

UNITED NUCLEAR CORPORATION



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

Telephone: (505) 722-6651
Fax: (505) 722-6654

January 3, 1997

U.S. Nuclear Regulatory Commission
Mr. Joseph J. Holonich, Chief
Uranium Recovery Branch MS T-7J9
Division of Waste Management
Office of Nuclear Material Safety & Safeguards
11545 Rockville Pike
Rockville, MD 20853

Re: Docket No. 40-8907
License No. SUA-1475
Report on Emanation Testing of Final Radon Cover
Over UNC's Church Rock Tailings' Site

Dear Mr. Holonich:

United Nuclear Corporation completed the tailings reclamation as per approved plan dated March 2, 1991, as per License Condition 35 Part A, Items 1-3, Part B, Item 1. Tailings reclamation was completed July 15, 1996.

Closing of the evaporation ponds will be delayed until the Ground Water Corrective Action Plan is deemed completed by the NRC and EPA.

26

Radon Emanation Samples were collected on September 15, 1996. We realize that we tested beyond the sixty days after completion of the reclamation as required by the regulations, but due to weather conditions, it was necessary to delay the radon testing. The sampling was performed pursuant to 40CFR, Part 61, Method 115 of EPA regulations and Criterion 6, Appendix A, 10CFR40 of NRC regulations.

If you have any questions, please feel free to call us.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Edward M. Morales".

Edward M. Morales
General Manager/Radiation Safety Officer

EMM:m

Attachments

cc: Juan Velasquez, President, UNC
US NRC, Region IV
2 copies - Mr. Joseph J. Holonich, Chief, US NRC Uranium Recovery Branch

TABLE OF CONTENTS

1.0	Introduction	Page 2
2.0	Milestones of Mill and Tailings Reclamation	Page 2
3.0	Summary of Radon Emanation Testing	Page 3
4.0	Summary of Radon Flux Results	Page 3
5.0	Appendix A	
	◦ Laboratory Report	
	◦ Chain of Custody Letters	
	◦ Copy of Procedure	
	◦ Sampling Site Map	

1.0 Introduction

The Church Rock mill, owned and operated by United Nuclear Corporation, is located approximately 17 miles northeast of Gallup, New Mexico, on Section 2, Township 16 North, Range 16 West, McKinley County. The mill was licensed to operate by the State of New Mexico. Mill operations commenced May, 1977, and placed on standby May, 1982, due to economic conditions of the uranium industry. In November, 1984, United Nuclear Corporation determined the facility to be closed permanently.

2.0 Milestones of Mill and Tailings Reclamation

- 1988 - Construction of two (2) synthetically-lined evaporation ponds
- 1989 - Cleanup of wind-blown, report submitted December, 1989
 - ° Interim reclamation of North Cell portion of tailings
- 1990 - Interim reclamation of Central Cell portion of tailings
- 1991 - Interim reclamation of South Cell portion of tailings
 - ° Decommissioning of equipment and mill buildings
- 1992 - Completed mill foundations decommissioning, report submitted 1993
- 1993 - Final reclamation of North Cell portion of tailings
 - ° Completed decontamination of mill site and report submitted with request for mill site released for unrestricted use
- 1994 - Final reclamation of central portion of tailings
- 1995 - Final reclamation of south portion of tailings
 - ° Received License Amendment No. 21 releasing mill site for unrestricted use
- 1996 - Completed construction of drainage swales and channels to carry surface water away from tailings site

3.0 Summary of Radon Emanation Testing

The first radon sampling containers were set out at 0947 and the last one at 1331 on September 25, 1996. The first sampling containers were removed at 0914 and the last one at 1340 on September 26. Because of the threat of rain on the morning of the 26th, twenty-six of the first samples removed were short of the 24 hour exposure time, nineteen at 33 to 52 minutes short, and seven at 63 to 71 minutes short. The rest of the eighty-nine samples were exposed from 24 hours to 24 hours and 15 minutes.

During the sampling, the minimum temperature was 44°F, cloudy with mild wind. We did receive about a five-minute sprinkle of rain on each day. The rain was not enough to really wet the ground so no puddling occurred. The regulations require that no puddling of rain occurs during the sampling period.

The charcoal containers and canisters were obtained from Energy Laboratories, Inc., in Casper, Wyoming. The charcoal used was received pre-weighed in the shipping containers sealed with tape. Immediately prior to setting the sample canisters in the field, the charcoal was transferred from the shipping container to the sampling canisters at UNC's administration office. At the end of the exposure time, the canisters were picked up and brought back to the administration office, transferred back into the corresponding shipping container, sealed with tape and shipped UPS overnight back to Energy Laboratories, Inc., for the samples to be analyzed.

4.0 Summary of Radon Results

Total number of samples set out on tailings	115
Total number of trip blanks	25
Total number of laboratory duplicates	12
Average radon flux for tailings	6.46 pci/m ² s
Minimum radon flux for tailings	<0.5 pci/m ² s
Maximum radon flux for tailings	86.81 pci/m ² s

Copy of laboratory report, chain of custody, and site map showing sampling locations is enclosed in Appendix A

APPENDIX A

1. LABORATORY REPORT

- ° LAB I.D. NO.
- ° LAACC NO.
- ° CANISTER NO.
- ° LOCATION
- ° TIME SET OUT
- ° TIME REMOVED
- ° RADON FLUX RESULTS

2. CHAIN OF CUSTODY FROM ENERGY LABORATORIES, INC.

- ° NUMBER OF CANISTERS SHIPPED
- ° PROCEDURES FOR RADON FLUX MEASURING

3. CHAIN OF CUSTODY FROM UNITED NUCLEAR

- ° NUMBER OF CANISTERS USED FOR MEASUREMENTS SHIPPED
- ° NUMBER OF TRIP BLANK CANISTERS
- ° ANALYSIS REQUIRED
- ° FIELD NOTES

4. SAMPLING SITE MAP

LOCATION NO. IN LABORATORY REPORT CORRESPONDS WITH
LOCATION NO. ON SITE MAP

LABORATORY REPORT

- ° LAB I.D. NO.
- ° LAACC NO.
- ° CANISTER NO.
- ° LOCATION
- ° TIME SET OUT
- ° TIME REMOVED
- ° RADON FLUX RESULTS

**ENERGY LABORATORIES, INC.**P.O. BOX 3258 • CASPER, WY 82602 • PHONE (307) 235-0515
2393 SALT CREEK HIGHWAY • CASPER, WY 82601 • FAX (307) 234-1639**Large Area Activated Charcoal Canister (LAACC) Radon Flux Report**

Page 1 of 5

Project: UNC CHURCHROCK MILL SITE Date Set: 09-25-96
 Location: Tailings Cell Date Remove: 09-26-96
 Report Date: October 7, 1996 Date Counted: 09-27-96
 Weather: Cloudy, mild wind, slight short shower on 9-25 (p.m.) & 9-26 at 09:00. Min. temp 44°.

Method: UNC's employees placed and retrieved LAACC units. EPA Method 115 per 40 CFR 61 (NESHAPs). Radon Flux results have been corrected for instrument & charcoal background counts.

Lab I.D.	LAACC #	Canister #	Location	09-25-96 Time Set	09-26-96 Time Remove	Radon Flux pCi/m2s
96- 54354	1	127	31A	9:47	9:14	4.5
Duplicate	-	-	-	-	-	4.4
96- 54355	2	128	33A	9:48	9:15	38.3
96- 54356	3	129	* 36A	9:50	9:15	20.8
96- 54357	4	131	37A	9:51	9:15	86.8
96- 54358	5	133	39A	9:55	9:16	51.5
96- 54359	6	134	41A	9:56	9:16	2.5
96- 54360	7	136	41C	9:57	9:17	4.6
96- 54361	8	137	39C	10:00	9:17	67.0
96- 54362	9	139	37C	10:01	9:18	1.2
96- 54363	10	142	35C	10:02	9:18	<0.5
Duplicate	-	-	-	-	-	<0.5
96- 54364	11	143	33C	10:04	9:19	<0.5
96- 54365	12	145	31C	10:07	9:19	<0.5
96- 54366	13	147	29.5C	10:09	9:20	0.7
96- 54367	14	148	30E	10:10	9:20	<0.5
96- 54368	15	149	33E	10:11	9:21	0.5
96- 54369	16	150	35E	10:13	9:21	<0.5
96- 54370	17	151	36E	10:15	9:22	<0.5
96- 54371	18	152	39E	10:21	9:23	<0.5
96- 54372	19	153	39D	10:20	9:23	2.2
96- 54373	20	155	36F	10:27	9:24	<0.5
Duplicate	-	-	-	-	-	<0.5
96- 54374	21	158	35G	10:28	9:25	<0.5
96- 54375	22	160	33G	10:30	9:25	<0.5
96- 54376	23	161	31G	10:32	9:26	<0.5
96- 54377	24	162	29G	10:34	9:26	1.9
96- 54378	25	163	31I	10:36	9:27	0.6
96- 54379	26	164	35I	10:39	9:28	<0.5

* CORRECTION - 36A IS 35A

lmh f:\reports\client96\unc\9654354



Large Area Activated Charcoal Canister (LAACC) Radon Flux Report

Project: UNC CHURCHROCK MILL SITE Date Set: 09-25-96
 Location: Tailings Cell Date Remove: 09-26-96
 Report Date: October 7, 1996 Date Counted: 09-27-96
 Weather: Cloudy, mild wind, slight short shower on 9-25 (p.m.) & 9-26 at 09:00. Min. temp 44°.

Lab I.D.	LAACC #	Canister #	Location	09-25-96 Time Set	09-26-96 Time Remove	Radon Flux pCi/m2s
96- 54380	27	165	19I	10:43	10:53	<0.5
96- 54381	28	166	19G	10:45	10:55	1.8
96- 54382	29	167	19E	10:47	10:56	<0.5
96- 54383	30	168	19C	10:50	10:58	<0.5
Duplicate	-	-	-	-	-	<0.5
96- 54384	31	170	19A	10:51	10:59	0.8
96- 54385	32	171	17A	10:54	11:01	1.2
96- 54386	33	172	17C	10:57	11:02	7.4
96- 54387	34	174	17E	11:00	11:06	8.9
96- 54388	35	175	17G	11:04	11:08	5.0
96- 54389	36	176	17I	11:06	11:09	0.7
96- 54390	37	180	17K	11:07	11:11	<0.5
96- 54391	38	181	15M	11:10	11:14	4.8
96- 54392	39	182	15K	11:13	11:16	4.0
96- 54393	40	183	15I	11:14	11:17	2.9
Duplicate	-	-	-	-	-	2.9
96- 54394	41	184	15G	11:18	11:19	4.3
96- 54395	42	186	15E	11:20	11:22	20.8
96- 54396	43	187	15C	11:24	11:24	<0.5
96- 54397	44	188	15A	11:25	11:26	<0.5
96- 54398	45	189	13C	11:26	11:39	4.9
96- 54399	46	190	13E	11:28	11:40	<0.5
96- 54400	47	192	13G	11:29	11:41	0.8
96- 54401	48	193	13I	11:31	11:43	<0.5
96- 54402	49	195	13K	11:33	11:44	<0.5
96- 54403	50	196	13M	11:40	11:48	0.9
Duplicate	-	-	-	-	-	0.8
96- 54404	51	197	11O	11:41	11:58	7.4
96- 54405	52	198	11M	11:43	12:00	5.9
96- 54406	53	199	11K	11:45	12:01	<0.5
96- 54407	54	200	11I	11:48	12:04	<0.5



Large Area Activated Charcoal Canister (LAACC) Radon Flux Report

Project: UNC CHURCHROCK MILL SITE Date Set: 09-25-96
Location: Tailings Cell Date Remove: 09-26-96
Report Date: October 7, 1996 Date Counted: 09-27-96
Weather: Cloudy, mild wind, slight short shower on 9-25 (p.m.) & 9-26 at 09:00. Min. temp 44°.

Lab I.D.	LAACC #	Canister #	Location	09-25-96 Time Set	09-26-96 Time Remove	Radon Flux pCi/m2s
96- 54408	55	201	11G	11:50	12:05	9.8
96- 54409	56	202	11E	11:51	12:06	3.1
96- 54410	57	203	11C	11:53	12:07	4.8
96- 54411	58	204	11A	11:55	12:09	1.3
96- 54412	59	205	9I	11:58	12:10	15.7
96- 54413	60	206	9K	12:00	12:16	<0.5
Duplicate	-	-	-	-	-	<0.5
96- 54414	61	207	9M	12:04	12:18	11.6
96- 54415	62	208	9O	12:05	12:19	47.1
96- 54416	63	211	9Q	12:08	12:21	16.4
96- 54417	64	212	7Q	12:09	12:22	1.0
96- 54418	65	214	7O	12:11	12:23	2.3
96- 54419	66	215	7M	12:14	12:24	13.9
96- 54420	67	217	7K	12:17	12:25	6.5
96- 54421	68	218	5M	12:18	12:38	0.6
96- 54422	69	223	5O	12:20	12:39	1.0
96- 54423	70	226	5Q	12:22	12:40	<0.5
Duplicate	-	-	-	-	-	<0.5
96- 54424	71	228	3Q	12:24	12:41	3.0
96- 54425	72	229	3O	12:27	12:42	3.1
96- 54426	73	233	3M	12:29	12:44	16.1
96- 54427	74	234	3K	12:31	12:45	0.6
96- 54428	75	235	1M	12:33	12:46	<0.5
96- 54429	76	237	1O	12:35	12:48	5.5
96- 54430	77	238	0Q	12:38	12:49	11.7
96- 54431	78	239	1Q	12:40	12:50	<0.5
96- 54432	79	240	1S	12:42	12:51	<0.5
96- 54433	80	244	3S	12:43	12:53	<0.5
Duplicate	-	-	-	-	-	<0.5
96- 54434	81	245	5S	12:44	12:54	<0.5
96- 54435	82	246	7S	12:46	12:55	<0.5



Large Area Activated Charcoal Canister (LAACC) Radon Flux Report

Project: UNC CHURCHROCK MILL SITE Date Set: 09-25-96
Location: Tailings Cell Date Remove: 09-26-96
Report Date: October 7, 1996 Date Counted: 09-27-96
Weather: Cloudy, mild wind, slight short shower on 9-25 (p.m.) & 9-26 at 09:00. Min. temp 44°.

Lab I.D.	LAACC #	Canister #	Location	09-25-96 Time Set	09-26-96 Time Remove	Radon Flux pCi/m2s
96- 54436	83	253	5U	12:47	12:55	0.6
96- 54437	84	255	3U	12:49	12:57	<0.5
96- 54438	85	257	-1A	12:53	12:59	<0.5
96- 54439	86	258	3A	12:55	13:01	<0.5
96- 54440	87	259	7A	12:56	13:02	0.7
96- 54441	88	260	9C	12:58	13:03	<0.5
96- 54442	89	261	7C	12:59	13:04	0.5
96- 54443	90	262	5C	13:00	13:12	0.9
Duplicate						0.9
96- 54444	91	265	3C	13:00	13:14	1.7
96- 54445	92	266	1C	13:01	13:15	16.7
96- 54446	93	267	-1C	13:02	13:16	<0.5
96- 54447	94	269	-3C	13:04	13:17	<0.5
96- 54448	95	270	-3E	13:06	13:18	<0.5
96- 54449	96	272	-1E	13:07	13:19	0.7
96- 54450	97	273	1E	13:09	13:20	2.8
96- 54451	98	274	3E	13:09	13:22	2.8
96- 54452	99	275	5E	13:11	13:22	0.8
96- 54453	100	276	7E	13:13	13:23	6.4
Duplicate	-	-	-	-	-	6.5
96- 54454	101	277	9E	13:14	13:25	24.0
96- 54455	102	281	9G	13:14	13:25	6.1
96- 54456	103	282	7G	13:15	13:26	<0.5
96- 54457	104	284	5G	13:16	13:27	<0.5
96- 54458	105	285	3G	13:17	13:28	1.6
96- 54459	106	287	1G	13:19	13:29	<0.5
96- 54460	107	288	-3G	13:21	13:30	<0.5
96- 54461	108	289	-5G	13:24	13:31	<0.5
96- 54462	109	290	-5I	13:25	13:32	3.8



Large Area Activated Charcoal Canister (LAACC) Radon Flux Report

Project: UNC CHURCHROCK MILL SITE Date Set: 09-25-96
Location: Tailings Cell Date Remove: 09-26-96
Report Date: October 7, 1996 Date Counted: 09-27-96
Weather: Cloudy, mild wind, slight short shower on 9-25 (p.m.) & 9-26 at 09:00. Min. temp 44°.

Lab I.D.	LAACC #	Canister #	Location	09-25-96 Time Set	09-26-96 Time Remove	Radon Flux pCi/m2s
96- 54463	110	291	-3I	13:26	13:34	0.7
Duplicate	-	-	-	-	-	0.7
96- 54464	111	292	-1I	13:27	13:35	1.2
96- 54465	112	293	1I	13:28	13:36	0.8
96- 54466	113	298	3I	13:29	13:37	0.5
96- 54467	114	309	5I	13:30	13:38	<0.5
96- 54468	115	310	7I	13:31	13:40	5.4



Large Area Activated Charcoal Canister (LAACC) Radon Flux Quality Assurance Report

Project: UNC CHURCHROCK MILL SITE **Date Set:** 09-25-96
Location: Tailings Cell **Date Remove:** 09-26-96
Report Date: October 12, 1996 **Date Counted:** 09-27-96
Weather: Cloudy, mild wind, slight short shower on 9-25 (p.m.) & 9-26 at 09:00. Min. temp 44°.

Trip Blank - Lab I.D.	Cannister #	Radon Flux - pCi/m2s*
96- 54469	9	<0.5
96- 54470	10	<0.5
96- 54471	11	<0.5
96- 54472	12	<0.5
96- 54473	13	<0.5
96- 54474	14	<0.5
96- 54475	15	<0.5
96- 54476	16	<0.5
96- 54477	17	<0.5
96- 54478	18	<0.5
96- 54479	19	<0.5
96- 54480	20	<0.5
96- 54481	21	<0.5
96- 54482	22	<0.5
96- 54483	23	<0.5
96- 54484	24	<0.5
96- 54485	25	<0.5

Blank Charcoal cpm	Standard Number 1 cpm	Standard Number 2 cpm
125	1810	3592

Total Number of Laboratory Duplicates: 12
 Total Number of Field Duplicates: NA
 Total Number of Trip Blank Cannisters: 25
 Total Number of Measurements On Tailings Cell: 115

Average Radon Flux for Tailings Cell: 6.46 pCi/m2s
 Minimum Radon Flux for Tailings Cell: <0.5 pCi/m2s
 Maximum Radon Flux for Tailings Cell: 86.81 pCi/m2s

* Note: ELI's Radon Flux Practical Quantitative Limit (PQL) is 0.5 pCi/m2s.

Report Approved By: *D. D. Saida*

lmh f:\reports\client96\unc\9654354

CHAIN OF CUSTODY FROM ENERGY LABORATORIES, INC.

- NUMBER OF CANISTERS SHIPPED
- PROCEDURES FOR RADON FLUX MEASURING

MEMORANDUM

LAACCS SENT VIA
NPT- 5/27/117 9/16/96

To: LAACC Users
From: Sheryl Garling with Energy Laboratories, Inc.
Subject: Chain-of-Custody For Large Area Activated Charcoal Canister (LAACC) Units

ELI has designed this memorandum to serve as (1) Chain-of-Custody for shipping and receiving the LAACC Units and supplies that accompany the equipment, (2) directions on transfer of activated carbon to and from LAACC Units, and (3) placement information.

Packed by: DAVE GASSER 9/16/96 ELI-Casper Branch, Casper, Wyoming.

The LAACC Units have been shipped or delivered to:

Company Name: UNC MINING & MILLING
Street Address: _____
City, State, Zip: GALLUP NM
Phone & Fax: 505-722-6651
Contact Person: ED MORALES

LAACC Units Shipped & No's: 1-115[#] LAACC Units Rec'd & No's: #1-#115 (9-20-96) *nc*
Charcoal Cans Shipped & No's: 127-336^(210.202) Charcoal Cans Rec'd & No's: #127-#336 (9-20-96) *nc*

LAACC UNIT ACCESSORIES + THE PUMPS #1-25 box #7 #1-#25 (9-20-96) *nc*

The attached Large Area Activated Charcoal Canister (LAACC) Field Notes table should be used when placing the LAACC Unit onto the tailings impoundments or stacks. The data necessary to generate proper radon flux is transcribed from your notes. Please write clearly. Field notes should be copied and one set returned to the laboratory along with LAACC Units, canisters, and any other equipment.

The following materials would be helpful for LAACC Unit set up and transfer of charcoal:

- ▶ funnel and holder,
- ▶ silicon grease,
- ▶ pliers,
- ▶ extra electrical tape, and
- ▶ a table within a building.

When transferring activated carbon (charcoal) into the LAACC Unit (preferably inside a building), care should be taken that:

- ▶ charcoal is leveled into the units,
- ▶ charcoal canister number has been identified to the corresponding LAACC unit number on the field notes, and
- ▶ the retaining rod is securely placed back into position.

ENERGY LABORATORIES, INC. - CASPER, WYOMING

STANDARD OPERATING PROCEDURES

LARGE AREA ACTIVATED CHARCOAL COLLECTORS (LAACC)

Approved By:

Originator

Date

Technical Reviewer (if applicable)

Date

ELI Quality Assurance Officer

Date

ELI Laboratory Manager

Date

Distribution of Official Copies:

ELI Laboratory Manager
All ELI Staff

1.0 MEASURING RADON FLUX USING LARGE AREA ACTIVATED CHARCOAL COLLECTORS (LAACC)

The method used to measure radon flux involves absorption of radon on activated charcoal in a large area collector. The collector is placed onto the surface of the material to be measured and is allowed to collect radon for a time period of 24 hours. The radon collected on the charcoal is then measured by gamma spectroscopy.

Per 40 Code of Federal Regulations (CFR), *Part 61, Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants; Radionuclides; Final Rule and Notice of Reconsideration*, December 15, 1989, it is imperative that the temperature and moisture conditions are met for the measurement activity. Notification to the appropriate agencies should be made accordingly.

The collector consists of a PVC end cap with handle, screened spacer pads, charcoal distribution grid, screened retainer pad, and a steel retaining rod. Approximately 180 grams of activated charcoal is spread in the distribution grid. The retainer pad is placed over the charcoal and held in place by the retaining rod.

The collector is loaded with the charcoal by removing the retaining rod and pad, and placing the preweighed charcoal into the collector. The charcoal is then transported to the field in a sealed prenumbered can. The LAACC and charcoal canister numbers are recorded. The loading process should be done in an enclosed area so adverse wind conditions do not disturb the charcoal (blow it away). To allow for a quick transfer of charcoal into the LAACCs prior to deployment, LAACC units should be loaded by two or more personnel. Another team of two or more personnel should begin deployment immediately upon the charcoal transfer of a group of 10 to 20 LAACCs. Minimize the time a loaded LAACC is allowed to sit in ambient atmosphere. Care must be taken to minimize confusion and order of LAACCs and charcoal cans. An organized method of transfer and a large working area assist in minimizing any errors in LAACC/canister mismatching. A large vehicle could provide for the necessary enclosed area (such as a Suburban or equivalent).

The prenumbered collectors are deployed by carefully positioning the end cap on a flat surface of the material to be measured with soils or tailings used to seal the edge, at the predetermined location. It is imperative that a complete seal is obtained between the collector and the material to be measured. A shovel or a hand trowel may be used to scoop the material around the edge of the collector, being careful not to scoop material into the vent hole. The location identification, LAACC number, and the set time should be recorded.

After approximately 24 hours (minor time overruns are acceptable) of exposure, the collectors are picked up and the time retrieved is recorded. If any other conditions are observed (such as a broken seal, wind blown conditions, etc.), they should also be recorded. The transfer of the charcoal should begin immediately upon retrieval. The LAACCs are transported to the enclosed work area where a team of two or more personnel are responsible for transferring the charcoal carefully back into the appropriate prenumbered cans. The time between retrieval and transferring the exposed charcoal should be held to a minimum, however, site and field conditions contribute to the timeliness of the transfer.

The activated charcoal is removed from the collector by removing the retaining rod and pad from the collector and dumping the charcoal into a large funnel which leads into the prenumbered steel alloy can. The can's lid is placed and a wrap of electrical tape is applied to the can seam to eliminate any leakage or introduction of air into the can. The tape also assists in creating a closed (sealed) system to allow for the radon collected to equilibrate for four (4) hours before counting to allow the ingrowth of the radon daughters.

The sealed cans are transported to the laboratory where they are counted and recorded. The following information pertains to the calculation that will be made to ascertain the radon flux for each specific LAACC location.

2.0 U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) REQUIREMENTS FOR FIELD MEASUREMENT OF RADON FLUX

Radon-222 Emissions from Uranium Mill Tailings Piles - Per 40 CFR, Part 61, Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants; Radionuclides; Final Rule and Notice of Reconsideration, December 15, 1989, the following has been reprinted:

Method 115 - Monitoring for Radon-222 (^{222}Rn) Emissions

This Appendix describes the monitoring methods which must be used in determining the ^{222}Rn emissions from underground uranium mines, uranium mill tailings piles, phosphogypsum stacks, and other piles of waste material emitting radon.

2.1 Measurement and Calculation of Radon Flux from Uranium Mill Tailings Piles

2.1.1 Frequency of flux measurement

A single set of radon flux measurements may be made, or if the owner or operator chooses, more frequent measurements may be made over a one year period. These measurements may involve quarterly, monthly, or weekly intervals. All radon measurements shall be made as described in paragraphs 2.1.2 through 2.1.6 except that for measurements made over a one year period, the requirement of paragraph 2.1.4(c) shall not apply. The mean radon flux from the pile shall be the arithmetic mean of the mean radon flux for each measurement period. The weather conditions, moisture content of the tailings and area of the pile covered by water existing at the time of the measurement shall be chosen so as to provide measurements representative of the long term radon flux from the pile and shall be subject to EPA review and approval.

2.1.2 Distribution of flux measurements

The distribution and number of radon flux measurements required on a pile will depend on the clearly defined areas of the pile (called regions) that can have significantly different radon fluxes due to surface conditions. The mean radon flux shall be determined for each individual region of the pile. Regions that shall be considered for operating mill tailings piles are:

- ▶ water covered areas,
- ▶ water saturated areas (beaches),
- ▶ dry top surface areas, and
- ▶ sides, except where earthen material is used in dam construction.

For mill tailings after disposal the pile shall be considered to consist of only one region.

2.1.3 *Number of radon flux measurements*

Radon flux measurements shall be made within each region of the pile, except for those areas covered with water. Measurements shall be made at regularly spaced locations across the surface of the region, realizing that surface roughness will prohibit measurements in some areas of a region. The minimum number of flux measurements considered necessary to determine a representative mean radon flux value for each type of region on an operating pile is:

- ▶ water saturated area - no measurements required as radon flux is assumed to be zero,
- ▶ water saturated beaches - 100 radon flux measurements,
- ▶ loose and dry top surface - 100 radon flux measurements, and
- ▶ sides - 100 radon flux measurements, except where earthen materials is used in dam construction.

For mill tailings pile after disposal which consists of only one regional minimum of 100 measurements are required.

2.1.4 *Restrictions to radon flux*

Measurements - the following restrictions are placed on making radon flux measurements:

- ▶ measurements shall not be initiated within 24 hours of a rainfall;
- ▶ if a rainfall occurs during the 24 hour measurements period, the measurement is invalid if the seal around the lip of the collector is surrounded by water; and
- ▶ measurements shall not be performed if the ambient temperature is below 35°F or if the ground is frozen.

2.1.5 *Areas of pile regions*

The approximate area of each region of the pile shall be determined in units of square meters.

2.1.6 *Radon Flux Measurements*

Measuring radon flux involves the absorption of radon on activated charcoal in a large-area collector. The radon collector is placed on the surface of the pile area to be measured and allowed to collect for a period of 24 hours. The radon collected on the charcoal is measured by gamma-ray spectroscopy. The detailed measurement procedure provided in Appendix A of EPA 520/5-85-0029(1) shall be used to measure the radon flux on uranium mill tailings, except the surface of the tailings shall not be penetrated by the lip of the radon collector as directed in the procedure, rather the collector shall be carefully positioned on a flat surface with soil or tailings used to seal the edge.

2.1.7 Calculations

The mean radon flux for each region on the pile and for the total pile shall be calculated and reported as follows:

- a. The individual radon flux calculations shall be made as provided in Appendix A EPA 86 (1). The mean radon flux for each region of the pile shall be calculated by summing all individual flux measurements for the region and dividing by the total number of flux measurements for the region.
- b. The mean radon flux for the total uranium mill tailings pile shall be calculated as follows:

$$J_s = \frac{J_1 A_1 + \dots + J_2 A_2 + \dots + J_i A_i}{A_t}$$

Where:

J_s	=	mean flux for the total pile (pCi/m ² -s)
J_i	=	mean flux measured in region i (pCi/m ² -s)
A_i	=	area of region i (m ²)
A_t	=	total area of pile (m ²)

2.1.8 Reporting

The results of the individual flux measurements, the approximate locations on the pile, and the mean radon flux for each region and the mean radon flux for the total stack shall be included in the emission test report. Any conditions or unusual event that occurred during the measurements that could significantly affect the results should be reported.

3.0 SAMPLING AND LABORATORY PROCEDURES FOR ATTAINING RADON FLUX MEASUREMENTS

Quality Assurance Procedures for Measuring ²²²Rn Flux - Per 40 CFR, Part 61, Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants; Radionuclides; Final Rule and Notice of Reconsideration, December 15, 1989, the following has been reprinted:

Method 115 - Monitoring for ²²²Rn Emissions

This Appendix describes the monitoring methods which must be used in determining the ²²²Rn emissions from underground uranium mines, uranium mill tailings piles, phosphogypsum stacks, and other piles of waste material emitting radon.

a. *Sampling Procedures*

Records of field activities and laboratory measurements shall be maintained. The following information shall be recorded for each charcoal canister measurement:

- ▶ site,
- ▶ name of pile,
- ▶ sample location,
- ▶ sample ID number,
- ▶ date and time on,
- ▶ date and time off, and
- ▶ observations of meteorological conditions and comments.

Records shall include all applicable information associated with determining the sample measurement, calculations, observations, and comments.

b. *Sample Custody*

Custodial control of all charcoal samples exposed in the field shall be maintained in accordance with EPA chain of custody field procedures. A control record shall document all custody changes that occur between the field and laboratory personnel.

c. *Calibration Procedures and Frequency*

The radioactivity of two standard charcoal sources, each containing a carefully determined quantity of Radium-226 (^{226}Ra) uniformly distributed through 180 grams of activated charcoal, shall be measured. An efficiency factor is computed by dividing the average measured radioactivity of the two standard charcoal sources, minus the background, in cpm by the known radioactivity of the sources in dpm. The same two standard charcoal sources shall be at the beginning and at the end of each day's counting as a check of the radioactivity counting equipment. A background count using unexposed charcoal should be made at the beginning and at the end of each counting day to check for inadvertent contamination of the detector or other changes affecting the background. The unexposed charcoal comprising the blank is changed with each new batch of charcoal used.

d. *Internal Quality Control Checks and Frequency*

The charcoal from every tenth exposed canister shall be recounted. Five percent of the samples analyzed shall be either blanks (charcoal having no radioactivity added) or samples spiked with known quantities of ^{226}Ra .

e. *Data Precision, Accuracy, and Completeness*

The precision, accuracy, and completeness of measurements and analyses shall be within the following limits for samples measuring greater than 1.0 pCi/m²-s.

- ▶ Precision: 10%
- ▶ Accuracy: 10%
- ▶ Completeness: At least 85% of the measurements must yield usable results

Energy Laboratories, Inc. (ELI) has two multi-channel gamma spectrometers available at its Casper facility.

ELI is an EPA certified and listed laboratory. Certification has been maintained in the areas for determination of radiochemical, inorganics, and organics in drinking waters. ELI has been actively participating in EPA's Radon Proficiency Program since its inception for determination of radon concentrations in homes and structures. ELI has two staff members presently accepted by the U. S. Nuclear Regulatory Commission (NRC) as Radiation Safety Officers and have performed radiation surveys for uranium operations since 1980. These surveys include alpha, beta, and gamma emitting radionuclides in air, soil/surface, and water for determination of employee occupational exposure awhile working at mine sites.

Copies of ELI's Quality Assurance and certifications are available upon request.

The professional personnel will be available for consultation prior to and during the sampling duration. The following areas should be addressed before sampling:

- ▶ timing of collection (24 hours sampling or annual),
- ▶ regions within the tailings impoundment (quantity and area),
- ▶ personnel responsible for placement of collectors,
- ▶ EPA notification of intent to proceed with collection,
- ▶ current topographical map of tailings impoundments to be sampled,
- ▶ sample point locations to be marked prior to collector placement, and
- ▶ location of any background samples such as up wind of the impoundment (undisturbed areas) as a point of comparison.

ELI will provide the company with a report that will include a minimum of the following:

- ▶ number and laboratory ID of collectors placed;
- ▶ date and time of collectors placed, retrieved, and charcoal counted;
- ▶ map of location of collectors (provided by company);
- ▶ radon flux calculations for each detector, region, and total tailings impoundment;
- ▶ spectrum print out for each detector, if requested; and
- ▶ quality assurance data will be provided upon request: This data will consist of duplicates, blanks, standards, and geometry verification.

CHAIN OF CUSTODY FROM UNITED NUCLEAR

- NUMBER OF CANISTERS USED FOR MEASUREMENTS SHIPPED
- NUMBER OF TRIP BLANK CANISTERS
- ANALYSIS REQUIRED
- FIELD NOTES

UNC MINING & MILLING
 (St. Rd. 566 - 21 Miles NE of Gallup)
 P. O. Box 3077
 Gallup, NM 87305-3077
 (505) 722-6651

CHAIN OF CUSTODY

Energy Laboratories, Inc.
 Laboratory
 25A North Center Street
 Address
 Casper, NY State 82601 Zip
 (307) 235-0515 Phone No.
 UNC Submittal No. EM-17-9-96

All analysis will be performed in accordance with
 EPA approved procedures and/or 15th Edition of
 Standard Methods

Sample Description	Date	Time	Filter 0.45u	PRESERVATION plain	HNO ₃	H ₂ SO ₄	Na ₂ S ₂ O ₃	NaOH	Preserved By	Analysis Required
TOTAL OF 115 (AACC CANNISTERS)	9-26-96	1340								RN-222
Bx. 4: #127-186										
Bx. 5: #187-255										
Bx. 6: #257-310										
TOTAL OF 25										
TRIP BLANKS										
#1-#25										

Sampled By: M. Chaddley Received By: M. Chaddley
 Dispatched By: M. K. Seidel 9-26-96 3:30 P.M. Time
 Date
 Carrier: UPS
 The above analysis to be performed is authorized by: M. Chaddley for E. Miles
 Signature Date
9-26-96 1350 Time
 Lab Receipt Signature Date
9-27-96 1000 Time
 Date

3 - CARDBOARD BXS
 Method of Shipment

LARGE AREA ACTIVATED CHARCOAL CANISTER (LAACC) FIELD NOTES

Client: <u>UNC - CHURCHROCK MILL SITE</u>		Location: <u>TRAILING S CELL</u>		Inst.: _____ Eff: _____ Tech: _____							
Weather Condition: <u>CLOUDY, MILD WIND</u>		Precip: <u>< 0.06 IN</u>		Min Temp: <u>44°F</u>							
LAACC Unit #		Charcoal Can #	Location I.D. / Station	Mo/Day/Yr 24 hr time set	Mo/Day/Yr 24 hr time removed	Site Personnel Initials	Lab Sample Number	Date/Time Start	Count Min	Gross Counts	Comments
1	127		31A	0947	0947	MC					
2	128		33A	0948	0948	MC					
3	129		36A MC	0950	0915	MC					
4	131		37A	0951	0915	MC					
5	133		39A	0955	0916	MC					
6	134		41A	0956	0916	MC					
7	136		41C	0957	0917	MC					
8	137		39C	1000	0917	MC					
9	139		37C	1001	0918	MC					
10	142		35C	1002	0918	MC					
11	143		33C	1004	0919	MC					
12	145		31C	1007	0919	MC					
13	147		29.5C	1009	0920	MC					
14	148		30E	1010	0920	MC					
15	149		33E	1011	0921	MC					
16	150		35E	1013	0921	MC					
17	151		36E	1015	0922	MC					

Inst.: _____ Eff: _____ Tech: _____

Inst. Back: _____

Charcoal Back: _____ Lot: _____

Standard: _____ Count: _____

Client: UNC - CHURCHROCK MILL SITE Location: TRAILING S CELL

Weather Condition: CLOUDY, MILD WIND Precip: < 0.06 IN Min Temp: 44°F

LAACC Unit #

Charcoal Can #

Location I.D. / Station

Mo/Day/Yr 24 hr time set

Mo/Day/Yr 24 hr time removed

Site Personnel Initials

Lab Sample Number

Date/Time Start

Count Min

Gross Counts

Comments

LARGE AREA ACTIVATED CHARCOAL CANISTER (LAACC) FIELD NOTES

Client: <u>UNC - CHARCOAL MILL SITE</u>		Location: <u>TRAILING CELL</u>		Inst.: _____ Eff: _____		Tech: _____	
Weather Condition: <u>Cloudy, mild wind, Precip: < 0.06 in.</u>		Min Temp: <u>44.0 F</u>		Inst. Back: _____		Charcoal Back: _____	
LAACC Unit #		Charcoal Can #		Location I.D. / Station		Date/Time Start	
9-25-96 Mo/Day/Yr 24 hr time set		9-26-96 Mo/Day/Yr 24 hr time removed		Site Personnel Initials		Count Min	
9-25-96 Mo/Day/Yr 24 hr time set		9-26-96 Mo/Day/Yr 24 hr time removed		Site Personnel Initials		Gross Counts	
9-25-96 Mo/Day/Yr 24 hr time set		9-26-96 Mo/Day/Yr 24 hr time removed		Site Personnel Initials		Comments	
18	152	39E	1021	0923	MC		
19	153	39D	1020	0923	MC		1
20	155	36F	1027	0924	MC		
21	158	35G	1028	0925	MC		
22	160	33G	1030	0925	MC		
23	161	31G	1032	0926	MC		
24	162	29G	1034	0926	MC		
25	163	31I	1036	0927	MC		
26	164	35I	1039	0928	MC		
27	165	19I	1043	1053	MC		
28	166	19G	1045	1055	MC		
29	167	19E	1047	1056	MC		
30	168	19C	1050	1058	MC		
31	170	19A	1051	1059	MC		
32	171	17A	1054	1101	MC		
33	172	17C	1057	1102	MC		
34	174	17E	1100	1106	MC		

Standard: _____ Count: _____
 Charcoal Back: _____
 Inst. Back: _____
 Inst.: _____ Eff: _____
 Tech: _____

LARGE AREA ACTIVATED CHARCOAL CANISTER (LAACC) FIELD NOTES

Client: UNC - CHURCHROCK MILL SITE		Location: TRAILINGS CELL		Inst.: _____ Eff: _____ Tech: _____						
Weather Condition: cloudy mild wind, Precip: _____		<0.06 in.		Min Temp: 44°F						
LAACC Unit #	Charcoal Can #	Location I.D. / Station	Mo/Day/Yr 24 hr time set	Mo/Day/Yr 24 hr time removed	Site Personnel Initials	Lab Sample Number	Date/Time Start	Count Min	Gross Counts	Comments
35	175	17G	1104	9-26-96	AC					
36	176	17I	1106	1109	AC					
37	180	17K	1107	1111	AC					
38	181	15M	1110	1114	AC					
39	182	15K	1113	1116	AC					
40	183	15I	1114	1117	AC					
41	184	15G	1118	1119	AC					
42	186	15E	1120	1122	AC					
43	187	15C	1124	1124	AC					
44	188	15A	1125	1126	AC					
45	189	13C	1126	1139	AC					
46	190	13E	1128	1140	AC					
47	192	13G	1129	1141	AC					
48	193	13I	1131	1143	AC					
49	195	13K	1133	1144	AC					
50	196	13M	1140	1148	AC					
51	197	110	1141	1158	AC					

Weather Condition: cloudy mild wind, Precip: _____ in pm @ 0900 on 9-26

LARGE AREA ACTIVATED CHARCOAL CANISTER (LAACC) FIELD NOTES Page 4 of 7

Client: UNC - CHURCH ROCK MILL SITE		Location: TAILINGS CELL		Inst.:	Eff:	Tech:					
Weather Condition: CLOUDY, MILD WIND, SLIGHT/SHORT SHOWER ON 9/24 IN PM @ 1900 ON 9/24		Precip:	Mo/Day/Yr 24 hr time removed	Mo/Day/Yr 24 hr time set	Mo/Day/Yr 24 hr time removed	Site Personnel Initials	Lab Sample Number	Date/Time Start	Count Min	Gross Counts	Comments
LAACC Unit #	Charcoal Can #	Location I.D. / Station	9-25-96 Mo/Day/Yr 24 hr time set	9-26-96 Mo/Day/Yr 24 hr time removed	Min Temp: 44°F						
52	198	11M	1143	1200							
53	199	11K	1145	1201							
54	200	11I	1148	1204							
55	201	11G	1150	1205							
56	202	11E	1151	1206							
57	203	11C	1153	1207							
58	204	11A	1155	1209							
59	205	9I	1158	1210							
60	206	9K	1200	1216							
61	207	9M	1204	1218							
62	208	9O	1205	1219							
63	211	9Q	1208	1221							
64	212	7Q	1209	1222							
65	214	7O	1211	1223							
66	215	7M	1214	1224							
67	217	7K	1217	1225							
68	218	5M	1218	1238							

LARGE AREA ACTIVATED CHARCOAL CANISTER (LAACC) FIELD NOTES Page 5 of 7

Client: UNC - CHURCHROCK MILL SITE		Location: TAILINGS CELL		Inst.:	Eff:	Tech:		
Weather Condition: CLOUDY, MILD WIND, LIGHT/SQUAT SHOWERS ON 9-25		Precip: < 0.06 IN	Min Temp: 44°F	Inst. Back:	Charcoal Back:	Lot:		
LAACC Unit #	Charcoal Can #	Location I.D. / Station	9-25-96 Mo/Day/Yr 24 hr time set	9-26-96 Mo/Day/Yr 24 hr time removed	Site Personnel Initials	Lab Sample Number		
					Date/Time Start	Count Min	Gross Counts	Comments
69	223	50	1220	1239	AC			
70	226	5Q	1222	1240	AC			
71	228	3Q	1224	1241	AC			
72	229	30	1227	1242	AC			
73	233	3M	1229	1244	AC			
74	234	3K	1231	1245	AC			
75	235	1M	1233	1246	AC			
76	237	10	1235	1248	AC			
77	238	0Q	1238	1249	AC			
78	239	1Q	1240	1250	AC			
79	240	1S	1242	1251	AC			
80	244	3S	1243	1253	AC			
81	245	5S	1244	1254	AC			
82	246	7S	1246	1255	AC			
83	253	5U	1247	1255	AC			
84	255	3U	1249	1257	AC			
85	257	-1A	1253	1259	AC			

SAMPLING SITE MAP

**LOCATION NO. IN LABORATORY REPORT CORRESPONDS
WITH LOCATION NO. ON SITE MAP**