40-7102

SHIELDALLOY METALLURGICAL CORPORATION

WEST BOULEVARD
P.O. BOX 768
NEWFIELD, NJ 08344
TELEPHONE (609) 692-4200
FAX (609) 692-4017

March 13, 1996

Mr. Gary Comfort
USNRC
Mail Stop T - 8D16
Washington DC 20555

RE: Radon testing at Newfield facility

Dear Mr. Comfort:

Inclosed herewith please find a copy of the report prepared outlining the evaluation of radon emissions at the Newfield facility.

If you have any questions, or if you need additional information, please do not hesitate to contact me.

Cordially,

C. Scott Eves

CSE/emb

200020

NFO1

IEM
Integrated Environmental Management, Inc.

9040 Executive Park Drive, Suite 205
P.O. Box 50785
Knoxville, TN 37950-0785
Phone: (615) 531-9140
FAX: (615) 531-9130

1680 East Gude Drive, Suite 305
Rockville, MD 20850
Phone: (301) 762-0502
FAX: (301) 762-0638

January 12, 1995

C. Scott Eves
Shieldalloy Metallurgical Corporation
West Boulevard
Post Office Box 768
Newfield, New Jersey, 08344

Dear Mr. Eves,

The purpose of this letter is to transmit for your review the assessment of radon emissions at the Newfield facility (Enclosure). This assessment documents the results of the measurements, sampling, and analysis I conducted at the Newfield facility during the week of November 28 through December 3, 1994.

Please note that most of the figures included in this draft are photocopies of photographs taken at the site. In the final document, I will be using a color photocopier to make sure that the figures are clear. In addition, the site drawing is a reduction of the actual figure you provided to me. In the final document, I will be including a full-sized copy of this figure.

I would appreciate hearing about any comments you might have on the report. Please give me a call if you would like to discuss any aspect of it.

Thank you for your continued support of **IEM**.

Sincerely,

Brian A. Kelly

Brian A. Kelly, CHP, PE

cc: C. Berger

ENCLOSURE

Assessment of Radon Emissions
Newfield, N.J. Facility

RADON-222 EMISSION ASSESSMENT

FERROCOLUMBIUM SLAG
at the Newfield, N. J. Facility

Submitted to:

Shieldalloy Metallurgical Corporation
West Boulevard, Post Office Box 768
Newfield, New Jersey 08344
(609) 692-4200

Submitted by:

Integrated Environmental Management, Inc.
9040 Executive Park Drive, Suite 205
Knoxville, Tennessee, 37923
(615) 531-9140

Report No. 94005/3-001
January 11, 1995

I. Purpose

This report documents a study designed to determine if Radon-222 is being released from ferrocolumbium slag material at the Shieldalloy Metallurgical Corporation's Newfield, N.J. facility. The study has two elements:

- To determine if Rn-222 is emanating from the slag at the Newfield facility, and
- To monitor Rn-222 in air concentrations around the perimeter of the Newfield facility.

This report includes sections describing the data collection methodologies used for each element, the results obtained, and a discussion of the results in light of the study's purpose.

II. Methodology

II.1 Rn-222 Emanation

The basic procedure used to determine radon emanation rates was Method 115 ("Monitoring for Radon-222 Emissions"), contained in Appendix B of 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants." This method references the detailed procedure contained in Appendix A of document EPA 520/5-85-0029[1], and utilizes a Large Area Activated Charcoal Canister (LAACC) to collect a sample of the Radon-222 emanating from a surface.

In applying this procedure, an adjustment had to be made to account for the physical form of the slag. Because the ferrocolumbium slag exists in a large granular form, it is not possible to seal the edges of a LAACC below the surface of the slag. The adjustment consisted of performing Radon-222 measurements under two extreme circumstances:

- A LAACC was sealed to the surface of a large slag "button" to measure the Radon-222 emanation from the surface of a large monolithic piece (see Figures 1 and 2).
- A second LAACC was deployed on a pile of crushed slag, where radon emanation is likely to be maximized due to the high surface-to-volume ratio of the material (Figure 3).

In addition, three Radon-222 emanation rates were obtained at locations selected to represent background soil concentrations in previous investigations at the Newfield facility. A typical deployment is shown in Figure 4. The locations of these background samples are shown in Figure 5.

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[1] Hartley, J.N. and Freeman, H.D., "Radon Flux Measurements on the Gardinier and Royster Phosphogypsum Piles Near Tampa and Mulberry, Florida," U.S. Environmental Protection Agency Report EPA 520/5-85-029, dated January, 1986.

Each LAACC was filled with a pre-weighed charge (approximately 450 grams) of activated charcoal. It was then deployed with the starting time and the temperature noted. After a 24-hour exposure time, the LAACC was collected, and the time and temperature noted. The activated charcoal in the LAACC was transferred to a labelled plastic bag for shipment to Air Chek, Inc., the laboratory that analyzed the samples, under strict chain-of -custody procedures (see Appendix 1).

II.2 Radon-222-in-Air Concentrations

Radon-in-air concentrations were determined using Electret-Passive Environmental Radon Monitors (E-PERMs) deployed around the perimeter of the Newfield site. E-PERMs were selected to measure radon-in-air concentrations rather than charcoal canisters because of their lower sensitivity to environmental conditions, particularly moisture. Since the E-PERMs are sensitive to gamma radiation, the monitoring scheme was designed to account for the gamma radiation at each site.

The E-PERMs selected utilized a one-liter "H-type" ion chamber, coupled with the electret. According to the manufacturer (Rad Elec, Inc.), this configuration has a minimum measurable concentration of 0.19 picocuries per liter (pCi/L) at a 50% error level[2].

The locations were selected to represent the eight major compass-point directions around the slag pile. The locations coincided with thermoluminescent dosimeter (TLD) monitoring stations at the Newfield site (see Figure 5). One location (Station 15) were designated as a background monitor, since it was both up-wind of the slag pile and located remote from it.

Three E-PERMs were deployed at each monitoring location (Figure 6), at a height approximately six feet above the ground surface. Two of the E-PERMs made replicate measurements of the radon-in-air concentrations. The third E-PERM was thermally sealed in a plastic bag to eliminate sensitivity to Radon-222. It thus provided a measurement of the gamma radiation dose rate, and was used to compensate the other two measurements.

The voltage on each electret was measured prior to deployment. The electrets and ion chambers were then assembled and deployed. After a 44.25 hour exposure at their locations, the E-PERMs were collected and the electret voltages remeasured. The voltages were converted into a Radon-222 concentration using the following formulae:

$$[\text{Rn-222}]\ (\text{pCi/L}) = (I - F)/(CF * D) - [\text{Rn}(\gamma)]$$

where

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[2] E-PERM System Manual, Revision 5, issued by Rad Elec Inc., November 1, 1994

I = The initial electret voltage (Volts)
F = The final electret voltage (Volts)
D = The exposure time (days)
[Rn(γ)] = The apparent Rn-222 concentration caused by gamma radiation
CF = The calibration factor calculated by the following equation:

$$CF = 7.2954 + 0.004293*(I + F)/2$$

Errors in the measurements were calculated using the methodology included in Appendix 4 of the System Manual[2]. The replicate radon measurements were then averaged for each location and compared with the averages at the other locations, especially the background measured at Station # 15.

III. **Results**

III.1 Radon-222 Emanation

The radon flux rates measured for the five sites are shown in Table 1. The three background samples showed comparable flux rates. The sample collected from the LAACC sealed to the ferrocolumbium "button" exhibited a flux rate similar to background. The flux rate measured for crushed slag was 20.7 picocuries per square meter per second ($pCi/m^2/s$).

III.2 Radon-222-in-Air Concentrations

Table 2 shows the Radon-in-air concentrations measured at the eight locations shown in Figure 5. On three of the E-PERMs, the voltage drop caused by the gamma radiation was greater than the voltage drop caused by the Radon-222. The results for these E-PERMs are shown as "No Detectible" Radon-222.

At two of the stations (5 and 6), the standard deviations were much higher than at the other stations. These large error bands are attributed to the comparatively high gamma radiation levels resulting from the proximity of these stations to the ferrocolumbium slag pile.

IV. **Discussion**

IV.1 Radon-222 Emanation

In waste storage operations where uranium, thorium, and their progeny exist (e.g., phosphogypsum stacks, mill tailings piles) , a Radon-222 flux level of 20 $pCi/m^2/s$ is considered to be acceptable. Based on the readings obtained in this study, the slag pile at the Newfield facility meets this standard. The flux measured on the "button" is indistinguishable from background. The flux measured for the crushed slag is higher, but still meets acceptance criteria.

The actual value will be between these two extremes, which indicates that the flux from the whole pile will have no problem meeting acceptance limits. This conclusion is bolstered by the fact that the slag pile has relatively little fine material present. The large size of the individual slag pieces will result in fluxes closer to the "button" level than to that of the crushed slag.

Therefore, Radon-222 emanation rates from the Newfield ferrocolumbium slag pile are not a regulatory concern.

IV.2 Radon-222 in Air Concentrations

For all but two of the E-PERM locations, the Radon-222 concentrations were not distinguishable from zero. The two locations that did show significant results were Stations 7 (northeast of the slag pile) and 15 (the background location). The Station 7 measurement was slightly higher than the background (0.81 pCi/L vs. 0.47 pCi/L), but the difference is not statistically significant. Both readings are compatible with the range of Radon-222 concentrations reported for outdoor air (0.11 to 0.32 pCi/L[3] measured between 1977 and 1982 in Chester, N.J.). Therefore, the Newfield slag pile has not affected the Radon-222-in-air concentrations around the Newfield facility.

V. Conclusions

A study was performed to determine if the ferrocolumbium slag pile located at the Shieldalloy Metallurgical Corporations's Newfield, N.J. facility has affected Radon-222 levels in the environment. Based of measurements of Radon-222 flux rates from the pile and Radon-222-in-Air concentrations around it, the conclusion is that the pile has not impacted Radon-222 levels.

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[3] "Sources, Effects, and Risks of Ionizing Radiation," United Nations Scientific Committee on the Effects of Atomic Radiation, 1988.

TABLE 1

Radon-222 Flux Rate from the Selected Sites[4]

Shieldalloy Metallurgical Corporation, Newfield, N.J. Site

Station No.	Description	Radon-222 Flux Rate ($pCi/m^2/s$)
B-1	Grassy area at the western entrance area to the Newfield Plant	0.52
B-2	Grassy area to the south of the western entrance area to the Newfield Plant	0.77
B-3	Forested area north of the Newfield Plant adjacent to railroad tracks (see Figure 4)	0.34
S-1	Ferrocolumbium slag button on slag pile at Newfield Plant (see Figures 1 and 2)	0.58
S-2	Crushed ferrocolumbium slag pile on east side of Building 102 (see Figure 3)	20.7

[4] Sites shown on Figure 5.

TABLE 2

Radon-222 in Air Concentrations at Site Perimeter[5]

Shieldalloy Metallurgical Corporation, Newfield, N.J. Site

Station No.	Radon In Air Concentration (pCi/L)	Standard Deviation of Mean
5	0.19	0.97
6	0.83	1.9
7	0.81	0.26
8	0.11	0.30
9	0.32	0.41
11	ND[6]	0.41
12	0.36	0.37
15	0.47	0.21

[5] Sites shown on Figure 5.

[6] Non-detectable Radon-222 concentration (indication that the response of the E-PERMs sensitive to Radon-222 were less than the response of the E-PERM sensitive to gamma radiation only)

Figure 1, Newfield, N.J. Slag Pile Showing LAACC Sealed to a "Button"

Figure 2, Close-up of LAACC Sealed to a Ferrocolumbium "Button"

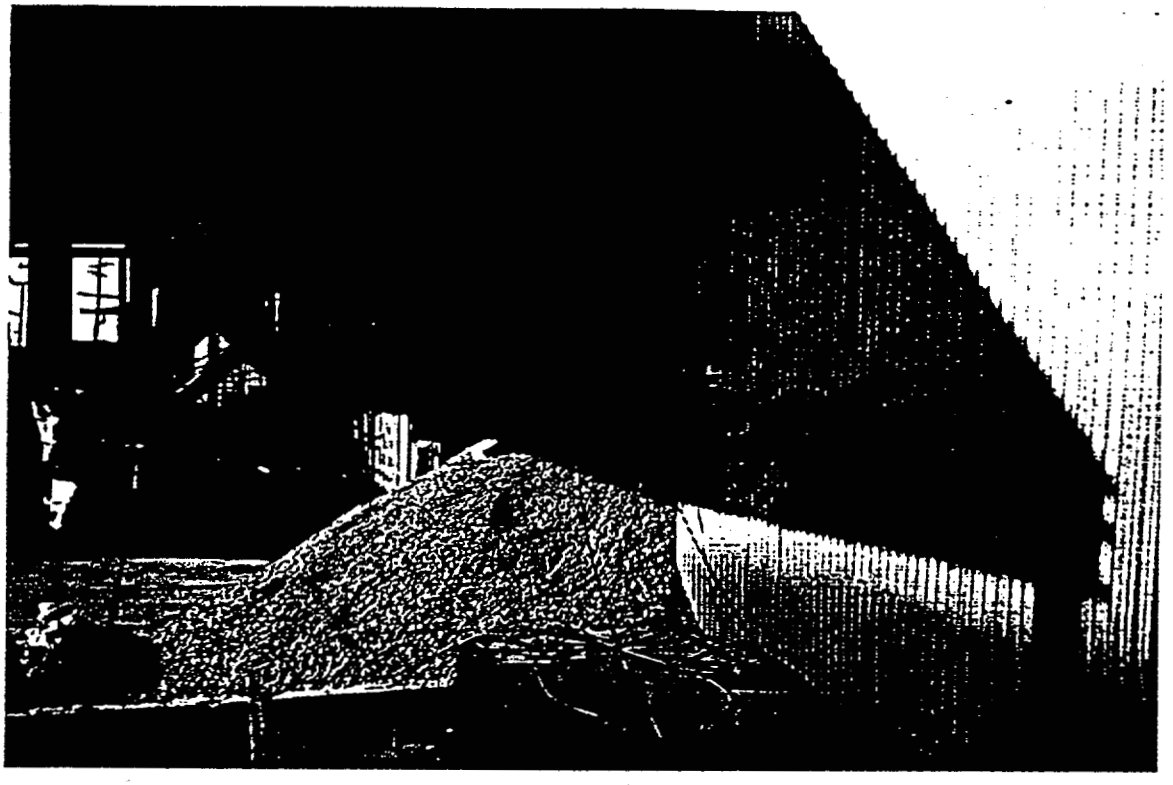

Figure 3, LAACC Deployed on Crushed Ferrocolumbium Slag at Building 102

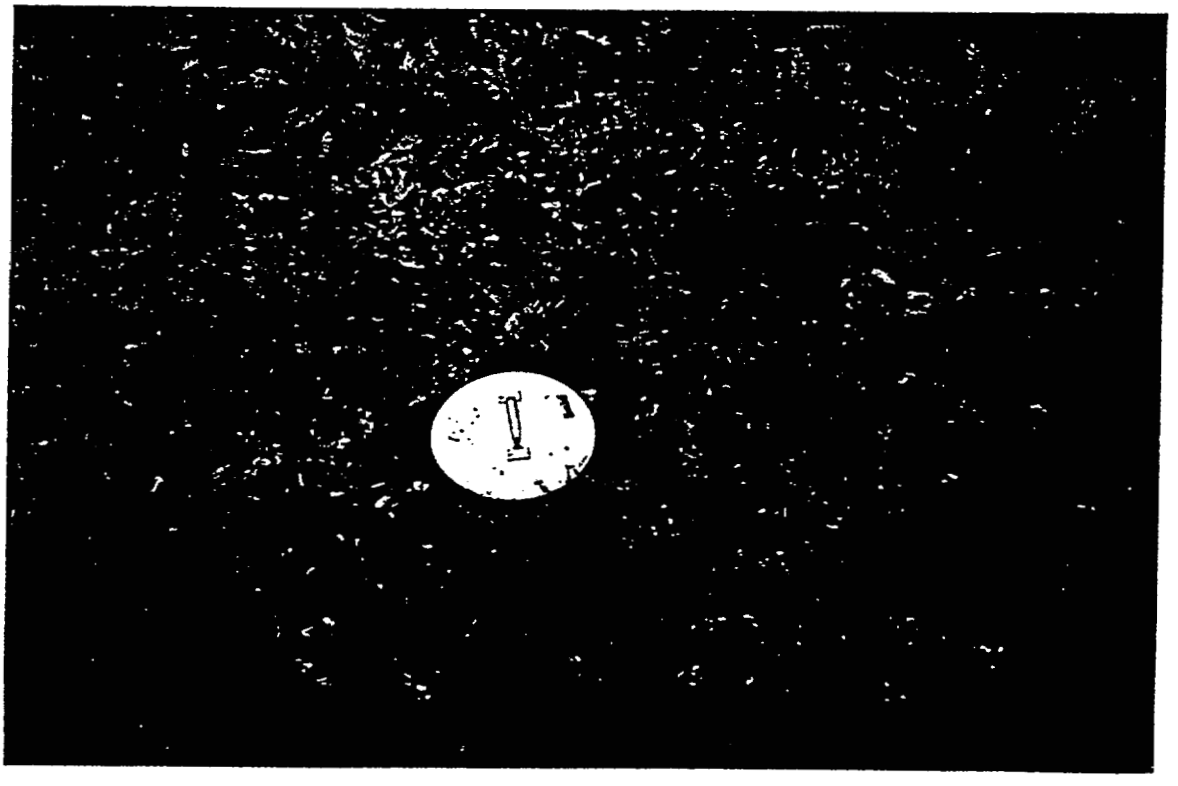

Figure 4, LAACC Deployed at Location B-3 (North of Newfield Site)

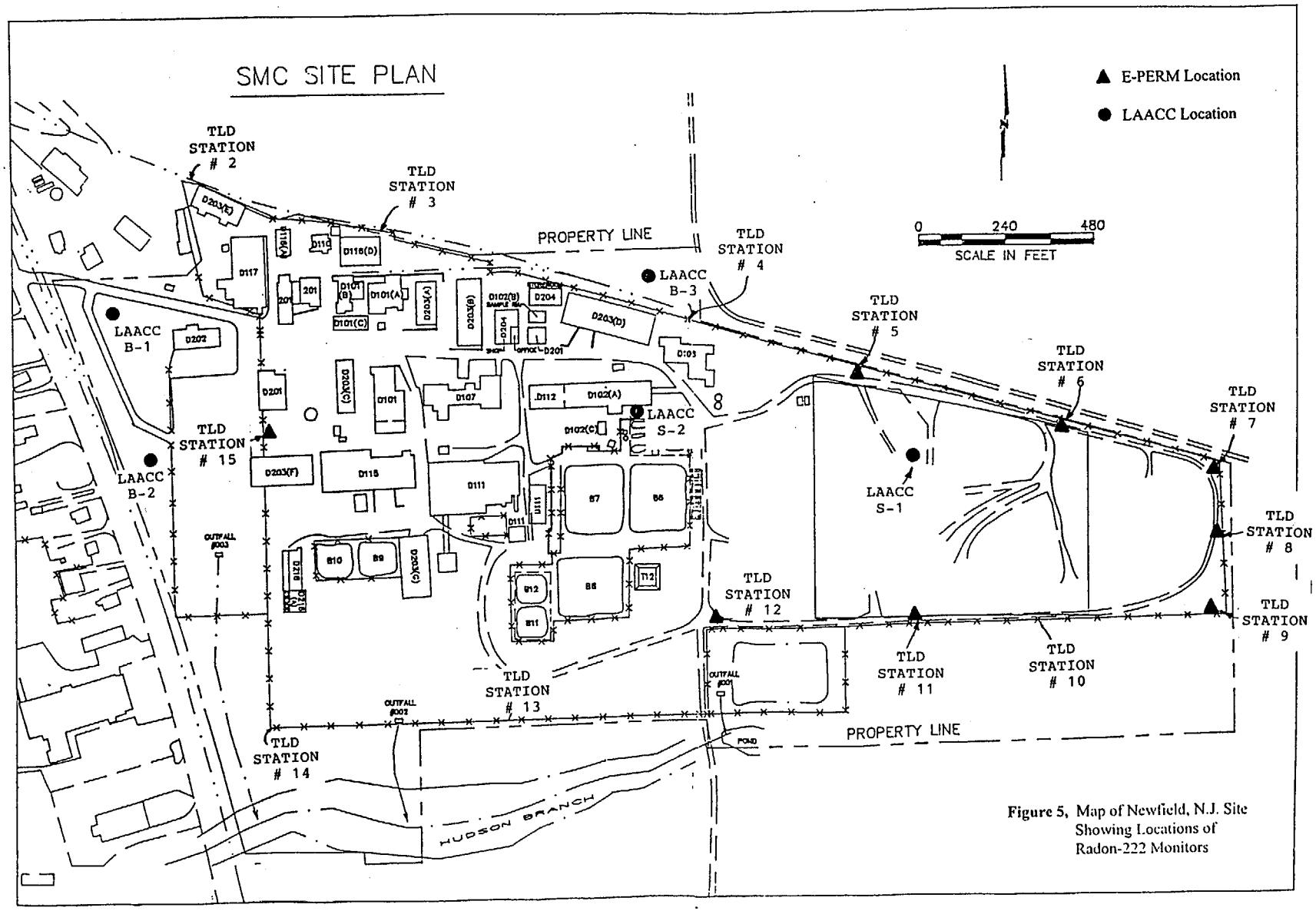

Figure 5, Map of Newfield, N.J. Site Showing Locations of Radon-222 Monitors

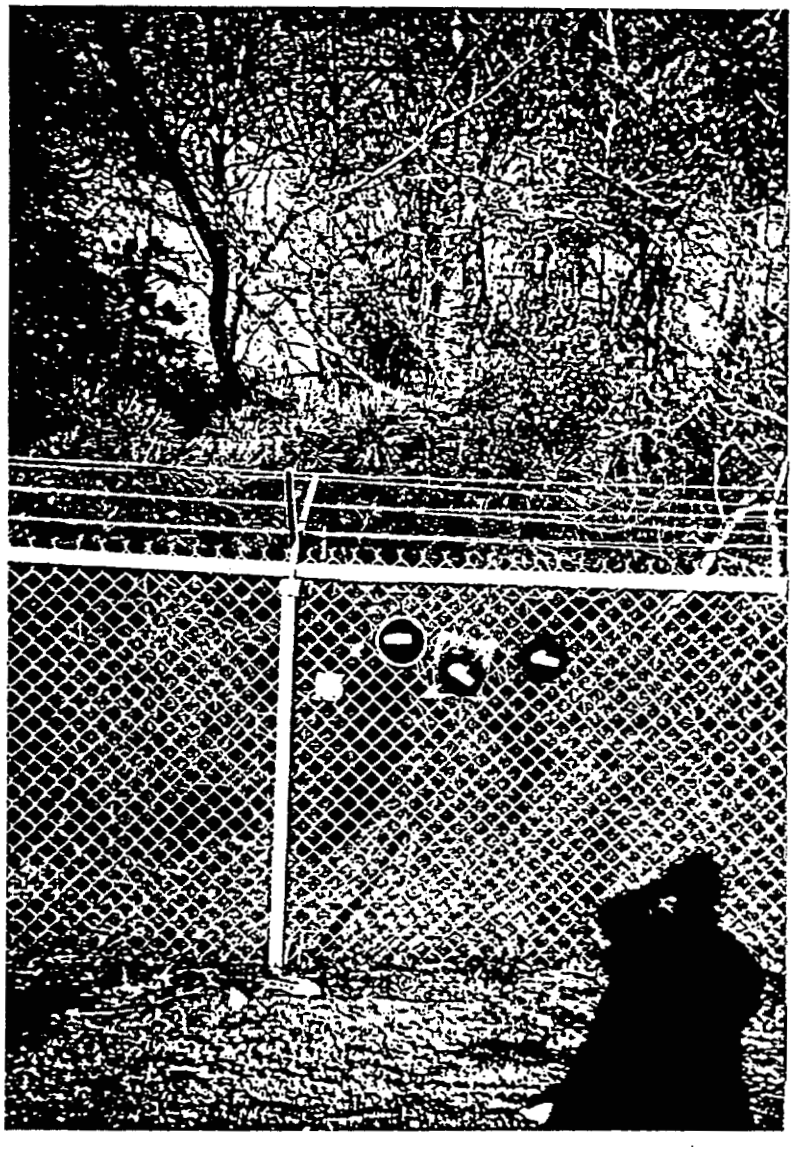

Figure 6, E-PERMs Deployed at TLD Monitoring Station # 5

APPENDIX 1

Chain of Custody Record for LAACC Samples

INTEGRATED ENVIRONMENTAL MANAGEMENT, INC.
ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference No. _____

(1) Client Name: BRIAN A. KELLY	(7) Samples Shipment Date: 12/6/94	(5) Bill to: IEM, INC
(2) Sample Team Leader: BRIAN A. KELLY	(8) Lab Destination: AIRCHEK	9040 EXECUTIVE PARK DR, SUITE 205
(3) Task No.: 94005.02	(9) Lab Contact: JIM KRUEGER	KNOXVILLE, TN, 37923
(4) Project Manager: B. A. KELLY	(12) Technical Contact/Phone: BRIAN KELLY 615-531-9140	(10) Report to: IEM, INC
(6) Purchase Order No.: N/A	(13) Carrier/Waybill No.: 3778162850	9040 EXECUTIVE PARK DR, SUITE 205
(11) Required Report Date: 1/7/95	FED EX	KNOXVILLE, TN, 37923

ONE CONTAINER PER LINE

(14) Sample Number	(15) Sample Description/Type	(16) Date/Time Collected	(17) Container Type	(18) Sample Volume	(19) Preservative	(20) Requested Testing Program
CANAL	CHARCOAL	12/3/94 12:12	PLASTIC BAG	235.2	NONE	RADON FLUX
BACKGROUND#1	"	12/3/94 14:30	"	242.2	"	"
BACKGROUND #2	"	12/3/94 14:55	"	246.8	"	"
GRASSY AREA	"	12/3/94 14:29	"	243.4	"	"
BUTTON	"	12/3/94 12:08	"	242.0	"	"

(23) Special Instructions

(24) Possible Hazard Identification
Non-hazard [X] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown [ ]

(25) Sample Disposal BK
Return to Client [X] Disposal by Lab [X] Archive _____ months

(26) Turnaround Time Required: Normal [X] Rush [ ]

(27) QC Level: I [X] II [ ] III [ ] Project Specific _____

(28) Relinquished by: (signature, date, time): Brian A. Kelly 12/6/94 19:13	Received by: (signature, date, time)
Relinquished by: (signature, date, time):	Received by: (signature, date, time)
Relinquished by: (signature, date, time):	Received by: (signature, date, time)

(See Reverse for Instructions)