ROCKY MOUNTAIN ENERGY

40-8697

A Subsidiary of
Union Pacific Corporation

04008697350E

August 21, 1986

Ms. Candice C. Jierree
U.S. Nuclear Regulatory Commission
Uranium Recovery Field Office
Region IV
P. O. Box 25325
Denver, Colorado 80225

Dear Candy:

Re: Docket No. 40-8697, License
SUA-1338

Enclosed for NRC docket files is another copy of the Reno Creek Decommissioning report.

Thank you for arranging your schedule to include the Reno Creek inspection last week and continued commitment to efficient handling of remaining Reno Creek licensing actions.

Please call Pat or me, if we can be of any assistance.

Sincerely,

Michael R Neumann

Michael R. Neumann
Environmental Coordinator

MRN/asm
Enclosure
cc: P. R. Spieles

10 Longs Peak Drive
Box 2000
Broomfield, Colorado 80020
303/469-8844

812

ROCKY MOUNTAIN ENERGY

A Subsidiary of
Union Pacific Corporation

August 13, 1986

Mr. R. Dale Smith, Director
U. S. Nuclear Regulatory Agency
Uranium Recovery Field Office
Region IV
Box 25325
Denver, CO 80225

Dear Mr. Smith:

Re: Decommissioning Report for Reno Creek
In Situ Leach R&D Project (Docket
No. 40-8697, License SUA-1338)

Attached is a report describing decommissioning activities and results as required by the referenced source materials license. This report documents that all radioactive contamination resulting from uranium recovery operations at the site has either been removed or reduced to acceptable levels for unrestricted use.

Accordingly, RME requests that License SUA-1338 be terminated prior to the expiration date of September 30, 1986. If you have any questions, please call me at our Broomfield office (469-8844) or Pat Spieles at (307)358-2514.

Sincerely,

Michael R. Neumann

Michael R. Neumann
Environmental Coordinator

MRN/asm
Attachment
cc: Candice C. Jierree
Patrick R. Spieles

10 Longs Peak Drive
Box 2000
Broomfield, Colorado 80020
303 469-8844

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FINAL REPORT

RENO CREEK DECOMMISSIONING

JULY 1986

Rocky Mountain Energy
10 Longs Peak Drive
P. O. Box 2000
Broomfield, CO 80020

RENO CREEK DECOMMISSIONING REPORT

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INTRODUCTION

A sulfuric acid in-situ uranium leaching test began on Pattern 1 during February 1979 and was terminated in November 1979, at which time restoration efforts began. The restoration circuits were shut down June 1, 1981. During February of 1986, the NRC acknowledged restoration and stabilization of Pattern 1 had been achieved.

A second well pattern using a sodium carbonate lixiviant was started in September 1980. Leaching was stopped in December 1980 and restoration efforts were initiated. Restoration activities ceased in April 1981 and, after two years of stabilization, the NRC approved the restoration adequacy for Pattern 2.

Rocky Mountain Energy submitted a Decontamination and Decommissioning Plan for the Reno Creek site on April 1, 1985 (reference Appendix A). The plan was approved by the NRC via Amendment 34 to Source Materials License SUA-1338 on February 24, 1986 (reference Appendix B).

As required by the approved plan and 10CFR40.42 ("Expiration and Termination of Licenses"), this report summarizes the results of decommissioning efforts at the site. All data and survey results support the conclusion that the site and remaining buildings, structures, etc. meet applicable NRC criteria for unrestricted use.

DECOMMISSIONING CHRONOLOGY

Preliminary decommissioning activities began in the fall of 1985. With NRC approval, RME began removal of the Reno Creek reservoir contents via contract tankers. The material was hauled to Bear Creek Uranium for disposal in the tailings impoundment. Nearly 800,000 gallons had been removed by December, 1985, at which time winter weather shut down the hauling operation.

The winter months, January and February, 1986, were primarily spent gathering preliminary radiation data. A preliminary gamma survey was performed to identify contaminated areas. Soil samples were collected to establish a cleanup "action level" based on the Ra-226 - Gamma correlation.

During March, the weather allowed resumption of the reservoir cleanout. On and off until June, the reservoir contents were hauled to Bear Creek for disposal. Nearly 1.5 million gallons were hauled, starting in the fall of 1985.

Pattern 1 and Pattern 2 wells were cemented and abandoned during April. Immediately following well abandonment, the well fields were reclaimed.

Most of final decommissioning surveys were taken during May. Included were gamma surveys on the entire project, removable alpha smears on the buildings, equipment and the reservoir liner.

A decision was made during May to "mothball" the process building. Included with this structure was the surrounding fencing and the egress road. RME agreed to "mothball" the building only if applicable unrestricted use criteria were met.

Final decommissioning tasks were completed during June. Utilities were disconnected, remaining buildings were cleaned and final radiation surveys were performed.

SOIL CONTAMINATION IDENTIFICATION

Condition 34B of license SUA-1338 required RME to develop a proposed cleanup action level for contaminated soils in μR/hr, which corresponds to a soil Ra-226 content of 5.0 pCi/g above background. RME recognizes the action level served only a means for identifying possible contamination and that final cleanup confirmation will be determined by soil Ra-226 analysis.

Six sites within the project boundary were designated for establishing a gamma Ra-226 correlation. Gross gamma readings were obtained using a Ludlum Model 12S Micro R Meter held one meter above ground. Core samples were taken to a depth of 15cm and sent to Accu-Labs of Wheat Ridge, Colorado for Ra-226 analyses.

On the advice of NRC personnel, RME did not determine soil moisture, K-40 and Th-232 as recommended by the Bendix report entitled "Surface Gamma-Ray Measurement Protocol". Past experience has shown these parameters have an insignificant influence on the gamma Ra-226 correlation.

A soil concentration of 5.0 pCi Ra-226/gram corresponded to a gamma reading of 24.7 uR/hr.

On April 24, 1986, RME submitted a report to the NRC (reference Appendix C) which proposed a conservative gamma action level of 24 µR/hr for identifying contaminated soil. The NRC approved the proposed level by letter dated May 21, 1986 (reference Appendix D).

GAMMA SURVEYS

Gamma surveys were conducted at the Reno Creek project before and after decommissioning.

A comprehensive grid encompassing the entire R&D site was established prior to actual decommissioning activities. Basically, the grid consisted of survey sites on 100-foot intervals in the wellfields and undisturbed areas, on 50-foot intervals in the reservoir, and on 10-foot intervals in the buildings. Wellfields were supplemented with additional surveys at each wellhead. Refer to Figures 1 and 2 and Table 1 for results of the preliminary and final gamma surveys.

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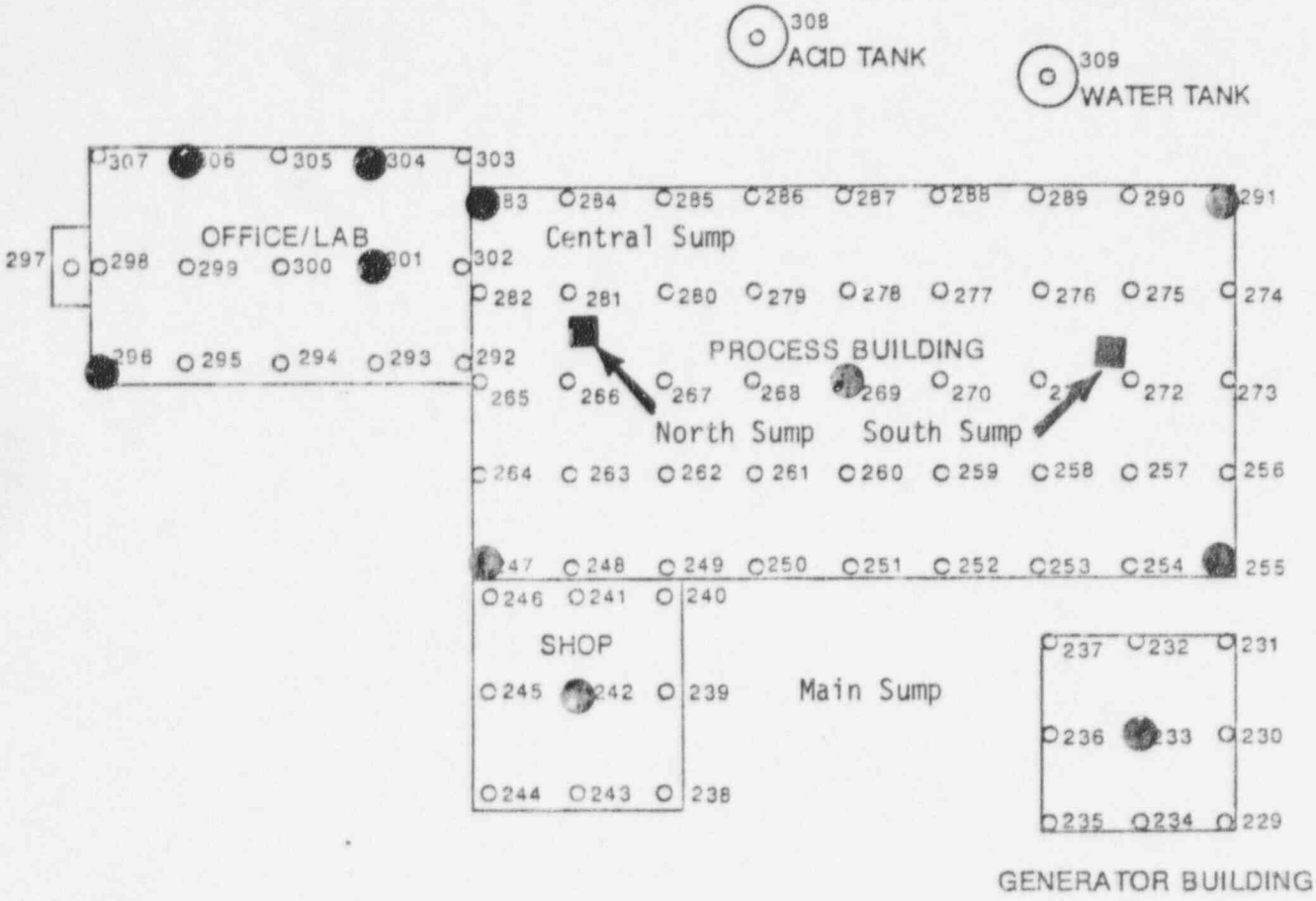

Sump

Floor Removable Alpha Site

O GAMMA SURVEY POINT

Issue	Date
LR	

ROCKY MOUNTAIN ENERGY

RENO CREEK

GAMMA SURVEY GRID

File/Dwg. No.

RME-M

TABLE

RENO CREEK
GAMMA RADIATION SURVEY

Grid No.	Prelim µr/hr.	Final µr/hr.	Grid No.	Prelim µr/hr.	Final µr/hr.	Grid No.	Prelim µr/hr.	Final µr/hr.	Grid No.	Prelim µr/hr.	Final µr/hr.	Grid No.	Prelim µr/hr.	Final µr/hr.	Grid No.	Prelim µr/hr.	Final µr/vr.	Grid No.	Prelim µr/hr.	Final µr/hr.
1	14	14	32	16	15	63	15	15	94	16	16	125	15	15	156	16	17	187	-	16
2	14	14	33	16	15	64	15	15	95	15	15	126	15	15	157	16	16	188	-	16
3	15	14	34	16	15	65	15	15	96	15	15	127	14	15	158	16	17	189	-	16
4	14	14	35	16	16	66	15	15	97	14	15	128	15	15	159	-	15	190	20	15
5	14	14	36	16	16	67	15	15	98	16	15	129	15	15	160	-	16	191	16	15
6	15	14	37	15	16	68	15	14	99	14	14	130	15	16	161	-	15	192	14	15
7	14	14	38	15	15	69	15	15	100	15	15	131	15	16	162	-	15	193	14	15
8	14	15	39	15	15	70	16	14	101	15	14	132	15	15	163	-	15	194	16	15
9	14	15	40	15	15	71	15	14	102	15	14	133	16	17	164	-	16	195	-	15
10	15	15	41	15	15	72	15	14	103	14	14	134	15	16	165	20	16	196	-	16
11	15	15	42	16	15	73	14	14	104	15	15	135	15	16	166	20	16	197	-	16
12	15	15	43	15	15	74	15	15	105	15	13	136	17	16	167	-	15	198	-	17
13	14	15	44	15	15	75	15	15	106	15	15	137	15	16	168	-	17	199	-	15
14	15	15	45	15	15	76	14	14	107	14	15	138	16	16	169	-	17	200	-	15
15	15	15	46	15	15	77	14	14	108	15	15	139	16	16	170	-	15	201	18	17
16	14	15	47	15	15	78	15	14	109	16	15	140	16	16	171	-	15	202	18	16
17	15	15	48	14	15	79	15	13	110	15	15	141	17	17	172	-	16	203	-	15
18	15	15	49	15	15	80	15	14	111	15	15	142	15	15	173	18	15	204	-	15
19	15	15	50	15	15	81	15	15	112	15	15	143	15	15	174	15	15	205	-	15
20	16	16	51	14	15	82	15	15	113	15	15	144	16	16	175	15	16	206	-	15
21	16	16	52	14	15	83	15	15	114	15	15	145	19	19	176	18	15	207	-	15
22	17	16	53	15	15	84	17	15	115	15	15	146	16	16	177	-	16	208	-	16
23	16	16	54	15	15	85	17	15	116	14	15	147	15	15	178	-	16	209	19	16
24	16	15	55	15	15	86	16	16	117	15	15	148	17	19	179	-	16	210	14	15
25	15	15	56	15	15	87	15	15	118	14	15	149	20	20	180	-	15	211	14	15
26	15	15	57	16	15	88	15	15	119	15	15	150	20	19	181	-	15	212	16	16
27	15	15	58	16	16	89	15	15	120	15	14	151	20	20	182	-	15	213	-	15
28	15	15	59	15	16	90	15	15	121	14	14	152	20	19	183	19	17	214	-	15
29	15	15	60	15	16	91	14	15	122	15	14	153	20	21	184	19	16	215	-	15
30	15	15	61	15	16	92	15	15	123	15	14	154	18	17	185	-	16	216	-	17
31	15	15	62	15	15	93	15	16	124	15	15	155	16	17	186	-	17	217	-	15

TABLE I (Continued)

RENO CREEK
GAMMA RADIATION SURVEY

Grid No.	Prelim µr/hr.	Final µr/hr.	Grid No.	Prelim µr/hr.	Final µr/hr.	Grid No.	Prelim µr/hr.	Final µr/hr.	Grid No.	Prelim µr/hr.	Final µr/hr.
218	-	15	250	13	14	282	12	11	M-2	14	13
219	-	16	251	13	14	283	12	11	M-3	15	14
220	16	16	252	12	13	284	13	11	M-4	15	14
221	18	17	253	12	12	285	13	12	LSM-1	15	15
222	18	18	254	13	11	286	15	12	USM-1	15	15
223	19	20	255	11	11	287	12	12	I-1	15	15
224	19	19	256	14	13	288	13	11	I-2	15	15
225	19	18	257	14	15	289	13	12	I-3	15	15
226	19	18	258	11	12	290	13	12	I-4	17	15
227	18	17	259	10	12	291	13	14	P-10	15	15
228	15	14	260	11	11	292	9	8	P-11	15	15
229	15	16	261	11	11	293	10	9	I-12	15	15
230	15	15	262	11	11	294	10	8	I-13	15	15
231	15	14	263	11	12	295	10	10	I-14	15	15
232	14	15	264	12	12	296	10	10	I-15	15	15
233	13	12	265	12	11	297	9	8	M-16	15	15
234	12	12	266	11	11	298	9	10	M-17	15	16
235	11	12	267	11	12	299	9	8	M-18	15	15
236	12	12	268	11	11	300	9	9	M-19	15	15
237	11	11	269	11	11	301	9	9	LSM-2	15	14
238	11	11	270	12	11	302	9	9	USM-2	15	14
239	12	12	271	11	12	303	10	10			
240	12	11	272	11	11	304	11	10			
241	12	11	273	10	11	305	9	8			
242	11	12	274	9	10	306	9	9			
243	12	11	275	9	10	307	9	9			
244	12	11	276	9	10	308	9	10			
245	11	11	277	11	11	309	10	9			
246	11	11	278	13	11	P-1	24	21			
247	15	14	279	12	11	P-2	26	20			
248	14	15	280	11	11	08-1	32	20			
249	13	14	281	11	11	M-1	14	14			

Measurements performed with Ludlum Model 12S micro R meter S/N 12128 by P. R. Spieles. Preliminary survey - January 1986; Final Survey - May-June 1986.

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All gamma surveys were conducted with a recently calibrated Ludlum Model 12S Micro R meter held at a height of one meter from the ground. Exceptions to the one meter measurement were walls, ceilings, floors and equipment; these gamma measurements were taken at the surface.

Results of the gamma survey indicate no residual radioactive contamination on site. Soil samplings and alpha surveys were used to confirm gamma data.

SOIL SURVEYS

Soil samples were collected at several sites and analyzed for Ra-226. Using a worst case scenario, the most likely areas for contamination were selected as the sample points. Areas included were the production wellheads, the reservoir perimeter, the process building perimeter, and below the reservoir liner. Sample sites are shown on Figure 1.

Samples were collected to a depth of 15cm using a stainless steel auger. The soil was dried, crushed, split and sent to an EPA certified commercial laboratory for Ra-226 analysis. Table 2 shows the Ra-226 analyses for a particular site. All sites were less than the cleanup level of 5 pCi/gram.

ALPHA SURVEYS

Walls/Ceiling

Extensive sampling was performed on the walls and ceiling. Random sites were selected and labeled throughout the building, with special attention given to breaks in the insulation vapor barrier and at the top and bottom of the fiberglass panels. Each sample point was checked for gamma emissions at the surface of the vapor barrier. Alpha smears were taken on the vapor barrier and under the fiberglass on the metal wall. In addition, samples of fiberglass wool were taken for total alpha analysis.

Table 2

Reno Creek Soil Survey

Radium-226

Site	Ra-226 pCi/g
Well Pattern #1	3.1 ± 0.4
Well Pattern #1	1.4 ± 0.3
Well Pattern #2	1.5 ± 0.3
Grid #156	1.0 ± 0.3
Grid #89	1.9 ± 0.2
Sewage lagoon	0.8 ± 0.3
Grid #145	1.6 ± 0.3
Air Station #8 (upwind) Grid #4	1.0 ± 0.3
Air Station #10 (downwind) Grid #193	1.3 ± 0.3
Downwind of Project Grid #137	1.2 ± 0.3
Grid #158 (below liner)	1.1 ± 0.3
Grid #161 (below liner)	3.0 ± 0.4
Grid #164 (below liner)	3.6 ± 0.4
Grid #164 (below liner 15-30 cm)	1.6 ± 0.3
Grid #185 (below liner)	5.2 ± 0.4
Grid #185 (below liner 15-30 cm)	2.1 ± 0.2
Grid #188 (below liner)	1.2 ± 0.3
Grid #201 (below liner)	4.6 ± 0.4
Grid #148 (below liner)	1.4 ± 0.2
Grid #149 (below liner)	1.8 ± 0.2
Grid #163 (below liner)	1.1 ± 0.2
Grid #165 (below liner)	1.2 ± 0.2
Grid #167 (below liner)	1.5 ± 0.3
Grid #168 (below liner)	1.3 ± 0.2
Grid #186 (below liner)	0.9 ± 0.2
Grid #191 (below liner)	1.4 ± 0.2
Grid #200 (below liner)	2.4 ± 0.3
Grid #212 (below liner)	1.3 ± 0.2
Grid #215 (below liner)	1.5 ± 0.3
Grid #218 (below liner)	1.0 ± 0.3
Grid #227 (below liner)	1.6 ± 0.3

Table 3 lists the results. All values approximate background values and are significantly less than regulatory standards. Because the insulation proved radioactively clean, it was not removed.

Floor/Sump

Removable alpha smears were performed on floor and sump sample points located throughout the process and office building. A gamma reading at the surface supplemented the alpha smear. Floor and sump data are listed in Table 4. All values are well below the 1000 dpm/100cm^2 standard.

EQUIPMENT REMOVAL

Process equipment at Reno Creek was tranferred to Bear Creek Uranium for storage in the restricted area. Prior to the transfer, each item was surveyed for removable alpha and gamma. Table 5 summarizes the results. Equipment not shipped to Bear Creek and meeting unrestricted use standards was either sold, transferred to other RME projects or mothballed indefinitely. Ancillary equipment such as office furniture, tools and laboratory items meeting unrestricted use standards were sold to RME employees.

Table 3

Alpha and Gamma Contamination Surveys

Reno Creek Walls and Ceiling

Site I.D.	Gamma Vapor Barrier μr/hr	Total Alpha Fiberglass Wool dpm	Removable Alpha Vapor Barrier dpm/100 cm^2	Removable Alpha Metal Surface dpm/100cm^2
A	11	< 1	< 1	2
B	12	6	< 1	2
C	11	< 1	2	4
D	10	2	30	< 1
E	10	8	14	< 1
F	12	2	10	< 1
G	12	6	24	6
H	11	8	14	12
I	10	4	12	12
J	11	2	18	2
K	12	12	8	< 1
L	10	8	2	14
M	15	4	22	< 1
N	16	26	20	8
O	9	12	< 1	< 1
P	9	< 1	38	< 1
Q	11	< 1	36	6
R	9	< 1	20	< 1
S	11	28	16	4
T	10	< 1	8	2
U	11	12	10	< 1
V	12	< 1	20	< 1
W	11	4	4	2
X	11	8	8	10
Y	10	8	30	< 1
Z	11	< 1	< 1	< 1

Note: NRC standard for removable alpha = 1,000 dpm/100 cm^2.

Table 4

Reno Creek Process Building and Office

Gamma and Removable Alpha Measurements

Location	Gamma μR/hr	Removable Alpha dpm/100 cm^2
North Sump Wall	13	38
North Sump Bottom	12	32
South Sump Wall	16	50
South Sump Bottom	16	70
East end ledge	11	16
West end ledge	10	42
South end ledge	10	42
North end ledge	10	22
Floor - grid #247 (process bldg)	10	24
Floor - grid #242 (shop)	12	6
Floor - grid #283 (process bldg)	11	36
Floor - grid #255 (process bldg)	11	28
Floor - grid #291 (process bldg)	14	1
Floor - grid #269 (process bldg)	11	28
Floor - grid #296 (lab)	10	14
Floor - grid #304 (change room)	10	56
Floor - grid #306 (office)	9	34
Floor - grid #301 (hall way)	9	18
Floor - grid #233 (generator shed)	12	2

Note: NRC standard for removable alpha = 1,000 dpm/100 cm^2.

Table 5

Reno Creek Equipment

Final Removable Alpha Survey

Item	dpm/100 cm^2	Item	dpm/100 cm^2
Office table	14	Pallet of cement	2
Office desks	<1	Radon barrels	4
Office electric furnace	<1	Green trash barrel	<1
Lab storage closet	18	Wooden bench	6
Lab wall shelves	8	Gray trash can	6
Shelf under lab counter	6	Main switch - generator shed	24
18" lab funnel	12	Fire brick table	12
Fume hood	8	Spare pumps	12
weatherscope	4	Gear pump	14
Office chairs	12	Battery charger	2
Office propane furnace	<1	White trash can	14
Metal shelving unit - office	16	LP bottle	20
Urinal	12	Spare Hi-Vols	8
Shower - change room	<1	Shoumaker trailer	12
Toilet - change room	<1	Process water panel	18
Microwave	<1	6' wood stepladder	10
Hach Conductivity Meter	2	2-step ladder	14
Well probe	8	Floor creeper	10
Magnetic stirrers	2	16" C clamps	18
Lab sink	14	4 ton floor jack	6
Lab drying rack	8	Shop stool	16
Corning 125 pH meter	6	Gray storage cabinet - shop	16
Lab counter top	20	Tan metal cabinet - shop	10
Cabinet - generator shed	<1	Shop work bench	26
Onan 175 KW generator	12	Onan generator parts	18
Onan 30 KW generator	16	220V sump pump	18
Onan 2.5 generator	4	Plastic Bins - shop	14
Miller welder	20	Wood bins - shop	22
Desk in plant	14	Portable light stand	20
Motor control center	2	Catwalk	10
Oxygen - acetylene unit	4	Reservoir liner, Grid #220	10
Emergency lighting panel	6	Reservoir liner, Grid #213	34
Cat 175 generator	12	Reservoir liner, Grid #207	340
Cat 175 radiator	14	Reservoir liner, Grid #171	150
Hyster forklift	10	Reservoir liner, Grid #155	20
Dayton air compressor	16	Reservoir liner, Grid #149	130
Yale forklift	16	Reservoir liner, Grid #159	294
Zee first aid kit	6	Outside surface, office building	<1
Wall lockers	20	Blue water storage tanks	<1
Pipe vise	10	Outhouse	<1
Parts bin - generator building	14	Propane tanks	<1
Duct - heat exchanger	4	Acid tank	<1
Fan - heat exchanger	4	Main water storage tank	<1
Mill safety shower	2	Storage trailer (KMS)	4
Lube drum	4	Ammonia tank	<1
Swamp cooler - mill	10	Electric skid	<1
Welding helmet	16	Unit 212 pickup	<1
Shovels	6	Unit 223 pickup	6
Dolly	4	Orange fuel tank	<1
Propane weed burner	4	Red fuel tank	

RESERVOIR DECOMMISSIONING

License condition number 34C required disposal of the reservoir contents at an NRC licensed tailings disposal site. RME contracted Black Hills Trucking of Casper, Wyoming to haul the material to Bear Creek Uranium for disposal in the tailings impoundment. Over 1.5 million gallons were removed and hauled from October 1985 to June 1986.

The sediment in the reservoir was mixed into solution and the resultant slurry pumped into 8000 gallon tankers.

Prior to departure, gamma surveys were performed on the outside of the haul trucks and in the cabs. The gamma exposure limit on the outside of the truck and in the cab was not to exceed 200 mrem/hour and 2 mrem/hour, respectively. For contamination control, removable surface contamination on the trucks was to be kept within the limit of 2,200 dpm/100 cm^2 of alpha, the limit specified for natural uranium and thorium (49CFR183.397).

All measurements performed for gamma emissions and removable alpha were but a small fraction of the allowable. Gamma readings ranged from 10 to 30 µR/hour and removable alpha less than 100 dpm/100 cm^2. The results are shown in Appendix E, "Reno Creek Shipment Log".

Additional radiation safety measures were employed for the contract workers. Each worker was supplied with a personnel TLD badge. An environmental area TLD monitor was installed in the cab of each vehicle. A precalibrated Model G MSA pump, equipped with a filter, was placed in the cab of selected contractor vehicles to sample the air for radionuclide content. Urinalysis samples were collected from contract personnel prior to and after completion of the job to verify exposure estimates. Data for the contractors are shown in Appendix F. All results are significantly less than the MPC.

According to Department of Transportation and Nuclear Regulatory Commission regulations (49CFR173.389e, 10CFR71), material in the reservoir was not classified as radioactive material for packaging and transportation requirements. Radioactive material is defined as material in which the estimated specific activity is greater than 2,000 pCi/g of material. Therefore, no placarding, special packaging, or sampling was used for the haul.

After removal of the reservoir contents and the liner, a gamma survey and 10-15cm and 15-30cm soil cores were taken on the underlying material. Soil failing to meet the 5 pCi/gram Ra-226 standard was removed and hauled to Bear Creek Uranium for disposal in the tailings impoundment. The cleaned liner was hauled to Bear Creek Uranium for storage. Osborne Brothers Construction of Gillette, Wyoming was contracted to backfill the reservoir and spread topsoil. The disturbed area was seeded with a barley nurse crop in July and will be seeded in late fall with a native seed mixture consisting of 14% blue grama, 43% buffalo grass, 7% yellow sweetclover and 36% western wheatgrass.

WELL ABANDONMENT

This section describes the procedures used to abandon the wells in accordance with W.S. 35-11-404 and Part III of the Wyoming State Engineer's Office Regulations and Instructions. Included is a list of all R&D wells and a tabulation of the pertinent well data.

Table 6 gives the depth, casing diameter, and volume of cement used for each well. Also included in the table are the RME well number and the pattern number, well type, permit number, location, and abandonment date.

Well cementing was performed by Halliburton Services out of the Gillette, Wyoming district office under the direction of RME's Facility Superintendent on

Table 6

Reno Creek R&D In-Situ Project

Well Abandonment Data

Well Number	Pattern Designation	WSEO Permit No.	Location	Depth (ft)	Casing I.D.	Cement (ft^3)	Completion Interval	Date Plugged
P-1	One - Production	U.W. 45984	NWNW Sec 27	413	4.00	45	319-366	04/29/86
P-2	One - Production	U.W. 156320	NWNW Sec 27	413	4.75	51	319-366	04/29/86
M-1	One - Monitor	U.W. 45990	NWNW Sec 27	386	4.00	56	266-386	04/29/86
M-2	One - Monitor	U.W. 45989	NWNW Sec 27	405	4.00	152	249-405	04/29/86
M-3	One - Monitor	U.W. 45983	NWNW Sec 27	407	4.00	124	270-407	04/29/86
M-4	One - Monitor	U.W. 45987	NWNW Sec 27	383	4.00	56	265-383	04/29/86
I-1	One - Injection	U.W. 45984	NWNW Sec 27	414	3.00	56	323-370	04/29/86
I-2	One - Injection	U.W. 45984	NWNW Sec 27	413	3.00	67	320-372	04/29/86
I-3	One - Injection	U.W. 45984	NWNW Sec 27	418	3.00	101	320-365	04/29/86
I-4	One - Injection	U.W. 45984	NWNW Sec 27	414	3.00	101	317-355	04/29/86
USM-1	One - Monitor	U.W. 45986	NWNW Sec 27	215	4.00	45	176-215	04/29/86
LSM-1	One - Monitor	U.W. 45985	NWNW Sec 27	461	4.00	51	415-455	04/29/86
P-10	Two - Production	U.W. 52549	SWSW Sec 22	420	4.75	45	244-335	04/29/86
P-11	Two - Production	U.W. 52549	SWSW Sec 22	420	4.75	45	244-335	04/29/86
I-12	Two - Injection	U.W. 52549	SWSW Sec 22	420	4.75	51	244-335	04/29/86
I-13	Two - Injection	U.W. 52549	SWSW Sec 22	420	4.75	39	244-335	04/29/86
I-14	Two - Injection	U.W. 52549	SWSW Sec 22	420	4.75	34	244-335	04/29/86
I-15	Two - Injection	U.W. 52549	SWSW Sec 22	420	4.75	39	244-335	04/29/86
M-16	Two - Monitor	U.W. 52550	SWSW Sec 22	420	4.75	51	262-374	04/29/86
M-17	Two - Monitor	U.W. 52551	SWSW Sec 22	453	4.75	51	269-377	04/29/86
M-18	Two - Monitor	U.W. 52552	SWSW Sec 22	452	4.75	51	258-378	04/29/86
M-19	Two - Monitor	U.W. 52553	SWSW Sec 22	450	4.75	39	257-353	04/29/86
USM-20	Two - Monitor	U.W. 52554	SWSW Sec 22	190	4.75	39	151-190	04/29/86
LSM-21	Two - Monitor	U.W. 52555	SWSW Sec 22	440	4.75	39	410-440	04/29/86

April 29, 1986. A representative of the Wyoming Department of Environmental Quality observed the job. The cement mix consisted of Halliburton Light Cement, 2 percent Econolite (sodium silicate powder), and 0.25 pounds per sack Kwik Seal. The mix was slurried to a density of 11.4 pounds per gallon giving a yield of 2.74 cubic feet per sack and a strength of 150 psi in 72 hours.

The cementing procedure consisted of inserting one inch diameter flexible PVC tubing into the well casing to the bottom of each well. Cement was pumped through the tubing to the bottom of each well displacing water to the surface. When positive return of cement to the well surface was observed, the tubing was pulled from the casing and inserted in another well. Additional cement was injected from the surface to bring the cement column to the top of the casing.

After the cement hardened, the well casing was cut approximately two feet below the ground surface. The holes were capped, backfilled with the excavated material to the original ground surface, and seeded.

RADIATION MONITORING

Area Dosimetry

Area environmental TLD badges, provided by Eberline, were placed at selected Reno Creek work areas. Table 7 and Figures 3 and 4 summarize the data.

The annual 10CFR20 limit for gamma exposure to the general public is 500 mrem above background. All TLD monitoring sites at Reno Creek approximated the upwind control and were significantly below the limit.

Personnel Dosimetry

All Rocky Mountain Energy personnel and contract personnel were assigned Eberline personnel TLD's during decommissioning. Badges were exchanged quarterly. All results were less than 1% of the MPC. Data are shown in Appendix F.

Table 7

Reno Creek Area Dosimetry

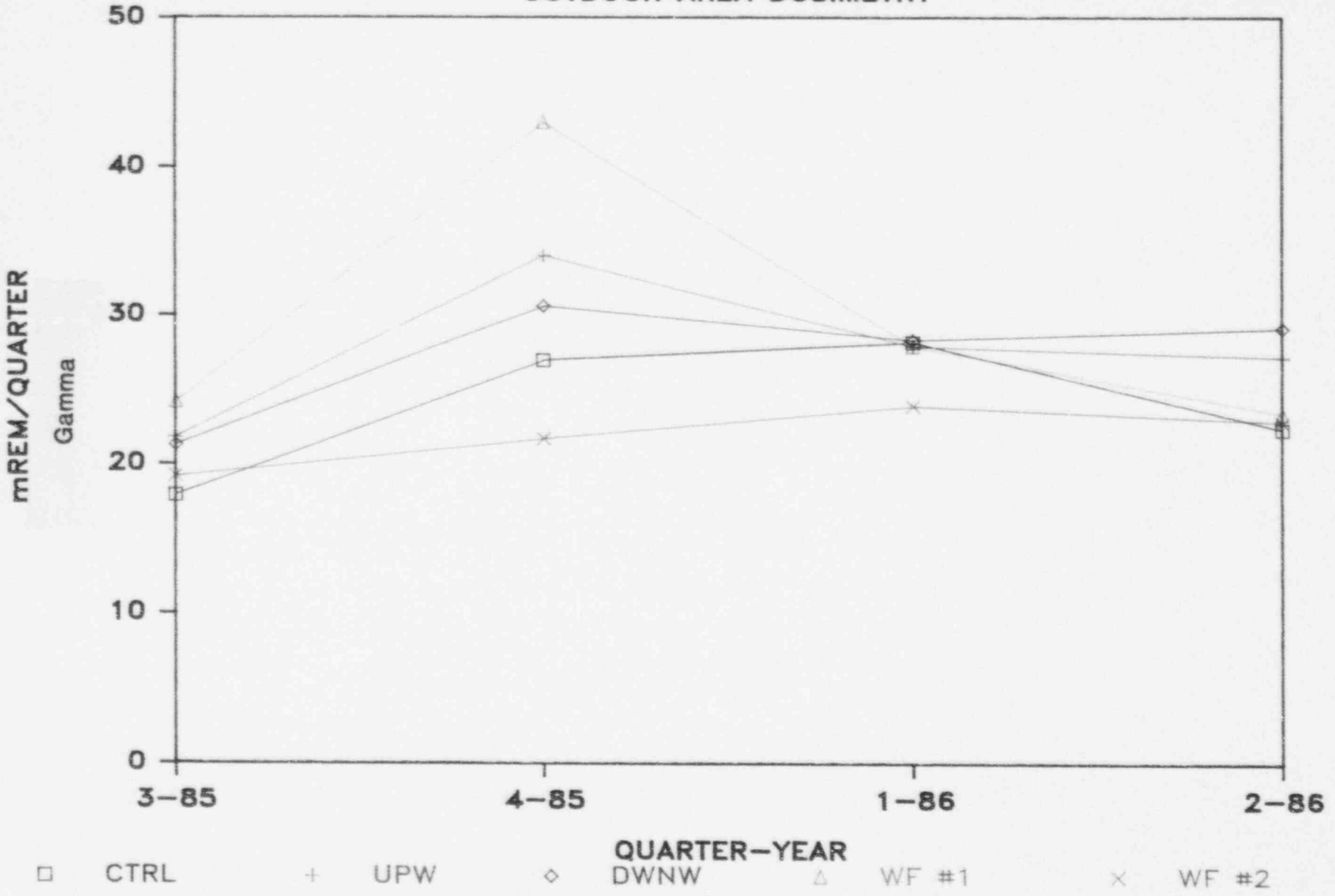
1985 - 1986

Site	3rd Quarter 1985 mrem	4th Quarter 1985 mrem	1st Quarter 1986 mrem	2nd Quarter 1986 mrem	Annual Total mrem	Net Exposure mrem	% MPC
Control	17.87	26.94	28.16	22.36	95.33	-	-
Upwind Boundary (#8)	21.82	34.04	27.90	27.17	110.93	15.60	3.12
Downwind Boundary (#10)	21.29	30.62	28.29	29.12	109.32	13.99	2.80
Well Pattern #1	24.18	42.98	27.90	23.40	118.46	23.13	4.63
Well Pattern #2	19.19	21.69	23.91	22.84	87.63	- 7.70	0.00
Office	19.06	23.65	18.90	19.89	81.50	-13.83	0.00
Laboratory	18.01	25.23	24.94	21.84	90.02	- 5.31	0.00
Sump	14.46	21.69	20.44	18.85	75.44	-19.89	0.00
Process Building	22.34	27.47	23.53	22.75	96.09	0.76	0.15

Dosimetry service performed by Eberline Instrument Corp.

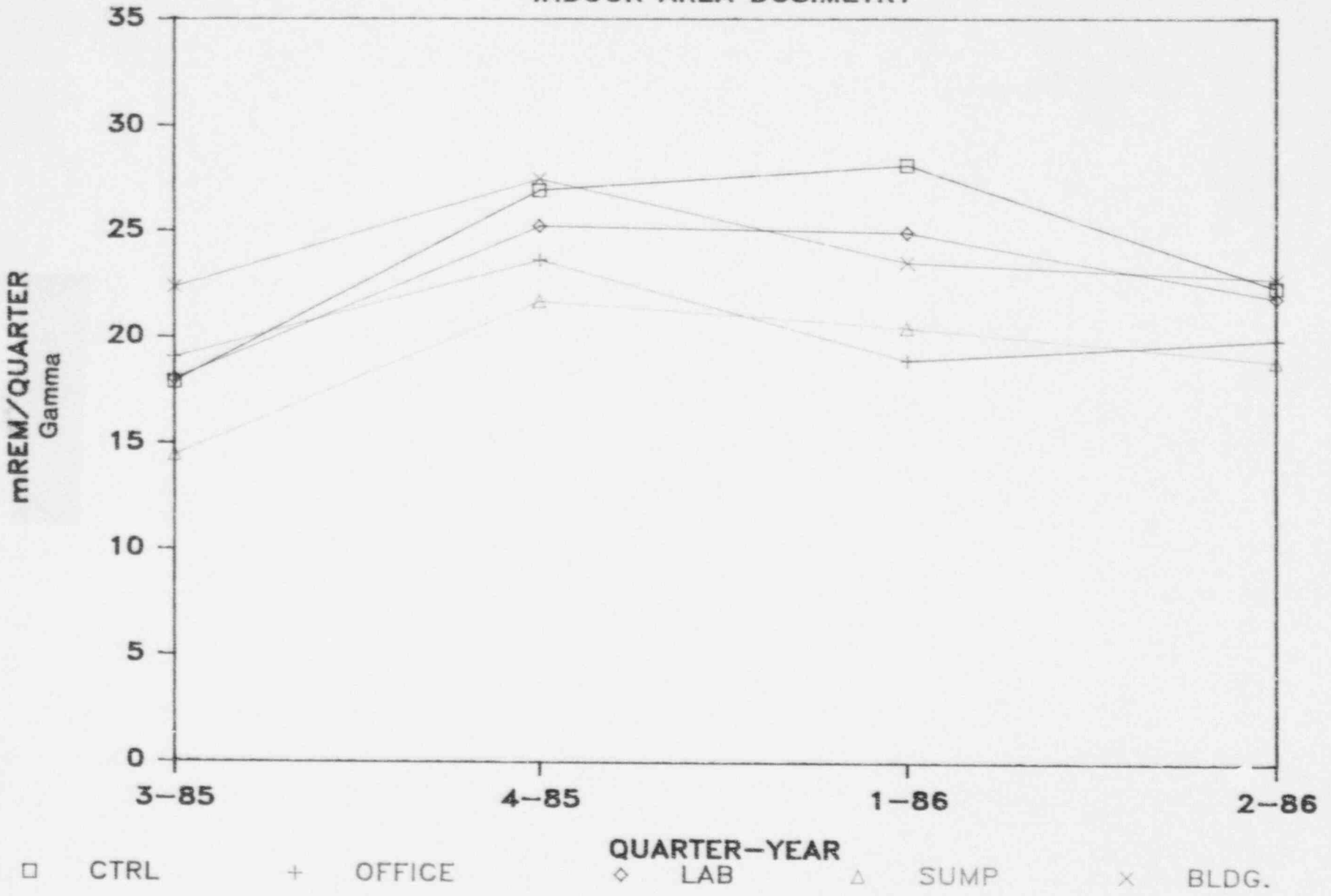
ROCKY MOUNTAIN ENERGY—RENO CREEK

OUTDOOR AREA DOSIMETRY



ROCKY MOUNTAIN ENERGY—RENO CREEK

INDOOR AREA DOSIMETRY



Airborne Radionuclides

High volume air samplers were located upwind, downwind, and inside the process building. Filters from each site were composited quarterly and analyzed for Ra-226, Th-230, and U-nat. Table 8 and Figures 5 through 10 list and display the results for the past year. All results were several orders of magnitude below 10CFR20 limits.

Radon Gas

Track Etch Type F Radon Detectors were placed at Site 8, an upwind location; Site 10, a downwind location; and at Site 9, within the process building. Detectors were exchanged quarterly at each site. Table 9 and Figure 11 summarize the results. In all cases, results were well below the 10CFR20 limit of 3.0×10^{-9} µCi/ml above background.

Table 8

Airborne Radionuclides

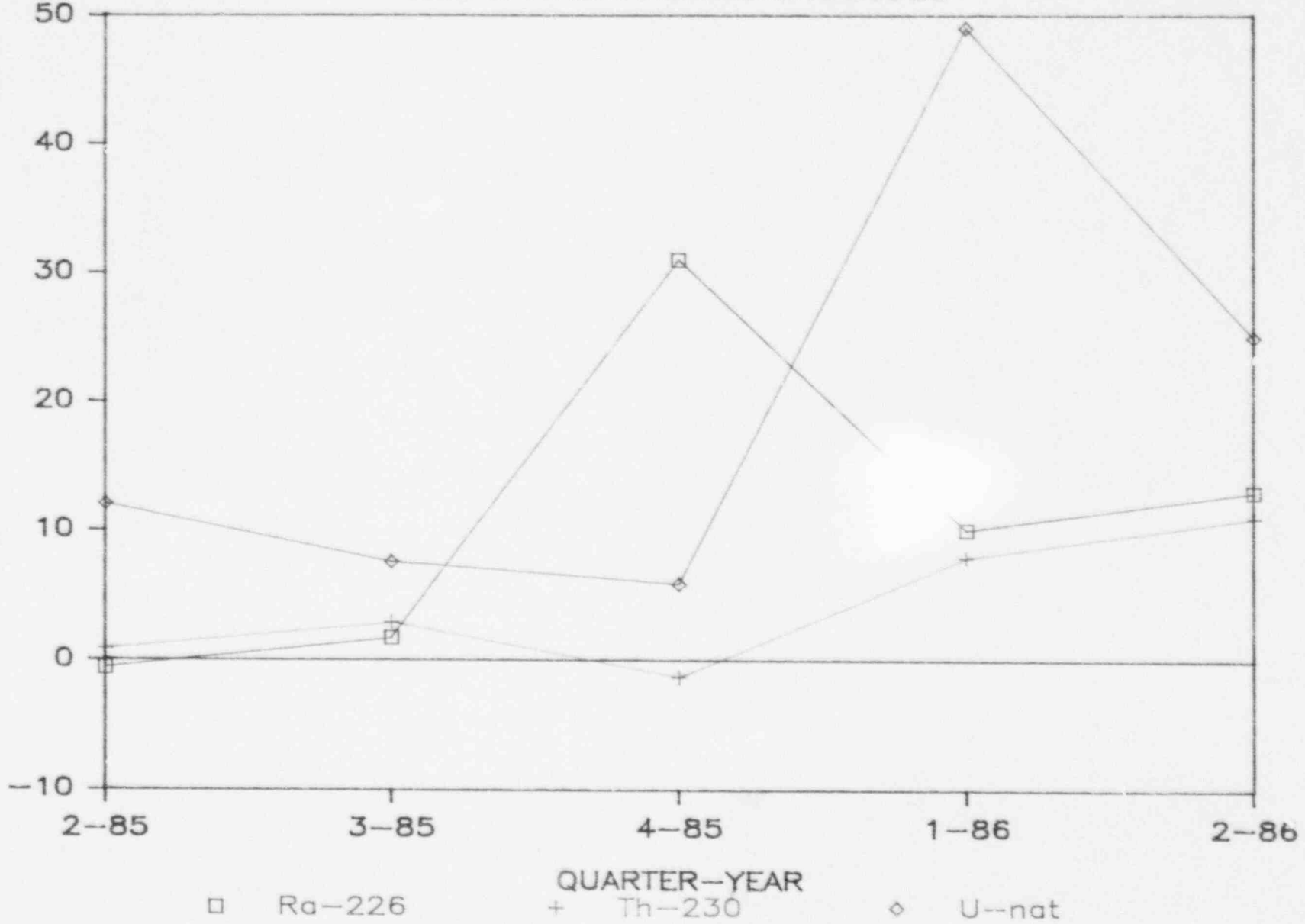
Reno Creek

	Radium-226 $\mu Ci x 10^{-16}/ml$	Thorium-230 $\mu Ci x 10^{-16}/ml$	Uranium-nat $\mu Ci x 10^{-16}/ml$
Site 8 (upwind)*			
Second Quarter 1985	-0.6 ± 3.3	0.9 ± 1.9	12.0
Third Quarter 1985	1.7 ± 4.3	2.9 ± 2.0	7.5
Fourth Quarter 1985	31.0 ± 4.0	-1.3 ± 3.1	5.8
First Quarter 1986	10.0 ± 5.0	7.9 ± 2.2	49.0
Second Quarter 1986	13.0 ± 5.0	11.0 ± 3.0	25.0
Site 10 (downwind)*			
Second Quarter 1985	0.9 ± 4.2	7.4 ± 3.0	8.9
Third Quarter 1985	4.1 ± 2.1	1.5 ± 2.1	0.8
Fourth Quarter 1985	20.0 ± 5.0	2.2 ± 3.0	27.0
First Quarter 1986	17.0 ± 8.0	6.6 ± 2.1	44.0
Second Quarter 1986	8.8 ± 5.4	5.1 ± 2.2	20.0
Site 9 (process bldg)**			
Second Quarter 1985	7.3 ± 6.4	14.0 ± 4.0	25.0
Third Quarter 1985	4.4 ± 6.2	4.1 ± 2.1	1.5
Fourth Quarter 1985	2.4 ± 4.1	0.5 ± 2.9	30.0
First Quarter 1986	9.5 ± 4.6	3.0 ± 1.3	26.0
Second Quarter 1986	18.0 ± 7.0	4.9 ± 2.0	30.0
* 10CFR20 Limit (unrestricted area)	2×10^{-12}	8×10^{-14}	3×12^{-12}
** 10CFR20 Limit (restricted area)	3×10^{-11}	2×10^{-12}	7×10^{-11}

FIGU[illegible]

ROCKY MOUNTAIN ENERGY—RENO CREEK

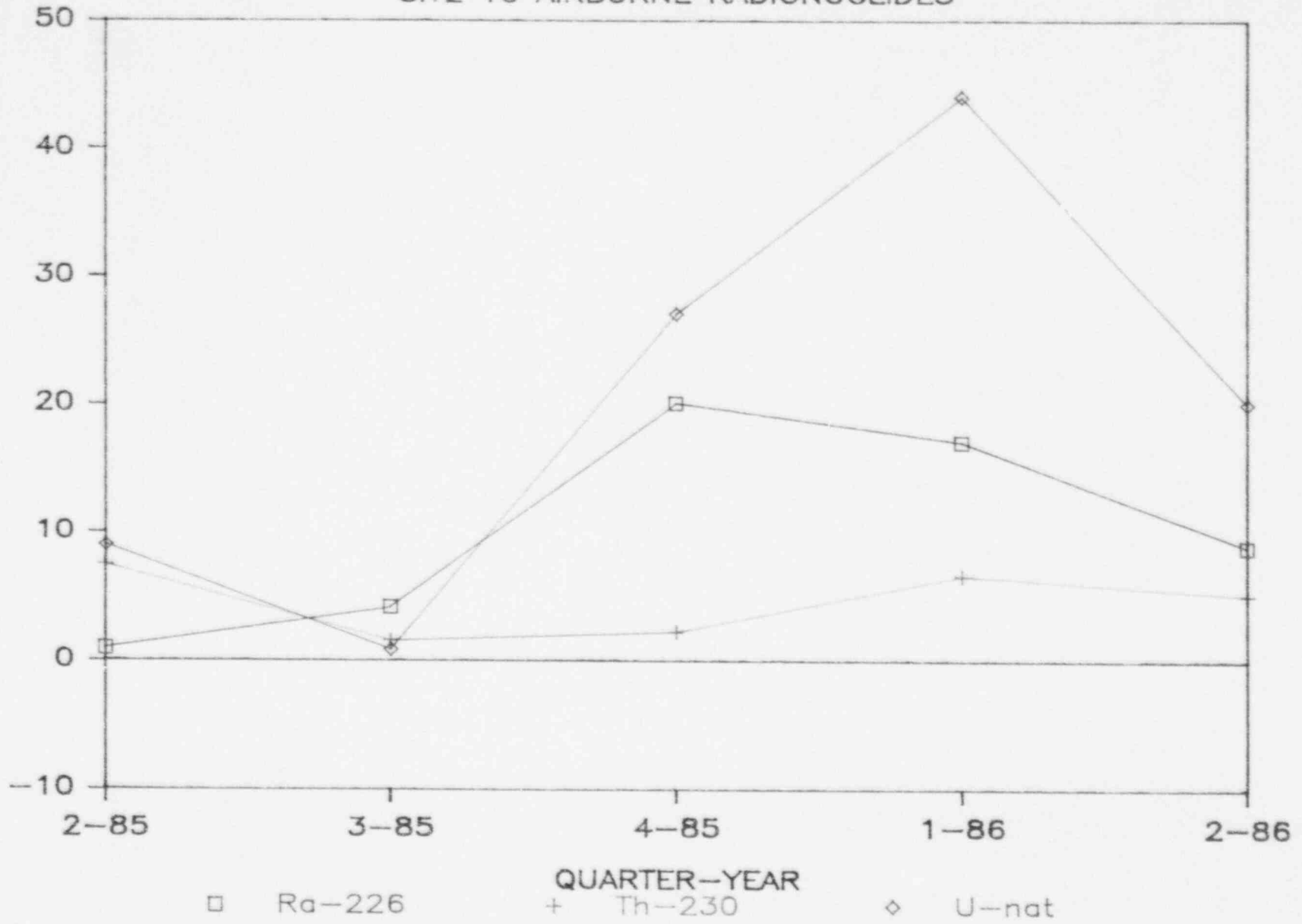
SITE 8 AIRBORNE RADIONUCLIDES



FIGUR

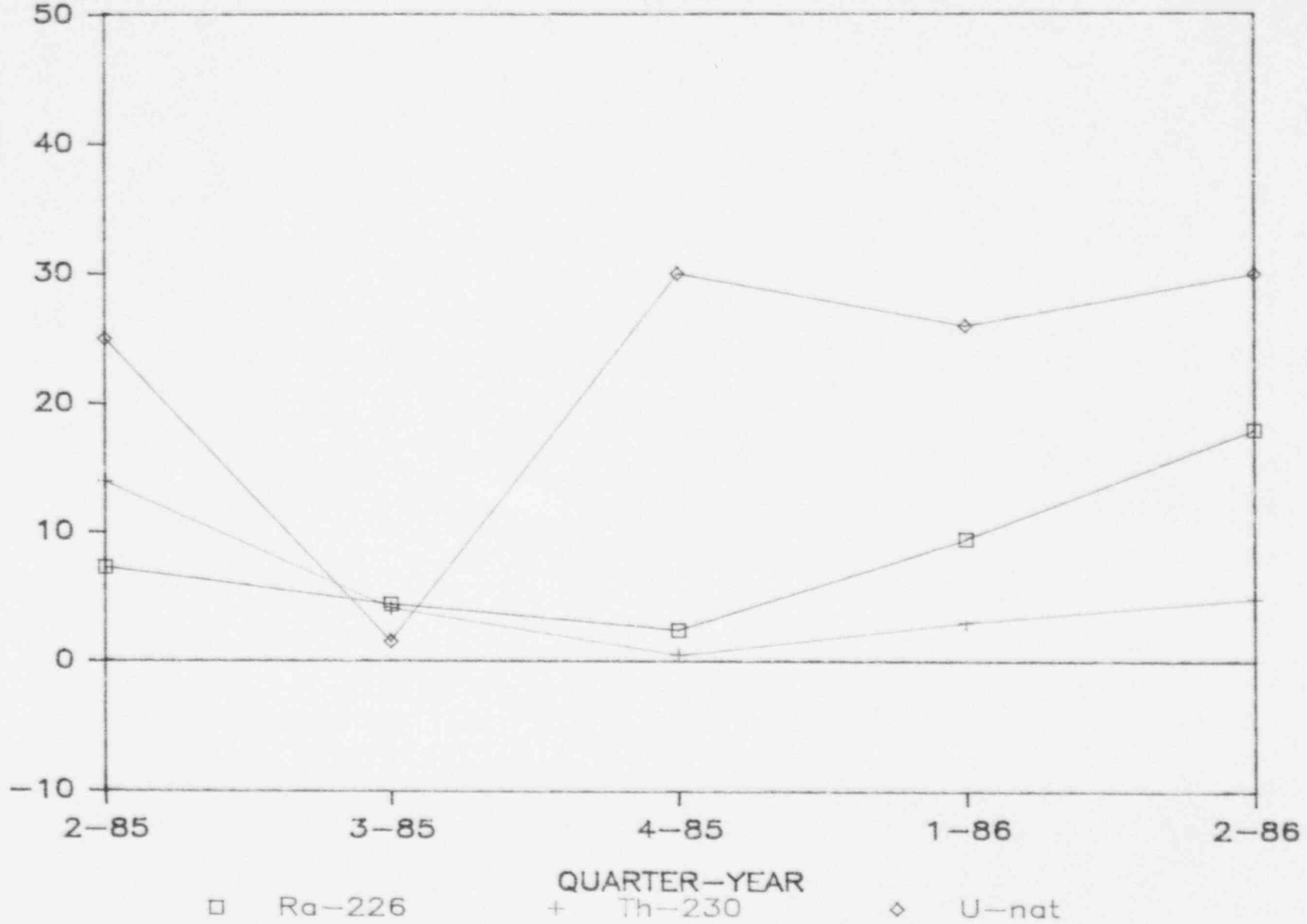
ROCKY MOUNTAIN ENERGY–RENO CREEK

SITE 10 AIRBORNE RADIONUCLIDES



ROCKY MOUNTAIN ENERGY—RENO CREEK

SITE 9 AIRBORNE RADIONUCLIDES



ROCKY MOUNTAIN ENERGY—RENO CREEK

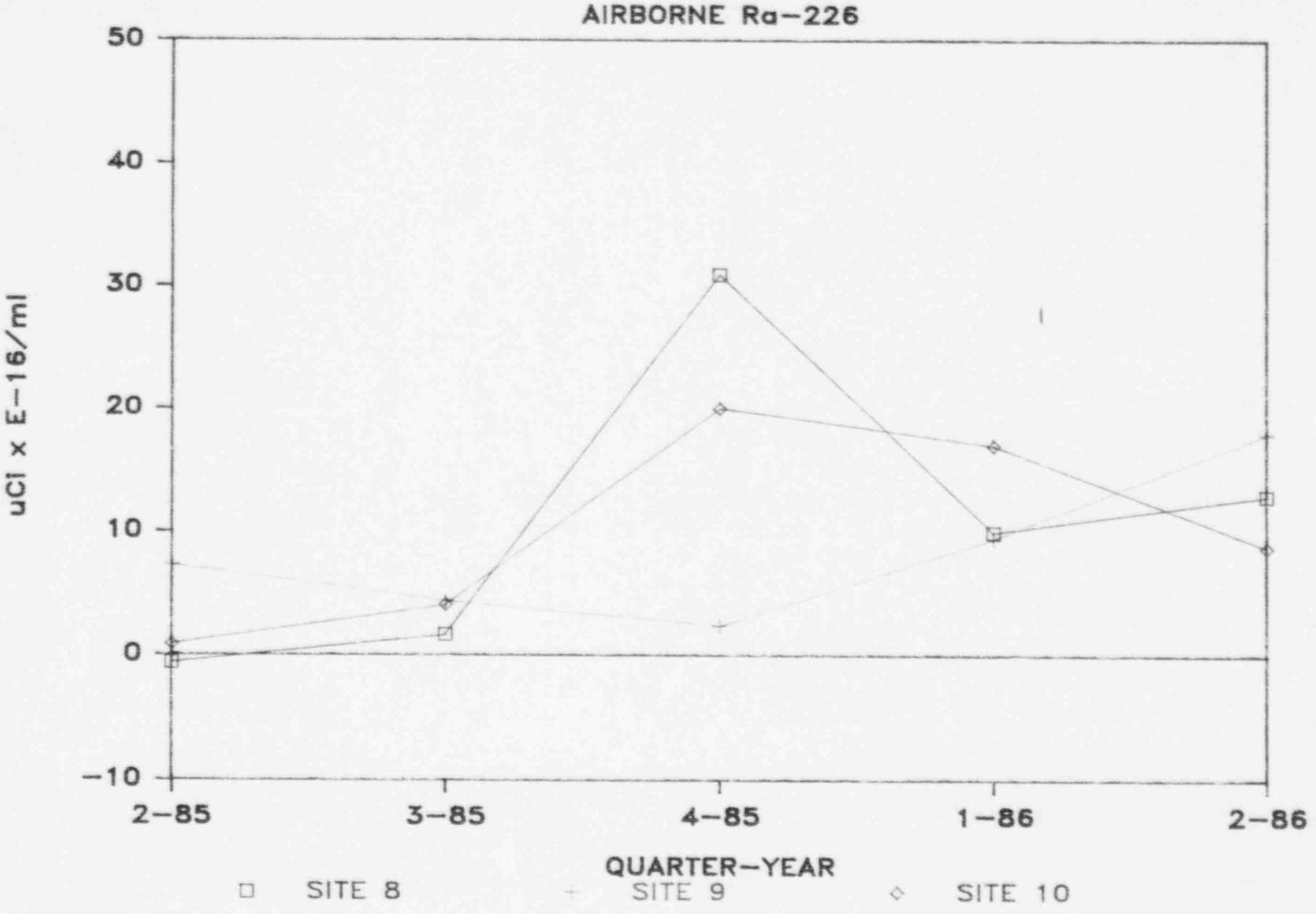
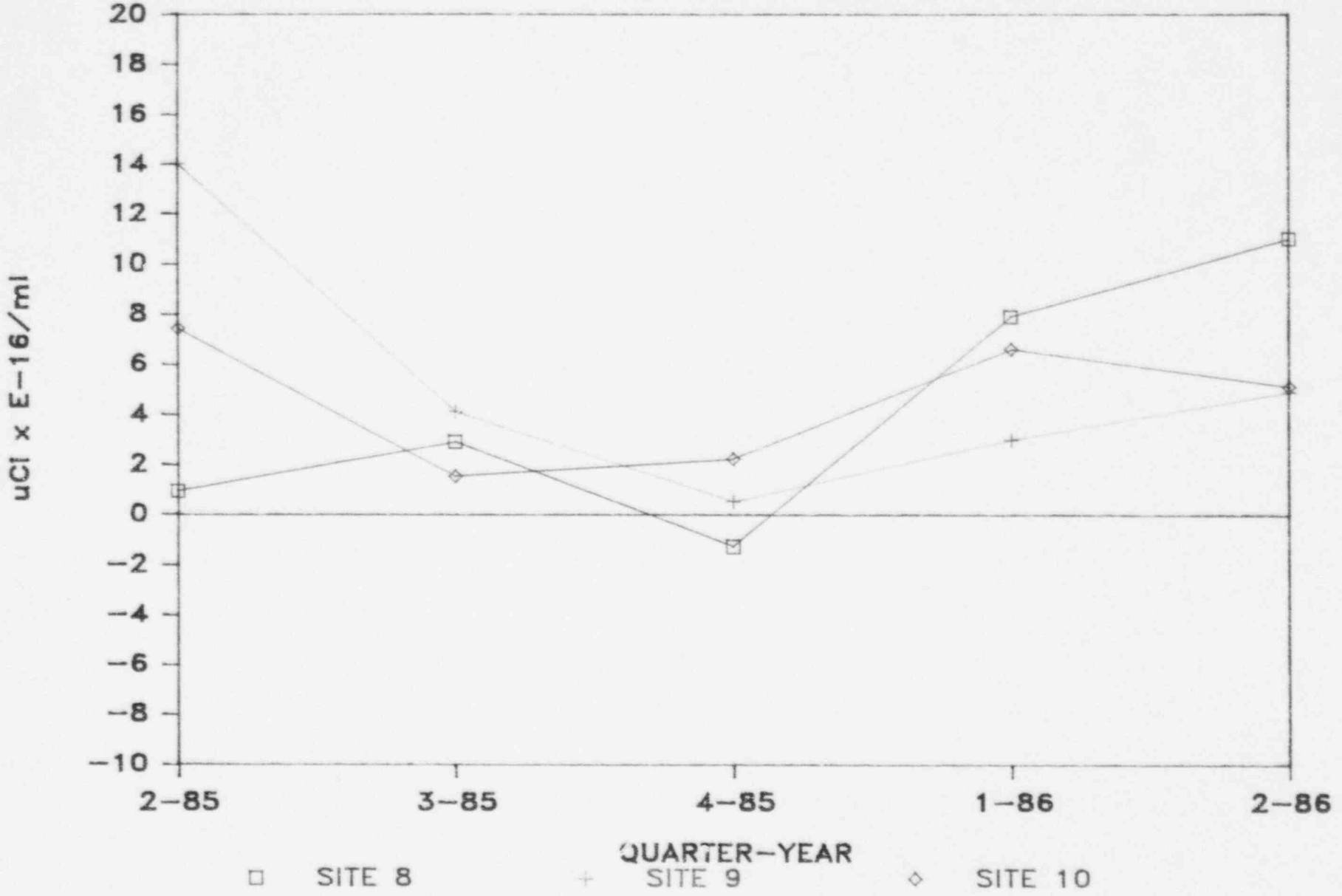


FIGURE 9

ROCKY MOUNTAIN ENERGY—RENO CREEK

AIRBORNE Th-230



ROCKY MOUNTAIN ENERGY—RENO CREEK

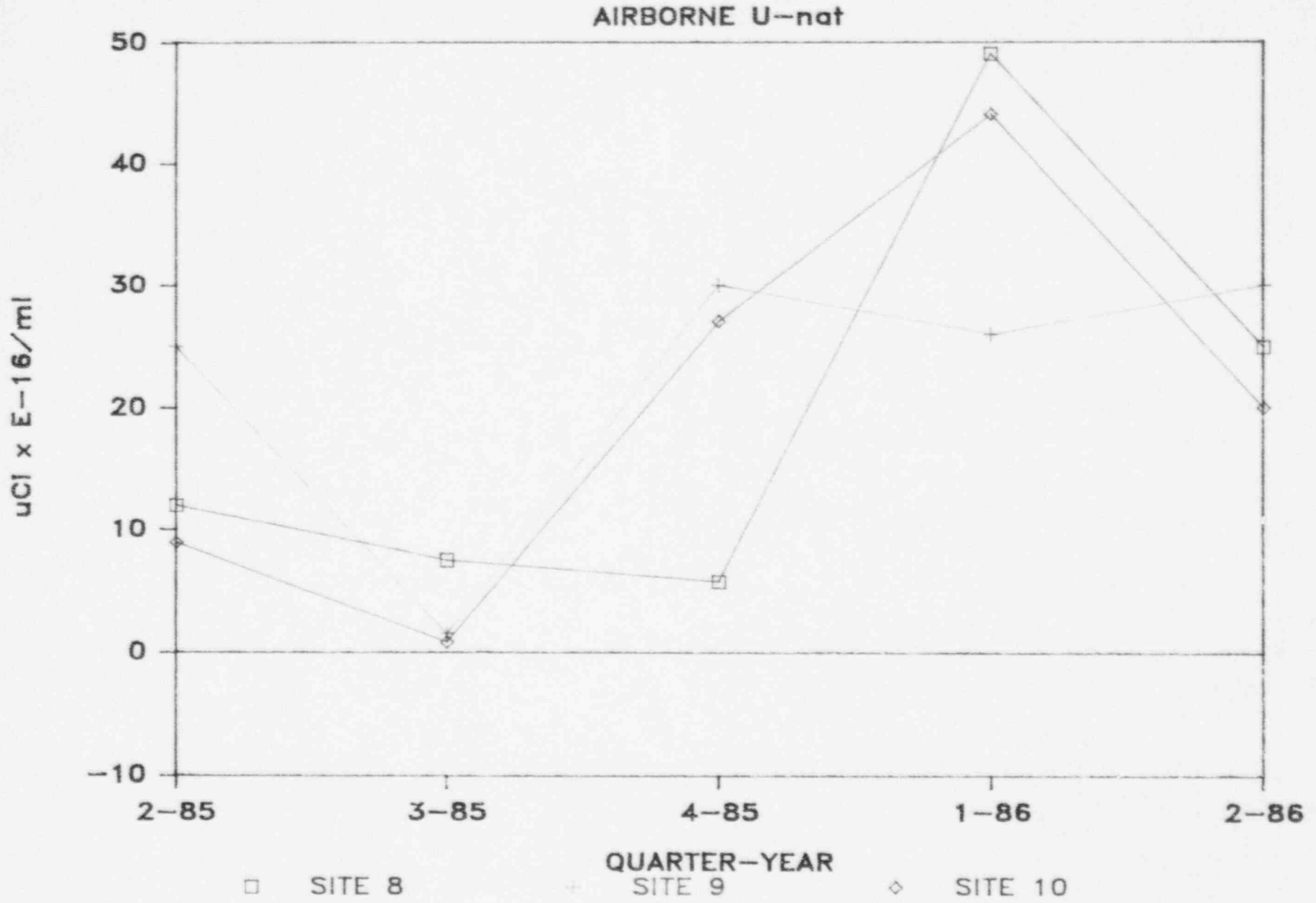


Table 9

Radon Gas

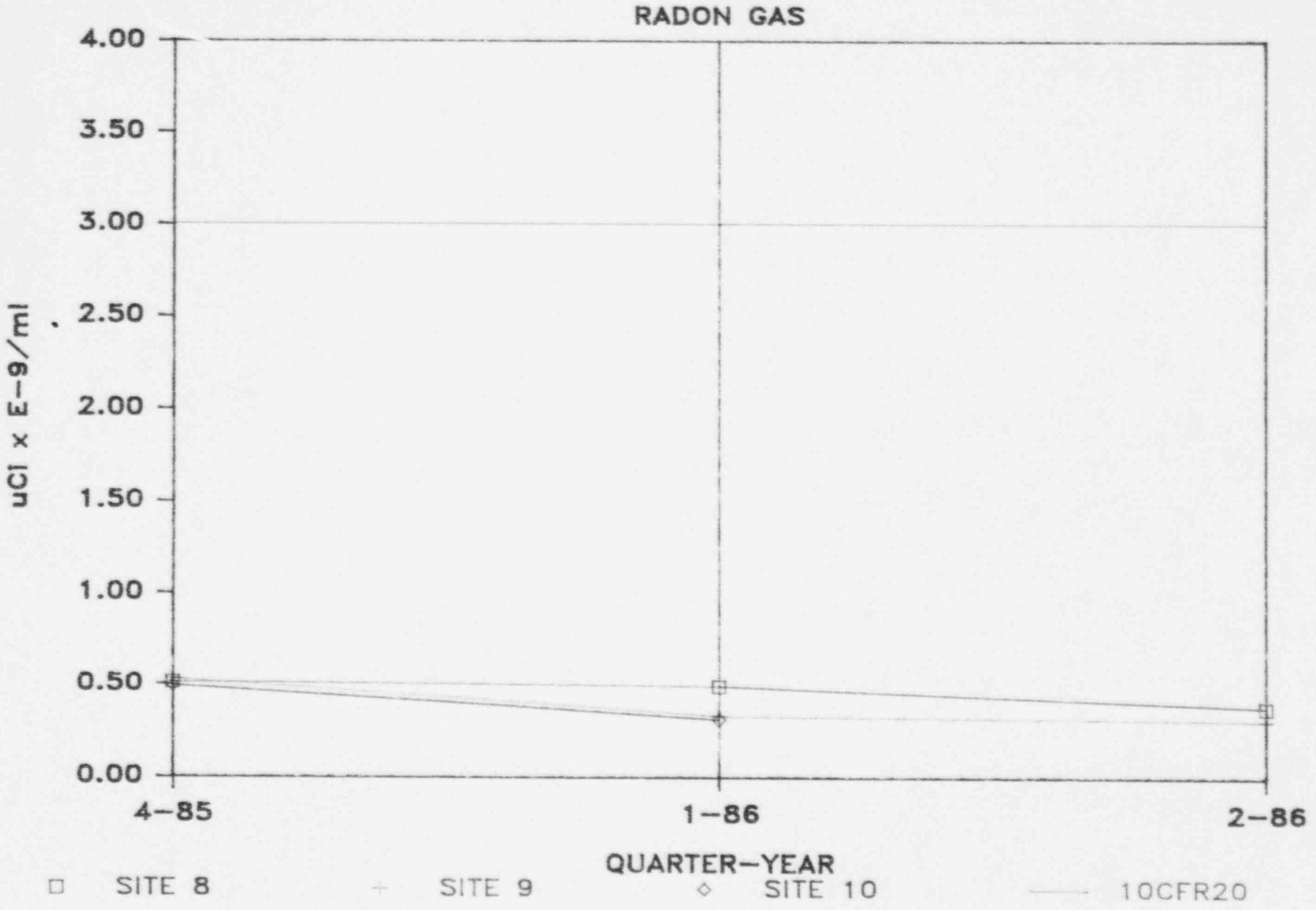
Reno Creek Decommissioning

	Radon $\mu Ci x 10^{-9}/ml$
Site 8 (upwind)*	
Fourth Quarter 1985	0.51 ± 15.5%
First Quarter 1986	0.49 ± 13.9%
Second Quarter 1986	0.38 ± 16.3%
Site 10 (downwind)*	
Fourth Quarter 1985	0.49 ± 15.9%
First Quarter 1986	0.31 ± 17.6%
Second Quarter 1986	Damaged Detector
Site 9 (process bldg)**	
Fourth Quarter 1985	0.53 ± 15.2%
First Quarter 1986	0.33 ± 17.0%
Second Quarter 1986	0.31 ± 18.1%

* 10CFR20 Limit (unrestricted area) 3.0×10^{-9} µCi/ml

** 10CFR20 Limit (restricted area) 3.0×10^{-8} µCi/ml

ROCKY MOUNTAIN ENERGY—RENO CREEK



APPENDIX A

ROCKY MOUNTAIN ENERGY

A Subsidiary of
Union Pacific Corporation

Ref: ESD/85/123

April 1, 1985

Mr. R. Dale Smith
Director, Uranium Recovery Field Office
U. S. Nuclear Regulatory Commission
P. O. Box 25325
Denver, CO 80225

Dear Mr. Smith:

Re: License SUA 1338, Docket No. 40-8697
Reno Creek R&D ISL Project

Enclosed is Rocky Mountain Energy's decommissioning plan for the Reno Creek project. As discussed with Ed Hawkins on February 13, 1985, this plan is submitted to support limited extension of the Reno Creek license until such time as the site can be released for unrestricted use.

Current plans to initiate decontamination and decommissioning activities are contingent upon regulatory agency approvals to abandon Pattern 1 wells. RME understands that Sandra Wastler has been assigned to the project and will be reviewing the Pattern 1 restoration and stabilization data. As you may know, the DEQ is presently evaluating Pattern 1. It would be helpful if any NRC concerns could be made known in the immediate future so that all parties understand the issues, if any, to be addressed.

If there are any questions regarding the decommissioning plan or Pattern 1, please give me a call at your earliest convenience.

Sincerely,

Michael R. Neumann

Michael R. Neumann
Senior Licensing Specialist

Enclosure

cc: Mr. Ed Hawkins (NRC)
Ms. Sandra Wastler (NRC)
Mr. Kent Loest (RME)

bcc: L. W. Hersloff w/enc.
R. E. Iwanicki wo/enc.
P. R. Spieles w/enc.
J. A. Yopps wo/enc.

10 Longs Peak Drive
Box 2000
Broomfield, Colorado 80020
303/469-8844
Telex 45-0321

8507022355 1p.

RENO CREEK

DECONTAMINATION AND DECOMMISSIONING PLAN

INTRODUCTION

Rocky Mountain Energy (RME) has completed test work to evaluate the feasibility of recovering uranium by solution-mining (in-situ) techniques at the Reno Creek research and development project. RME and its partners, Halliburton and Mono Power, have elected to discontinue project development activities at this time and initiate actions to close the test site. The purpose of this plan is to describe procedures for meeting Nuclear Regulatory Commission (NRC) criteria for unrestricted use following decontamination, decommissioning, and surface reclamation of the test site.

The following plan incorporates as much detailed information on methodology as can reasonably be anticipated prior to actual commencement of decontamination/decommissioning activities. It should be noted that although objectives of decontamination and decommissioning can be readily quantified, specific procedures used to meet those objectives are not completely defined at this time. RME expects optimal procedures will be identified as actual work progresses and from experience gained during decommissioning of the Nine Mile Lake project. We expect certain structures or facilities may

be left for landowner use based on the assumption that appropriate criteria for unrestricted use can be met.

REFERENCE DOCUMENTS

A variety of sources have been used to develop a practical, cost-effective, decontamination plan and determine appropriate standards for different areas or structures. Reference materials used include:

1. Regulatory Guide 1.86 (NRC).

2. Regulatory Guide 8.30 "Health Physics Surveys in Uranium Mills," June 1983 (NRC).

3. Regulatory Guide 8.31 "Information Relevant to Ensuring That Occupational Radiation Exposures At Uranium Mills Will Be As Low As Is Reasonably Achievable," May 1983 (NRC).

4. Decommissioning Handbook (DOE/EV/10128-1).

5. DES Related to the Decommissioning of the Edgemont Uranium Mill (NUREG-0846).

6. Radiological Surveys of Properties Contaminated by Residual Radioactive Materials From Uranium Processing Sites (NUREG/CR-2954).

7. Title 49 CFR 173.389(e) (DOT).

8. Title 10 CFR 71.7(a) (NRC).

9. Title 10 CFR, Part 10, "Standards For Protection Against Radiation," January 1, 1983 (NRC).

10. "Environmental Standards For Uranium and Thorium Mill Tailings At Licensed Processing Sites," Final Rule, 1983, EPA. Federal Register, Vol. 48, No. 196, October 7, 1983.

11. "Surface Gamma-Ray Measurement Protocol," July 1984, U.S. DOE, prepared by Bendix Field Engineering Corp; Contract DE-AC07-76GJ01664.

DECONTAMINATION OBJECTIVES

Certain areas and equipment within the process building may contain residual radioactivity from uranium recovery operations. Soils within the test pattern areas and

beneath the evaporation pond may also show evidence of residual contamination. Prior to decommissioning activities, radiological surveys will be conducted to define areas, equipment, structures, etc. requiring remedial action and to identify the potential for personnel exposure during decommissioning. The goal of decommissioning operations will be to provide reasonable assurance that residual radioactive materials do not cause:

1. Gamma radiation exposure rates exceeding 10 μR/hour above background in any occupied or occupiable building.

2. Concentration of Ra^{226} exceeding 5 pCi/g above background in the first 15 cm. of soil and 15 pCi/g averaged over any 15 cm. layer of soil below the surface, averaged over a 100 square meter area.

3. Surface contamination levels exceeding those stipulated for U-nat and associated decay products in Table 1 of NRC Regulatory Guide 8.30.

DECOMMISSIONING PROCEDURES FOR STRUCTURES AND EQUIPMENT

To the extent possible, equipment will be transferred to the restricted area of another NRC licensed facility, thus

eliminating the decontamination requirement. Items transferred to another licensed facility will first be surveyed for removable alpha and the results of the surveys documented. All vehicles used in equipment transfers will be placarded according to applicable DOT regulations.

For contaminated items to be released to the unrestricted area, the external and, where possible, internal surface will be cleaned by abrasive blasting, vacuum cleaning, water scrubbing, and high pressure water spray, or combinations of these processes. If blasting abrasives are used, work will be conducted in compliance with MSHA and OSHA requirements, including the use of respirators as appropriate. Chemical agents such as nitric acid, sulfuric acid, and solvents may also be used. For maximum decontamination, acid solutions, if used, will be allowed to stay on the surfaces for 10 to 30 minutes. The acid or other cleaning fluids will be rinsed off and directed to an appropriate holding tank for temporary storage prior to final disposal. Respirators may be used and adequate ventilation will be provided as required by MSHA and OSHA worker protection regulations. Air sampling will be conducted pursuant to Regulatory Guide 8.30 during decontamination activities.

Concrete trenches, footings, and floors in the process building will be decontaminated by vacuum cleaning, water scrubbing, and/or high pressure spraying or abrasive blasting. Cleaning solutions or abrasives used to decontaminate concrete structures will also be routed to the holding tank. If it becomes necessary to remove portions of concrete structures, worker protection from dust exposure will be provided through proper ventilation, water spraying, and/or use of respirators. All workers will be informed of potential radiation exposure pathways in accordance with the Worker Training Program attached to this plan (Attachment A).

Prior to release, decontaminated surfaces will be surveyed to insure contamination levels do not exceed the following:

ACCEPTABLE SURFACE CONTAMINATION LEVELS
Regulatory Guide 8.30

	Average	Maximum	Removable
U-nat, U-235, U-238 and Associated Decay Products	5,000 dpm/ 100 cm^2	15,000 dpm/ 100 cm^2	1,000 dpm/ 100 cm^2

The average and maximum values, in disintegrations per minute, will be determined with an appropriate alpha detector. The amount of removable alpha contamination will be determined by wiping the area with a Nu-Con® cloth smear while applying

modest pressure. The level of radioactive material on the smear will be determined with an Eberline mini-scaler and SAC/R5 detector.

A Radiation Safety Technician will monitor the decontamination procedures to ensure structural materials and equipment meet the specified release limits and to maintain personnel exposure records. A Radiation Safety Officer will review and certify the results.

No equipment or structural material will be painted or coated in any way prior to the final radiation survey to determine whether such equipment or material meets radiation limits for release to the unrestricted area.

Results of all radiation surveys and wipe tests on equipment and structures will be documented. Documentation will include a description of the item surveyed, date, survey instrumentation, survey results, and signature of the individual performing the survey or wipe test. All instruments used for radiation measurements will be calibrated in accordance with NRC or the manufacturers' specifications and calibration results recorded as appropriate.

SOIL DECONTAMINATION/REMOVAL

Areas of possible soil contamination around the site, including the wellfields, pond, and plant will be identified using a gamma survey.

Baseline gamma exposure rates will be determined by surveying an adjoining off-site area unaffected by mining activities. The survey will be conducted at one meter above the ground with a Ludlum model 12S micrometer using grid intervals of 100 feet over an area approximately equal to the test site. Soil moisture content will be determined at 10 percent of the survey sites. The meter will be calibrated by the Denver U. S. Bureau of Mines or other qualified entity using a Ra-226 standard and cross-calibrated to RME's Cs-137 check source.

Areas of possible soil contamination around the site, including the well patterns, pond, and plant will be identified using a gross gamma survey. The survey will be conducted at one meter above the ground using a grid interval of 100 feet. Grid measurements will be supplemented with readings taken between grid points to ensure a minimum of 25 measurements per feature (e.g., pond, well patterns, etc.) are obtained. All measurement locations will be flagged or surveyed.

Gamma exposure rates at 5 cm. above ground will be measured at a minimum of 10 gross gamma survey locations. The 5 cm. survey locations will be selected to cover the complete range of readings from the gross gamma survey. These readings will be supplemented with Ra-226 and soil moisture content analyses from surface soil samples (top 15 cm.) taken from the same locations as the 5 cm. gamma readings. RME will establish a correlation between gamma exposure rate (adjusted for moisture content) in µR/hour and Ra-226 activity in pCi/g. This correlation, in conjunction with "baseline" gamma exposure rates, will be used to calculate a proposed cleanup action level in µR/hour corresponding to 5 pCi/g over background radium-226 activity. The results of the gamma survey, Ra-226 analyses, and action level calculations will be submitted to the NRC.

Soil cleanup activities will begin after the proposed action level has been established. Wherever gamma exposure rates exceed the approved action level, soils will be removed for disposal. Gamma surveys will be employed during the removal process to ensure the adequacy of cleanup. Soil removal for any given area will be terminated when gamma exposure rates are below the action level.

RESERVOIR DECOMMISSIONING

Decommissioning will commence when water in the evaporation reservoir has essentially dissipated through evaporation to a point where material can be handled with conventional earthmoving equipment or covered in place.

Sediment core samples will be obtained using a 50-foot interval grid. The samples will be collected from surface to liner using a conventional soil auger. The sediment cores will be analyzed individually for Ra-226, Th-230, Pb-210, Po-210, and U-nat. If analyses indicate the sediment radionuclide content is less than applicable NRC standards, the material and liner will be properly covered for on-site disposal.

If the analyses exceed applicable standards, the sediment will be removed from the reservoir, loaded into trucks, and hauled to an approved licensed tailings site for permanent disposal. The synthetic liner will be hauled with the sediment or decontaminated to meet applicable criteria. The soil beneath the reservoir liner will be surveyed for gamma radiation. Soil exceeding the predetermined gamma action level for Ra-226 content will be hauled away with the sediment.

TRANSPORTATION OF RESERVOIR SEDIMENT AND LINER

Department of Transportation and Nuclear Regulatory Commission regulations (49 CFR 173.389(e), (10 CFR 71.7), d fine radioactive material as having a specific activity greater than 2,000 pCi/g. Placarding and special packaging of the sediment will be implemented only if prior analysis indicates the material to be in excess of 2,000 pCi/g.

Gamma surveys will be performed on the outside of the haul trucks prior to each run. The gamma exposure on the outside of the truck will not exceed 200,000 µrem/hour.

Gamma surveys and alpha smears will be performed in the cab prior to each run. The exposures will not exceed 2,000/µrem/hour and 2,200 dpm removable alpha/100 cm^2, respectively.

For contamination control, removable surface contamination on the trucks will be kept less than 2,200 dpm/ 100 cm^2 of alpha, the limit specified for natural uranium and thorium (49 CFR 183.397). The material will also be covered to prevent loss during transportation.

Personnel involved in loading and hauling material will be issued Personnel TLD badges.

All vehicles involved in loading and hauling material will be equipped with Environmental TLD monitors in the cab.

DOCUMENTATION OF SURVEYS

All radiation surveys will be documented. Documentation will include a description of item surveyed, date, survey instrumentation, survey results, and signature of the person performing the surveys. These records shall be maintained on file at Rocky Mountain Energy for a period of five years following decommissioning.

Prior to release of premises for unrestricted use, RME will conduct a comprehensive radiation survey establishing contamination has been reduced to respective limits previously specified. A copy of the final survey report will be filed with the Division of Fuel Cycle and Material Safety, U. S. Nuclear Regulatory Commission, Washington, DC 20555 and also with the Director of the Region IV Office of Inspection and Enforcement, U. S. Nuclear Regulatory Commission.

WELL ABANDONMENT

All injection, production, observation, and monitor wells within the test site will be sealed in accordance with

Wyoming Department of Environmental Quality (DEQ) and State Engineer requirements. Wells will be sealed by a down-hole, positive displacement method intended to ensure maximum plugging of the open completion interval and prevent vertical movement of groundwater through the well casing. The procedure which will be used is:

1. Insert injection string of tubing inside well casing to bottom of hole.

2. Batch mix abandonment fluid, typically consisting of cement, bentonite clay, and sodium silicate filler to a strength of 150 psi in 72 hours.

3. Inject cement slurry to bottom of well through tubing using positive displacement pump.

4. Continue injection until volume sufficient to seal hole, completion interval and casing to surface.

5. Withdraw injection string.

6. Measure depth to top of cement column in casing. If necessary, top off with cement to the surface.

7. Cut off casing at least two feet below ground surface.

8. Plug top of casing with cement to prevent entry.

9. Backfill to surface.

SURFACE RECLAMATION

All areas of significant disturbance, including unreclaimed wellfield areas, evaporation ponds, access roads, and building or trailer sites will be reclaimed according to DEQ and surface owner requirements. The reclamation seed mixture will be determined through consultation with the landowner, local Soil Conservation Service, and DEQ personnel. Certain structures such as the process building, storage and generator sheds, and site fencing may be left intact for landowner use after meeting unrestricted use standards. As per State of Wyoming regulations, a "consent agreement" between RME and the landowners will be executed prior to leaving structures onsite.

0730S
3/20/85

ATTACHMENT A

WORKER TRAINING PROGRAM

The radiation training program established for the Reno Creek facility's decommissioning plan will outline the potential exposure pathways to radiation and the fundamentals of protection from exposure to uranium and associated decay products. This program has been approved by the corporate Radiation Safety Officer (RSO) and will be implemented by the project Radiation Safety Technician (RST). The RSO and RST are qualified pursuant to the requirements of Conditions 11, 12, and 14 of Source Material License SUA-1228. This training program, although generic to uranium mills as per Regulatory Guide 8.31, will address and emphasize specifically those concerns related to decontamination and decommissioning of a uranium facility. The following areas will be included in the program:

1. Fundamentals of Health Protection
    a. Hazards of Exposure
    b. Modes of Entry Into the Body
    c. Philosophy of ALARA

2. Protection Afforded Workers to Reduce Exposures

   a. Respirators - Proper Fit and Use; Appropriate Circumstances for Use

   b. Protective Clothing

   c. Breathing Zone Samplers - Proper Use and Circumstances for Use

   d. Designation of Eating, Drinking, Smoking Areas

   e. Adherence to Standard Operating Procedures and Radiation Work Permits

   f. Responsible Participation in Dosimetry and Bioassay

   g. Proper Procedures of Self-Decontamination

3. Responsibilities

   a. Radiation Safety Staff - Maintain Exposures at ALARA levels, preparation of written SOPs for monitoring (per Regulatory Guide 8.30) and decommissioning. Maintain properly working and calibrated equipment. Issue Radiation Work Permits (RWP) as required and requested.

   b. Radiation Worker - Conscientious adherence to rules, SOPs, expedient reporting of equipment malfunctions.

4. Rules and Regulations

   a. NRC 10 CFR 20, 30, 40, 50, 60, 71, 72

   b. EPA 40 CFR 192

   c. EPA 40 CFR 190

   d. DOT requirements for radioactive materials (LSA)

APPENDIX B

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
URANIUM RECOVERY FIELD OFFICE
BOX 25325
DENVER, COLORADO 80225

FEB 25 1986

FEB 24 1986

URFO:GRK
Docket No. 40-8697
SUA-1338, Amendment No. 11
04008697111E

Rocky Mountain Energy Company
ATTN: Mr. Michael R. Neumann,
Senior Licensing Specialist
10 Longs Peak Drive
Box 2000
Broomfield, CO 80020

Gentlemen:

The Uranium Recovery Field Office has completed its review of the June 1981 wellfield water quality data collected from test pattern I and the confirmation samples collected on September 17, 1985, as well as the injection well pumping data submitted on May 12, 1985. As a result, the NRC finds that restoration and stabilization of pattern I at the Reno Creek R&D in situ leach facility has been achieved. As you will recall, a similar finding was reached for test pattern II and is documented by NRC letter dated June 17, 1983. Although this finding was made, no licensing action occurred at that time. This letter therefore serves as notification of successful restoration and stabilization in both test patterns.

It should be noted that the staff does not consider your restoration techniques for test pattern I to be applicable on a commercial scale venture. The "natural restoration" which took place at the site may in fact be unique to the area in test pattern I and would not be considered feasible in a commercial size production wellfield. Considering these points, the staff has deleted all license conditions from Source Material License SUA-1338 which involve restorating, sampling and production activities in pattern I. During this licensing action, consideration was also given to Amendment No. 8 to Source Material License SUA-1338 dated May 3, 1985, and the December 20, 1985 meeting held at the Uranium Recovery Field Office. Both of these items concern the pending decommissioning and decontamination of the site as well as the removal of

uranium slurry from the facility. Because all uranium slurry had been removed from the site, the staff recommends deletion of license conditions, from your license, which deal with this matter.

You will also note that Source Material License SUA-1338 has an expiration date of September 30, 1986. We would urge that in order to avoid an expiration date amendment, RMEC rapidly pursue wellfield abandonment and facility decontamination and decommissioning in accordance to your amended license. Prompt action in this matter will allow our staff to perform a final decontamination survey and terminate Source Material License SUA-1338 prior to its expiration date.

Based upon the above discussion and pursuant to Title 10, Code of Federal Regulations, Part 40, the USNRC hereby amends Source Material License SUA-1338 by deleting Condition Nos. 15-21, 24, 25, 27, 29, 32, 33 and 35 as well as revising Condition Nos. 2 and 34 to read as follows:

2. 10 Longs Peak Drive
   Box 2000
   Broomfield, Colorado 80020

34. The decommissioning plan submitted by RMEC on April 1, 1985, is approved with the following modifications:

    A. The Radiation Safety Technician (RST) and the Radiation Safety Officer (RSO) shall meet the appropriate qualifications as defined in Regulatory Guide 8.31, "Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Mills are As Low As Reasonably Achievable " and be approved by the Nuclear Regulatory Commission, Uranium Recovery Field Office.

    B. The results of RMEC's gamma survey, Ra-226 analysis and action level calculations as described on pages 8 and 9 of the decommissioning plan (dated April 1, 1985), shall be submitted for NRC review and approval. Soil cleanup activities shall not begin until the NRC has approved the proposed action level for the gamma survey.

    C. The removal of the sludge from the evaporation pond and its transfer to a licensed disposal facility shall be as described in the licensee's letter dated September 4, 1985.

The effect of this amendment is to recognize restoration and stabilization of test patterns I and II and delete license conditions which require ground water monitoring for these test patterns.

All other conditions shall remain the same. The license is being reissued in its entirety in order to incorporate the amendment described above.

The issuance of this amendment was discussed and agreed to via telephone between your Mr. Neumann and Mr. Konwinski of my staff on February 12, 1986.

FOR THE NUCLEAR REGULATORY COMMISSION

R. Dale Smith, Director
Uranium Recovery Field Office
Region IV

Enclosure: Source Material License SUA-1383

APPENDIX C

ROCKY MOUNTAIN ENERGY

A Subsidiary of
Union Pacific Corporation

April 24, 1986

Ms. Candice C. Jierree
U.S. Nuclear Regulatory Commission
Region IV
Uranium Recovery Field Office
P. O. Box 25325
Denver, CO 80225

Dear Candy:

Re: SUA-1338, Docket No. 40-8697
Reno Creek R&D Project

As required by Condition No. 34.B. of the referenced source material license, enclosed are the results of our gamma survey, soil radium assays, and proposed action level for soil cleanup.

In keeping with our mutual desire to complete site decontamination and decommissioning prior to the license expiration date, we would appreciate prompt consideration of this request. Please give me or Pat Spieles (307/265-4158) a call if you have any questions.

Thank you for your cooperation.

Sincerely,

Michael R. Neumann

Michael R. Neumann
Environmental Coordinator

MRN/asm
Enclosure
cc: P. R. Spieles

10 Longs Peak Drive
Box 2000
Broomfield, Colorado 80020
303 469-8844

RENO CREEK

SOIL CONTAMINATION IDENTIFICATION

INTRODUCTION

Condition 34B of license SUA-1338 requires RME to develop a proposed cleanup action level for contaminated soils in μR/hr, which corresponds to a soil Ra-226 content of 5.0 pCi/g above background. RME recognizes the action level serves only as a means for identifying possible contamination and that final cleanup confirmation will be determined by soil Ra-226 analysis.

PROCEDURE

Six sites within the project boundary were designated for establishing a gamma-Ra-226 correlation. Gross gamma readings were obtained using a Ludlum Model 12S Micro R Meter held one meter above ground. Soil samples were taken to a depth of 15 cm and sent to Accu-Labs of Wheat Ridge, Colorado for Ra-226 analyses.

On the advice of NRC personnel, RME did not determine soil moisture, K-40 and Th-232 as recommended by the Bendix report entitled "Surface Gamma-Ray Measurement Protocol". Past experience has shown these parameters have an insignificant influence on the gamma-Ra-226 correlation.

DATA EVALUATION

Table 1 lists results of the gamma survey and soil Ra-226 concentrations. The data were analyzed using both linear regression and a power curve fit. Correlation coefficients for linear regression and power curve fit were 0.86 and 0.94 respectively. Because of the better correlation coefficient, the power curve fit was used to determine the cleanup action level.

Past soil analyses in the Reno Creek area show background Ra-226 levels to be in the 0.0 to 1.0 pCi/gram range. For the sake of establishing an action level, RME has taken the conservative direction and assumed background to be 0.0 pCi/gram. A soil concentration of 5.0 pCi/gram corresponds to a gamma reading of 24.66 uR/hr using the power curve fit.

CONCLUSION

RME proposes a conservative gamma action level of 24 uR/hr for identifying soil requiring cleanup. Soils exceeding this level will either be removed or sampled to determine actual Ra-226 concentrations and then handled accordingly.

TABLE 1

Gamma Exposure Rate vs Ra-226 Concentration

Sample Site	Gamma uR/hr	Ra-226 pCi/gram
P-1	21	2.0 ± 0.3
Ob-1	32	14.0 ± 1.0
P-2	27	6.1 ± 0.5
S-10	15	1.3 ± 0.3
SE Corner	16	1.6 ± 0.3
S-8	15	1.0 ± 0.3

Accu-Labs Research, Inc.
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766

March 5, 1986

Mr. Pat Spieles
Rocky Mountain Energy Co.
P.O. Box 2654
Casper, WY 82602-2654

RE: 8756-21345-6
Date Samples Rec'd 2-4-86
P.O. No. AP5-1889

REPORT OF ANALYSIS

ALR Designation	Sponsor Designation	Radium-226, ± counting error* pCi/g (dry)	Air Dry Loss, %
8756-21345-6-1	RC OB-1 1-30-86	14 ± 1	27.5
-2	RC P-1 1-30-86	2.0 ± 0.3	0.7
-3	RC P-2 1-30-86	6.1 ± 0.5	0.6
-4	RC S-8 1-30-86	1.0 ± 0.3	1.2
-5	RC S-10 1-30-86	1.3 ± 0.3	1.2
-6	RC SE Corner 1-30-86	1.6 ± 0.3	1.0

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.
These samples are scheduled to be disposed of 45 days after the date of this report.

Bud Summers
Radiochemistry
Supervisor

BS/dh

CURVE FITTING

This program can be used to fit data to:

1. Straight lines (linear regression); $y = a + bx$,
2. Exponential curves; $y = ae^{bx}$ $(a > 0)$,
3. Logarithmic curves; $y = a + b \ln x$,
4. Power curves; $y = ax^b$ $(a > 0)$.

The type of curve fit must be determined before data input begins. To select linear regression, you would press the [B] keys. To select exponential curve fit, press [C]. To select logarithmic curve fit, press [D]. To select power curve fit, press [E]. Do not attempt to change from one type of fit to another after data input has begun because the summation registers are cleared when the type of curve fit is selected. Restarting can be accomplished by repeating the curve fit selection process.

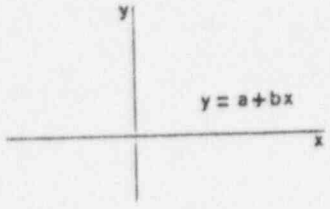
Data pairs (x_i and y_i) are input by keying in x_i, pressing [ENTER↑], keying in y_i and pressing the [A] key. Any number of data pairs may be input. If, after pressing the [A] key, you discover a data pair was incorrect, wait until execution stops, press [R/S], then the [B] key. This will eliminate the errant data pair. If you wish to eliminate any data pair previously input, key it in (x [ENTER↑] y) and press [B]. If the print mode is set, a negative -1.00 is printed immediately before the errant data pair indicating deletion from the data set.

The print mode of this program controls printing of inputs. It toggles on and off displaying 1.00 and 0.00 alternately when [A] is pressed. 1.00 indicates that the print mode is set, 0.00 indicates that the print mode is not set. The print input mode is turned off when the program is loaded.

After all data pairs have been input, press [C]. This initiates calculation and output of the coefficient of determination r^2, and the regression coefficients a and b. The coefficient of determination indicates the quality of fit achieved by the regression. Values of r^2 close to 1.00 indicate a better fit than values close to zero. The regression coefficients a and b define the curve generated, according to the equations at the beginning of this discussion.

After the regression coefficients have been calculated, projections may be made based on the curve fit. Key in a known x value, press [E] and see an estimated y value, $\hat{y}$, or key in a known y value, press [D] and see an estimated x value, $\hat{x}$.

Linear Regression

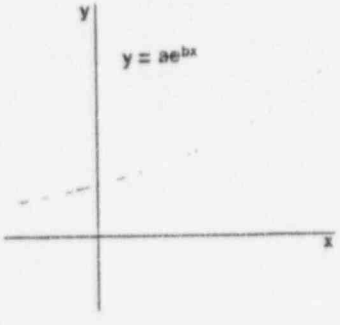


$$b = \frac{\Sigma x_i y_i - \frac{\Sigma x_i \, \Sigma y_i}{n}}{\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}}$$

$$a = \left[\frac{\Sigma y_i}{n} - b \cdot \frac{\Sigma x_i}{n} \right]$$

$$r^2 = \frac{\left[\Sigma x_i y_i - \frac{\Sigma x_i \, \Sigma y_i}{n} \right]^2}{\left[\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n} \right] \left[\Sigma y_i^2 - \frac{(\Sigma y_i)^2}{n} \right]}$$

Exponential Curve Fit

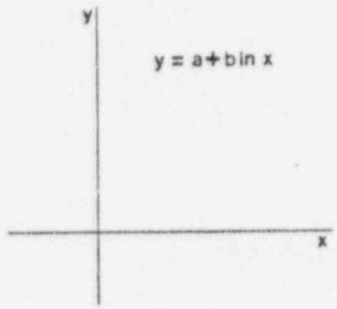


$$b = \frac{\Sigma x_i \ln y_i - \frac{1}{n} (\Sigma x_i)(\Sigma \ln y_i)}{\Sigma x_i^2 - \frac{1}{n} (\Sigma x_i)^2}$$

$$a = \exp\left[\frac{\Sigma \ln y_i}{n} - b\frac{\Sigma x_i}{n}\right]$$

$$r^2 = \frac{\left[\Sigma x_i \ln y_i - \frac{1}{n}\Sigma x_i \Sigma \ln y_i\right]^2}{\left[\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}\right]\left[\Sigma(\ln y_i)^2 - \frac{(\Sigma \ln y_i)^2}{n}\right]}$$

Logarithmic Curve Fit



$$b = \frac{\Sigma y_i \ln x_i - \frac{1}{n}\Sigma \ln x_i \Sigma y_i}{\Sigma(\ln x_i)^2 - \frac{1}{n}(\Sigma \ln x_i)^2}$$

$$a = \frac{1}{n}(\Sigma y_i - b\Sigma \ln x_i)$$

$$r^2 = \frac{\left[\Sigma y_i \ln x_i - \frac{1}{n}\Sigma \ln x_i \Sigma y_i\right]^2}{\left[\Sigma(\ln x_i)^2 - \frac{1}{n}(\Sigma \ln x_i)^2\right]\left[\Sigma y_i^2 - \frac{1}{n}(\Sigma y_i)^2\right]}$$

APPENDIX D

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
URANIUM RECOVERY FIELD OFFICE
BOX 25325
DENVER, COLORADO 80225

MAY 21 1986

URFO:CCJ
Docket No. 40-8697
SUA-1338, Amendment No. 12
04008697330E

Rocky Mountain Energy Company
ATTN: M. Neumann, Senior Licensing Specialist
10 Longs Peak Drive
P.O. Box 2000
Broomfield, Colorado 80020

Gentlemen:

The Uranium Recovery Field Office has completed its review of the April 20, 1986 submittal made in response to License Condition No. 34(B) of Source Material License SUA-1338. Accordingly, the staff has approved a soil cleanup action level of 24 uR/hr, including background, for initial soil cleanup. Prior to releasing the site for unrestricted use, verification of soil radium-226 concentration will have to be performed by direct soil sampling by Rocky Mountain Energy Company and the USNRC.

Therefore, pursuant to Title 10, Code of Federal Regulations, Part 40, the USNRC hereby amends Source Material License SUA-1338 by revising License Condition No. 34 to read as follows:

34. The decommissioning plan submitted by RMEC on April 1, 1986, is approved with the following modifications:

    A. The Radiation Safety Technician (RST) and the Radiation Safety Officer (RSO) shall meet the appropriate qualifications as defined in Regulatory Guide 8.31, "Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Mills are As Low As Reasonably Achievable," and be approved by the Nuclear Regulatory Commission, Uranium Recovery Field Office.

    B. The licensee shall utilize a gamma ray exposure rate of 24 uR/hr, including background, as described in their

letter dated April 24, 1986, for initial site cleanup of contaminated soil.

C. The removal of the sludge from the evaporation pond and its transfer to a licensed disposal facility shall be as described in the licensee's letter dated September 4, 1985.

The effect of this amendment is to incorporate in the license the approved gamma ray exposure rate cleanup action level of 24 uR/hr, including background.

All other license conditions shall remain the same. The license is being reissued in its entirety in order to incorporate the amendment described above.

The issuance of this amendment was discussed with Mr. P. Spieles on May 19, 1986, via telecon with Ms. C. Jierree of my staff.

FOR THE NUCLEAR REGULATORY COMMISSION

R. Dale Smith, Director
Uranium Recovery Field Office
Region IV

Enclosure: Source Material License SUA-1338