

WINDBLOWN TAILINGS CLEANUP
VERIFICATION REPORT
CHURCHROCK, NM

NOVEMBER, 1990

9101140338 901121
PDR ADOCK 04008907
C PDR

1.0 Introduction

In accordance with Condition 33 of Material License SUA-1475, United Nuclear Corporation has completed the cleanup of areas contaminated by windblown tailings. This report supplements an earlier report submitted to the NRC on December 21, 1989 for cleanup to Section 2, T16N, R16W and Section 36, T17N, R16W. This report presents data verifying that the cleanup was conducted on Section 1, T16N, R16W in accordance with Criterion 6 of Appendix A to Title 10, Part 40 of the Code of Federal Regulations.

Windblown tailings cleanup is an integral part of the reclamation of the Churchrock tailings facility as presented in the Reclamation Plan of June 1987 and the schedule of activities as presented in Amendment 1 to that plan dated July 1988.

2.0 Areas to be Cleaned

Section 2.0 of the 1987 Reclamation Plan report presents the radiological survey of the Churchrock site and the areas which were affected by windblown tailings. A more detailed survey of Sections 1 and 2, T16N, R16W and Section 36, T17N, R16W has refined this delineation. The previous report submitted to the NRC on December 21, 1989 contains the information regarding Sections 2 and 36. This report provides the information for work conducted in Section 1.

2.1 Section 1

In accordance with Condition 16 of the license, a radiological survey of the northwest corner of Section 1, T16N, R16W was conducted in 1988. Section 1 is Navajo trust land. The results of this survey were presented to the NRC in a letter dated December 22, 1988. The

gamma survey identified an area of about 15 acres as potentially being impacted by windblown tailings. However, soil analyses failed to confirm the gamma readings in the eastern and southeastern portions of the area. UNC performed a detailed, systematic soil sampling and analyses survey in Section 1 to conclusively delineate areas exceeding Criterion 6 standards. This survey was performed by UNC in 1989 and the results were submitted to the NRC by letter dated May 24, 1989.

An area of approximately five acres in the northwest corner of Section 1 was identified as exceeding the criteria. UNC informed the Navajo Tribe in May regarding Section 1 results and recommended that this area not be cleaned due to the impact such action would have on the vegetation and archaeological sites.

The Tribe subsequently determined that the cleanup should be performed and notified UNC by letter dated October 20, 1989. The Tribe's decision was received after the 1989 interim reclamation work had been completed and the earthwork contractor had demobilized. UNC requested a license amendment on October 26 to extend the completion of the Section 1 cleanup to December 31, 1990. The Amendment Request was approved by the NRC in December 1989 which allowed the Section 1 cleanup to be conducted in 1990.

In order to ensure that no contamination was pushed beyond the Section 1 border into Section 36, the border area of Section 36 was re-cleaned. The areas cleaned as shown on Figure 1, were 6.7 acres in Section 1 and 0.7 acres in Section 36.

3.0 Cleanup Methods

The boundaries of the areas to be cleaned were staked by survey. Some of the trees and all of the shrubs within these areas were removed

using a dozer and transported to the south end of Borrow Pit #2 where they will be burned. Earthmoving equipment was then used to remove at least the upper six inches of soil. The soil was disposed in Borrow Pit #2 of UNC's Churchrock mill tailings facility.

4.0 Verification Surveys

Verification surveys were conducted after excavation and removal of the soil from the target area. The surveys consisted of unshielded gamma readings taken with a uR meter at one meter above ground surface, and shielded gamma readings right on the surface. The readings were taken at 10-meter intervals using surveyed 50-meter grid points as control. The data is reported in Tables 1, 2, and 3.

The control used was correlation between shielded gamma uR and pCi/gms Ra-226 which was developed in the 1989 verification work, submitted to the NRC on December 21, 1989 where a 16 uR/hr reading is equal to 6 pCi/gm Ra-226. The criteria used for cleanup was to clean areas with values higher than 5 pCi/gm Ra-226 above background and background that is 1 pCi/gm as stated in Section 2.0 of the 1987 Reclamation Plan. A graph showing the correlation between uR/hr and pCi/gm is enclosed as Figure 2.

The gamma meter used was a Ludlum Model 19 calibrated by the manufacturer yearly. The meter was function checked each day prior to use. The shielded surface readings were taken with the meter set inside of an open bottom box lined with lead sheeting. Field checks were made against a Cesium 137 source. Background shielded gamma was determined to be in the range of 8-10 uR/hr by taking 14 readings

at 50-meter intervals along a north-south line in the southeast quarter of Section 2. This area is identified as Background Area 3 on Figure 2.1 of the Reclamation Plan.

Thirty (30) soil samples were taken from the clean area. The sample points were selected by taking a sample of the lowest and the highest uR reading of each 2500 square meters. Twenty-two (22) samples from Section 1 and eight (8) from Section 36. The samples were oven-dried, pulverized, blended, split, and sent to the contract laboratory in metal cannisters. Radium analyses were performed by gamma spectroscopy at Radon-222 equilibrium. Checks on the gamma spectroscopy results were performed by analyzing seven (7) of the samples by the chemical digestion method. These results are reported on Tables 4-7.

5.0 1990 Data Correlation (uR/hr Gamma vs. pCi/gm)

The shielded gamma readings were correlated with the soil analyses used to develop the correlation were those determined by gamma spectroscopy at Rn-222 equilibrium.

Figure 3 shows the 1990 correlation to be no different than the 1989 correlation shown in Figure 2 where $16 \text{ uR/hr} = 6 \text{ pCi/gm Ra-226}$.

6.0 Conclusion

The data has verified that the 6.7 acres in Section 1 and the 0.7 acres in Section 36 are clean and meet the criteria of less than 6.0 pCi/gm of Ra-226 in the soil ($5\text{pCi} + \text{Background } 1.0 \text{ pCi}$).

7.0 Revegetation of the Windblown Area

7.1 Seeding Methods

- o On the flat areas drill seeding was performed.
- o On the slope areas broadcast seeding was performed.
- o For seed mixture and application see Table 9.

8.0 Fertilization

Based on previous soil nutrient and fertilizer requirement analysis, the area was fertilized with 30 lbs/acre nitrogen and 40 lbs/acre phosphate.

VERIFICATION REPORT
CHURCHROCK, NM

NOVEMBER, 1990

FIGURES 1-3

FIGURE 1

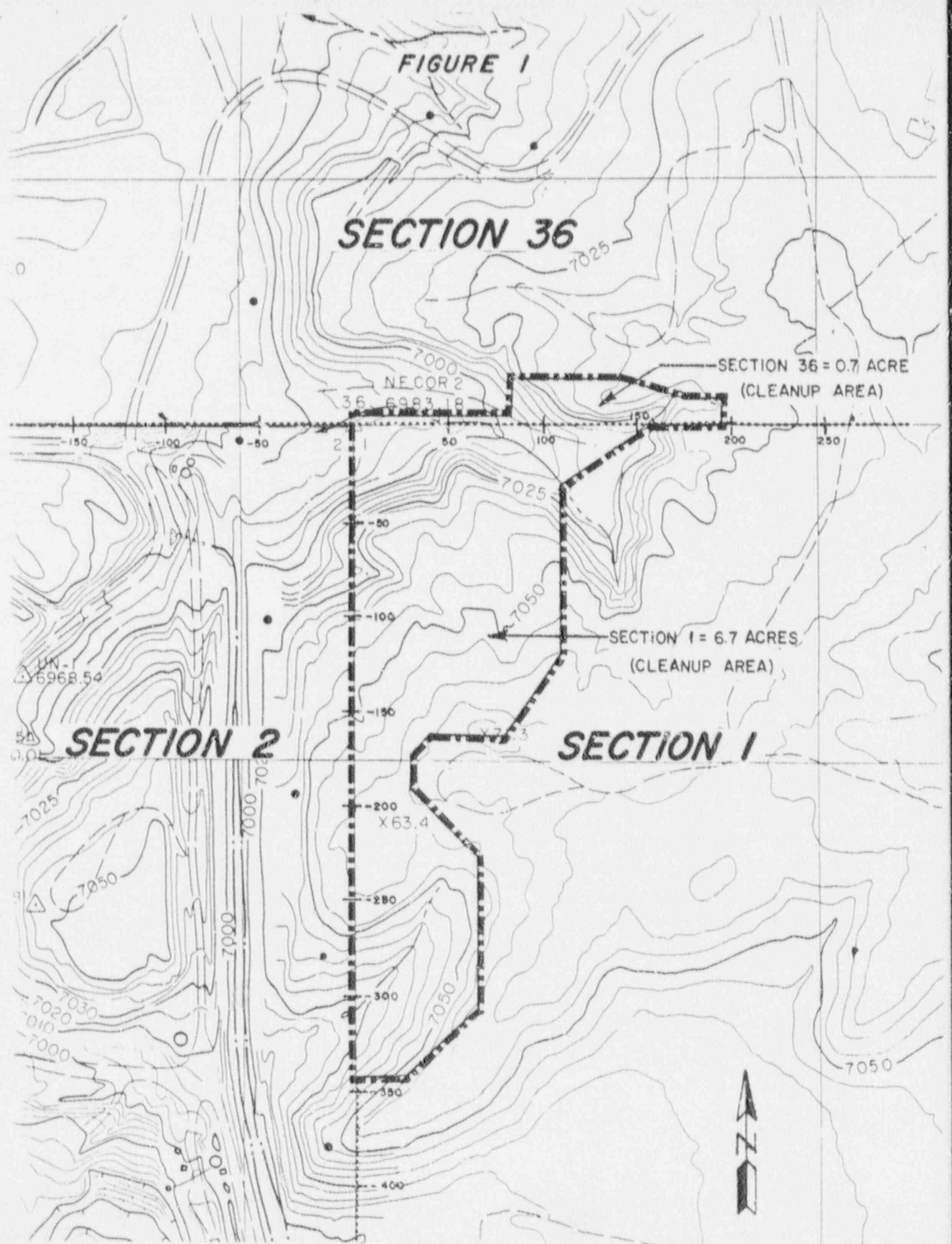
SECTION 36

SECTION 36 = 0.7 ACRE
(CLEANUP AREA)

SECTION 1 = 6.7 ACRES
(CLEANUP AREA)

SECTION 2

SECTION 1



(Razzi) SOIL PCU/gm VS. METER μ R/HR W/ SHIELD (CONTACT)

FIGURE 2

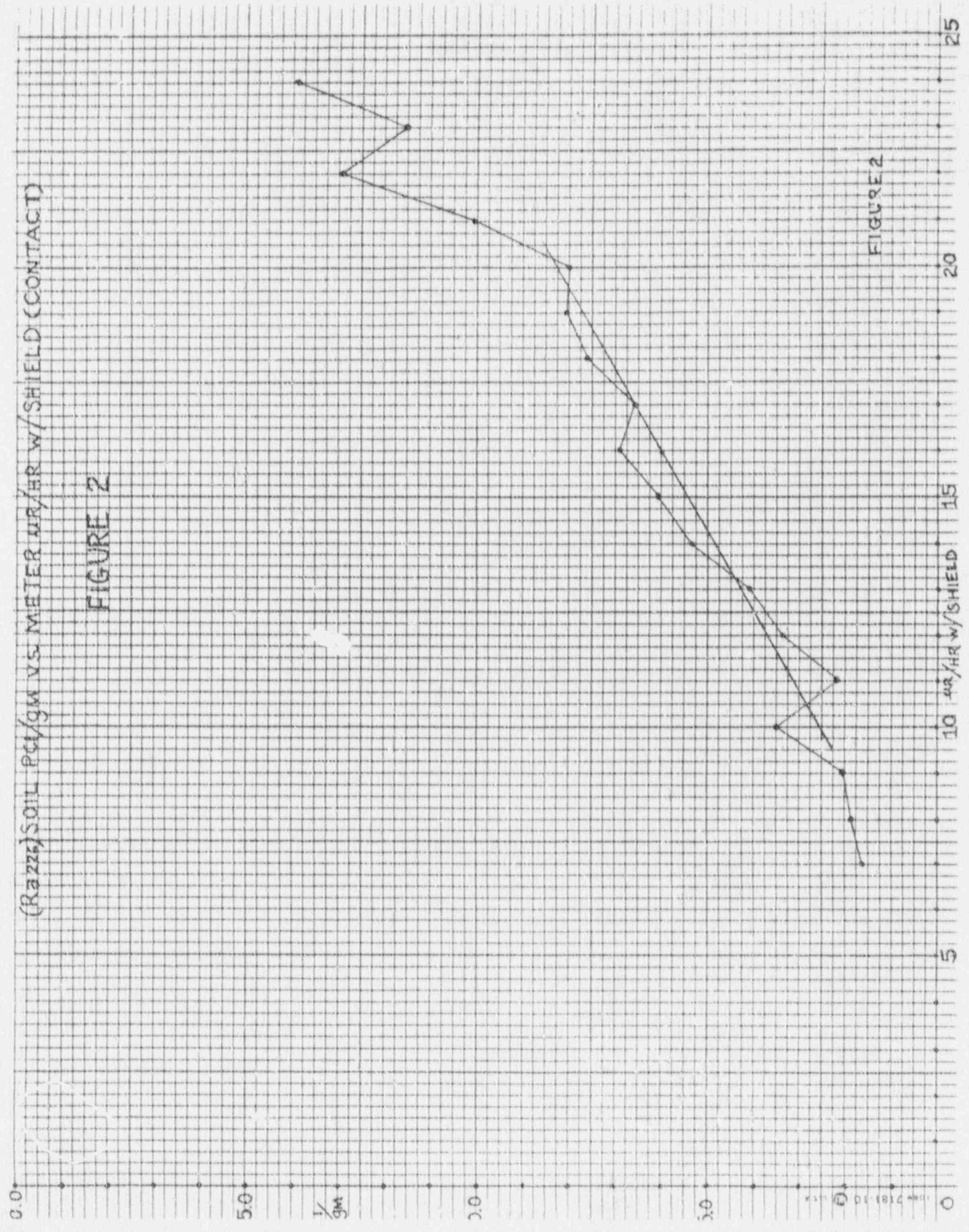
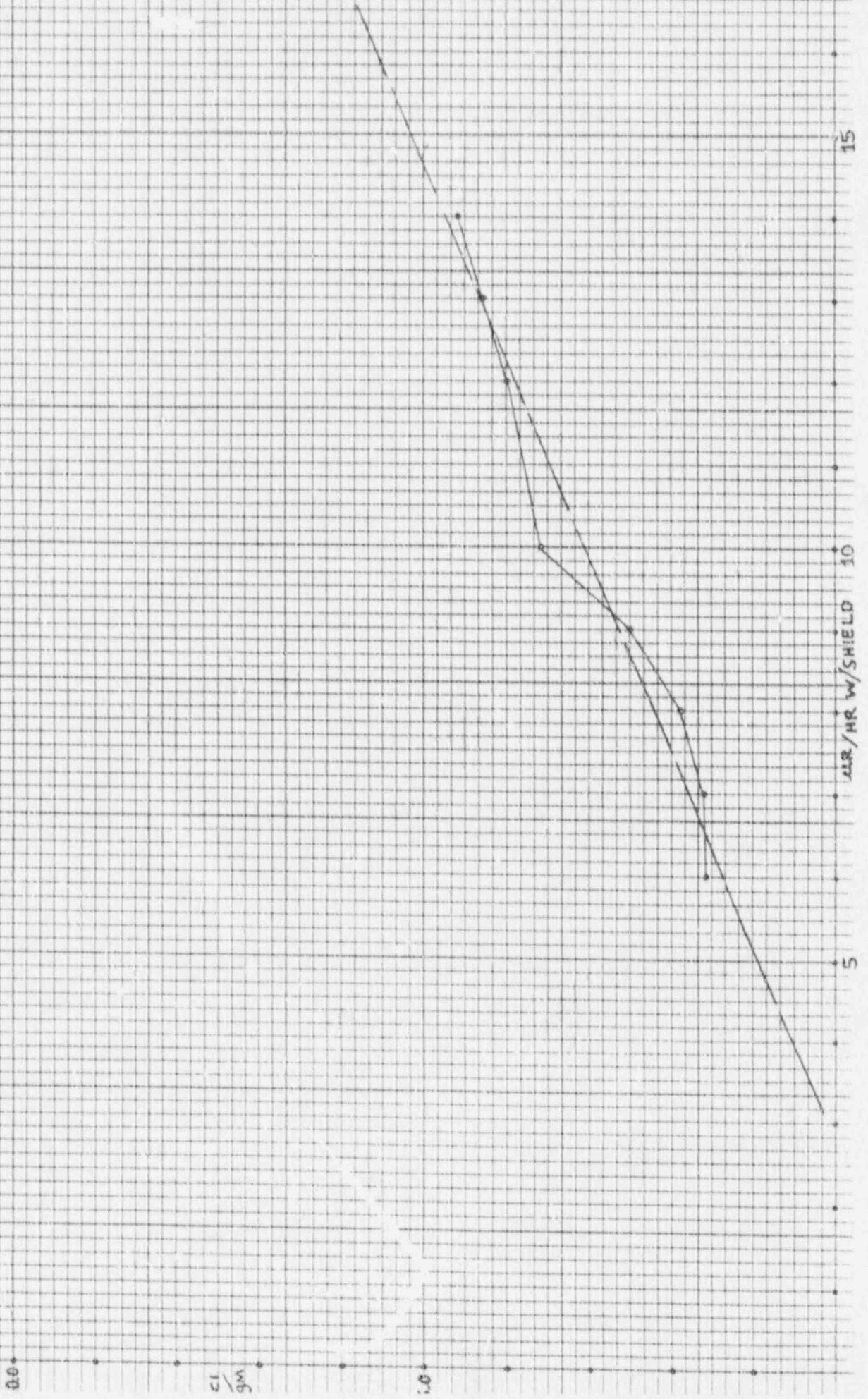


FIGURE 2

(R0226-SOIL) PC/GM VS. AIR/HR CONTACT W/SHIELD (METER)

FORM 7181-10 U.S.A.

FIGURE 3



VERIFICATION REPORT
CHURCHROCK, NM

NOVEMBER, 1990

TABLES 1-9

UNC MINING AND MILLING

CHURCHROCK MINE
P.O. BOX 00
GALLUP, NEW MEXICO
(505) 722-6651

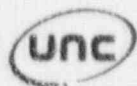


TABLE 1 OF SEC. 1

COMPUTATIONS

SUBJECT REMEDIATION - VERIFICATION GAMMA SURVEY AFTER CLEANUP IN Sheet No. 1 of 2
NW CORNER OF SECTION 1, T16N, R16W, REFER TO FIGURE 1 MAP FOR Made By MC Date 7-27-90
SPECIFIC LOCATION AND COORDINATES. Chkd. By EPI Date 8-3-90

					0+50					0+100		
0-0	8/17	7/16	7/15	9/17	9/17	11/19	11/20	11/20	8/16	12/20	10/18	11/18
	7/15	8/10	8/10	9/17	9/17	8/17	11/18	9/18	9/8	9/16	11/18	9/18
	9/18	13/21	10/17	14/22	13/23	9/19	8/16	11/19	12/21	8/17	9/16	13/18
	10/19	9/17	9/19	8/16	9/19	9/17	9/17	7/13	8/16	11/17	12/20	11/17
	9/17	9/16	8/16	7/16	10/19	11/8	10/8	9/17	8/15	11/8	8/16	11/18
-50-0	8/16	9/16	8/16	9/16	8/14	9/17	10/16	9/16	7/14	7/14	8/13	9/16
	13/19	11/18	10/19	10/8	8/15	7/14	12/18	10/16	12/18	8/14	8/14	7/13
	10/20	13/19	13/21	11/18	8/18	6/13	12/17	8/16	8/15	7/13	8/15	7/14
	10/16	13/20	10/19	12/18	13/18	6/13	7/14	11/17	12/19	7/14	7/13	7/13
	12/22	13/17	8/19	7/13	13/18	8/15	8/16	8/15	8/17	6/13	11/17	8/16
-100-0	11/20	11/17	10/18	7/14	11/14	7/14	9/16	8/15	11/16	7/13	9/16	8/15
	11/20	13/20	7/14	7/15	9/16	8/16	7/14	7/14	8/14	12/17	9/15	8/16
	11/22	7/15	9/16	8/15	7/14	8/16	12/19	7/14	8/16	8/14	6/14	6/14
	9/17	10/17	7/15	9/16	8/16	7/14	14/19	10/16	8/15	10/18	7/14	12/19
	7/14	7/14	7/14	7/14	8/13	8/16	8/16	10/15	9/16	8/16	12/19	12/20
-150-0	10/19	13/19	9/16	8/16	9/18	8/16	8/14	9/14	10/16	10/19	9/18	12/22
	12/19	9/16	11/19	7/14	7/14	10/16	6/13	8/14	7/14	13/21	12/20	
	10/19	11/19	8/16	11/17	11/20	9/16	10/18	8/16	13/20	13/21		
	8/16	10/16	8/17	8/16	8/18	10/18	11/18	13/22	13/20			
	9/16	13/21	9/19	11/14	7/14	12/21	12/18	11/20				
-200-0	10/18	7/14	8/17	8/17	9/17	10/18	12/19					

↑
N

NOTES:

- a) TOP/READING = CONTACT WITH LEAD SHIELD
- b) BOTTOM/READING = 1 METER WITHOUT LEAD SHIELD
- c) 0-0 @ INTERSECTION POINT OF SECTIONS 1, 2 AND 36 (SEE FIGURE 1)

①
-200+100

UNC MINING AND MILLING

CHURCHROCK MINE
P.O. BOX 00
GALLUP, NEWMEXICO
(505) 722-8651

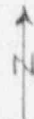


TABLE 2 OF SEC. 1

COMPUTATIONS

SUBJECT REMEDIATION/VERIFICATION GAMMA SURVEY AFTER CLEANUP IN Sheet No. 2 of 2
THE NW CORNER OF SECTION 1, T16N, R16W. REFER TO FIGURE 1 Made By MLC Date 7-27-90
MAP FOR SPECIFIC LOCATION AND COORDINATES. Chkd. By EM Date 8-3-90

-200-0								-200+50
7/16	12/20	10/18	10/18	9/18	12/21	12/22		
9/18	14/22	11/19	12/21	13/20	7/16	10/19		
12/20	9/17	9/19	7/16	10/18	10/20	12/21		
8/16	8/18	10/16	12/22	13/20	14/20	8/17		
-250-0	8/16	9/18	9/19	11/19	9/18	8/17	13/20	
13/22	11/20	9/17	7/17	10/19	9/18	11/19		
13/22	10/19	14/22	9/16	8/18	8/17	10/19		
13/22	7/17	8/16	8/18	9/18	11/21	9/18		
11/18	13/21	8/17	9/19	8/16	10/20	10/18		
-300-0	8/17	8/18	9/19	7/16	13/21	9/18	11/18	
9/19	10/19	12/20	9/19	9/18	8/18			
8/20	11/20	13/21	11/19	10/17				
11/20	13/20	11/21	9/18					
11/18	11/21	9/19						
-350-0	13/21	13/23						-350+50



NOTES:

- a) TOP/READING • CONTACT WITH LEAD SHIELD
- b) BOTTOM/READING • 1 METER WITHOUT LEAD SHIELD
- c) -200-0 • GRID POINT CONTINUATION OF TABLE 1 200 METERS SOUTH OF 0-0 INTERSECTION POINT ALONG SECTIONS 1 AND 2 BANNERLINE.

UNC MINING AND MILLING

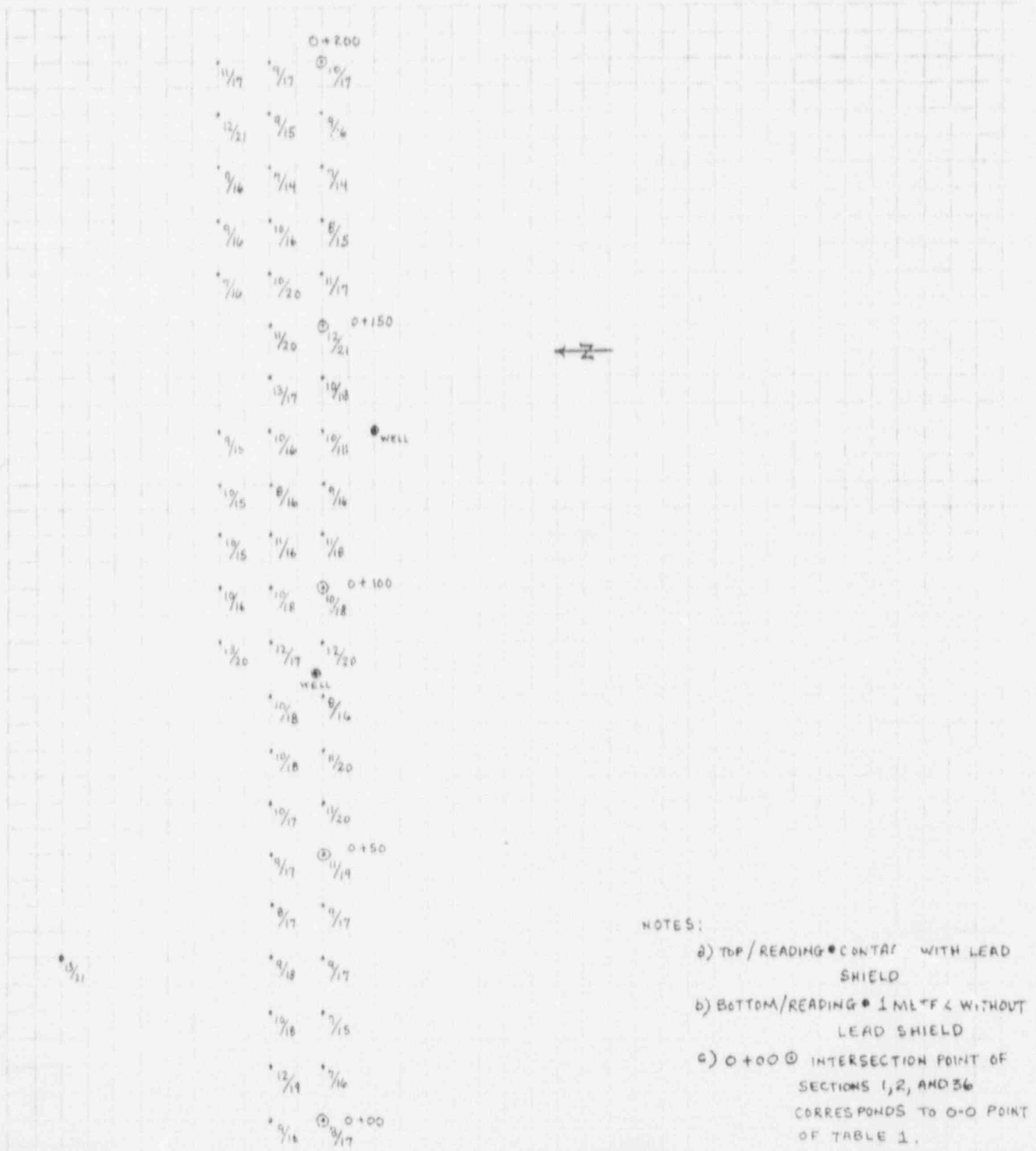
CHURCHROCK MINE
P.O. BOX 00
GALLUP, NEW MEXICO
(505) 722-6651



TABLE 3 OF SEC. 36

COMPUTATIONS

SUBJECT REMEDIATION-VERIFICATION GAMMA SURVEY AFTER ADDITIONAL Sheet No. 1 of 1
CLEANUP IN THE SW CORNER OF SECTION 36, REFER TO FIGURE 1 Made By MC Date 7-27-90
MAP FOR SPECIFIC LOCATION AND COORDINATES. Chkd. By CM Date 8-3-90



- NOTES:
- a) TOP/READING • CONTACT WITH LEAD SHIELD
 - b) BOTTOM/READING • 1 MLTF < WITHOUT LEAD SHIELD
 - c) O+00 • INTERSECTION POINT OF SECTIONS 1, 2, AND 36 CORRESPONDS TO O-O POINT OF TABLE 1.



ENERGY LABORATORIES, INC.

P.O. BOX 3258 * CASPER, WY 82602 * PHONE (307) 235-0515
254 NORTH CENTER, SUITE 100 * CASPER, WY 82601 * FAX (307) 234-1639

UNC - RADIOCHEMICAL SOIL ANALYSIS

Table 4

Ra-226 pCi/gm:

Section 1

Sample I.D.	-20+90	-10+80	-90+80	-80+110
Sample Date	07-27-90	07-27-90	07-27-90	07-27-90
Report Date	08-31-90	08-31-90	08-31-90	08-31-90
Sample #	90-21362	90-21363	90-21364	90-21365

Ra-226 *1				
precision +/-				
Ra-226 *2	1.4	3.3	2.0	1.9
precision +/-	0.1	0.4	0.3	0.1
Ra-226 *3		0.8		
precision +/-		0.1		

Sample I.D.	-120+100	-150+90	-180+70	-160+70
Sample Date	07-27-90	07-27-90	07-27-90	07-27-90
Report Date	08-31-90	08-31-90	08-31-90	08-31-90
Sample #	90-21366	90-21367	90-21368	90-21369

Ra-226 *1				
precision +/-				
Ra-226 *2	2.1	3.4	4.4	1.8
precision +/-	0.2	0.4	0.3	0.1
Ra-226 *3		0.7	5.8	
precision +/-		0.1	0.3	

- *1 Analysis performed by quick turnaround gamma spectroscopy
- *2 Analysis performed by gamma spectroscopy @ Rn-222 equilibrium
- *3 Analysis performed by EPA-900.1 following chemical digestion

QUALITY ASSURANCE MANAGER: *W.A. Hartwig*
 Energy Laboratories, Inc.
 Casper, Wyoming 82602



ENERGY LABORATORIES, INC.

P.O. BOX 325B • CASPER, WY 82602 • PHONE (307) 235-0515
254 NORTH CENTER, SUITE 100 • CASPER, WY 82601 • FAX (307) 234-1639

UNC - RADIOCHEMICAL SOIL ANALYSIS
Ra-226 pCi/gm:

Table 5

Section 1

Sample I.D.	-220+50	-240+50	-180+10	-200+10
Sample Date	07-27-90	07-27-90	07-27-90	07-27-90
Report Date	08-31-90	08-31-90	08-31-90	08-31-90
Sample #	90-21370	90-21371	90-21372	90-21373

Ra-226 *1 precision +/-				
Ra-226 *2 precision +/-	1.7	6.3	3.1	0.3
Ra-226 *3 precision +/-	0.1	0.4	0.4	0.1

Sample I.D.	-110+10	-120+10	-70+50	-90+40
Sample Date	07-27-90	07-27-90	07-27-90	07-27-90
Report Date	08-31-90	08-31-90	08-31-90	08-31-90
Sample #	90-21374	90-21375	90-21376	90-21377

Ra-226 *1 precision +/-				
Ra-226 *2 precision +/-	5.9	0.9	1.6	3.7
Ra-226 *3 precision +/-	0.4	0.1	0.2	0.3

- *1 Analysis performed by quick turnaround gamma spectroscopy
- *2 Analysis performed by gamma spectroscopy @ Rn-222 equilibrium
- *3 Analysis performed by EPA-900.1 following chemical digestion

QUALITY ASSURANCE MANAGER: *J.A. Harding*
 Energy Laboratories, Inc.
 Casper, Wyoming 82602



ENERGY LABORATORIES, INC.

P.O. BOX 3258 * CASPER, WY 82602 * PHONE (307) 235-0515
254 NORTH CENTER, SUITE 100 * CASPER, WY 82601 * FAX (307) 234-1639

UNC - RADIOCHEMICAL SOIL ANALYSIS

Table 6

Ra-226 pCi/gm:

Section 1

Sample I.D.	-20+30	-40+30	-310+50	-310+20
Sample Date	07-27-90	07-27-90	07-27-90	07-27-90
Report Date	08-31-90	08-31-90	08-31-90	08-31-90
Sample #	90-21378	90-21379	90-21380	90-21381

Ra-226 *1 precision +/-				
Ra-226 *2 precision +/-	2.5	2.3	2.2	3.0
Ra-226 *3 precision +/-	0.2	0.2	0.2	0.4

Sample I.D.	-260+30	-270+20
Sample Date	07-27-90	07-27-90
Report Date	08-31-90	08-31-90
Sample #	90-21382	90-21383

Ra-226 *1 precision +/-		
Ra-226 *2 precision +/-	2.5	4.9
Ra-226 *3 precision +/-	0.2	0.3

- *1 Analysis performed by quick turnaround gamma spectroscopy
- *2 Analysis performed by gamma spectroscopy @ Rn-222 equilibrium
- *3 Analysis performed by EPA-900.1 following chemical digestion

QUALITY ASSURANCE MANAGER: *R.A. Leachling*
 Energy Laboratories, Inc.
 Casper, Wyoming 82602

UNC - RADIOCHEMICAL SOIL ANALYSIS
Ra-226 pCi/gm:Table 7

Section 36

Sample I.D.	+10+190	00+190	+10+130	00+130
Sample Date	07-27-90	07-27-90	07-27-90	07-27-90
Report Date	08-31-90	08-31-90	08-31-90	08-31-90
Sample #	90-21384	90-21385	90-21386	90-21387

Ra-226 *1 precision +/-				
Ra-226 *2 precision +/-	2.6	1.7	5.0	3.0
Ra-226 *3 precision +/-	0.2	0.1	0.3	0.2
			4.6	
			0.3	

Sample I.D.	00+90	+20+90	00+20	+50+30
Sample Date	07-27-90	07-27-90	07-27-90	07-27-90
Report Date	08-31-90	08-31-90	08-31-90	08-31-90
Sample #	90-21388	90-21389	90-21390	90-21391

Ra-226 *1 precision +/-				
Ra-226 *2 precision +/-	3.1	4.9	0.5	4.1
Ra-226 *3 precision +/-	0.2	0.3	0.1	0.3

- *1 Analysis performed by quick turnaround gamma spectroscopy
*2 Analysis performed by gamma spectroscopy @ Rn-222 equilibrium
*3 Analysis performed by EPA-900.1 following chemical digestion

QUALITY ASSURANCE MANAGER: *S.A. Leasing*
Energy Laboratories, Inc.
Casper, Wyoming 82602

UNC MINING AND MILLING

CHURCHROCK MINE
P.O. BOX 00
GALLUP, NEWMEXICO
(505) 722-6651



TABLE 8

COMPUTATIONS

SUBJECT AVERAGE COORDINATES FOR CORRELATION GRAPH - SOIL LAB Sheet No. _____ of _____
 ANALYSIS PC1/GM VS. METER ^{HR}/HR (CONTACT-SHIELDED) IN THE _____ Made By MC Date 9-21-90
NW CORNER OF SEC. 1 AND SW CORNER OF SEC. 36 Chkd. By CM Date 10-13-90

CONTACT SHIELDED (HR/HR)	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
	2.1	0.5	1.4	2.6	5.0		3.1	4.9	2.5
Ra-226 SOIL ANALYZES	1.8	1.9	2.2	1.7	3.0		5.9	4.1	4.9
(PC1/GM)	0.9	1.7	2.0	3.3	3.4		3.0	4.4	6.3
	1.6	0.8			3.1			3.7	
		2.3							
		2.5							
AVERAGE (PC1/GM)	1.60	1.62	1.87	2.53	3.63		4.00	4.28	4.57

* NOTE: SOIL ANALYSES PERFORMED BY GAMMA SPECTROSCOPY @ RH-222 EQUILIBRIUM

Table 9

REVEGETATION SEED MIXTURE AND APPLICATION RATES
FOR
WINDBLOWN AREA

<u>Common Name</u>	<u>Scientific Name</u>	<u>Growth Habit</u> ¹	<u>Pounds Pure Live₂ Seed/Acre</u> ²
Western Wheatgrass	<i>Agropyron smithii</i>	NS	5.0
Blue Grama	<i>Bouteloua gracilis</i>	NB	2.0
Indian Ricegrass	<i>Oryzopsis hymenoides</i>	NB	4.0
Alkali Sacaton	<i>Sporobolus airoides</i>	NB	0.5
Sideoats Grama	<i>Bouteloua curtipendula</i>	NB	2.0
Galleta	<i>Hilaria jamisii</i>	NS	3.0

¹NB - Native Bunchgrass

NS - Native Sodgrass

²Seeding rate is for drill seeding. In the case of broadcast seeding, the seeding rate was doubled.