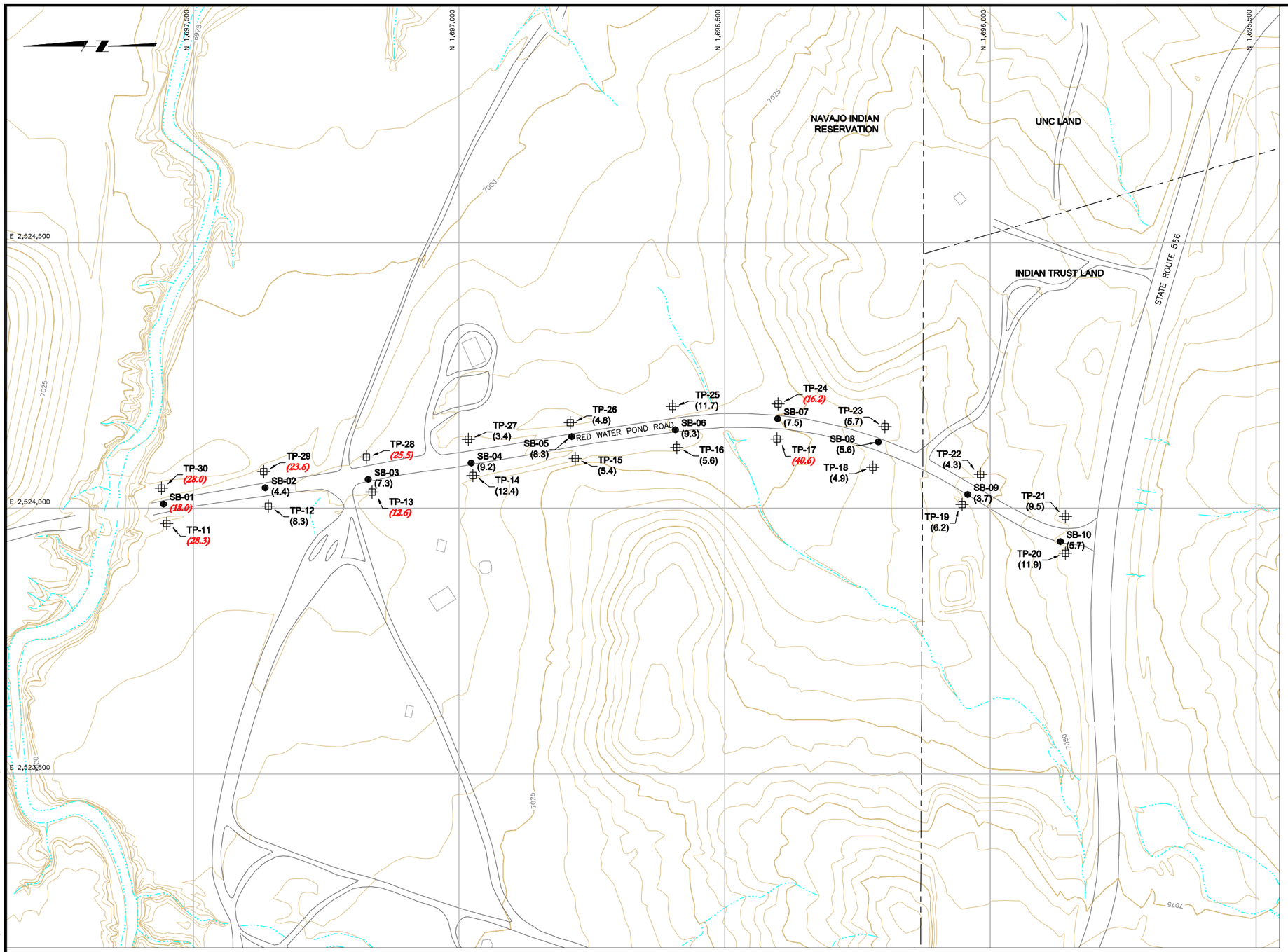

LEGEND:

7040	EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
	APPROXIMATE OWNERSHIP BOUNDARY
	ROADS
	NATURAL DRAINAGE
	PHYSICAL STRUCTURE
	SOIL BORING
	TEST PIT
SB-08 (5.6)	LOCATION ID / Ra-226 (pCi/g) EQUIVALENT
(40.6)	MEASUREMENTS WITHIN UPPER 75% OF VALUES (>12.6 pCi/g)

NOTE:

GAMMA MEASUREMENTS COLLECTED IN SEPTEMBER 2009 AS PART OF THE RED WATER POND ROAD REMOVAL SITE EVALUATION.

PLAN

SCALE

100 0 100 200 FEET

CONTOUR INTERVAL = 5 FEET

ISSUE REV	DESCRIPTION	TECH	ENG	DATE
0	ISSUED FOR FINAL	CHF	RTL	01/14/10
A	DRAFT	CHF	RTL	12/22/09

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DRAWING REFERENCE(S):
SURFACE TOPOGRAPHY GENERATED FROM AERIAL PHOTOGRAPHS DATED MAY 2007 BY COOPER AERIAL SURVEYS CO. AND USGS 10m DIGITAL ELEVATION MODELS (DEM).

PROJECTION:
STATE PLANE COORADINATES

ZONE:
NEW MEXICO WEST

DATUM:
NAD 83

UNITS:
US FEET

DESIGNED BY	T LEESON	01/14/10
DRAWN BY	C FOWLER	01/14/10
CHECKED BY	T LEESON	01/14/10
APPROVED BY	T LEESON	01/14/10
PROJECT MANAGER	T LEESON	01/14/10
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

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

PROJECT LOCATION: NORTHEAST CHURCH ROCK MINE

PROJECT: REMOVAL SITE EVALUATION RED WATER POND ROAD

TITLE: RWPR RSE STATIC GAMMA MEASUREMENTS

MWH

DRAWING: 3 of 4

REVISION: 0

FILE NAME: 1007552D011

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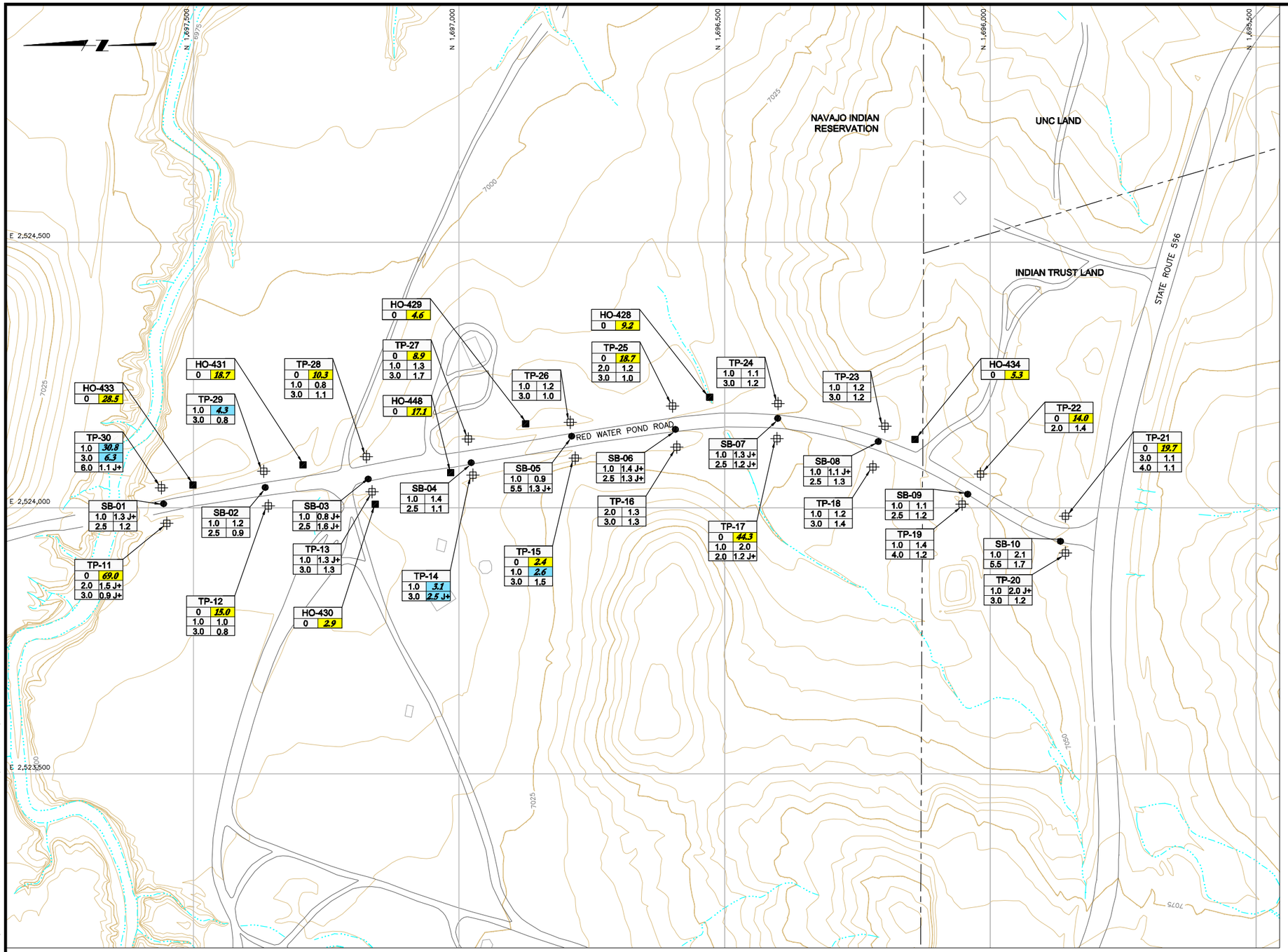

LEGEND:

- 7040 — EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
- APPROXIMATE OWNERSHIP BOUNDARY
- ROADS
- NATURAL DRAINAGE
- PHYSICAL STRUCTURE
- SOIL BORING
- TEST PIT
- RSE SURFACE SOIL SAMPLE
- SB-09 (1.0: 1.1; 2.5: 1.2) — LOCATION ID; Ra-226 (pCi/g); DEPTH (ft bgs)
- 19.7 — SURFACE SAMPLES (0–0.5') EXCEEDING FIELD SCREENING LEVEL (2.24).
- 6.3 — SUBSURFACE SAMPLES (>0.5') EXCEEDING FIELD SCREENING LEVEL (2.24).
- J+ — POSSIBLY BIASED HIGH DUE TO HIGH MATRIX DENSITY COMPARED TO CALIBRATION STANDARD

NOTES:

1. SAMPLES COLLECTED SEPTEMBER 2009 (TEST PITS , SOIL BORINGS) AND NOVEMBER 2007 (SURFACE SOIL).
2. GAMMA MEASUREMENTS WERE USED TO SCREEN SOILS DURING DRILLING AND EXCAVATION AND ENSURE THAT SOILS BENEATH THE DEEPEST LAB SAMPLES ARE LESS THAN 2.24 pCi/g.

PLAN

SCALE
100 0 100 200 FEET
CONTOUR INTERVAL = 5 FEET

REV	DESCRIPTION	TECH	ENG	DATE
0	ISSUED FOR FINAL	CHF	RTL	01/14/10
A	DRAFT	CHF	RTL	12/22/09

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DRAWING REFERENCE(S):
SURFACE TOPOGRAPHY GENERATED FROM AERIAL PHOTOGRAPHS DATED MAY 2007 BY COOPER AERIAL SURVEYS CO. AND USGS 10m DIGITAL ELEVATION MODELS (DEM).

PROJECTION: STATE PLANE COORADINATES
ZONE: NEW MEXICO WEST
DATUM: NAD 83
UNITS: US FEET

DESIGNED BY	T LEESON	01/14/10
DRAWN BY	C FOWLER	01/14/10
CHECKED BY	T LEESON	01/14/10
APPROVED BY	T LEESON	01/14/10
PROJECT MANAGER	T LEESON	01/14/10
CLIENT APPROVAL		
CLIENT REFERENCE NO.		

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

PROJECT LOCATION: NORTHEAST CHURCH ROCK MINE
PROJECT: REMOVAL SITE EVALUATION RED WATER POND ROAD
TITLE: SOIL ANALYTICAL RESULTS

MWH

DRAWING: 4 of 4
REVISION: 0
FILE NAME: 1007552D008

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APPENDICES

APPENDIX A

FIELD NOTES

SOIL BORING LOGS

SOIL BORING LOG FORM

Project:	Boring ID:
NECR IRA RW Pond Rd.	RW-SB-01

BORING LOCATION		
Red Water Pond Rd.	Date Drilled: 9/9/09 Date Completed: _____	Northing: _____ Easting: _____
	Logged By: R. Young	Ground Surface Elevation (ft):
	Drilling Contractor: WDC	Measuring Point (MP) Elevation (ft):
	Drilling Method: HSA	MP is Ground Surface Datum:

DEPTH (FEET)	GRAIN SIZE % GRAVEL	GRAIN SIZE % SAND	% FINES	MAX. GAMMA READING (cpm)	BLOWS (6 IN.)	SAMPLE TYPE	% RECOVERY	USCS/ASTM CLASS	UNIT/LAYER	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; weathering, additional facts)
1						▼				
2	20	80	0			*C	90	SP		Fine-coarse gravelly sand, f-c sand, brown, dry to slightly moist, → subangular-angular gravel, medium dense
3	10	80	10			*C	100	SP		Fine sand w/some fine gravel and some fines, yellowish-brown to brown, slightly moist, medium dense to stiff,
4	5	80	15			*C	100	SP		Fine sand w/some fines and gravel, yellowish brown to brown, slightly moist, stiff
5										
6										END OF HOLE
7										
8										RY

*C California Split Sppon Sampler (2.5" I.D.)

S Standard penetration test sampler

c Cuttings

▼ Elevation of ground water

Unit/Layer: fill, road base, soil, alluvium, native, bedrock, etc.

Moisture: dry, moist or wet

SOIL BORING LOG FORM

Project:	Boring ID:
NECR IRA RW Pond Rd.	RW-SB-02

BORING LOCATION		
Red Water Pond Rd.	Date Drilled: 9/9/09 Date Completed: ____	Northing: ____ Easting: ____
	Logged By: R. Young	Ground Surface Elevation (ft):
	Drilling Contractor: WDC	Measuring Point (MP) Elevation (ft):
	Drilling Method: HSA	MP is Ground Surface Datum:

DEPTH (FEET)	GRAIN SIZE % GRAVEL	GRAIN SIZE % SAND	% FINES	MAX. GAMMA READING (cpm)	BLOWS (6 IN.)	SAMPLE TYPE	% RECOVERY	USCS/ASTM CLASS	UNIT/LAYER	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; weathering, additional facts)
1										
		MS	25			*C	100	SP		Fine sand w/silt, yellowish-brown, dry, loose to medium dense sand
2										
3		MS	25			*C	100	SP		Fine sand and some silt, yellowish-brown, dry to slightly moist, ~~loose to~~ medium dense
4										
		90	10			*C	100	SP		Fine sand w/some fines, yellowish-brown, dry to slightly moist, medium dense
5										
6										
7										END OF HOLE
8										RY
9										

*C California Split Sppon Sampler (2.5" I.D.)

S Standard penetration test sampler

c Cuttings

Elevation of ground water

Unit/Layer: fill, road base, soil, alluvium, native, bedrock, etc.

Moisture: dry, moist or wet

SOIL BORING LOG FORM

Project:	Boring ID:
NECR IRA RW Pond Rd.	RW-SB-~~04~~ RW 03

BORING LOCATION		
Red Water Pond Rd.	Date Drilled: 9/9/05 Date Completed: ____	Northing: ____ Easting: ____
	Logged By: R. Young	Ground Surface Elevation (ft):
	Drilling Contractor: WDC	Measuring Point (MP) Elevation (ft):
	Drilling Method: HSA	MP is Ground Surface Datum:

DEPTH (FEET)	GRAIN SIZE % GRAVEL	% SAND	% FINES	MAX. GAMMA READING (cpm)	BLOWS (6 IN.)	SAMPLE TYPE	% RECOVERY	USCS/ASTM CLASS	UNIT/LAYER	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; weathering, additional facts)
1										
		80	20			*C	100	SP		Sand w/ some silt, yellowish-brown, dry, medium dense
2										
	<5	85	15			*C	100	SP		Sand w/some silt, trace fine gravel, yellowish-brown, dry to slightly moist, medium dense
3										
4										
	25	75				*C	100	SP		Fine-coarse gravelly sand, f-c sand, yellowish-brown, dry to slightly moist, medium dense to loose, some "wash" material w/ variable colors
5										
6										END OF HOLE
7										
8						RY				
9										

*C California Split Spoon Sampler (2.5" I.D.)
S Standard penetration test sampler
c Cuttings
▼ Elevation of ground water

Unit/Layer: fill, road base, soil, alluvium, native, bedrock, etc.
Moisture: dry, moist or wet

SOIL BORING LOG FORM

Project:	Boring ID:
NELR IRA RW Pond Rd.	RW-SB-04

BORING LOCATION		
Red Water Pond Rd.	Date Drilled: 9/7/09 Date Completed:	Northing: Easting:
	Logged By: R. Young	Ground Surface Elevation (ft):
	Drilling Contractor: WDC	Measuring Point (MP) Elevation (ft):
	Drilling Method: HSA	MP is Ground Surface Datum:

DEPTH (FEET)	GRAIN SIZE % GRAVEL	% SAND	% FINES	MAX. GAMMA READING (cpm)	BLOWS (6 IN.)	SAMPLE TYPE	% RECOVERY	USCS/ASTM CLASS	UNIT/LAYER	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; weathering, additional facts)
							~~100~~			
1										
	20	80	0			*C	100	SP		Sand w/ some fine gravel, f-med sand, yellowish-brown, dry to slightly moist, loose sand
2										↓
	20	80				*C	100	SP		As above, fine-coarse sand, angular to sub-angular gravel, slightly moist
3										
4										
	<5	60	40			*C	100	SP		Silty sand mix w/ trace fine gravel, yellowish-brown, slightly moist, medium dense sand, couple ~~cobbles~~ RY coarse gravel pieces
5										
										END OF HOLE
6										
7										
8										
9										

*C California Split Sppon Sampler (2.5" I.D.)

S Standard penetration test sampler

c Cuttings

▼ Elevation of ground water

Unit/Layer: fill, road base, soil, alluvium, native, bedrock, etc.

Moisture: dry, moist or wet

SOIL BORING LOG FORM

Project:	Boring ID:
NECR IRA RW Pond Rd	RW-SB-05

BORING LOCATION		
Red Water Pond Rd. (Road cut)	Date Drilled: 9/9/09 Date Completed:	Northing: Easting:
	Logged By: R. Young	Ground Surface Elevation (ft):
	Drilling Contractor: WCD	Measuring Point (MP) Elevation (ft):
	Drilling Method: HSA	MP is Ground Surface Datum:

DEPTH (FEET)	GRAIN SIZE % GRAVEL	GRAIN SIZE % SAND	% FINES	MAX. GAMMA READING (cpm)	BLOWS (6 IN.)	SAMPLE TYPE	% RECOVERY	USCS/ASTM CLASS	UNIT/LAYER	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; weathering, additional facts)
1										
	<5	80	20			*C	100	SP		Silty sand w/ trace fine gravel, tan to yellowish brown, dense, dry (road base)
2		90	10					SP		Silty sand, yellowish-brown, medium dense, dry to slightly moist
	30	70						SP		Gravelly sand, f-c gravel, medium sand, yellowish ~~brown, dry to slightly moist, loose~~
3	ROCK					*C	80	Rock		Limestone rock core, bedrock?, boulder? @ ~3.0' bgs
4	40	60	0			*C	95	SP		Gravelly sand, fine to coarse sand and fine to coarse gravel, angular, moist, variable colors (yellow-brn, yellow, tan) loose to medium dense
5										* doesn't look natural, old drainage?
	<5	10	90			*C	100	ML		Silt w/ some fine sand and trace fine gravel, yellowish-brown, very hard / dense, slightly moist, NATIVE
6										
7										END OF HOLE
8										
9										

*C California Split Sppon Sampler (2.5" I.D.)

S Standard penetration test sampler

c Cuttings

▼ Elevation of ground water

Unit/Layer: fill, road base, soil, alluvium, native, bedrock, etc.

Moisture: dry, moist or wet

SOIL BORING LOG FORM

Project:	Boring ID:
NECR IRA RW Pond Rd	RW-SB-06

BORING LOCATION		
Red Water Pond Rd	Date Drilled: 9/9/09 Date Completed: _____	Northing: _____ Easting: _____
	Logged By: R. Young	Ground Surface Elevation (ft):
	Drilling Contractor: WDC	Measuring Point (MP) Elevation (ft): _____
	Drilling Method: HSA	MP is Ground Surface Datum: _____

DEPTH (FEET)	GRAIN SIZE % GRAVEL	GRAIN SIZE % SAND	% FINES	MAX. GAMMA READING (cpm)	BLOWS (6 IN.)	SAMPLE TYPE	% RECOVERY	USCS/ASTM CLASS	UNIT/LAYER	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; weathering, additional facts)
1										
	<5	80	20			*C	100	SP		Silty sand w/ trace fine gravel, brown, dry, very dense road pack
2										
3		80	20			*C	100	SP		Fine sand w/ some fine sands, yellowish, dry to slightly moist, medium dense
4										* Road Fill / Native Interface @ 2.6' bgs
	0	100	0			*C	100	SP		Fine sand, yellowish-brown, dry to slightly moist, loose to medium sand ^dense
5										
6										END OF HOLE
7										RW
8										
9										

*C California Split Sppon Sampler (2.5" I.D.)

S Standard penetration test sampler

c Cuttings

▼ Elevation of ground water

Unit/Layer: fill, road base, soil, alluvium, native, bedrock, etc.

Moisture: dry, moist or wet

SOIL BORING LOG FORM

Project:	Boring ID:
NECR IRA RW Pond Rd	RW-SB-07

BORING LOCATION		
Red Water Pond Rd	Date Drilled: 9/9/09 Date Completed: ____	Northing: ____ Easting: ____
	Logged By: R. Young	Ground Surface Elevation (ft):
	Drilling Contractor: WDC	Measuring Point (MP) Elevation (ft):
	Drilling Method: HSA	MP is Ground Surface Datum:

DEPTH (FEET)	GRAIN SIZE % GRAVEL	GRAIN SIZE % SAND	GRAIN SIZE % FINES	MAX. GAMMA READING (cpm)	BLOWS (6 IN.)	SAMPLE TYPE	% RECOVERY	USCS/ASTM CLASS	UNIT/LAYER	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; weathering, additional facts)
1										
2	25	75	0			*C	100	SP		Fine to medium sand w/ some fine gravel, reddish brown to brown, medium dense to dense, dry to slightly moist (road fill)
3	5	85	10			*C	100	SP		Silty sand w/ trace fine gravel, yellowish-bn, medium dense, slightly moist, (native soil)
4	<5	100	<5				100	SP		Fine sand w/ trace fines and trace fine gravel, yellowish-brown, dry to slightly moist, medium dense
5										
6										END
7										
8										
9										

*C California Split Spoon Sampler (2.5" I.D.)

S Standard penetration test sampler

c Cuttings

Elevation of ground water

Unit/Layer: fill, road base, soil, alluvium, native, bedrock, etc.

Moisture: dry, moist or wet

SOIL BORING LOG FORM

Project:	Boring ID:
NELR IRA RW Pond Rd.	RW-SB-08

BORING LOCATION		
Red Water Pond Rd.	Date Drilled: 9/9/03 Date Completed:	Northing: Easting:
	Logged By: R. Young	Ground Surface Elevation (ft):
	Drilling Contractor: WDC	Measuring Point (MP) Elevation (ft):
	Drilling Method: HSA	MP is Ground Surface Datum:

DEPTH (FEET)	GRAIN SIZE % GRAVEL	% SAND	% FINES	MAX. GAMMA READING (cpm)	BLOWS (6 IN.)	SAMPLE TYPE	% RECOVERY	USCS/ASTM CLASS	UNIT/LAYER	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; weathering, additional facts)
1	20	80	0			*C	100	SP		Gravelly sand, brown, fine-coarse gravel, dry to slightly moist, medium dense to dense (road fill)
2										
3	30	70	0			*C	100	SP		Gravelly sand, light brown, fine-coarse gravel up to 1" dry, very hard/dense, road fill/native ~ 3'
4	5	95	0			*C	100	SP		Fine sand w/some fine gravel, yellowish-brown, medium dense sand, dry to slightly moist
5										
6										
7										END OF HOLE
8										LY
9										

*C California Split Sppon Sampler (2.5" I.D.)

S Standard penetration test sampler

c Cuttings

▼ Elevation of ground water

Unit/Layer: fill, road base, soil, alluvium, native, bedrock, etc.

Moisture: dry, moist or wet

SOIL BORING LOG FORM

Project:	Boring ID:
NECR IRA RW Pond Rd.	RW-SB-09

BORING LOCATION		
Red Water Pond Rd.	Date Drilled: 9/9/09 Date Completed:	Northing: Easting:
	Logged By: R. Young	Ground Surface Elevation (ft):
	Drilling Contractor: WDC	Measuring Point (MP) Elevation (ft):
	Drilling Method: HSA	MP is Ground Surface Datum:

DEPTH (FEET)	GRAIN SIZE % GRAVEL	GRAIN SIZE % SAND	% FINES	MAX. GAMMA READING (cpm)	BLOWS (6 IN.)	SAMPLE TYPE	% RECOVERY	USCS/ASTM CLASS	UNIT/LAYER	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; weathering, additional facts)
1										
	<5	100				*C	100	SP		Fine sand w/ some fine gravel, dry to slightly moist, yellowish-bn, loose to medium dense sand
2										
		100				*C	100	SP		Fine sand, yellowish-bn, dry, very loose sand
3										
4										
	<5	100				*C	100	SP		Fine to med sand, yellowish-bn, dry to slightly moist, medium dense, trace fine-coarse gravel
5										
										END OF HOLE
6										
7										
8										RY
9										

*C California Split Sppon Sampler (2.5" I.D.)

S Standard penetration test sampler

c Cuttings

▼ Elevation of ground water

Unit/Layer: fill, road base, soil, alluvium, native, bedrock, etc.

Moisture: dry, moist or wet

SOIL BORING LOG FORM

Project:	Boring ID:
NELR IRA Red Water Pond Rd.	RW-SB-10 (1')

BORING LOCATION		
Red Water Pond Rd.	Date Drilled: 4/4/09 Date Completed:	Northing: Easting:
	Logged By: Rob Young	Ground Surface Elevation (ft):
	Drilling Contractor: WDC	Measuring Point (MP) Elevation (ft):
	Drilling Method: HSA	MP is Ground Surface Datum:

DEPTH (FEET)	GRAIN SIZE % GRAVEL	GRAIN SIZE % SAND	% FINES	MAX. GAMMA READING (cpm)	BLOWS (6 IN.)	SAMPLE TYPE	% RECOVERY	USCS/ASTM CLASS	UNIT/LAYER	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; weathering, additional facts)
						*C	~~100~~ RY	~~SP~~ RY		
1	25	100					100	SP		Medium sand, some fine gravel, tan, loose sand, dry
2							↓	↓		
3	0	100	0			*C				Fine sand, tan to yellowish-brown, loose sand, dry
							100	SP		
4	0	100				*C	100	SP		As above, grades to dry to slightly moist
5										
										As above, finer material with depth
6		100				*C	100	SP		
7										EOH
8										RY

*C California Split Sppon Sampler (2.5" I.D.)
S Standard penetration test sampler
c Cuttings
▼ Elevation of ground water

Unit/Layer: fill, road base, soil, alluvium, native, bedrock, etc.
Moisture: dry, moist or wet

FIELD-TESTED GAMMA RESULTS

NECR IRA RWPR RSE
Borehole Soil Sample Screening

PRB-01-08

Instrument:								Hole
		Reference Material	1.9 pCi/g	Gross Counts	77059/5min	CPM	15412	10
		Reference Material	1.9 pCi/g	Gross Counts	77989/5MIN	CPM	15598	9
Background Counts		Reference Material	1.9 pCi/g	Gross Counts	98810/5min	CPM	19762	8
CPM		Reference Material		Gross Counts		CPM		

Date	Soil Sample ID	Sample Location	Gross Gamma counts	Gross cpm	Comments
9/9/08	RW-SB-10 (1')	10	15994/1m	15994	
9/9/08	RW-SB-10 (2.5)	10	15678/1m	15678	
9/9/08	RW-SB-10 (4.0)	10	15855/1m	15855	
9/9/08	RW-SB-10 (5.5)	10	15357/1m	15357	
9/9/08	" "	"	80296/5m	16059	
"	"	"	15605/1m	15605	
"	"	"	15697/1m	15697	
9/9/08	RW-SB-09 (1.0)	9	14750/1m	14750	
9/9/08	RW-SB-09 (2.5)	9	14880/1m	14880	
9/9/08	RW-SB-09 (4.0)	9	15127/1m	15127	
9/9/08	RW-SB-09 (4.0)	9	15590/1m	15590	
9/9/08	RW-SB-08 (1.0)	8	19234/1m	19234	
"	RW-SB-08 (2.5)	8	19659/1m	19659	
"	RW-SB-08 (4.0)	8	38130/2m	19065	
"	RW-SB-08 (4.0)	8	19216/1m	19216	

NECR IRA RWPR RSE
Borehole Soil Sample Screening

PRB 1-08

Instrument:

							Hole
		Reference Material	1.9 pCi/g	Gross Counts	113242/5min	CPM	22648	7
		Reference Material	1.9 pCi/g	Gross Counts	104325/5min	CPM	20865	6
Background Counts		Reference Material	1.9 pCi/g	Gross Counts	120197/5min	CPM	24039	5
CPM		Reference Material	1.9 pCi/g	Gross Counts	92321 /5min	CPM	18464	4

Date	Soil Sample ID	Sample Location	Gross Gamma counts	Gross cpm	Comments
9/9/09	RW-SB-07 (1.0)	7	22176/1min	22176	•
9/9/09	RW-SB-07 (2.5)	"	21113/1min	21113	•
9/9/09	RW-SB-07 (4.0)	"	21432/1min	21432	
9/9/09	RW-SB-07 (4.0)	"	21983/1min	21983	
9/9/09	RW-SB-06 (1.0)	6	20587/1min	20589	
9/9/09	RW-SB-06 (2.5)	"	20539/1min	20539	
9/9/09	RW-SB-06 (~~1.0~~) 2.5	"	20497/1min	20497	
9/9/09	RW-SB-06 (4.0)	"	40895/2m	20447	
9/9/09	RW-SB-05 (1.0)	5	22840/1m	22840	
9/9/09	RW-SB-05 (2.5)	"	22855/1m	22855	SHORT SAMPLE/SMALLER THAN REF
9/9/09	RW-SB-05 (4.0)	"	23082/1m	23082	
9/9/09	"	"	22679/1m	22679	
9/9/09	RW-SB-05 (5.5)	"	24647/1m	24647	
9/9/09	RW-SB-05 (5.5)	"	25028/1m	25028	
9/9/09	RW-SB-04 (1.0)	4	17286 ~~17239~~/1m	17286	
9/9/09	RW-SB-04 (2.5)	"	17002/1m	17002	
9/9/09	RW-SB-04 (4.0)	"	17156/1m	17156	
9/9/09					

NECR IRA RWPR RSE
Borehole Soil Sample Screening

PRBI-08

Instrument:

								Hole
		Reference Material	1.9 pCi/g	Gross Counts	89485/5m	CPM	17897	3
		Reference Material	1.9 pCi/g	Gross Counts	100324/5m	CPM	20064	2
Background Counts		Reference Material	1.9 pCi/g	Gross Counts	153119/5m	CPM	30624	1
CPM		Reference Material		Gross Counts		CPM		

Date	Soil Sample ID	Sample Location	Gross Gamma counts	Gross cpm	Comments
9/9/09	RW-SB-03 (1.0)	3	17615/1MIN	17615	
9/9/09	RW-SB-03(2.5)	"	17181 /1MIN	17181	SHORT SAMPLE
9/9/09	RW-SB-03(4.0)	"	16111 /1min	16111	
9/9/09	RW-SB-02(1.0)	2	/1 min	20152	
9/9/09	RW-SB-02(2.5)	"	/1 min	19752	
9/9/09	RW-SB-02(4.0)	"	/1min	~~31~~	
9/9/09	RW-SB-01 (1.0)	1	31246/1 MIN	31246	
9/9/09	RW-SB-01 (2.5)	"	31444 /1 MIN	31444	
9/9/09	RW-SB-01 (4.0)	"	30269/1MIN	30269	

* Recheck done in office

NECR IRA RWPR RSE
Borehole Soil Sample Screening

Instrument:		Reference Material	1.9 pCi/g	Gross Counts	41598/5MIN	CPM	8320
		Reference Material		Gross Counts		CPM	
Background Counts		Reference Material		Gross Counts		CPM	
CPM		Reference Material		Gross Counts		CPM	

Date	Soil Sample ID	Sample Location	Gross Gamma counts	Gross cpm	Comments
9/9/09	RW-SB-02 (4.0)	2	7706 /min	7706	Recheck in office
~~9/9/09~~	~~RW-SB-01 (1.0)~~	~~1~~			~~Recheck in office~~ RY
9/9/09	RW-SB-01 (1.0)	1	8059 /1min	8059	Recheck in office
9/9/09	RW-SB-01 (2.5)	1	8104 /1min	8104	Recheck in office
9/9/09	RW-SB-01 (4.0)	1	7522 /1min	7522	Recheck in office

NECR IRA RWPR RSE
Borehole Soil Sample Screening

Instrument:

		Reference Material	1.9 pCi/g	Gross Counts	72596/5min	CPM	14519
		Reference Material	1.9 pCi/g	Gross Counts	75691/5min	CPM	15138
Background Counts		Reference Material		Gross Counts		CPM	
CPM		Reference Material		Gross Counts		CPM	

Pit
21,
19,2

Date	Soil Sample ID	Sample Location	Gross Gamma counts	Gross cpm	Comments	
9/10/09	RW-TP-21(0)	21	16923/1min	16923	Surface sample	Gravelly sand
9/10/09	RW-TP-21(2.0)	"	14796/1min	14796		Fine sand
9/10/09	RW-TP-21(3.0)	"	14733/1min	14733		↓
9/10/09	"	"	29508/2min	14754		↓
9/10/09	RW-TP-21(4.0)	"	14377/1min	14377		Gravelly sand
9/10/09	"	"	29749/2min	14874		↓
9/10/09	RW-TP-20(1.0)	20	29561/2min	14780		Gravelly sand, dense
9/10/09	RW-TP-20(3.0)	"	13742/1min	13742		↓
9/10/09	"	"	28562/2min	14281		↓
9/10/09	RW-TP-~~20~~ 19(1.0)	19	15138/1min	15138		Fine sand
9/10/09	RW-TP-19(3.0)	"	15233/1min	15233		↓
9/10/09	"	"	15402/1min	15402		↓
9/10/09	RW-TP-19(4.0)	"	14929/1min	14929		↓
9/10/09	RW-TP-22(0)	22	16749/1min	16749	Surface Samp	Sandy gravel | gravelly sand
9/10/09	RW-TP-22(2.0)	"	13701/1min	13701		
9/10/09	RW-TP-22(3.0)	"	— /1min	—	NO SAMPLE - Bedrock @ ~2.5' bgs	

NECR IRA RWPR RSE
Borehole Soil Sample Screening

Instrument:

Reference Material	1.9 pCi/g	Gross Counts	85854 / 5 min	CPM	17170	
Reference Material	1.9 pCi/g	Gross Counts	99187 / 5 min	CPM	19837	
Reference Material		Gross Counts	109196 / 5 min	CPM	21839	
Reference Material		Gross Counts		CPM		

Background Counts	
CPM	

TP
23,1
24,1
25,1

Date	Soil Sample ID	Sample Location	Gross Gamma counts	Gross cpm	Comments	
9/10/09	RW-TP-23 (1.0)	23	17391 / 1 min	17391		Gravelly sand
9/10/09	RW-TP-23 (2.0)	"	16776 / 1 min	16776	* spooned off sidewall	Fine sand
9/10/09	RW-TP-23 (3.0)	"	16716 / 1 min	16716		↓
9/10/09	"	"	33571 / 2 min	16785		↓
9/10/09	RW-TP-18 (1.0)	18	17014 / 1 min	17014		Fine sand w/ some gravel
9/10/09	RW-TP-18 (2.0)	"	16957 / 1 min	16957		Fine sand
9/10/09	RW-TP-18 (3.0)	"	17132 / 1 min	17132		↓
9/10/09	"	"	16584 / 1 min	16584		
9/10/09	RW-TP-17 (0)	17	26552 / 1 min	26552	SURFACE SAMP	Gravelly sand
9/10/09	RW-TP-17 (1.0)	"	20576 / 1 min	20576		Fine sand
9/10/09	RW-TP-17 (2.0)	"	19817 / 1 min	19817		↓
9/10/09	RW-TP-17 (3.0)	"	39369 / 2 min	19684		↓
9/10/09	RW-TP-24 (1.0)	24	19193 / 1 min	19193		Fine sand
9/10/09	RW-TP-24 (2.0)	"	19579 / 1 min	19579		w/ some gravel
9/10/09	RW-TP-24 (3.0)	"	39347 / 2 min	19637		↓
9/10/09	RW-TP-25 (0)	25	24416 / 1 min	24416	SURFACE SAMP	Fine sand
9/10/09	RW-TP-25 (1.0)	"	21639 / 1 min	21639		↓
9/10/09	RW-TP-25 (2.0)	"	21901 / 1 min	21901		↓
9/10/09	RW-TP-25 (3.0)	"	43480 / 2 min	21740		

NECR IRA RWPR RSE
Borehole Soil Sample Screening

Instrument:

		Reference Material	1.9 pCi/g	Gross Counts	109196/5 min	CPM	21839	16,25
		Reference Material	1.9 pCi/g	Gross Counts	106222/5 min	CPM	21244	26,1
Background Counts		Reference Material	1.9 pCi/g	Gross Counts	111738/5 min	CPM	22347	14,27
CPM		Reference Material		Gross Counts		CPM		

Date	Soil Sample ID	Sample Location	Gross Gamma counts	Gross cpm	Comments
9/10/09	RW-TP-16(1.0)	16	21495/1min	21495	Gravelly sand
9/10/09	RW-TP-16(2.0)	"	21719/1min	21719	Fine sand
9/10/09	RW-TP-16(3.0)	"	43024/2min	21512	↓
9/10/09	RW-TP-26(1.0)	26	21369/1min	21369	* ROAD CUT BANK Fine sand, red, very dense
9/10/09	RW-TP-26(2.0)	"	20895/1min	20895	* top of Road Cut
9/10/09	RW-TP-26(3.0)	"	43053/2min	21526	↓
9/10/09	RW-TP-26(3.0)	"	42904/2min	21452	↓
9/10/09	RW-TP-26(4.0)	"	42103/2min	21051	Loose, fine sand
9/10/09	RW-TP-15(0)	15	21236/1min	21236	SURFACE SAMP Loose fine sand
9/10/09	RW-TP-15(1.0)	"	21561/1min	21561	↓
9/10/09	RW-TP-15(2.0)	"	20495/1min	20495	Gravelly sand
9/10/09	RW-TP-15(3.0)	"	40213/2min	20107	~~(med-coarse sand~~ + gravel) moist
9/10/09	RW-TP-14(1.0)	14	22302/1min	22302	- Gravelly sand
9/10/09	RW-TP-14(2.0)	"	21589/1min	21589	- (f-c sand) - moist to wet
9/10/09	RW-TP-14(3.0)	"	21570/1min	21570	- As above, wet
9/10/09	RW-TP-27(0)	27	23074/1min	23074	SURFACE SAMP Fine sand, drg
9/10/09	RW-TP-27(1.0)	"	21156/1min	21156	Gravelly sand (fine-coa moist
9/10/09	RW-TP-27(2.0)	"	21439/1min	21439	↓
9/10/09	RW-TP-27(3.0)	"	42783/2min	21391	

NECR IRA RWPR RSE
Borehole Soil Sample Screening

Instrument:

								TP
		Reference Material	1.9 pCi/g	Gross Counts	1096381/5M	CPM	21927	28,13
		Reference Material	1.9 pCi/g	Gross Counts	101280/5M	CPM	20256	12,29
Background Counts		Reference Material	1.9 pCi/g	Gross Counts	156067/5M	CPM	31213	30,1
CPM		Reference Material		Gross Counts		CPM		

Date	Soil Sample ID	Sample Location	Gross Gamma counts	Gross cpm	Comments
9/10/09	RW-TP-28 (0)	28	22427 /1min	22427	SURFACE SAMP Very fine sand, dry
9/10/09	RW-TP-28 (1.0)	"	21814 /1min	21814	
9/10/09	RW-TP-28 (2.0)	"	21676/1min	21676	
9/10/09	RW-TP-28 (3.0)	"	43761/2min	21880	Silty sand, dry
9/10/09	RW-TP-13 (1.0)	13	21519 /1min	21519	Red, silty sand, moist
9/10/09	RW-TP-13 (2.0)	"	21692 /1min	21692	Brown, as above
9/10/09	RW-TP-13 (3.0)	"	40648/2min	20324	yellow-bn gravelly sand
9/10/09	RW-TP-12 (0)	12	22120/1min	22120	SURFACE SAMP Fine sand w/ some gravel
9/10/09	RW-TP-12 (1.0)	"	20158 /1min	20158	
9/10/09	RW-TP-12 (2.0)	"	20198/1min	20198	
9/10/09	RW-TP-12 (3.0)	"	40319 /2min	20159	As above, trace gravel
9/10/09	RW-TP-29 (1.0)	29	20503 /1min	20503	Fine sand w/ some gravel
9/10/09	RW-TP-29 (2.0)	"	19807 /1min	19807	
9/10/09	RW-TP-29 (3.0)	"	39890/2min	19945	
9/10/09	RW-TP-30 (1.0)	30	36338/1min	36338	Silty sand, yellow-brown dry
9/10/09	RW-TP-30 (2.0)	"	32574/1min	32574	
9/10/09	RW-TP-30 (3.0)	"	31937/1min	31937	
9/10/09	RW-TP-30 (3.0)	"	32625/1min	32625	
9/10/09	RW-TP-30 (4.0)	"	63762/2min	31881	
9/10/09	RW-TP-30 (5.0)	"	64029/2min	32014	As above, moist
9/10/09	RW-TP-30 (5.0)	"	63458/2min	31729	

NECR IRA RWPR RSE
Borehole Soil Sample Screening

Instrument:

								TP
		Reference Material	1.9 pCi/g	Gross Counts	156067/5m	CPM	31213	30, 11
		Reference Material	1.9 pCi/g	Gross Counts	31444/1m	CPM	31444	30, 11
Background Counts		Reference Material		Gross Counts		CPM		
CPM		Reference Material		Gross Counts		CPM		

Date	Soil Sample ID	Sample Location	Gross Gamma counts	Gross cpm	Comments
9/10/09	RW-TP-30(5.0)	30	64123/2min	32061	*definitely once a drainage, yllw-bn
9/10/09	RW-TP-30(6.0)	"	62648/2min	31324	moist sandy silt
9/10/09	RW-TP-30(6.0)	"	62774/2min	31387	
9/10/09	RW-TP-30(7.0)	"	63484/2min	31742	
9/10/09	RW-TP-30(7.0)	"	31632/1min	31632	
9/10/09	RW-TP-30(8.0)	"	31590/1min	31590	
9/10/09	RW-TP-30(8.0)	"	31444/1min	31444	
9/10/09	RW-TP-11(0)	11	44751/1min	44751	SURFACE SAMP Fine Sand, dry
9/10/09	RW-TP-11(1.0)	11	31306/1min	31306	As above, moist
9/10/09	RW-TP-11(2.0)	11	31606/1min	31606	
9/10/09	RW-TP-11(3.0)	11	31285/1min	31285	
9/10/09	RW-TP-11(3.0)	11	63172/2min	31586	
9/10/09	RW-TP-11(4.0)	11	62921/2min	31460	Sandy Silt
9/10/09	RW-TP-11(5.0)	11	62828/2min	31414	
9/10/09	RW-TP-11(6.0)	11			

FIELD NOTE BOOK

"Rite in the Rain"®
ALL-WEATHER WRITING PAPER

ALL-WEATHER

ENVIRONMENTAL FIELD BOOK

Name Rob Young / Jed Thompson

Address

Phone

Project NECR Drilling (IRA)
Redwater Pond Road
Sept. 2009

This book is printed on "Rite in the Rain" All-Weather Writing Paper - A unique paper created to shed water and enhance the written image. It is widely used throughout the world for recording critical field data in all kinds of weather. For best results, use a pencil or an all-weather pen.

Specifications for this book:

Location NECR Date 9/8/09 RY 3

Project / Client UNC

~~-7000 - Met Jed in hotel lobby~~

RSC - Construction Ahead, R and L closed, only bases

Albuquerque Rental Co.
- Action Safety (505) 878-9690
- Highway Supply (505) 345-8295
- Convention Services (505) 243-9889

0920 - Phone calls to Rental Co's

Action Safety - Construction Ahead, one lane road, flagger (all x2), check on 15 mph signs

1000 - Travel to Albuquerque to pick up signage from Action Safety

1515 - Returned to NECR building

1545 - Drove site while Jed meets with NNEPA & EPA (Bill)

1600 - Deliver signage to site

Location RW Pond Rd. Date 9/9/09

Project / Client UNC R. Young

0630 - Depart LaQuinta
0645 - Meet Jed + Nat - drillers and floggers at UNC shop
0700 - Set up construction signs
0745 - Tailgate safety meeting w/ WDC, EPA, and MWH, and Reds
0800 - Drilled RW-SB-10 and sampled down to 7 feet bgs
0900 - EPA (Bill) found hole depth and final readings acceptable
0915 - Move rig and truck to RW-SB-09, re-reference the gamma meter
0920 - Start drilling RW-SB-09
0930 - No exceeding ref, 5.5 ft tot
0940 - Move and begin drilling RW-SB-08
1000
~~1010~~ 1010 - Moved to RW-SB-07
1030 - All samples clean
1035 - Move to RW-SB-06

Location Date 9/9/09

Project / Client

1100 - All samples below reference at RW-SB-06
1110 - Move to RW-SB-05
1130 - All samples below reference except deep outlier that is over but still w/in margin of error
1200 - LUNCH
1230 - Move to RW-SB-04
1245 - All samples below reference
1300 - Move rig + truck to RW-SB-03
1315 - All samples below RW-SB-03 below reference levels
1320 - Move rig + truck to RW-SB-02
1340 - All samples below reference
* had to use smaller bags, will take measurements / readings again at UNC building
1440 - Take down construction signs and load into UNC building
1540 - Begin splitting samples and prepping for shipment
1700 - END OF DAY @ site

Location NECR Date 9/10/09

Project / Client UNC/IRA R. Young

0605 - Depart hotel for UNC site
0630 - Arrive @ NECR
0700 - Calibrate gamma detector according to Nat's calibration steps
0730 - Prep sampling supplies and talk to Rick (UNC) bout getting the backhoe going
0820 - Arrive at Red Water Pond Rd and prep while waiting for backhoe
0840 - On-site (RW) w/ Ronald, backhoe operator, H&S meeting w/ Ron
0915 - Complete RW-TP-21 and move to RW-TP-20
0935 - Complete RW-TP-21 (clean @ 3.0 bgs) and move to RW-TP-19
0955 - Complete RW-TP-19 and move to RW-TP-22
1010 - Complete RW-TP-22, clean @ 2.0' bgs, bedrock @ 2.5' bgs, move rig to RW-TP-23
1030 - Complete RW-TP-23, clean @ 3.0' bgs, move to RW-TP-18

Location Date 9/10/09

Project / Client

1041 - Move to RW-TP-17 after RW-TP-18 was clean @ 3.0' bgs
- Jed wants samples @ 1, 2, 3+ feet bgs now, even w/ surface samples
1115 - Move to RW-TP-~~25~~ 16 after finishing 17 and 24 (both clean and term at 3.0' bgs)
1130 - RW-TP-16 done, clean, 3.0' bgs TD, move rig to RW-TP-25
1240 - Move to RW-TP-15, 25 was hot (~200-300) @ 3.0', but found material well under ref @ 4.0' bgs
1300 - Lunch, move to RW-TP-14
1310 - Sample RW-TP-14, clean @ 1.0' bgs, go down to 3.0', move to RW-TP-27
1320 - RW-TP-27 to 3.0', move to RW-TP-28
1338 - RW-TP-28 clean, down to 3.0' bgs
Move rig to RW-TP-13
1350 - RW-TP-13 down to 3.0' bgs, move to RW-TP-12 & 29

Location NECR Date 9/10/09

Project / Client UNC/ IRA R. Young

1350 - Wipe out tube for gamma reader for 3rd time today

1410 - RW-TP-12 clean @ 1.0' bgs, taken to 3.0' bgs, move to RW-TP-29

1420 - RW-TP-29 down to 3.0' bgs, move backhoe to RW-TP-30

1505 - RW-TP-30 taken down to 8.0' bgs. Likely an old drainage as "hot material" below 3.0' bgs was fine sandy silt w/ some gravel, point also located in current ditch/drainage that leads to unnamed arroyo. Readings below ~224 pCi/g but ~~not below~~ RY not quite lower than the 19 pCi/g reference

1506 - Move to RW-TP-11

1520 - Leave site after nearing 19 pCi/g @ RW-TP-11 at approx. 6.0' bgs

Location NECR Date 9/11/09

Project / Client UNC/ IRA

0630 - Leave hotel

0700 - Sort + prep samples for shipment

1000 - Fill out shipping labels and prep for shipment. Load truck w/ construction signs to take back to Action Safety in Albuquerque.

1100 - Leave for Albuquerque

1600 - Back to Gallup and depart for SLC (Rob)

APPENDIX B

LABORATORY ANALYTICAL AND DATA VALIDATION RESULTS

LABORATORY REPORT

Due to its size (>900 pages), the laboratory report will be included on a disk in the printed version of this report only.

VALIDATION REPORT

DATA VERIFICATION REPORT

INTRODUCTION

This report presents a summary of the verification results for the sample data collected as for United Nuclear Corporation (UNC) specific to the Northeast Church Rock (NECR) site.

Samples were collected in September 2009 and were analyzed by ALS Laboratory Group of Fort Collins, Colorado. Samples were analyzed for radium-226 (Ra-226) by U.S. EPA method 901.1

The analytical results are expressed in terms of precision, accuracy, representativeness, comparability, and completeness (PARCC). This data evaluation is presented in terms of the PARCC criteria and was based on the specific criteria presented in the *Quality Assurance Project Plan, United Nuclear Corporation, Northeast Church rock Site (QAPP),* (MWH 2006):

Data verification was performed by Laboratory Data Consultants (LDC) of Carlsbad, California. The verification report by LDC is attached to this report.

DATA VERIFICATION SUMMARY

Precision. Based on the laboratory replicate sample and field replicate results, the data are precise as reported.

Accuracy. Based on the calibration, and laboratory controls sample the data are accurate as qualified. Eighteen sample results were qualified by LDC with a “J+” flag, indicating a potential high bias, because the density of the sample was not within fifteen percent of the standard used to calibrate the instrument. A list of the samples qualified due to the sample density are listed below.

RW-SB-08(1.0)	RW-SB-05(5.5)	RW-TP-20(1.0)
RW-SB-07(1.0)	RW-SB-06(2.5)	RW-TP-14(3.0)
RW-SB-03(2.5)	RW-SB-06(1.0)	RW-TP-17(2.0)
RW-SB-01(1.0)	RW-SB-07(2.5)	RW-TP-13(1.0)
RW-SB-03(1.0)	RW-TP-11(3.0)	RW-TP-30(6.0)
RW-SB-06(12.5)	RW-TP-11(2.0)	RW-TP-11(0)DUP

Representativeness. Based on the results of the sample preservation and holding time evaluation; the method blank sample results; the field replicate sample evaluation; and the RL evaluation the data are considered representative of the site as reported.

Comparability. Standard methods of sample collection and standard units of measure were used during this project. The analysis performed by the laboratory was in accordance with current EPA methodology and the QAPP.

Completeness. Based on the results of the data verification, all data are considered valid as qualified.

APPENDIX C

STATISTICAL PLOTS AND RESULTS OF HYPTHOTHESIS TESTS USING ProUCL 4.0

STATISTICS EVALUATION MEMORANDUM
FEBRUARY 16, 2009

MWH

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MEMORANDUM

TO: Lance Hauer, GE

DATE: February 16, 2009

FROM: Leah Wolf Martin and Toby Leeson

CC: Larry Bush, UNC
Roger Florio, GE

SUBJECT: Statistical Evaluation of Gamma and Soil Analytical Results Along Red Water Pond Road, Northeast Church Rock Removal Site Evaluation

This memorandum provides a summary of a statistical data evaluation of gamma and soil analytical datasets from along Red Water Pond Road collected during the Northeast Church Rock Removal Site Evaluation (RSE). The collection and analysis of these data are presented in the *Removal Site Evaluation Report* (MWH, 2007) and *Supplemental Removal Site Evaluation Report* (MWH, 2008).

Objective

The objective of the statistical evaluation was to determine whether the Ra-226 concentrations are statistically different along Red Water Pond Road compared to Ra-226 concentrations in a reference area. Two separate datasets were compared consisting Ra-226 equivalent concentrations from the gamma surveying and concentrations from surface soil samples analyzed for Ra-226 in a laboratory. The gamma and surface soil data were collected as part of the Removal Site Evaluation (RSE) and Supplemental Removal Site Evaluation (SRSE) and these data as well as data collection methods are reported in the RSE and SRSE Reports (MWH, 2007 and MWH, 2008).

As reported in the Supplemental RSE Report (MWH, 2008), 100% of the gamma radiation measurements (Ra-226 equivalent) performed adjacent to the east and west sides of Red Water Pond Road, as well as the surface soil samples (Ra-226) collected adjacent to the road exceeded the field screening level (FSL) of 2.24 pCi/g. Elevated Ra-226 in soils near and beneath Red Water Pond Road may be associated with the historical use of this road as a haul road for former mine located to the north of the NECR site. In order to determine if the Ra-226 concentrations at sample locations adjacent to the Red Water Pond Road represent a different statistical population of data than from the area north of NECR-1 (reference area), the data from along Red Water Pond Road (within 50 feet) was statistically compared to data collected in the reference area north of NECR-1, as shown on Figure 1. If the populations are different, this implies that there are different sources of elevated Ra-226 concentrations in soils within these areas.

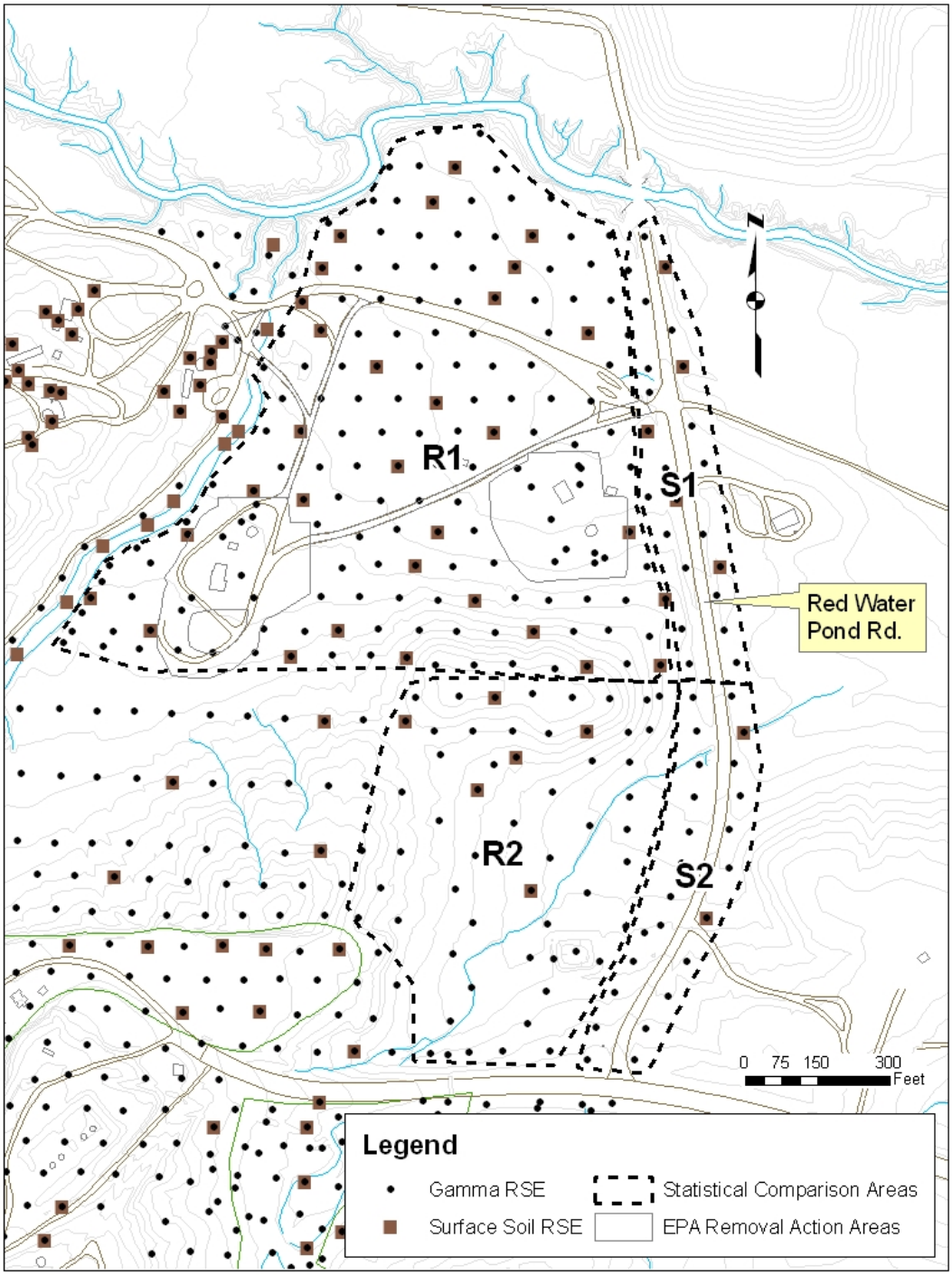

FIGURE 1 – STATISTICAL COMPARISON AREAS

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 Red Water Pond Road and reference area data sets. Simple two-sample hypotheses testing methods were used to compare populations, including the Wilcoxon-Mann-Whitney (WMW) Rank Sum test and the quantile test. In addition, graphical displays of the data (side-by-side box plots and histograms) were used to further evaluate the data sets.

The WMW Rank Sum test and the quantile tests do not require a specific mathematical form for the underlying distribution and are called distribution-free or nonparametric statistical tests. As stated in the *ProUCL Technical Guide*: "*The property of robustness is the main advantage of nonparametric statistical tests. Nonparametric tests have good test performances for a wide variety of distributions, and those performances are not unduly affected by outliers." … "Nonparametric tests can be used on normal as well as for non-normal data sets. If one or both of the data sets fail to meet the normality test, or if the data sets appear to come from different types of populations, then the use of nonparametric tests is preferable. It should be noted that parametric tests are more powerful provided the underlying assumptions associated with those tests are satisfied. Nonparametric tests compare the shape and location of the two distributions instead of a statistical parameter such as mean."*

The WMW test is a nonparametric test used for determining whether a difference exists between the site and the reference or background population distributions. The WMW test analyzes whether or not numerical values (Ra-226 concentrations in pCi/g) from one population consistently tend to be larger (or smaller) than those from the other population. This test determines which distribution central tendency is higher by comparing the relative ranks of the two data sets when the data from both sources are sorted into a single list. One assumes that any difference between the background (reference area) and the site (area-of-concern) concentration distributions is due to a shift in location (mean, median) of the site concentrations to higher values (due to the presence of contamination in addition to the reference area).

One weakness of the WMW test is that it lacks power for the higher value end of the distribution, and it is therefore recommended that the quantile test (EPA, 1994) be used to compare the upper tails (higher values) of the two distributions. The quantile test (EPA, 1994) is a nonparametric test and is useful for detecting a shift to the right (higher values) in the right-tails of the data distribution between the site and background datasets. The quantile test, when used in parallel with the WMW test, provides the user with stronger, statistically more powerful evidence to make removal action decisions based on whether the site and reference area sample datasets represent different populations, and therefore different sources.

Statistical Evaluation

The reference area and Red Water Pond Road data sets were divided up into four areas: Reference Area 1 (R1), Reference Area 2 (R2), Survey Area 1 (S1), and Survey Area 2 (S2) for both the gamma and surface soil data, as shown on Figure 1. This was done to account for topographic features and allow for separate analysis of the northern and southern segments of Red Water Pond Road. Three scenarios were evaluated using the WMW and the quantile tests. Each of these scenarios is described below.

Scenario 1: Compared equivalent Ra-226 concentrations from gamma survey data between R1 and S1

Scenario 2: Compared equivalent Ra-226 concentrations from gamma survey data between R2 and S2

Scenario 3: Compared surface soil Ra-226 concentrations between R1 and S1

A comparison of surface soil Ra-226 concentrations was not performed for R2 and S2 due to the limited amount of data.

Sample numbers and a summary of sample statistics for each scenario are provided in Table 1.

Table 1
Scenario Summary Statistics

Scenario	Area	n	Min	Max	Mean	Median
Scenario 1	Reference (R1)	171	0.3-	12.2	2.673	2.4
Gamma	Red Water Pond (S1)	22	2.4	26.8	11.66	11.25
Scenario 2	Reference (R2)	56	0.3	45.9	6.788	3.8
Gamma	Red Water Pond (S2)	24	2.3	29.9	8.717	5.9
Scenario 3	Reference (R1)	25	0.7	26.6	3.992	1.8
Soil	Red Water Pond (S1)	5	2.9	28.5	14.36	17.1

For each of the three scenarios evaluated, the null and alternative hypotheses were as show below.

Null (H_0): Site or AOC Mean/Median Less Than or Equal to Background Mean/Median Concentration

Alternative (H_A): Site or AOC Mean/Median Greater Than Background Mean/Median

Where:

Site or AOC = Red Water Pond Road sites

Background = Reference area R1 or R2

The confidence coefficient was set to 95% (alpha = 0.05) for each of the evaluations. In addition, potential statistical outliers were not removed from the datasets since all potential outliers were located in the reference area and leaving them in the data sets was a conservative assumption.

Data Sets

See Figure 1 and worksheets in Attachment 1

ProUCL Output

See worksheets in Attachment 1

Results

The statistical data evaluation for the three scenarios using the WMW and quantile methods showed that there is a statistical difference in the mean/median concentrations between the Red Water Pond Road samples (area-of-concern) and the reference area (background) samples. The statistical difference is also evident in the box plots and histograms included for each scenario in Attachment 1. The evaluation showed that the mean/median of Red Water Pond Road sample concentrations is greater than the mean/median of the corresponding reference areas for each of the three scenarios as shown in Table 2. However, as shown in Table 3, the quantile test did not find that the Red Water Pond Road area (S2) concentrations were greater than the adjacent reference area (R2) and it deferred to the WMW analysis. The WMW analysis did conclude that the Red Water Pond Road area (S2) dataset represents a different population with a greater mean value of Ra-226 than the adjacent Reference area (R2) dataset.

Table 2 Wilcoxon-Mann-Whitney Results		
	p-Value	**Conclusion**
Scenario 1 (Gamma - R1 vs S1)	4.23E-12	Reject H_0, Conclude Site > Reference
Scenario 2 (Gamma - R2 vs S2)	2.45E-02	Reject H_0, Conclude Site > Reference
Scenario 3 (Soil - R1 vs S1)	4.46E-03	Reject H_0, Conclude Site > Reference

Table 3 Quantile Results				
	R	**K**	**# of Obs. in R Largest**	**Conclusion**
Scenario 1 (Gamma - R1 vs S1)	6	3	6	Reject H_0, Conclude Site > Reference
Scenario 2 (Gamma - R2 vs S2)	8	5	3	Do Not Reject H_0, Perform WMW
Scenario 3 (Soil - R1 vs S1)	6	3	3	Reject H_0, Conclude Site > Reference

References

MWH, 2007. Final Removal Site Evaluation Report Northeast Church Rock Mine Site. October 2007.

MWH, 2008. Final Supplemental Removal Site Evaluation Report Northeast Church Rock Mine Site. February 2008.

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

EPA. 1994. *Statistical Methods for Evaluating the Attainment of Cleanup Standards*, EPA 230-R-94-004, Washington, DC.

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MEMORANDUM

ATTACHMENT 1
SCENARIO DATA AND PROUCL OUTPUT

MWH

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MEMORANDUM

SCENARIO 1

Scenario 1 - Equivalent Ra-226 data comparing Areas R1 to Area S1

NORTHING	EASTING	LOCID	SURVEY_DAT	GAMMA	Equivalent Ra-226 (pCi/g)	Reference Area
1697293.1981	2523289.2032	HO-97	SUPP	4856	1.8	R1
1696738.6024	2523290.2435	HO-30	SUPP	5299	2.4	R1
1696962.6939	2523315.7743	HO-58	SUPP	5011	2.0	R1
1697083.0650	2523320.2077	HO-70	SUPP	4708	1.6	R1
1697368.9760	2523322.2624	HO-169	SUPP	4911	1.8	R1
1697226.2653	2523322.4746	HO-88	SUPP	5939	3.2	R1
1696812.2405	2523323.2692	HO-40	SUPP	5840	3.1	R1
1697499.3990	2523326.4325	HO-172	SUPP	6388	3.8	R1
1697593.8413	2523339.2969	HO-185	SUPP	5340	2.4	R1
1696689.0979	2523345.3590	N1-263	RSE	5352	1.2	R1
1697019.5318	2523360.0501	HO-64	SUPP	4933	1.9	R1
1696741.9649	2523360.3281	HO-153	SUPP	5522	2.6	R1
1697565.3024	2523364.6077	HO-174	SUPP	6374	3.7	R1
1697293.9289	2523366.8418	HO-98	SUPP	5472	2.6	R1
1697153.8785	2523368.2042	HO-79	SUPP	5039	2.0	R1
1697432.8191	2523368.5053	HO-115	SUPP	5708	2.9	R1
1696872.2074	2523368.5525	HO-51	SUPP	5326	2.4	R1
1697085.5093	2523399.3310	HO-71	SUPP	5299	2.4	R1
1697361.5439	2523401.2338	HO-107	SUPP	5612	2.8	R1
1697497.8231	2523401.2650	HO-123	SUPP	6556	4.0	R1
1697225.6704	2523402.0956	HO-89	SUPP	5272	2.3	R1
1696937.0568	2523403.2494	HO-59	SUPP	4913	1.8	R1
1696812.8290	2523405.1811	HO-41	SUPP	5713	2.9	R1
1696689.6257	2523427.0343	N1-264	RSE	5220	0.9	R1
1697640.4273	2523432.2910	HO-184	SUPP	4842	1.8	R1
1697293.3047	2523440.3651	HO-168	SUPP	5563	2.7	R1
1696744.7900	2523442.3316	HO-31	SUPP	5081	2.1	R1
1696879.1633	2523442.4045	HO-52	SUPP	5380	2.5	R1
1697434.7175	2523448.4397	HO-116	SUPP	5511	2.6	R1
1697574.1770	2523449.1143	HO-131	SUPP	9018	7.2	R1
1697012.0565	2523449.1575	HO-65	SUPP	4679	1.5	R1
1697154.0654	2523450.7110	HO-80	SUPP	5344	2.4	R1
1697709.8875	2523467.3554	HO-189	SUPP	5121	2.1	R1
1697500.7368	2523480.2934	HO-124	SUPP	5915	3.2	R1
1697640.1836	2523480.7564	HO-138	SUPP	7937	5.8	R1
1697361.6693	2523481.4379	HO-108	SUPP	5316	2.4	R1
1696952.0275	2523482.9651	HO-60	SUPP	6049	3.3	R1
1697226.3356	2523483.8814	HO-90	SUPP	5271	2.3	R1
1697084.7310	2523484.4020	HO-163	SUPP	4692	1.6	R1
1696807.8680	2523488.1690	HO-42	SUPP	4862	1.8	R1
1696684.3785	2523503.6449	N1-265	RSE	4908	0.3	R1
1696876.2910	2523520.1257	HO-158	SUPP	5794	3.0	R1
1696741.9422	2523528.6147	HO-32	SUPP	4988	1.9	R1
1697012.4663	2523528.7461	HO-66	SUPP	4083	0.8	R1
1697566.6616	2523528.7949	HO-132	SUPP	4643	1.5	R1
1697430.8998	2523529.3856	HO-117	SUPP	4586	1.4	R1
1697292.4792	2523529.6438	HO-99	SUPP	5627	2.8	R1
1697152.0630	2523529.7501	HO-81	SUPP	4530	1.4	R1
1697711.8961	2523529.9804	HO-142	SUPP	5465	2.6	R1
1697636.6337	2523558.6269	HO-176	SUPP	5291	2.3	R1
1697500.8413	2523560.4513	HO-125	SUPP	5013	2.0	R1
1696667.3521	2523561.4564	HO-21	SUPP	4569	1.4	R1
1697363.6388	2523562.2225	HO-109	SUPP	5368	2.4	R1
1697088.0045	2523564.1079	HO-72	SUPP	5358	2.4	R1
1697218.8086	2523566.4532	HO-167	SUPP	5588	2.7	R1
1696945.8745	2523567.5684	HO-159	SUPP	4860	1.8	R1
1696804.2213	2523567.6574	HO-43	SUPP	5025	2.0	R1
1697785.1640	2523568.6429	HO-144	SUPP	4280	1.0	R1
1696875.1129	2523600.0295	HO-53	SUPP	5694	2.9	R1
1697709.9159	2523604.7853	HO-177	SUPP	5821	3.0	R1
1696738.8047	2523606.4146	HO-33	SUPP	4979	1.9	R1
1697296.2867	2523607.5742	HO-100	SUPP	5568	2.7	R1
1697010.5167	2523608.5179	HO-67	SUPP	5271	2.3	R1
1697429.8810	2523609.5864	HO-118	SUPP	5659	2.8	R1
1697569.3874	2523609.6896	HO-133	SUPP	4636	1.5	R1

Scenario 1 - Equivalent Ra-226 data comparing Areas R1 to Area S1

NORTHING	EASTING	LOCID	SURVEY_DAT	GAMMA	Equivalent Ra-226 (pCi/g)	Reference Area
1697157.3791	2523610.0602	HO-82	SUPP	5015	2.0	R1
1697639.0630	2523638.8759	HO-139	SUPP	4980	1.9	R1
1697361.5981	2523640.0569	HO-110	SUPP	5367	2.4	R1
1697498.5525	2523640.8802	HO-126	SUPP	4870	1.8	R1
1697081.8744	2523641.5654	HO-73	SUPP	5096	2.1	R1
1697223.1768	2523642.2987	HO-91	SUPP	4564	1.4	R1
1696668.9092	2523643.1820	HO-22	SUPP	4489	1.3	R1
1696949.9501	2523644.4263	HO-61	SUPP	5093	2.1	R1
1696804.3156	2523646.3840	HO-156	SUPP	5064	2.0	R1
1697781.1191	2523657.4762	HO-145	SUPP	5552	2.7	R1
1697292.6556	2523682.9497	HO-101	SUPP	5834	3.0	R1
1697154.0641	2523685.5581	HO-165	SUPP	4650	1.5	R1
1696881.5308	2523686.1582	HO-54	SUPP	5522	2.6	R1
1697564.4367	2523687.0348	HO-134	SUPP	4715	1.6	R1
1696737.1572	2523687.4315	HO-34	SUPP	5438	2.5	R1
1697435.9304	2523688.2484	HO-171	SUPP	4810	1.7	R1
1697705.4593	2523689.0130	HO-143	SUPP	4517	1.3	R1
1697644.3791	2523721.3020	HO-140	SUPP	4952	1.9	R1
1697226.0756	2523721.4971	HO-92	SUPP	4852	1.8	R1
1696671.3805	2523723.0060	HO-23	SUPP	4490	1.3	R1
1697500.3379	2523729.0448	HO-173	SUPP	5355	2.4	R1
1696807.8341	2523730.0992	HO-44	SUPP	5185	2.2	R1
1697078.5743	2523733.9161	HO-74	SUPP	4511	1.3	R1
1697295.2253	2523763.1812	HO-102	SUPP	5477	2.6	R1
1697565.5100	2523767.0223	HO-175	SUPP	4939	1.9	R1
1696738.5032	2523767.2509	HO-154	SUPP	5186	2.2	R1
1697156.1673	2523767.9539	HO-83	SUPP	4972	1.9	R1
1697430.9790	2523770.2182	HO-119	SUPP	5136	2.1	R1
1696804.9894	2523799.6788	HO-45	SUPP	5275	2.3	R1
1697364.4495	2523800.7689	HO-111	SUPP	5429	2.5	R1
1697496.4496	2523801.4927	HO-127	SUPP	5128	2.1	R1
1697226.6179	2523803.7100	HO-93	SUPP	4965	1.9	R1
1697644.3888	2523803.7889	HO-141	SUPP	5004	2.0	R1
1696660.7854	2523811.7672	HO-24	SUPP	5261	2.3	R1
1697562.8385	2523845.9698	HO-135	SUPP	5461	2.6	R1
1697432.7483	2523850.4273	HO-120	SUPP	4944	1.9	R1
1696738.3113	2523850.4338	HO-35	SUPP	4925	1.9	R1
1697128.7662	2523855.0693	HO-84	SUPP	5105	2.1	R1
1696805.9407	2523879.1217	HO-46	SUPP	5254	2.3	R1
1696666.2354	2523880.6642	HO-151	SUPP	5169	2.2	R1
1697362.9089	2523883.6594	HO-112	SUPP	5606	2.8	R1
1697506.2342	2523887.9124	HO-128	SUPP	5443	2.5	R1
1697220.9735	2523888.6101	HO-94	SUPP	4554	1.4	R1
1696742.1878	2523925.8127	HO-36	SUPP	4972	1.9	R1
1697295.1176	2523925.9415	HO-103	SUPP	7945	5.8	R1
1697566.0685	2523927.2527	HO-136	SUPP	5565	2.7	R1
1697154.7490	2523928.8464	HO-85	SUPP	5266	2.3	R1
1697431.4127	2523930.5184	HO-121	SUPP	5562	2.7	R1
1696804.8951	2523961.6340	HO-47	SUPP	5324	2.4	R1
1696670.4705	2523962.6624	HO-25	SUPP	5584	2.7	R1
1697358.1963	2523967.1230	HO-113	SUPP	7854	5.7	R1
1696947.0097	2523969.3518	HO-160	SUPP	5121	2.1	R1
1697082.0656	2523971.2296	HO-75	SUPP	5265	2.3	R1
1696873.8718	2524004.5224	HO-55	SUPP	5435	2.5	R1
1697021.0794	2524008.9949	HO-68	SUPP	5961	3.2	R1
1696728.9038	2524011.7530	HO-37	SUPP	6246	3.6	R1
1696667.5057	2524033.4041	N1-307	RSE	5331	1.2	R1
1696805.7026	2524043.0972	HO-157	SUPP	5678	2.8	R1
1696715.8448	2522783.4751	N1-256	RSE	9588	11.4	R1
1696738.9804	2522803.2191	HO-27	SUPP	5035	2.0	R1
1696777.9933	2522823.1095	AB-038	RSE	4807	0.6	R1
1696810.1088	2522842.0667	HO-155	SUPP	4649	1.5	R1
1696843.4623	2522865.1922	AB-037	RSE	4904	0.3	R1
1696707.1191	2522866.6998	N1-257	RSE	5474	1.5	R1
1696877.4952	2522881.0483	HO-49	SUPP	5156	2.2	R1

Scenario 1 - Equivalent Ra-226 data comparing Areas R1 to Area S1

NORTHING	EASTING	LOCID	SURVEY_DAT	GAMMA	Equivalent Ra-226 (pCi/g)	Reference Area
1696738.6131	2522887.6805	HO-28	SUPP	4971	1.9	R1
1696811.6485	2522928.8471	HO-39	SUPP	5497	2.6	R1
1696913.6554	2522936.7355	AB-036	RSE	6174	3.2	R1
1696702.1501	2522943.7838	N1-258	RSE	14804	9.8	R1
1696740.9917	2522967.1524	HO-152	SUPP	10242	8.8	R1
1696882.0521	2522967.4542	HO-50	SUPP	7602	5.3	R1
1697045.1733	2523096.3287	AB-034	RSE	5705	2.1	R1
1697032.9621	2523183.3713	H6-004	RSE	18754	1.0	R1
1696694.6265	2523185.7424	N1-261	RSE	5966	1.0	R1
1696743.0978	2523202.5204	HO-29	SUPP	6437	3.8	R1
1697291.5409	2523202.5423	HO-96	SUPP	3332	0.3	R1
1697158.7948	2523208.7360	HO-78	SUPP	4921	1.9	R1
1697083.5838	2523239.0202	HO-69	SUPP	4968	1.9	R1
1697360.7206	2523241.0100	HO-106	SUPP	5440	2.5	R1
1697224.8791	2523243.0133	HO-87	SUPP	5685	2.9	R1
1696687.5852	2523261.7961	N1-262	RSE	5383	1.3	R1
1697156.7178	2523281.9420	HO-164	SUPP	4461	1.3	R1
1697428.7454	2523282.9853	HO-170	SUPP	7166	4.8	R1
1697015.6423	2523287.2060	HO-161	SUPP	5551	2.7	R1
0.0000	0.0000	AB-035	RSE	0	12.2	R1
0.0000	0.0000	H7-005	RSE	0	4.0	R1
725707.6450	3949321.1370	H6-001	RSE	19807	3.8	R1
725726.1400	3949334.4720	H6-002	RSE	20100	4.0	R1
725728.0420	3949342.5870	H6-003	RSE	20605	4.2	R1
725726.7900	3949351.1010	H6-004	RSE	18754	3.3	R1
725719.5290	3949331.3340	H6-005	RSE	20483	4.2	R1
725728.8700	3949283.0120	H7-001	RSE	17088	2.5	R1
725689.1070	3949281.8260	H7-002	RSE	24045	6.0	R1
725682.7730	3949273.4530	H7-003	RSE	34047	11.0	R1
725720.1870	3949297.0030	H7-004	RSE	18024	2.9	R1
725685.2780	3949321.7550	H7-005	RSE	20174	4.0	R1
725932.7300	3949373.4660	H8-001	RSE	18235	3.0	R1
725935.0480	3949372.3930	H8-002	RSE	19201	3.5	R1
725934.5230	3949361.5230	H8-003	RSE	18271	3.1	R1
725916.3430	3949339.2100	H8-004	RSE	18232	3.0	R1
725903.3180	3949359.0680	H8-005	RSE	18032	2.9	R1
725926.9180	3949319.8380	H9-001	RSE	17057	2.5	R1
725945.0950	3949318.5620	H9-002	RSE	18128	3.0	R1
725951.4820	3949315.7480	H9-003	RSE	18609	3.2	R1
725945.1260	3949312.2590	H9-004	RSE	18115	3.0	R1
725920.2140	3949312.1320	H9-005	RSE	16910	2.4	R1
1697494.6387	2523965.1635	HO-129	SUPP	18610	19.7	S1
1697564.7856	2524001.2472	HO-137	SUPP	12046	11.1	S1
1697429.6724	2524003.6701	HO-122	SUPP	16197	16.5	S1
1697287.0005	2524006.9987	HO-104	SUPP	10306	8.9	S1
1697157.3839	2524007.8808	HO-86	SUPP	6206	3.5	S1
1697238.8442	2524009.8298	HO-95	SUPP	7218	4.8	S1
1697500.4939	2524043.7053	HO-130	SUPP	24105	26.8	S1
1697079.7103	2524044.4833	HO-76	SUPP	13740	13.3	S1
1696942.5733	2524046.7427	HO-62	SUPP	6759	4.2	S1
1697369.7992	2524056.7847	HO-114	SUPP	21696	23.7	S1
1697015.9543	2524066.8313	HO-162	SUPP	14628	14.5	S1
1696743.2324	2524077.4819	N1-306	RSE	5827	2.4	S1
1697293.8022	2524081.6967	HO-105	SUPP	20401	22.0	S1
1696871.5203	2524085.0424	HO-56	SUPP	13149	12.6	S1
1696670.4993	2524093.3890	N1-305	RSE	7381	6.1	S1
1697168.0244	2524099.7556	HO-166	SUPP	19972	21.4	S1
1696941.2259	2524121.6305	HO-63	SUPP	7961	5.8	S1
1697090.0369	2524124.8698	HO-77	SUPP	9168	7.4	S1
1696815.0049	2524151.3963	HO-48	SUPP	5946	3.2	S1
1696874.2218	2524158.9861	HO-57	SUPP	7577	5.3	S1
1696742.0717	2524167.4277	HO-38	SUPP	12276	11.4	S1
1696673.6291	2524191.8017	HO-26	SUPP	12619	11.9	S1

From File: J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Gamma3 eval\NECR Gamma3 r1s1.wst

Summary Statistics for Raw Full Data Sets

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
Equivalent Ra-226 (pCi/g) (reference r1)	171	0.3	12.2	2.673	2.4	3.025	1.739	0.741	3.189	12.84	0.651
Equivalent Ra-226 (pCi/g) (red water pond road s1)	22	2.4	26.8	11.66	11.25	54.01	7.349	8.451	0.594	-0.76	0.63

Wilcoxon-Mann-Whitney Comparison Test for Full Data Sets without NDs - R1 vs S1

User Selected Options

From File	J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Gamma3 eval\NECR Gamma3 r1s1.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Equivalent Ra-226 (pCi/g)(red water pond road s1)

Background Data: Equivalent Ra-226 (pCi/g)(reference r1)

Raw Statistics

	Site	Background
Number of Valid Observations	22	171
Number of Distinct Observations	22	60
Minimum	2.4	0.3
Maximum	26.8	12.2
Mean	11.66	2.673
Median	11.25	2.4
SD	7.349	1.739
SE of Mean	1.567	0.133

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	3819
WMW Test U-Stat	6.83
WMW Critical Value (0.050)	1.645
P-Value	4.231E-12

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

P-Value < alpha (0.05)

Non-parametric Quantile Hypothosis Test for Full Dataset (No NDs) - R1 vs S1

User Selected Options

From File	J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Gamma3 eval\NECR Gamma3 r1s1.wst
Full Precision	OFF
Confidence Coefficient	95%
Null Hypothesis	Site or AOC Concentration Less Than or Equal to Background Concentration (Form 1)
Alternative Hypothesis	Site or AOC Concentration Greater Than Background Concentration

Area of Concern Data: Equivalent Ra-226 (pCi/g)(red water pond road s1)

Background Data: Equivalent Ra-226 (pCi/g)(reference r1)

Raw Statistics

	Site	Background
Number of Valid Observations	22	171
Number of Distinct Observations	22	60
Minimum	2.4	0.3
Maximum	26.8	12.2
Mean	11.66	2.673
Median	11.25	2.4
SD	7.349	1.739
SE of Mean	1.567	0.133

Quantile Test

H0: Site Concentration <= Background Concentration (Form 1)

Approximate R Value (0.057)	6
Approximate K Value (0.057)	3
Number of Site Observations in 'R' Largest	6
Calculated Alpha	N/A

Conclusion with Alpha = 0.057

Reject H0, Conclude Site Concentration > Background Concentration

Outlier Tests for Selected Variables

User Selected Options

From File	J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Gamma3 eval\NECR Gamma3 r1s1.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers with Rosner test	1

Rosner's Outlier Test for Equivalent Ra-226 (pCi/g) (reference r1)

Number of data: 171

Number of suspected outliers: 1

#	Mean	sd	Potential outlier	Test value	Critical value (5%)	Critical value (1%)
1	2.67	1.73	12.2	5.49	3.5578	3.9278

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation 12.2 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation 12.2 is a Potential Statistical Outlier

Dixon's Outlier Test for Equivalent Ra-226 (pCi/g) (red water pond road s1)

Number of data = 22

10% critical value: 0.382

5% critical value: 0.43

1% critical value: 0.514

1. Data Value 26.8 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.206

For 10% significance level, 26.8 is not an outlier.

For 5% significance level, 26.8 is not an outlier.

For 1% significance level, 26.8 is not an outlier.

2. Data Value 2.4 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.056

For 10% significance level, 2.4 is not an outlier.

For 5% significance level, 2.4 is not an outlier.

For 1% significance level, 2.4 is not an outlier.

MWH

BUILDING A BETTER WORLD

MEMORANDUM

SCENARIO 2

Scenario 2 - Equivalent Ra-226 data comparing Areas R2 to Area S2

NORTHING	EASTING	LOCID	SURVEY_DAT	GAMMA	Equivalent Ra-226 (pCi/g)	Reference Area
1696139.0828	2523402.1260	N1-155	RSE	12924	6.8	r2
1696280.6708	2523408.8547	N1-185	RSE	5775	2.3	r2
1696202.0829	2523449.3123	N1-171	RSE	8180	8.0	r2
1696133.5417	2523483.9282	N1-156	RSE	13907	8.3	r2
1696277.0452	2523489.2626	N1-186	RSE	7340	6.0	r2
1696402.4925	2523493.0682	N1-213	RSE	7087	5.4	r2
1696551.4058	2523500.4611	N1-240	RSE	5073	0.3	r2
1696600.2543	2523522.2457	HO-15	SUPP	5492	2.6	r2
1695855.3543	2523553.0822	N1-268	RSE	21443	20.4	r2
1696531.2395	2523561.1157	HO-9	SUPP	5281	2.3	r2
1696341.9186	2523569.2801	N1-286	RSE	6445	3.9	r2
1696479.9067	2523573.5520	N1-292	RSE	5050	0.3	r2
1695854.2251	2523588.3375	N1-311	RSE	20578	19.0	r2
1695925.1106	2523594.8560	N1-270	RSE	10077	2.2	r2
1696063.3652	2523599.5239	N1-273	RSE	6368	3.7	r2
1696200.4066	2523603.1132	N1-280	RSE	18294	15.4	r2
1696602.2977	2523612.6999	HO-16	SUPP	5243	2.3	r2
1695859.2042	2523632.8369	N1-355	SUPP	12476	11.7	r2
1695994.0896	2523637.4179	N1-271	RSE	8904	9.8	r2
1696130.0183	2523639.7301	N1-277	RSE	9384	10.9	r2
1696530.2309	2523640.3559	HO-10	SUPP	6241	3.6	r2
1696269.2001	2523645.4046	N1-283	RSE	8327	8.4	r2
1696408.2536	2523650.8204	N1-289	RSE	5400	1.4	r2
1696460.3899	2523685.1739	HO-8	SUPP	6752	4.2	r2
1696601.1002	2523687.3618	HO-149	SUPP	4846	1.8	r2
1695861.1880	2523703.2671	N1-354	SUPP	10183	8.7	r2
1696530.1807	2523723.1579	HO-11	SUPP	5599	2.7	r2
1696337.5762	2523725.7591	N1-287	RSE	7617	6.7	r2
1696475.4675	2523731.0091	N1-293	RSE	6158	3.2	r2
1695918.8023	2523755.5384	N1-269	RSE	7047	5.3	r2
1696057.7200	2523759.2721	N1-274	RSE	16528	12.5	r2
1696197.1057	2523762.1950	N1-281	RSE	37406	45.9	r2
1696608.4692	2523764.9975	HO-17	SUPP	5222	2.3	r2
1695985.9171	2523794.1780	N1-272	RSE	5967	2.7	r2
1696126.5474	2523796.8390	N1-278	RSE	10609	3.1	r2
1696525.8443	2523800.6154	HO-12	SUPP	5341	2.4	r2
1696264.5326	2523803.0631	N1-284	RSE	8666	9.2	r2
1695861.0751	2523803.2487	N1-353	SUPP	8868	7.0	r2
1696402.7632	2523807.5771	N1-290	RSE	6467	3.9	r2
1696053.8601	2523808.9830	N1-275	RSE	6410	3.8	r2
1696601.5618	2523849.2177	HO-18	SUPP	5546	2.7	r2
1696530.5017	2523879.1999	HO-148	SUPP	5697	2.9	r2
1696193.1046	2523880.2918	N1-282	RSE	8298	8.3	r2
1696331.9110	2523886.6040	N1-288	RSE	27874	30.7	r2
1696469.2483	2523891.9763	N1-294	RSE	6353	3.6	r2
1696049.9303	2523905.0868	N1-276	RSE	5614	1.9	r2
1696597.9025	2523927.4231	HO-19	SUPP	4669	1.5	r2
1696323.6795	2523964.1445	N1-296	RSE	20349	18.6	r2
1696257.9956	2523964.6454	N1-285	RSE	6452	3.9	r2
1696527.8668	2523967.3749	HO-13	SUPP	6004	3.3	r2
1696393.2090	2523967.6553	N1-291	RSE	14088	8.6	r2
1696465.6634	2523969.3676	N1-300	RSE	6387	3.7	r2
1696596.8228	2524005.8130	HO-20	SUPP	6115	3.4	r2
1696531.9957	2524009.4148	N1-302	RSE	6428	3.8	r2
1696604.6148	2524032.3910	N1-303	RSE	5243	1.0	r2
1696070.3149	2523857.4809	N1-357	SUPP	55680	1.8	r2
1695843.4819	2523879.2739	N1-352	SUPP	7705	5.5	s2
1695910.4983	2523897.3545	N1-310	RSE	6602	4.2	s2

Scenario 2 - Equivalent Ra-226 data comparing Areas R2 to Area S2

NORTHING	EASTING	LOCID	SURVEY_DAT	GAMMA	Equivalent Ra-226 (pCi/g)	Reference Area
1695984.6960	2523938.3217	N1-309	RSE	5799	2.3	s2
1696048.4175	2523976.7508	N1-308	RSE	6076	3.0	s2
1695842.9565	2523978.7251	HO-1	SUPP	13800	13.4	s2
1696109.2062	2524000.4809	N1-356	SUPP	5568	2.7	s2
1695909.6391	2524002.0259	HO-2	SUPP	8143	6.0	s2
1696124.7711	2524033.0614	N1-350	RSE	5860	2.5	s2
1695977.0511	2524050.0631	HO-3	SUPP	6785	4.3	s2
1696184.3169	2524054.0359	N1-351	RSE	6835	4.8	s2
1696253.6105	2524078.1060	N1-295	RSE	7101	5.4	s2
1696048.3149	2524089.4613	HO-4	SUPP	5842	3.1	s2
1696319.4503	2524095.0271	N1-297	RSE	8397	8.5	s2
1696599.9394	2524102.1515	N1-304	RSE	8326	8.4	s2
1696391.8075	2524104.2509	N1-298	RSE	8367	8.5	s2
1696531.4170	2524110.4368	N1-301	RSE	12180	5.6	s2
1696460.2689	2524114.6014	N1-299	RSE	24537	25.4	s2
1696141.2178	2524129.2453	HO-146	SUPP	8176	6.1	s2
1696243.4281	2524175.9179	HO-5	SUPP	10436	9.0	s2
1696324.7241	2524176.9654	HO-6	SUPP	9805	8.2	s2
1696602.4717	2524183.1347	HO-150	SUPP	26529	29.9	s2
1696462.6587	2524188.0379	HO-147	SUPP	24617	27.5	s2
1696394.5915	2524200.0258	HO-7	SUPP	7930	5.8	s2
1696527.7237	2524208.8070	HO-14	SUPP	10488	9.1	s2

From File: J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Gamma4 eval\NECR gamma4 r2s2.wst

Summary Statistics for Raw Full Data Sets

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
Equivalent Ra-226 (pCi/g) (reference r2)	56	0.3	45.9	6.788	3.8	60.9	7.804	2.891	3.088	11.94	1.15
Equivalent Ra-226 (pCi/g) (red water pond road s2)	24	2.3	29.9	8.717	5.9	60.51	7.779	3.855	1.954	2.916	0.892

Wilcoxon-Mann-Whitney Test for Full Data Sets without NDs - Area R2 vs Area S2

User Selected Options

From File	J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Gamma4 eval\NECR gamma4 r2s2.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Equivalent Ra-226 (pCi/g)(red water pond road s2)
Background Data: Equivalent Ra-226 (pCi/g)(reference r2)

Raw Statistics

	Site	Background
Number of Valid Observations	24	56
Number of Distinct Observations	23	43
Minimum	2.3	0.3
Maximum	29.9	45.9
Mean	8.717	6.788
Median	5.9	3.8
SD	7.779	7.804
SE of Mean	1.588	1.043

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	1160
WMW Test U-Stat	1.969
WMW Critical Value (0.050)	1.645
P-Value	0.0245

Conclusion with Alpha = 0.05
Reject H0, Conclude Site > Background
P-Value < alpha (0.05)

Non-parametric Quantile Hypothosis Test for Full Dataset (No NDs) - Area R2 vs Area S2

User Selected Options

From File	J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Gamma4 eval\NECR gamma4 r2s2.wst
Full Precision	OFF
Confidence Coefficient	95%
Null Hypothesis	Site or AOC Concentration Less Than or Equal to Background Concentration (Form 1)
Alternative Hypothesis	Site or AOC Concentration Greater Than Background Concentration

Area of Concern Data: Equivalent Ra-226 (pCi/g)(red water pond road s2)
Background Data: Equivalent Ra-226 (pCi/g)(reference r2)

Raw Statistics

	Site	Background
Number of Valid Observations	24	56
Number of Distinct Observations	23	43
Minimum	2.3	0.3
Maximum	29.9	45.9
Mean	8.717	6.788
Median	5.9	3.8
SD	7.779	7.804
SE of Mean	1.588	1.043

Quantile Test

H0: Site Concentration <= Background Concentration (Form 1)

Approximate R Value (0.058)	8
Approximate K Value (0.058)	5
Number of Site Observations in 'R' Largest	3
Calculated Alpha	0.0485

Conclusion with Alpha = 0.058
Do Not Reject H0, Perform Wilcoxon-Mann-Whitney Ranked Sum

Outlier Tests for Selected Variables

User Selected Options

From File	J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Gamma4 eval\NECR gamma4 r2s2.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers with Rosner test	1

Rosner's Outlier Test for Equivalent Ra-226 (pCi/g) (reference r2)

Number of data: 56
Number of suspected outliers: 1

#	Mean	sd	Potential outlier	Test value	Critical value (5%)	Critical value (1%)
1	6.79	7.73	45.9	5.06	3.172	3.528

For 5% Significance Level, there is 1 Potential Outlier
Therefore, Observation 45.9 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier
Therefore, Observation 45.9 is a Potential Statistical Outlier

Dixon's Outlier Test for Equivalent Ra-226 (pCi/g) (red water pond road s2)

Number of data = 24
10% critical value: 0.367
5% critical value: 0.413
1% critical value: 0.497

1. Data Value 29.9 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.165

For 10% significance level, 29.9 is not an outlier.
For 5% significance level, 29.9 is not an outlier.
For 1% significance level, 29.9 is not an outlier.

2. Data Value 2.3 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.017

For 10% significance level, 2.3 is not an outlier.
For 5% significance level, 2.3 is not an outlier.
For 1% significance level, 2.3 is not an outlier.

MWH

BUILDING A BETTER WORLD

MEMORANDUM

SCENARIO 3

Scenario 3 - Surface Soil Ra-226 data comparing soil data north R1 vs S1

Point	Sample ID	Ra-226 Conc (pCi/g)	Area Code
1	HO-451	1.1	Reference
2	HO-461	1.2	Reference
3	H0-458	1.4	Reference
4	HO-462	1.7	Reference
5	HO-456	1.8	Reference
6	HO-460	1.9	Reference
7	HO-430	2.9	Survey
8	HO-453	3.2	Reference
9	HO-432	3.4	Reference
10	HO-452	4.1	Reference
11	HO-429	4.6	Survey
12	HO-448	17.1	Survey
13	HO-449	17.1	Reference
14	HO-431	18.7	Survey
15	HO-433	28.5	Survey
16	HO-459	2.5	Reference
17	HO-463	4.8	Reference
18	HO-457	4.4	Reference
19	HO-455	9.5	Reference
20	HO-454	26.6	Reference
21	HO-450	0.9	Reference
22	HO-447	2.5	Reference
23	HO-445	1.3	Reference
24	HO-444	2.9	Reference
25	HO-439	0.9	Reference
26	HO-442	1.5	Reference
27	HO-446	1.7	Reference
28	NECR1-262	1.4	Reference
29	HO-441	0.7	Reference
30	HO-438	1.3	Reference

From File: J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Soil ra226 eval2\NECR soil data north.wst

Summary Statistics for Raw Full Data Sets

Variable	NumObs	Minimum	Maximum	Mean	Median	Variance	SD	MAD/0.675	Skewness	Kurtosis	CV
Ra-226 Conc (pCi/g) (reference)	25	0.7	26.6	3.992	1.8	34.19	5.848	1.038	3.101	9.972	1.465
Ra-226 Conc (pCi/g) (red wate pond road)	5	2.9	28.5	14.36	17.1	113.2	10.64	16.9	0.171	-1.495	0.741

Wilcoxon-Mann-Whitney Comparison Test for Full Data Sets without NDs - Soil Data North

User Selected Options

From File	J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Soil ra226 eval2\NECR soil data north.wst
Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Ra-226 Conc (pCi/g)(red wate pond road)

Background Data: Ra-226 Conc (pCi/g)(reference)

Raw Statistics

	Site	Background
Number of Valid Observations	5	25
Number of Distinct Observations	5	20
Minimum	2.9	0.7
Maximum	28.5	26.6
Mean	14.36	3.992
Median	17.1	1.8
SD	10.64	5.848
SE of Mean	4.759	1.17

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	125
WMW Test U-Stat	110
WMW Critical Value (0.050)	99
Approximate P-Value	0.00446

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background

Non-parametric Quantile Hypothosis Test for Full Dataset (No NDs) - Soil Data North

User Selected Options

From File	J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Soil ra226 eval2\NECR soil data north.wst
Full Precision	OFF
Confidence Coefficient	95%
Null Hypothesis	Site or AOC Concentration Less Than or Equal to Background Concentration (Form 1)
Alternative Hypothesis	Site or AOC Concentration Greater Than Background Concentration

Area of Concern Data: Ra-226 Conc (pCi/g)(red wate pond road)

Background Data: Ra-226 Conc (pCi/g)(reference)

Raw Statistics

	Site	Background
Number of Valid Observations	5	25
Number of Distinct Observations	5	20
Minimum	2.9	0.7
Maximum	28.5	26.6
Mean	14.36	3.992
Median	17.1	1.8
SD	10.64	5.848
SE of Mean	4.759	1.17

Quantile Test

H0: Site Concentration <= Background Concentration (Form 1)

Approximate R Value (0.041)	6
Approximate K Value (0.041)	3
Number of Site Observations in 'R' Largest	3
Calculated Alpha	0.0413

Conclusion with Alpha = 0.041

Reject H0, Conclude Site Concentration > Background Concentration

Outlier Tests for Selected Variables

User Selected Options

From File	J:\1004747 UNC NE Church Rock\Data Repository\Rank Sum Tests - Red Water Pond Rd\Soil ra226 eval2\NECR soil data north.wst
Full Precision	OFF
Test for Suspected Outliers with Dixon test	1
Test for Suspected Outliers with Rosner test	1

Rosner's Outlier Test for Ra-226 Conc (pCi/g) (reference)

Number of data: 25

Number of suspected outliers: 1

#	Mean	sd	Potential outlier	Test value	Critical value (5%)	Critical value (1%)
1	3.99	5.73	26.6	3.95	2.82	3.14

For 5% Significance Level, there is 1 Potential Outlier

Therefore, Observation 26.6 is a Potential Statistical Outlier

For 1% Significance Level, there is 1 Potential Outlier

Therefore, Observation 26.6 is a Potential Statistical Outlier

on's Outlier Test for Ra-226 Conc (pCi/g) (red wate pond road)

Number of data = 5

10% critical value: 0.557

5% critical value: 0.642

1% critical value: 0.78

1. Data Value 28.5 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.383

For 10% significance level, 28.5 is not an outlier.

For 5% significance level, 28.5 is not an outlier.

For 1% significance level, 28.5 is not an outlier.

2. Data Value 2.9 is a Potential Outlier (Lower Tail)?

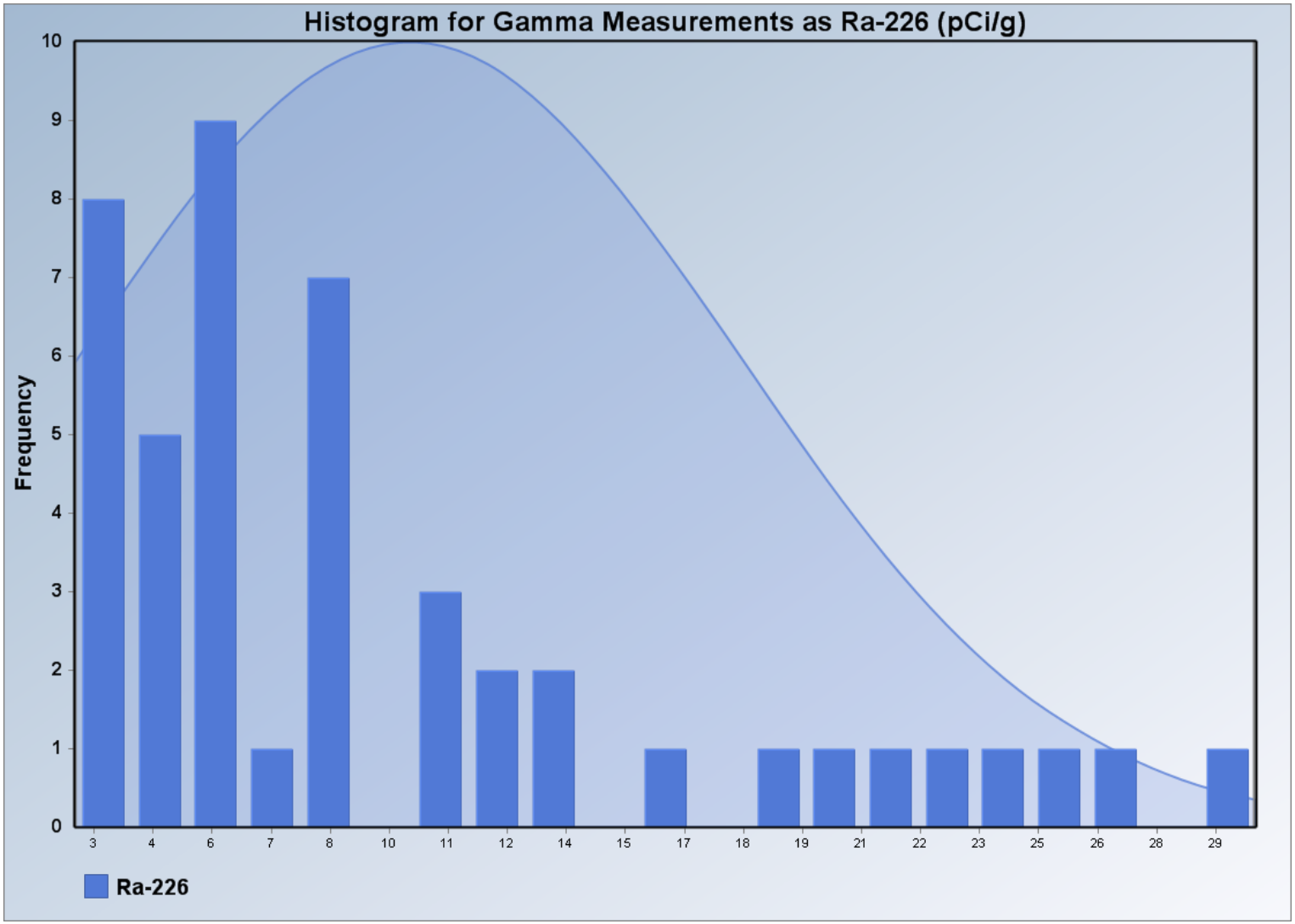
Test Statistic: 0.066

For 10% significance level, 2.9 is not an outlier.

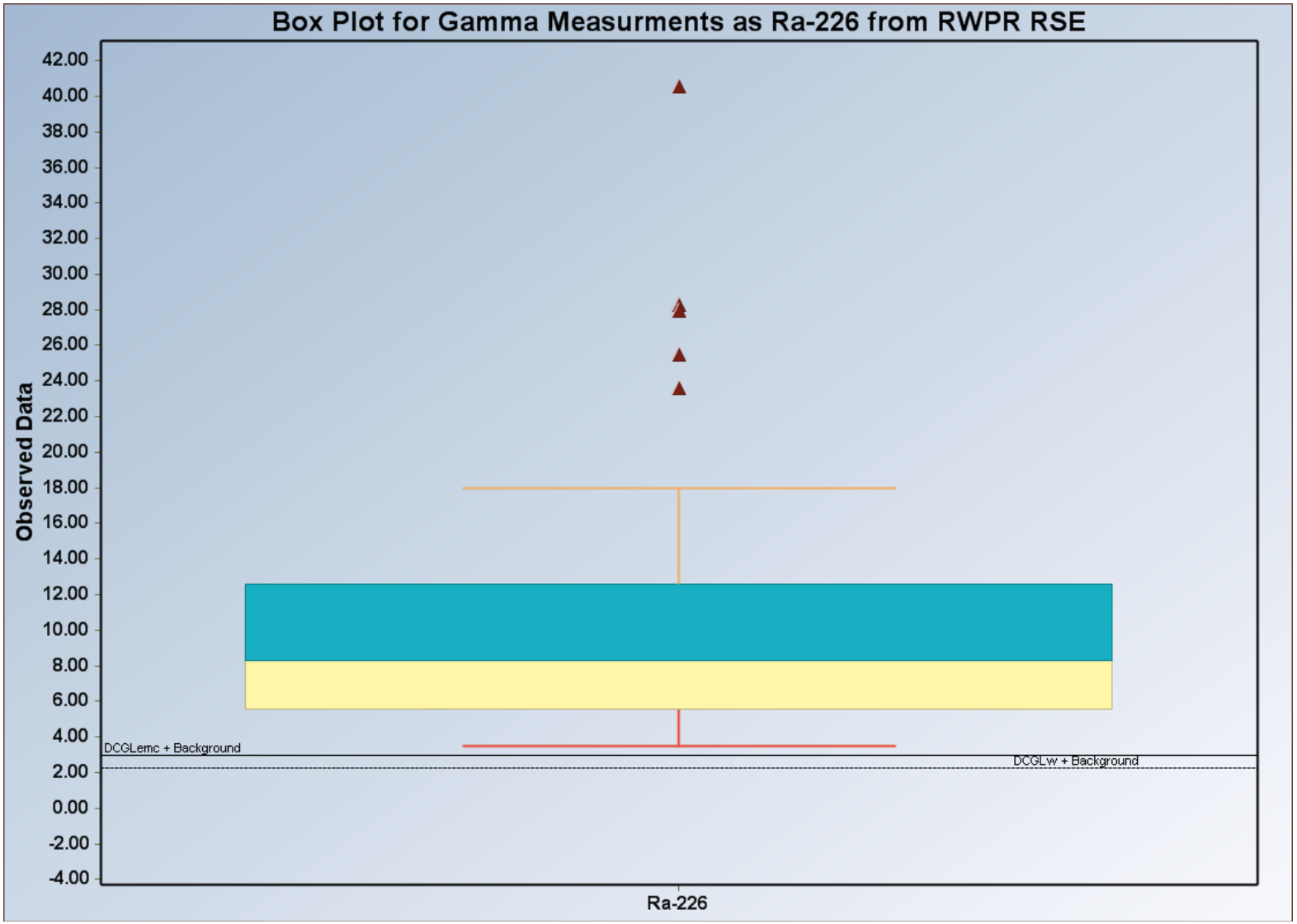
For 5% significance level, 2.9 is not an outlier.

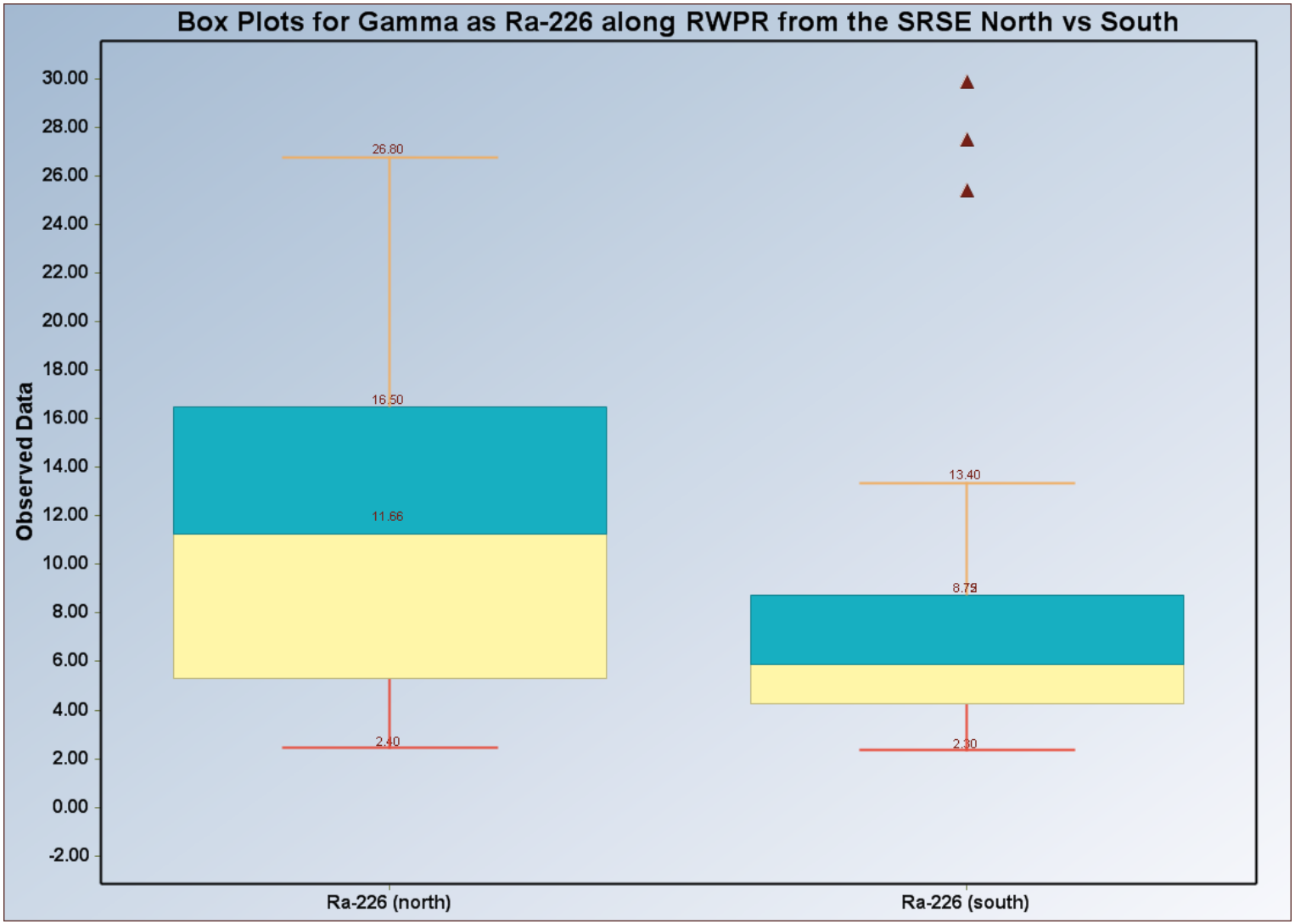
STATISTICAL PLOTS

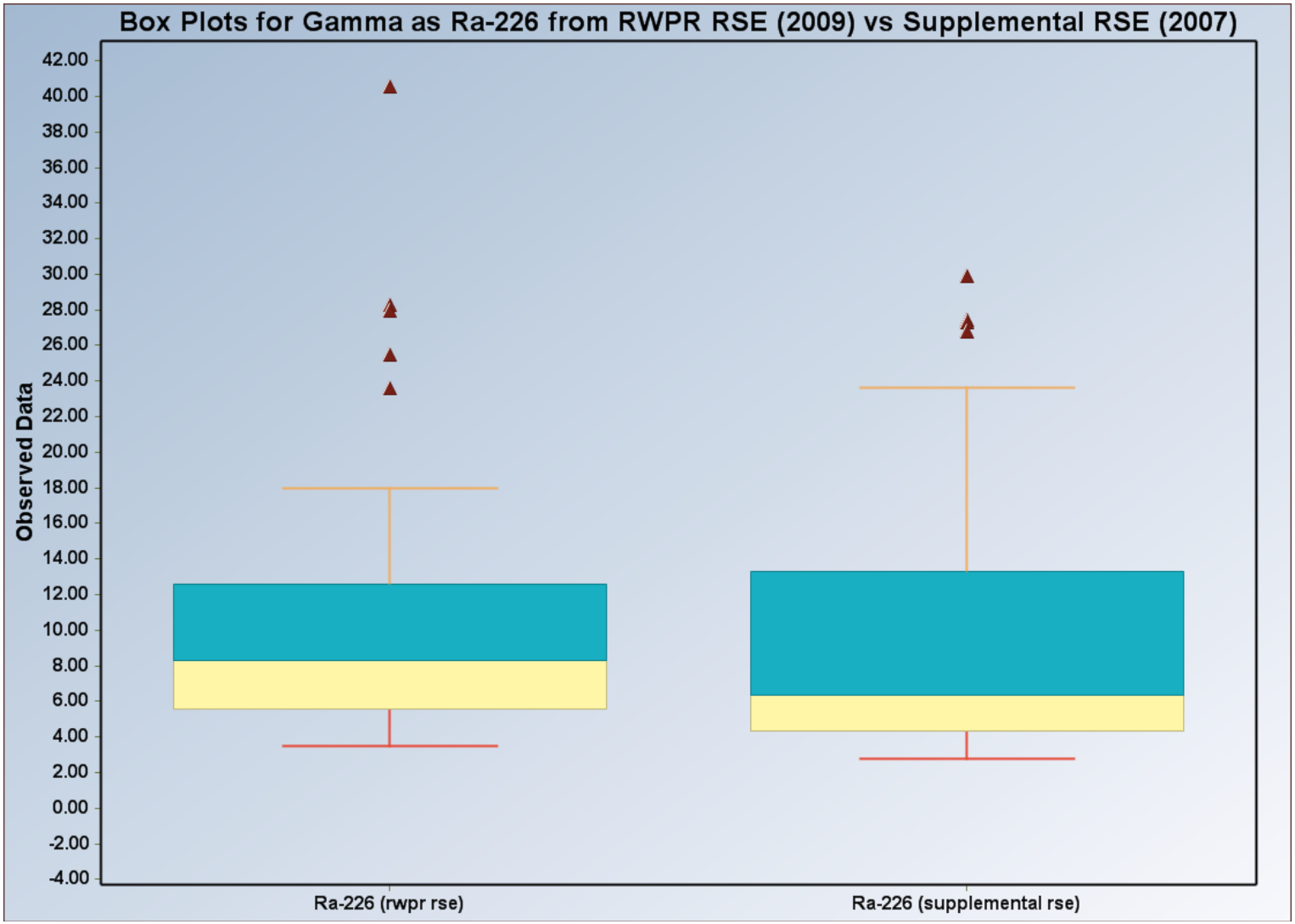
STATIC GAMMA RADIATION MEASUREMENTS

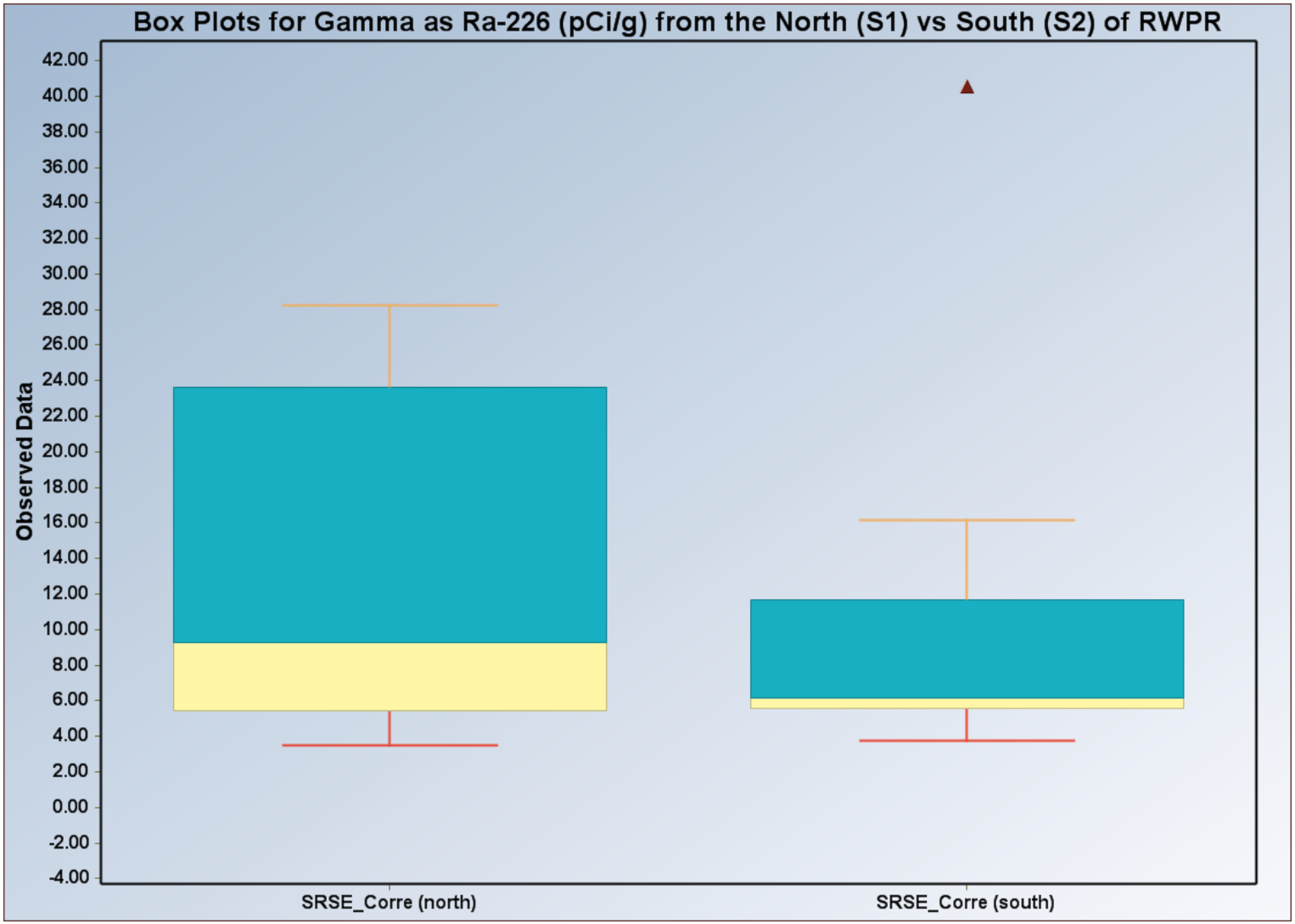


Static Gamma Measurements as Ra-226 from the RWPR RSE

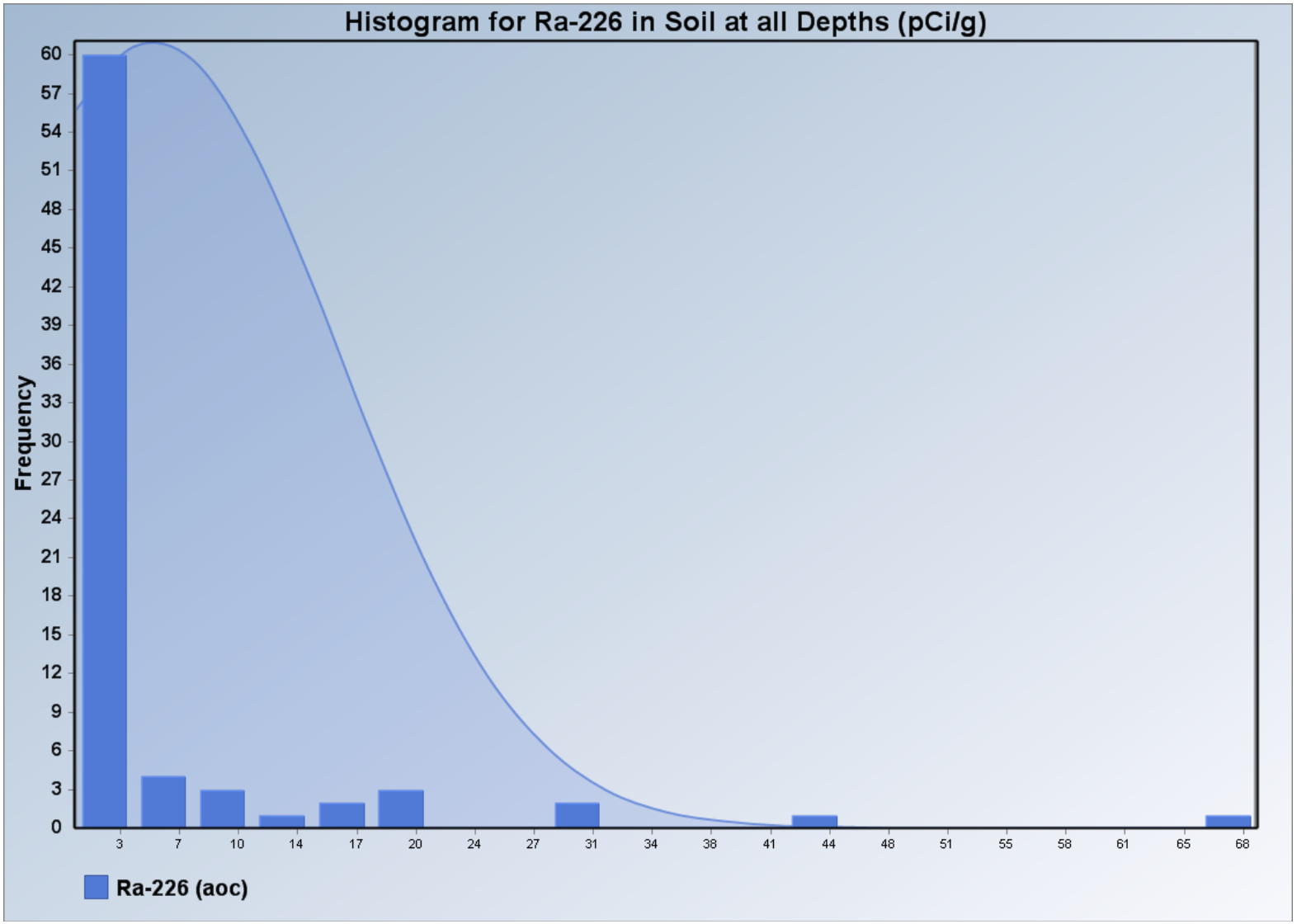

Box Plot for Gamma Measurments as Ra-226 from RWPR RSE
Observed Data
42.00
40.00
38.00
36.00
34.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
DCGLemc + Background
DCGLw + Background
Ra-226

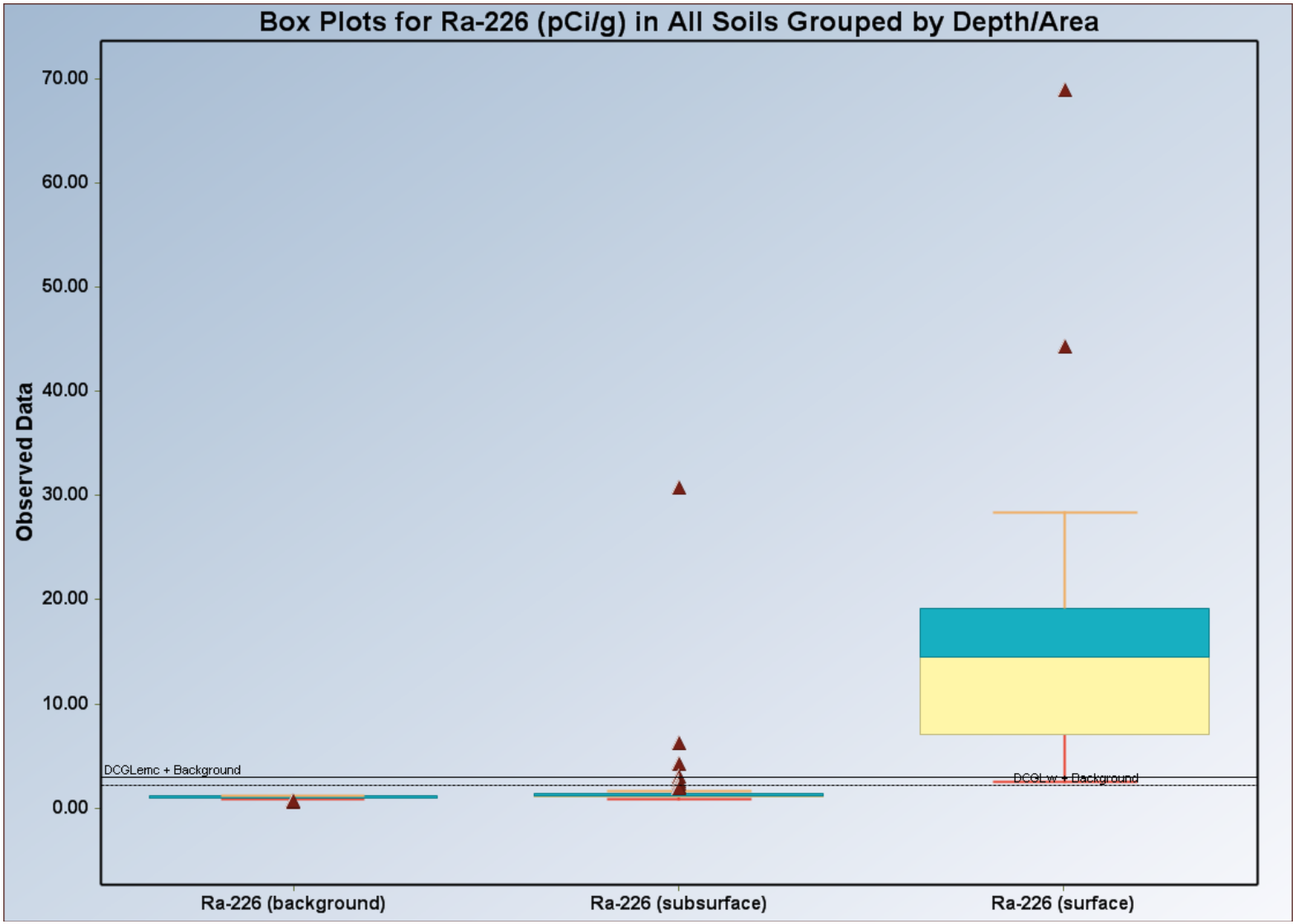

Box Plots for Gamma as Ra-226 along RWPR from the SRSE North vs South
Observed Data
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
26.80
16.50
11.66
2.40
13.40
8.79
2.30
Ra-226 (north)
Ra-226 (south)


Box Plots for Gamma as Ra-226 from RWPR RSE (2009) vs Supplemental RSE (2007)
Observed Data
42.00
40.00
38.00
36.00
34.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
Ra-226 (rwpr rse)
Ra-226 (supplemental rse)

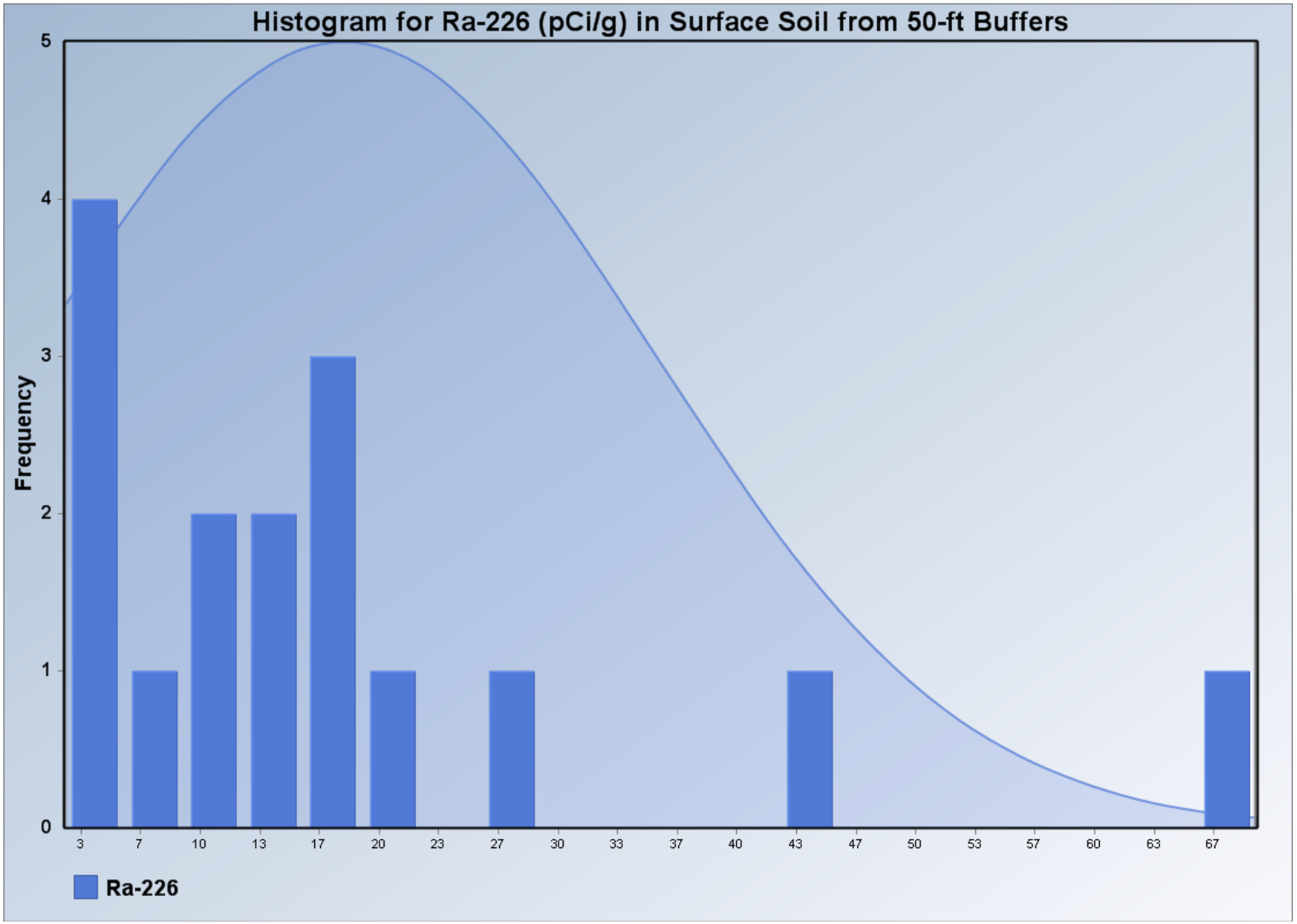

Box Plots for Gamma as Ra-226 (pCi/g) from the North (S1) vs South (S2) of RWPR
Observed Data
42.00
40.00
38.00
36.00
34.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
SRSE_Corre (north)
SRSE_Corre (south)

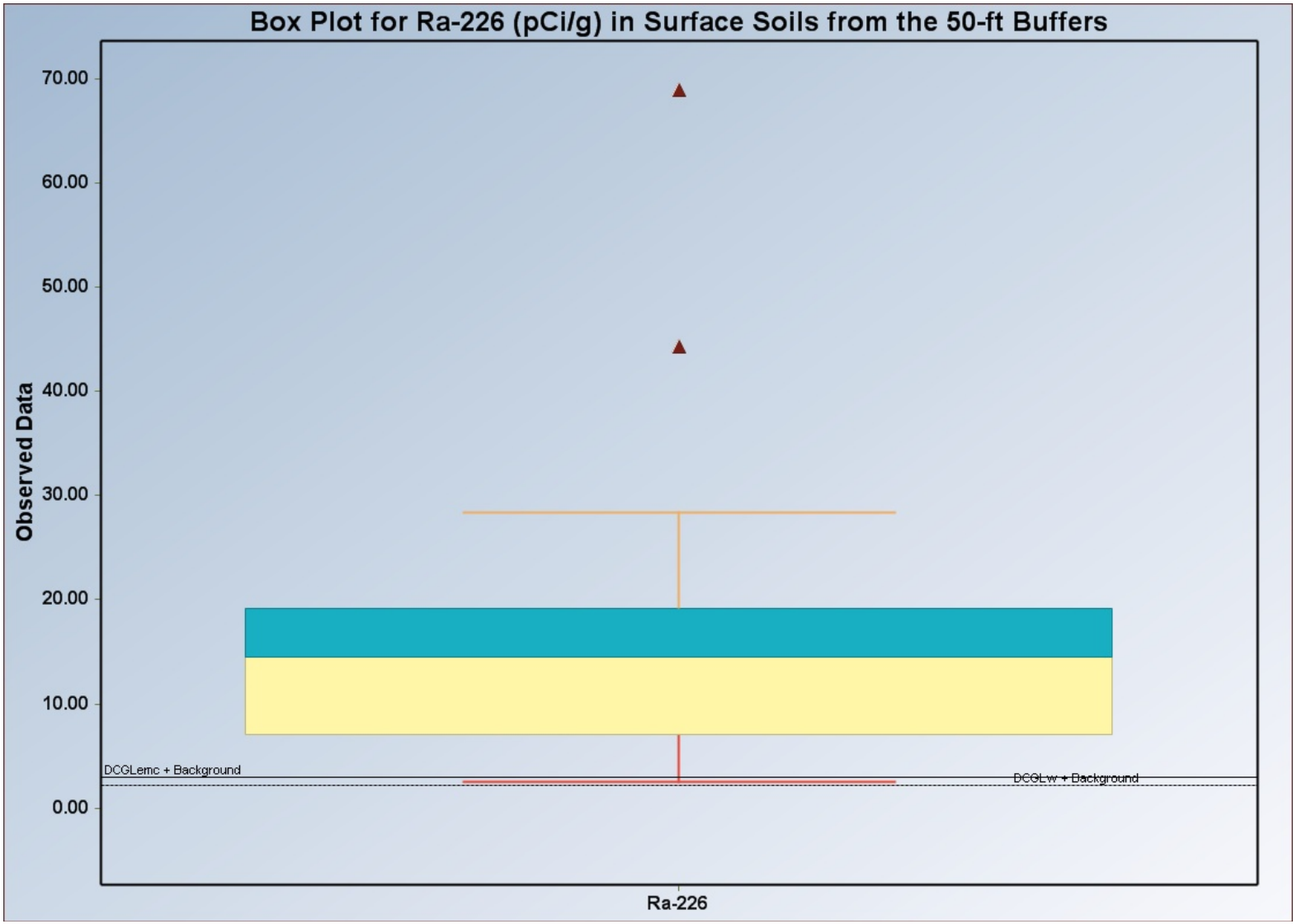
SOIL SAMPLES FROM ALL DEPTHS

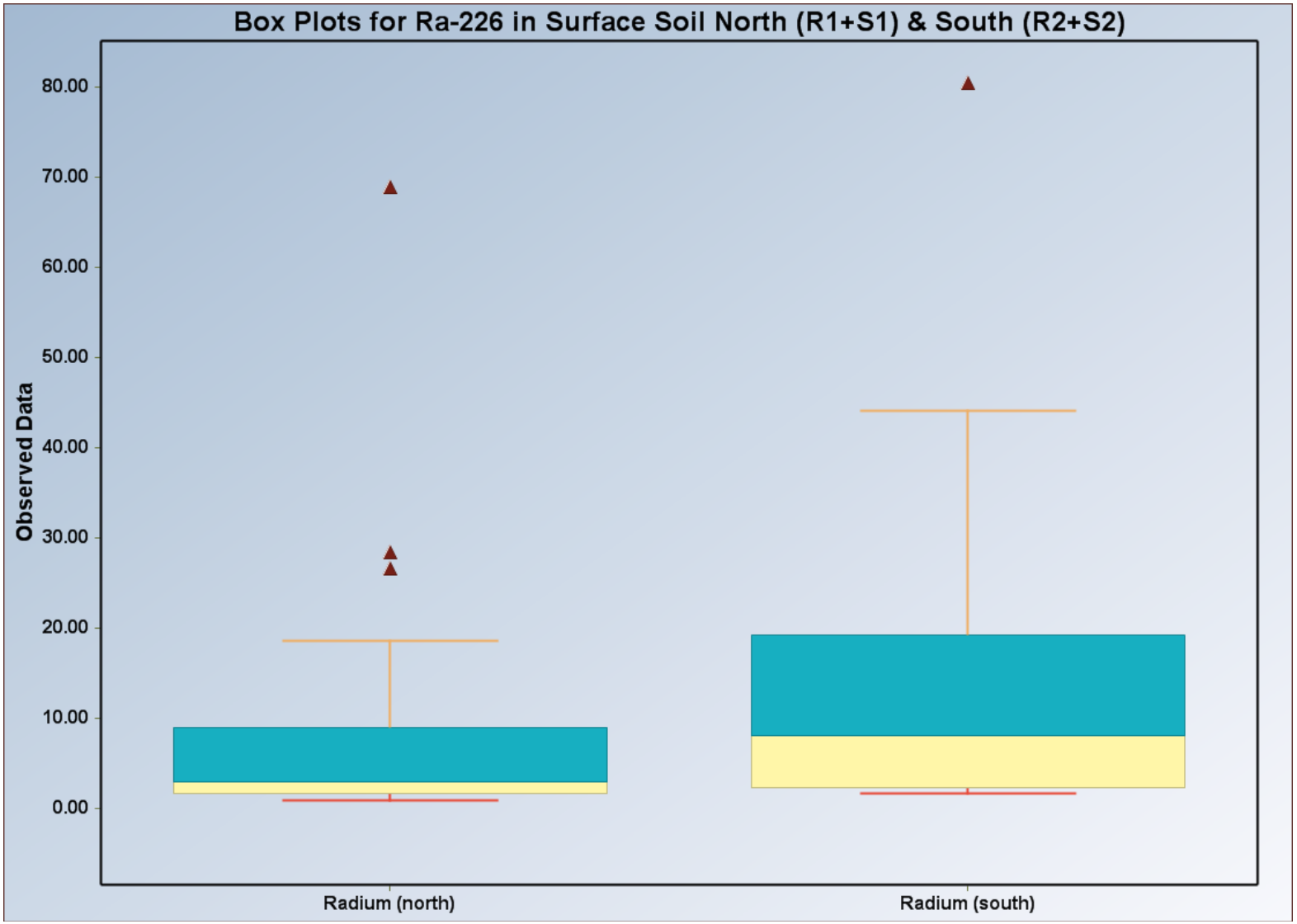

Histogram for Ra-226 in Soil at all Depths (pCi/g)
Frequency
60
57
54
51
48
45
42
39
36
33
30
27
24
21
18
15
12
9
6
3
0
3
7
10
14
17
20
24
27
31
34
38
41
44
48
51
55
58
61
65
68
Ra-226 (aoc)

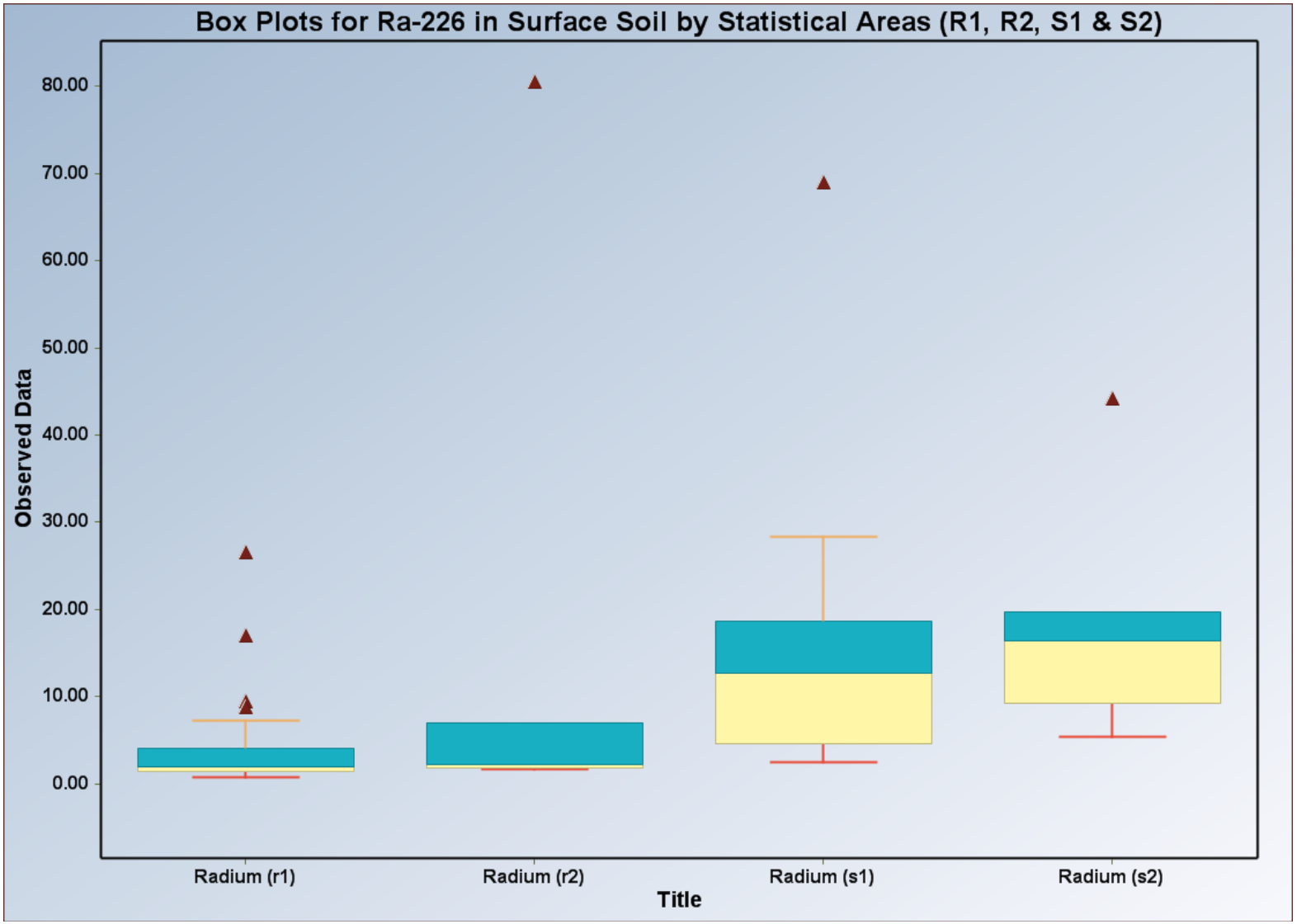

Box Plots for Ra-226 (pCi/g) in All Soils Grouped by Depth/Area
Observed Data
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DCGLemc + Background
DCGLw + Background
Ra-226 (background)
Ra-226 (subsurface)
Ra-226 (surface)

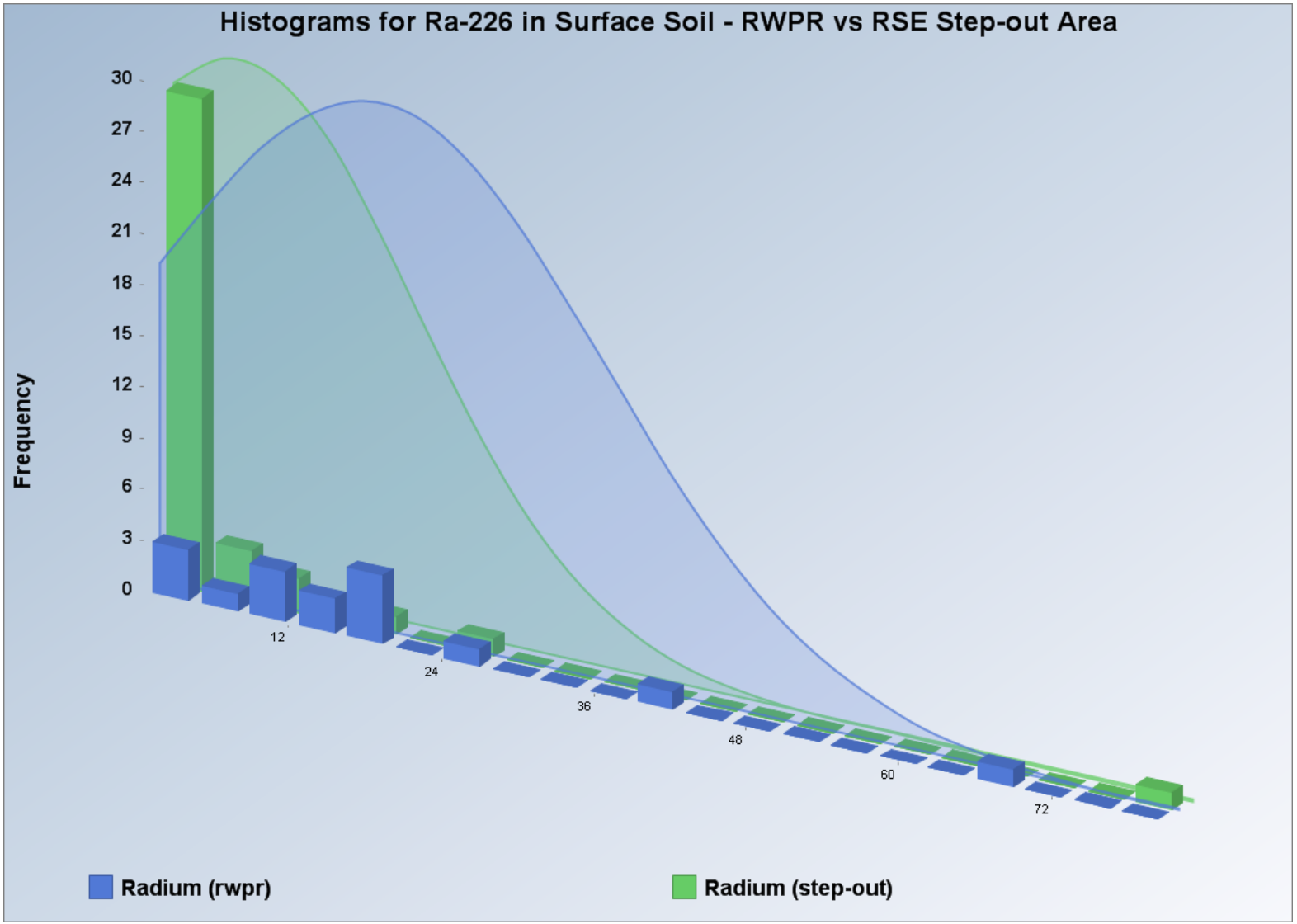
SURFACE SOIL SAMPLES WITHIN 50-FOOT BUFFERS


Histogram for Ra-226 (pCi/g) in Surface Soil from 50-ft Buffers
Frequency
0
1
2
3
4
5
3
7
10
13
17
20
23
27
30
33
37
40
43
47
50
53
57
60
63
67
Ra-226

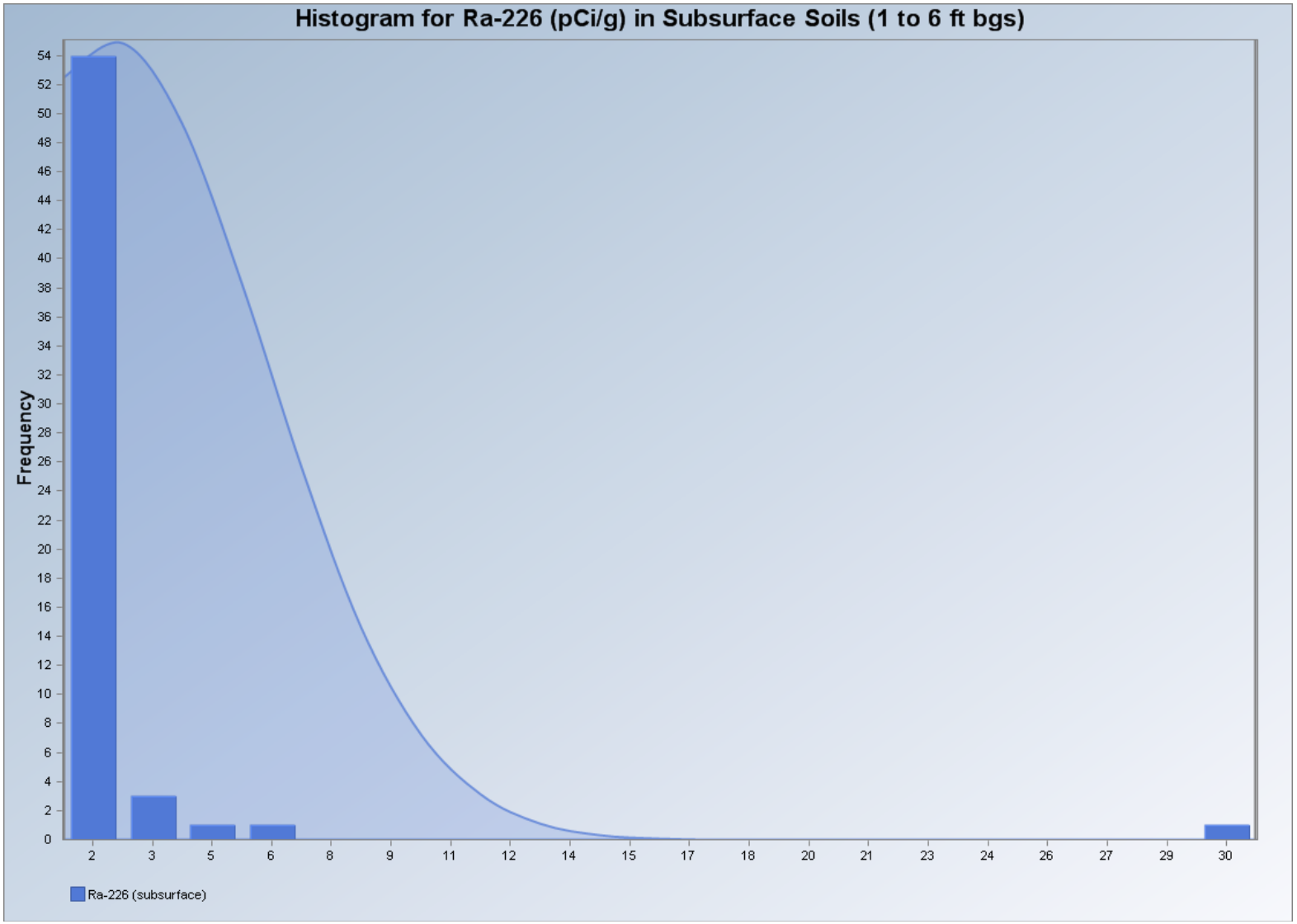

Box Plot for Ra-226 (pCi/g) in Surface Soils from the 50-ft Buffers
Observed Data
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
DCGLemc + Background
DCGLw + Background
Ra-226

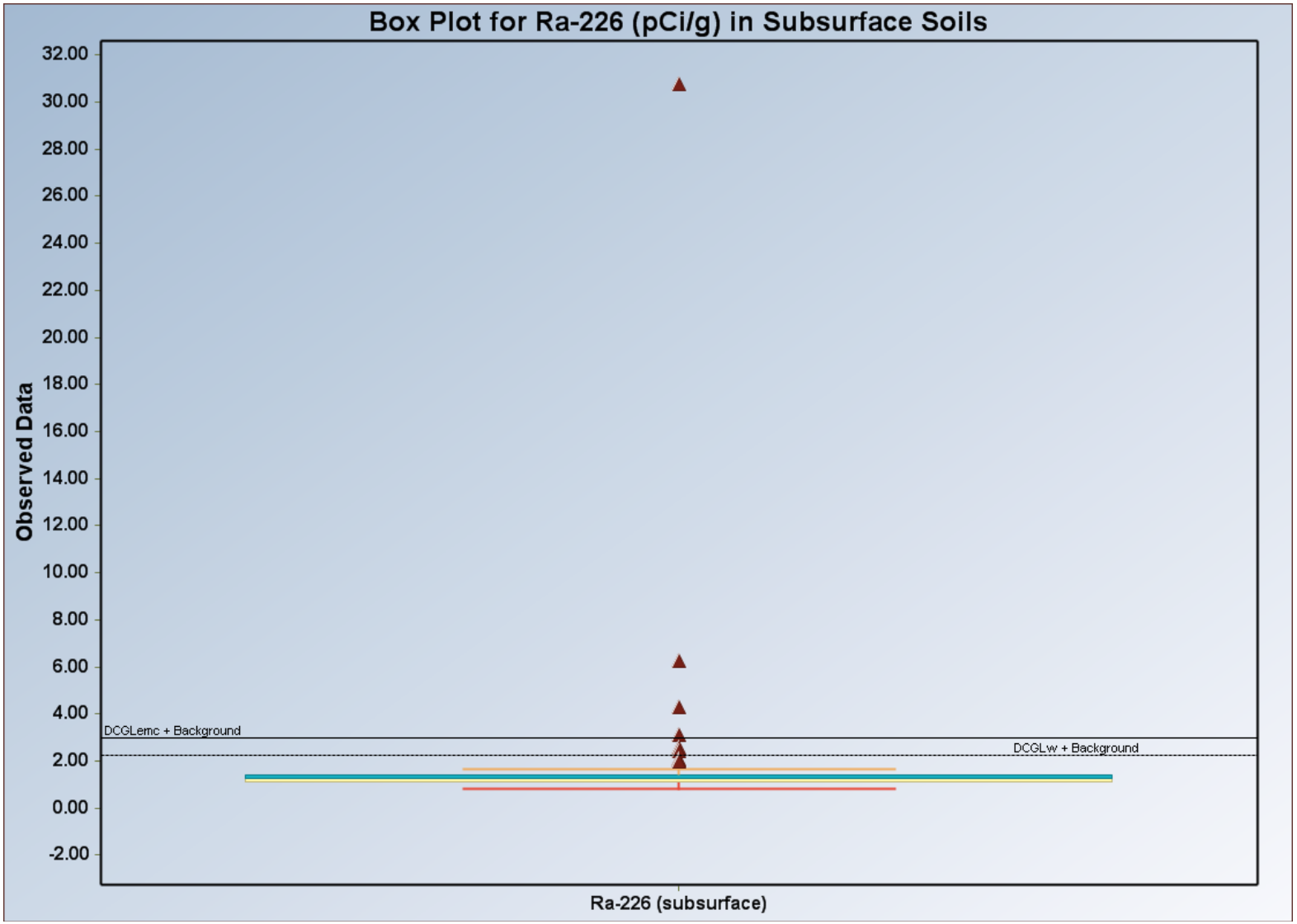

Box Plots for Ra-226 in Surface Soil North (R1+S1) & South (R2+S2)
Observed Data
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Radium (north)
Radium (south)

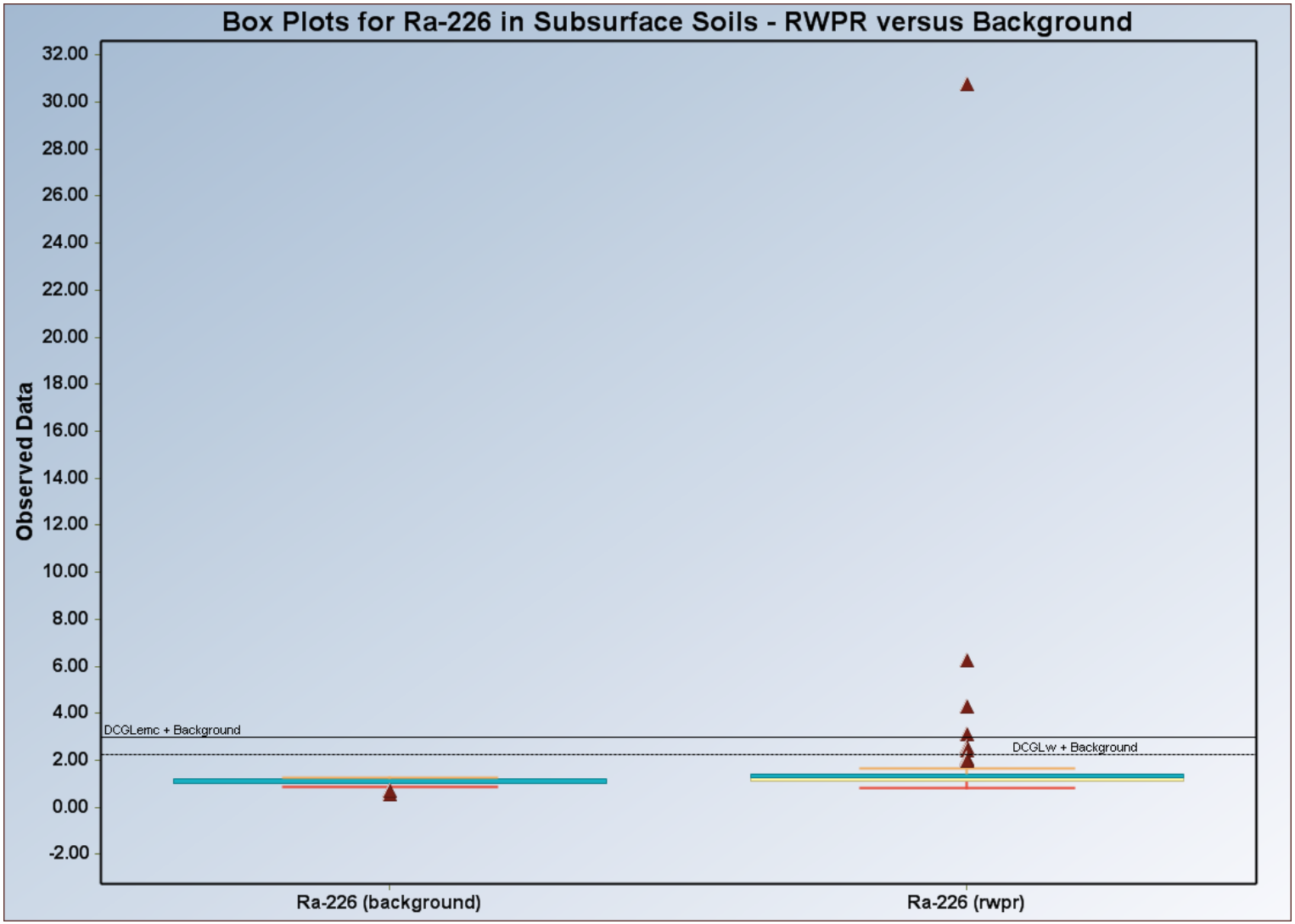

Box Plots for Ra-226 in Surface Soil by Statistical Areas (R1, R2, S1 & S2)
Observed Data
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Radium (r1)
Radium (r2)
Radium (s1)
Radium (s2)
Title


Histograms for Ra-226 in Surface Soil - RWPR vs RSE Step-out Area
Frequency
30
27
24
21
18
15
12
9
6
3
0
12
24
36
48
60
72
Radium (rwpr)
Radium (step-out)

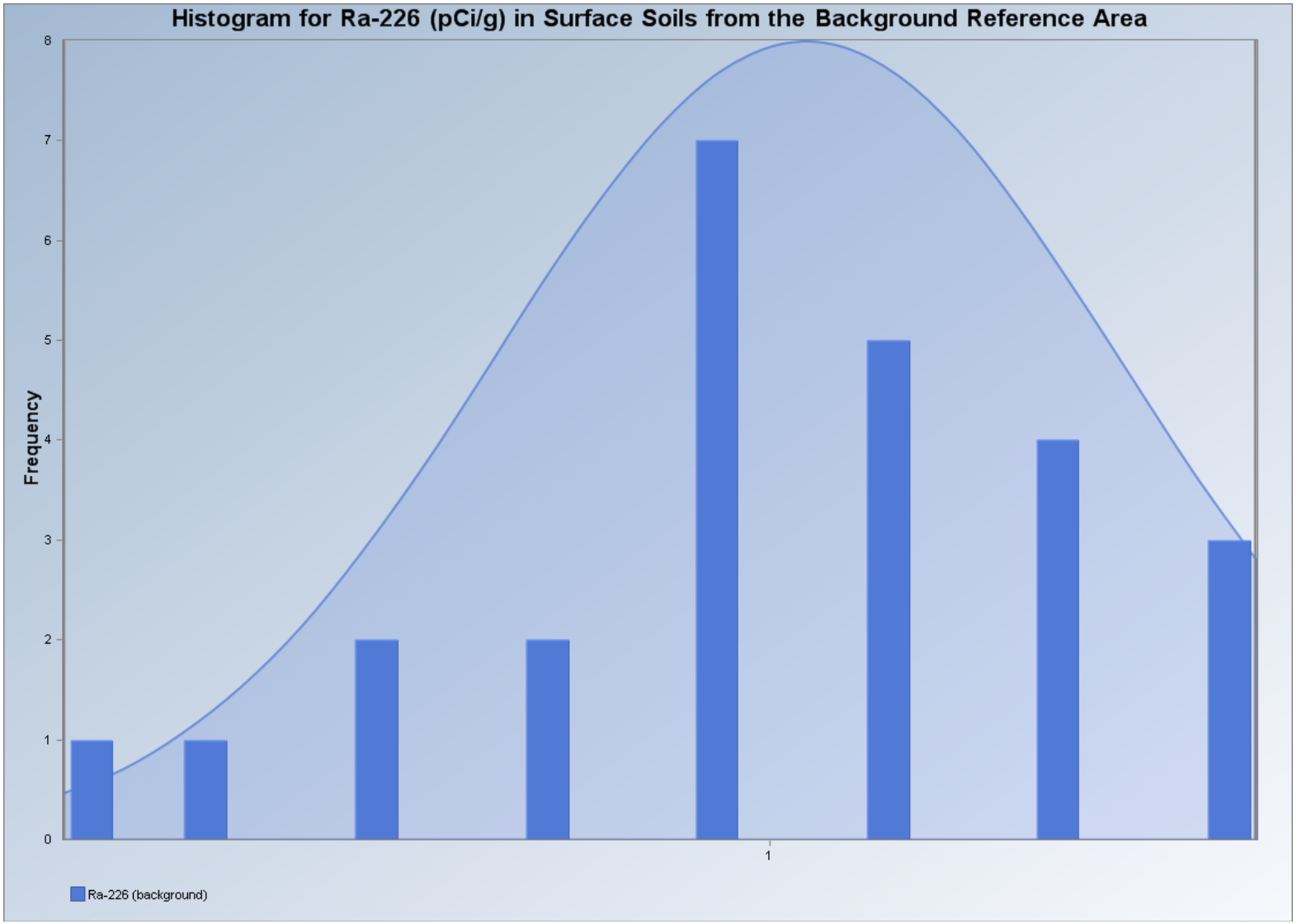
SUBSURFACE SOIL SAMPLES

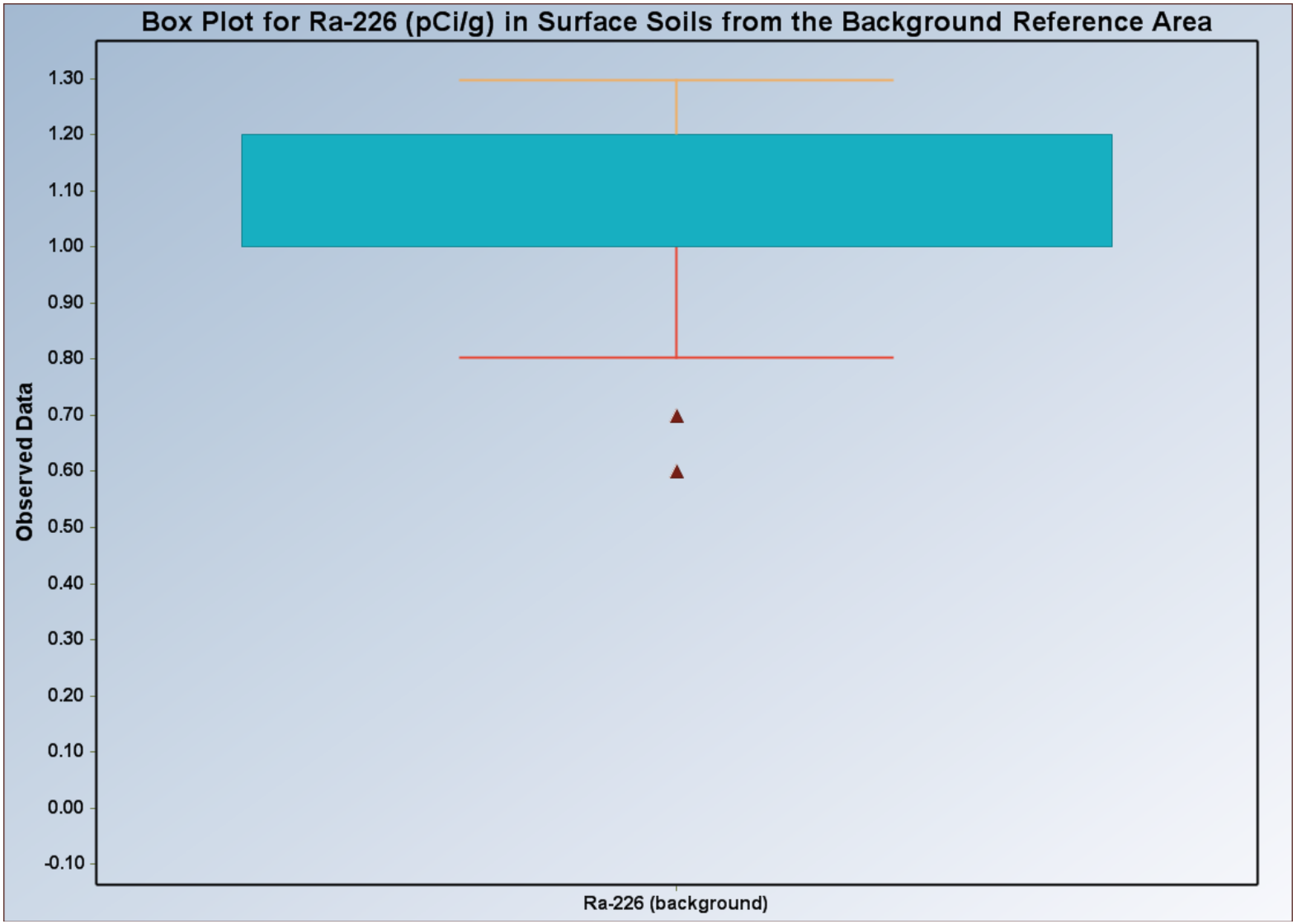

Histogram for Ra-226 (pCi/g) in Subsurface Soils (1 to 6 ft bgs)
Frequency
54
52
50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
2
3
5
6
8
9
11
12
14
15
17
18
20
21
23
24
26
27
29
30
Ra-226 (subsurface)


Box Plot for Ra-226 (pCi/g) in Subsurface Soils
Observed Data
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
DCGLemc + Background
DCGLw + Background
Ra-226 (subsurface)


Box Plots for Ra-226 in Subsurface Soils - RWPR versus Background
Observed Data
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
DCGLemc + Background
DCGLw + Background
Ra-226 (background)
Ra-226 (rwpr)

SURFACE SOIL SAMPLES FROM THE BACKGROUND REFERENCE AREA


Histogram for Ra-226 (pCi/g) in Surface Soils from the Background Reference Area
Frequency
0
1
2
3
4
5
6
7
8
1
Ra-226 (background)


Box Plot for Ra-226 (pCi/g) in Surface Soils from the Background Reference Area
Observed Data
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
Ra-226 (background)

STATISTICAL HYPOTHESIS TEST RESULTS

Wilcoxon-Mann-Whitney Site vs Background Comparison Test for Full Data Sets without NDs

User Selected Options

Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference	0
Selected Null Hypothesis	Site or AOC Mean/Median Less Than or Equal to Background Mean/Median (Form 1)
Alternative Hypothesis	Site or AOC Mean/Median Greater Than Background Mean/Median

Area of Concern Data: Red Water Pond Rd.
Background Data: NECR-1 Step-out Area

Raw Statistics

	Site	Background
Number of Valid Observations	16	37
Number of Distinct Observations	15	27
Minimum	2.38	0.7
Maximum	69	80.5
Mean	18.04	5.997
Median	14.5	2
SD	17.25	13.54
SE of Mean	4.313	2.226

Wilcoxon-Mann-Whitney (WMW) Test

H0: Mean/Median of Site or AOC <= Mean/Median of Background

Site Rank Sum W-Stat	651.5
WMW Test U-Stat	4.243
WMW Critical Value (0.050)	1.645
P-Value	1.10E-05

Conclusion with Alpha = 0.05

Reject H0, Conclude Site > Background
P-Value < alpha (0.05)

Non-parametric Quantile Hypothosis Test for Full Dataset (No NDs)

User Selected Options

Full Precision	OFF
Confidence Coefficient	95%
Null Hypothesis	Site or AOC Concentration Less Than or Equal to Background Concentration (Form 1)
Alternative Hypothesis	Site or AOC Concentration Greater Than Background Concentration

Area of Concern Data: Red Water Pond Rd.
Background Data: NECR-1 Step-out Area

Raw Statistics

	Site	Background
Number of Valid Observations	16	37
Number of Distinct Observations	15	27
Minimum	2.38	0.7
Maximum	69	80.5
Mean	18.04	5.997
Median	14.5	2
SD	17.25	13.54
SE of Mean	4.313	2.226

Quantile Test

H0: Site Concentration <= Background Concentration (Form 1)

Approximate R Value (0.058)	6
Approximate K Value (0.058)	4
Number of Site Observations in 'R' Largest	4
Calculated Alpha	0.0602

Conclusion with Alpha = 0.058

Reject H0, Conclude Site Concentration > Background Concentration

t-Test Site vs Background Comparison for Full Data Sets without NDs

User Selected Options

Full Precision	OFF
Confidence Coefficient	95%
Substantial Difference (S)	0
Selected Null Hypothesis	Site or AOC Mean Less Than or Equal to Background Mean (Form 1)
Alternative Hypothesis	Site or AOC Mean Greater Than the Background Mean

Area of Concern Data: Red Water Pond Rd.
Background Data: NECR-1 Step-out Area

Raw Statistics

	Site	Background
Number of Valid Observations	16	37
Number of Distinct Observations	15	27
Minimum	2.38	0.7
Maximum	69	80.5
Mean	18.04	5.997
Median	14.5	2
SD	17.25	13.54
SE of Mean	4.313	2.226

Site vs Background Two-Sample t-Test

H0: Mu of Site - Mu of Background <= 0

Method	DF	t-Test Value	Critical t (0.050)	P-Value
Pooled (Equal Variance)	51	2.732	1.675	0.004
Satterthwaite (Unequal Variance)	23.4	2.48	1.714	0.01

Pooled SD 14.730

Conclusion with Alpha = 0.050

* Student t (Pooled) Test: Reject H0, Conclude Site > Background
* Satterthwaite Test: Reject H0, Conclude Site > Background