

ALUMINUM COMPANY OF AMERICA
1800 HARVARD AVENUE
CLEVELAND, OHIO 44105



1992 March 30

Ken Lambert
U. S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, ILL 60137

RE: Radiation Surveys Bldg. 65 - Permanent Mold Division

The attached two (2) documents are reports from the surveying of Bldg. 65 at the Permanent Mold Division. The work was completed by Remcor and submitted to Alcoa for review. Please review the two documents and notify Alcoa if you need additional information or clarification.

Sincerely,

A handwritten signature in cursive script that reads "M. A. Gradert / ds".

M. A. Gradert

MAG/ds

cc: D. J. Ryan - letter only
Tony Huffert
Nuclear Regulatory Commission

Ref: RADS65.mag

APR 6 1992

9707030260 920330
PDR ADOCK 04000501
C PDR



REMCOR, Inc. • 701 Alpha Drive • P.O. Box 38310 • Pittsburgh, PA 15238-8310 • 412-963-1106

March 16, 1992

Project No. 91307.67

Mr. Mark A. Gradert
Senior Environmental Scientist
Aluminum Company of America
1600 Harvard Avenue
Cleveland, Ohio 44105

Letter Report
Preliminary Radiological Survey of Building 65
Cleveland Works
Aluminum Company of America
Cleveland, Ohio

Dear Mr. Gradert:

Remcor, Inc. (Remcor) is pleased to submit this letter report to the Aluminum Company of America (Alcoa) describing the preliminary radiological survey of Building 65 in the Alcoa facilities in Cleveland, Ohio (Figure 1). This work was performed under Alcoa Purchase Order No. CE 475980 CV, Change Order RI-2. The survey work plan was developed in the field in response to actual site conditions and observations and in consultation with representatives of Alcoa and the U.S. Nuclear Regulatory Commission (NRC). Based on field conditions and observations made at the start of the survey, the survey was designed to meet two objectives, as follows:

- Collect preliminary data to provide some indication of the direct, external radiation dose rates that would be experienced by personnel working in the building (assuming that such workers were not engaged in dust-generating activities)
- Collect preliminary data on the sources and levels of activity in bulk materials in the building including structural materials, bulk dusts, and ventilation system contents.

To meet these objectives, Remcor conducted the following activities:

- Performed a general, preliminary radiation dose rate survey of the first and second floors of the building.

- Performed direct radiation measurements at accessible locations in side duct work and air handlers in the building ventilation systems.
- Collected wipe samples from accessible locations inside the air handlers and duct work.
- Collected bulk samples of dust from the building floors and from within the ventilation systems and of chips of brick and wall tile for off-site radiological analysis.

The survey was conducted during a three-day period starting on October 16, 1991. Additional readings and samples were collected on November 8, 1991. The survey team consisted of a radiation engineer from Hilbert Associates, Inc. (Hilbert), a recording geologist from Remcor, and support labor from Remcor. Field instruments and laboratory analyses were provided by Hilbert.

Two field instruments were used to conduct this survey, as follows:

- Radiation dose rate readings were made with a Ludlum Model 125 Survey Meter (micro-R meter) reading in micro-Roentgens per hour ($\mu\text{R/hr}$).
- Direct surface readings were made with a Ludlum ESP-1 rate meter with a Geiger-Mueller (GM) pancake-style probe (pancake probe) reading in counts per minute (cpm).

SITE DESCRIPTION

Building 65 is a two-story building with a pipe tunnel. (The pipe tunnel was not included in this survey.) Available information suggests that the building was used as a research facility and that the principal activities conducted in this building were pilot-scale metals production and metals quality testing. The first floor is approximately 25,500 square feet (ft^2) and includes several high-bay areas. The second floor exists outside these high-bay areas and is approximately 12,500 ft^2 . The first floor is shown in Figure 2 and the second floor in Figure 2A. The building is a reinforced concrete structure with brick exterior curtain walls. Some interior walls are constructed of glazed tile block. The high-bay area portions of the first floor are brick; the rest of the first floor and the second floor are concrete.

Drawings of the building ventilation systems were not available, and the information on ventilation systems and air handler locations presented in this report are based on observations in the field and on general architectural drawings provided by Alcoa. The building ventilation systems are divided into three zones. Each zone contains one or more air supply units and



several exhaust units. Each of the six supply units had an Alcoa assigned number (S1 through S6). Nine of the 15 exhaust units have Alcoa assigned numbers (E1 through E9); the remaining six exhaust units have Remcor-assigned numbers (EU1 through EU7, skipping EU3). In addition, there are two air conditioners (AC1 and AC2) in the East Zone. The ventilation unit locations are as follows:

- Zone A - West Zone:
 - Supply No. 1 (S1)
 - Exhaust No. 1 (E1)
 - Exhaust No. 7 (E7)
 - Exhaust Unknown No. 1 (EU1)
 - Exhaust Unknown No. 2 (EU2)
- Zone B - Middle Zone:
 - Supply No. 2 (S2)
 - Supply No. 3 (S3)
 - Supply No. 6 (S6)
 - Exhaust No. 3 (E3)
 - Exhaust No. 8 (E8)
 - Exhaust No. 9 (E9)
 - Exhaust Unknown No. 4 (EU4)
 - Exhaust Unknown No. 5 (EU5)
- Zone C - East Zone:
 - Supply No. 4 (S4)
 - Supply No. 5 (S5)
 - Exhaust No. 2 (E2)
 - Exhaust No. 4 (E4)
 - Exhaust No. 5 (E5)
 - Exhaust No. 6 (E6)
 - Exhaust Unknown No. 6 (EU6)
 - Exhaust Unknown No. 7 (EU7)
 - Air Conditioner No. 1 (AC1)
 - Air Conditioner No. 2 (AC2).

Dose Rate Survey

Using the micro-R meter, gamma radiation dose rate readings were made at various locations on both floors. The dose rate readings were made by holding the micro-R meter approximately three feet (one meter) above the floor. Generally, one reading was taken near the center of each accessible room in the building, and multiple readings were taken in some

larger rooms. Approximately 65 readings were made on the first floor, and 28 readings were made on the second floor. This approach was designed to obtain preliminary representations on the general, external dose rate which would be encountered by an individual working in that room. The results of this survey are presented in Figures 2 and 2A. The results from the first floor range from 2.3 to 9.0 $\mu\text{R/hr}$. The results from the second floor range from 2.8 to 6.0 $\mu\text{R/hr}$. The arithmetic averages are 5.6 $\mu\text{R/hr}$ for the first floor and 3.9 $\mu\text{R/hr}$ for the second floor.

In addition, readings were made 1.5 feet from the wall at three locations on the first floor and one location on the second floor. This was done to observe the effect of the glazed ceramic tile in general radiation dose rates because some glazed tile products have been reported to produce measurable radiation dose rates due to naturally occurring radioactive materials in the clays from which the tiles were made. The results for these four readings also are shown in Figures 1 and 1A and were from 9.0, 9.9, and 10.0 $\mu\text{R/hr}$ on the first floor and 8.0 $\mu\text{R/hr}$ on the second floor.

Ventilation System Direct Surface Survey

Direct surface radiation survey measurements were made with the pancake probe at 19 locations inside the ventilation system duct work and air handlers (Figures 2 and 2a). Survey locations were limited to those accessible without use of ladders or cutting tools. Each direct measurement was initially recorded as total counts per minute (CPM) by the rate meter. The total count reading was converted to disintegrations per minute per 100 square centimeters (dpm/100 cm^2) as follows:

- The previously recorded background count rate (50 CPM) was subtracted from the total CPM measurement resulting in a corrected count per minute (CCPM) value
- CCPM was converted to dpm by dividing CCPM by the instrument efficiency (10 percent) that was determined by using the instrument to measure a known check-source
- Each value for dpm was converted to dpm/100 cm^2 by multiplying dpm by 100 cm^2 divided by the net area of the instrument (15 cm^2).

The instrument's minimum detectable activity (MDA) was calculated to be 2,332 dpm/100 cm^2 during this preliminary survey.

Prior to selecting the point at a location where a measurement was to be made, the pancake probe was passed over the entire accessible area. The point where the measurement was

taken was where the activity appeared to be the greatest. The accessible areas of the duct work was approximately 1 m² at each location. The accessible areas of the fan housings were approximately 3 m² at each location. The measured activities are representative of approximately 60 to 90 percent of the total accessible area at a particular location. Areas of elevated activity (relative to background) appear to be confined to dust accumulations within parts of the system.

Survey locations are identified in Figures 2 and 2A. The readings, in dpm/100 cm², are reported in Table 1.

Ventilation System Removable Contamination Survey

On November 8, 1991, wipe samples were collected at each of the 19 locations inside the ventilation system at which direct radiation readings had been made earlier. These samples were made by wiping an area of 100 cm² (approximately 4 by 4 inches) with a dry cotton cloth using moderate hand pressure. These wipes were counted on site for gross alpha radiation and gross beta-gamma radiation. The results for each of the 19 wipe samples were reported to be less than the minimum detectable activities (MDA) for the counting instrument for both alpha and beta-gamma radiation. The MDA for alpha was 39 dpm/100 cm² and 314 dpm/100 cm² for beta-gamma.

Bulk Samples Collection

A total of 15 bulk samples were collected from the following locations:

- Three samples were collected, as chips, from the tile wall and brick floor materials
- Two samples were collected by scraping material from floor drains
- Six samples were collected by scraping dust from inside the air handlers
- Four samples were collected by compositing dust swept from floor areas.

These samples were sent to Hilbert's off-site laboratory for gamma spectroscopy analysis using an Eberline germanium-lithium crystal counter. Chain-of-custody forms are presented as Attachment 1, and laboratory analysis reports specifying sample matrix, counting time, and energy peaks are presented as Attachment 2.

Uranium-238 (U-238) was detected in all samples. Thorium-232 (Th-232), potassium-40 (K-40), and cesium-137 (Cs-137) were reported in some samples.

CLOSING

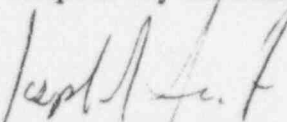
Based on the results of this survey, the following recommendations are offered:

- Based on the general dose rate readings, radiation levels in this building do not appear to exceed NRC guidelines for general, external radiation doses to workers or the public, as long as in-building activities do not generate respirable dust.
- Fixed surface radiation levels inside the ventilation systems suggest a need for further investigation. Planning of this investigation should include consultation with representatives of the NRC.

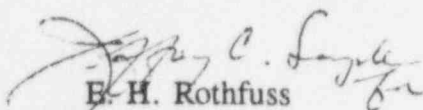
The NRC publishes guidelines for unrestricted release of facilities based on fixed radiation on surfaces. These guidelines provide different limits for U-238 and Th-232; input from the NRC should be obtained to define which limits are applicable to Building 65.

We trust that this report is clear and useful to your needs. If you have any questions or comments, please call us.

Respectfully submitted,



Joseph A. Senita,
Assistant Project Geologist



E. H. Rothfuss
Senior Project Manager

JAS:EHR:rmv
Attachments

TABLES

TABLE 1
DIRECT AND REMOVABLE RADIATION MEASUREMENTS
IN VENTILATION SYSTEM
ALCOA BUILDING 65

<u>SURVEY ID</u>	<u>LOCATION DESCRIPTION</u>	<u>DIRECT SURVEY⁽¹⁾</u>
<u>Second Floor</u>		
S-1	Supply No. 4	10,000
S-2	Supply No. 5	6,000
S-3	Exhaust No. 2	2,640
S-4	Exhaust No. 4	5,280
S-5	Supply No. 6	8,580
S-6	Supply No. 2	5,940
S-7	Exhaust No. 3	6,600
S-8	Supply No. 3	4,950
S-9	Exhaust No. 7	1,320
S-10	Not identified	1,320
S-11	Exhaust No. 1	1,320
S-12	Supply No. 4	2,640
<u>First Floor</u>		
S-13	Floor level supply	ND ⁽²⁾
S-14	Wall exhaust	ND
S-15	Ceiling supply	ND
S-16	Wall exhaust	ND
S-16A	Wall exhaust	3,300
S-17	Ceiling exhaust	ND
<u>Roof</u>		
S-18	Roof Exhaust	ND

⁽¹⁾Direct survey, field measurement in dpm/100 cm² using an ESP-1 rate meter with a Geiger-Mueller pancake probe.

⁽²⁾"ND" indicates counts per minute did not exceed background.

TABLE 2

BULK SAMPLE ANALYSIS RESULTS
ALCOA BUILDING 65

SAMPLE ID	SAMPLE DESCRIPTION	U-238 (pCi/g)	Th-232 (pCi/g)	K-40 (pCi/g)	Cs-137 (pCi/g)
1	Non-glazed tile - wall	18	4	18	NA
2	Glazed and non-glazed tile - wall	7	3	11	NA
3	Red brick - floor	13	2	44	NA
4	Material inside floor drain	16	ND	9	NA
5	Dust - Exhaust No. 2	58	4	19	2
6	Dust - Exhaust No. 4	96	19	ND	54
7	Dust - Supply No. 6	76	7	ND	4
8	Dust - Exhaust No. 3	184	72	ND	11
9	Dust - Exhaust No. 7	71	ND	23	7
10	Dust - Exhaust No. 1	70	ND	33	3
11	Material inside sump	14	ND	11	1
M-1	First floor dust composite	6.3	0.7	NA	NA
M-2	First floor dust composite	4.8	0.5	NA	NA
M-3	First floor dust composite	7.5	0.6	NA	NA
M-4	Second floor dust composite	16.3	0.9	NA	NA

FIGURES

DRAWING NUMBER 91307-A2

CHECKED APPROVED

RAZ 030492

DRAWN BY



SCALE, FEET
0 2000 4000



QUADRANGLE LOCATION

REFERENCE:

USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE,
CLEVELAND SOUTH, OHIO, DATED 1963,
PHOTOREVISED 1984. SCALE 1:24000.

FIGURE 1

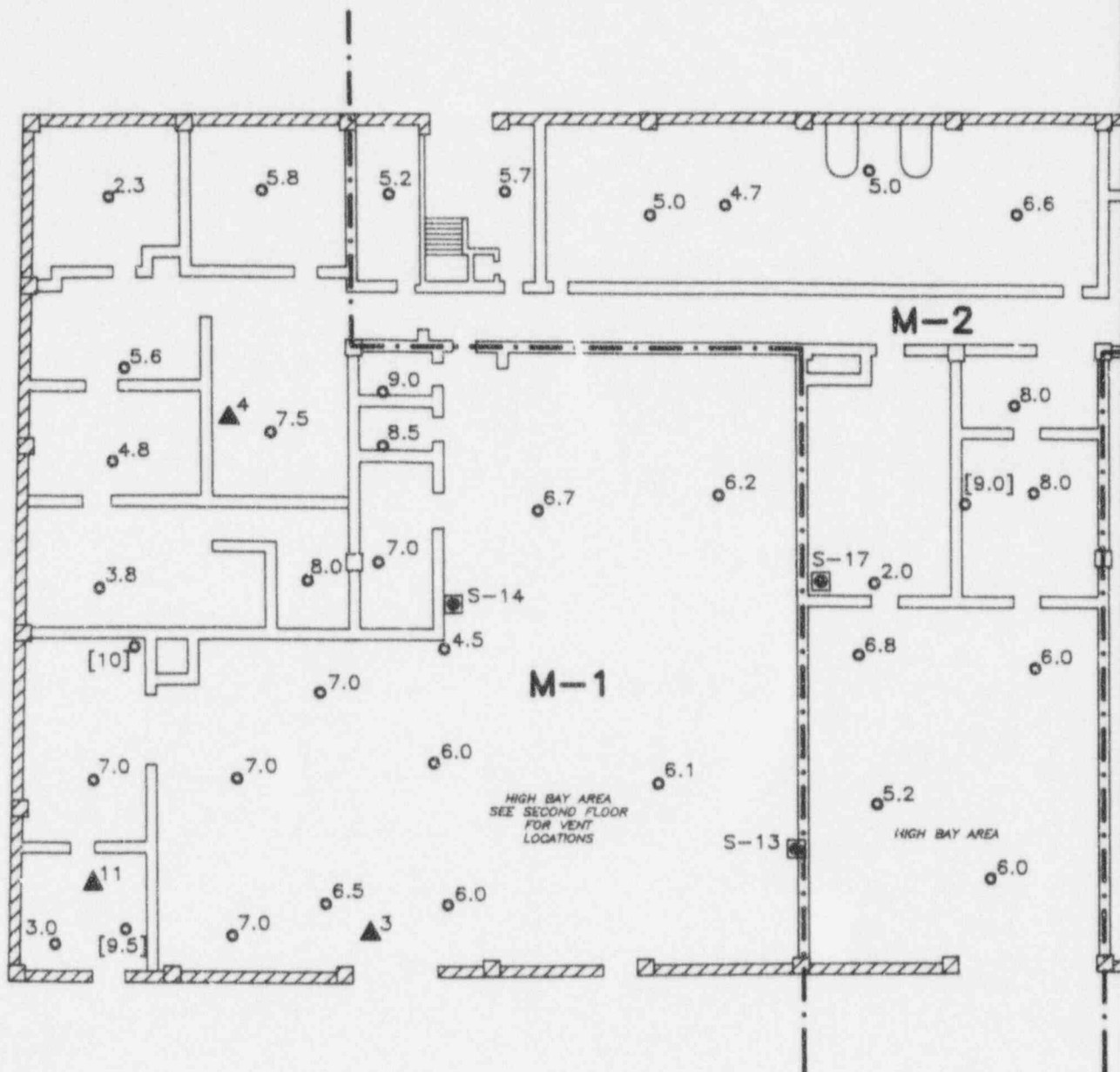
SITE LOCATION
MAP

PRELIMINARY RADIATION SURVEY
AND SAMPLE LOCATIONS

PREPARED FOR

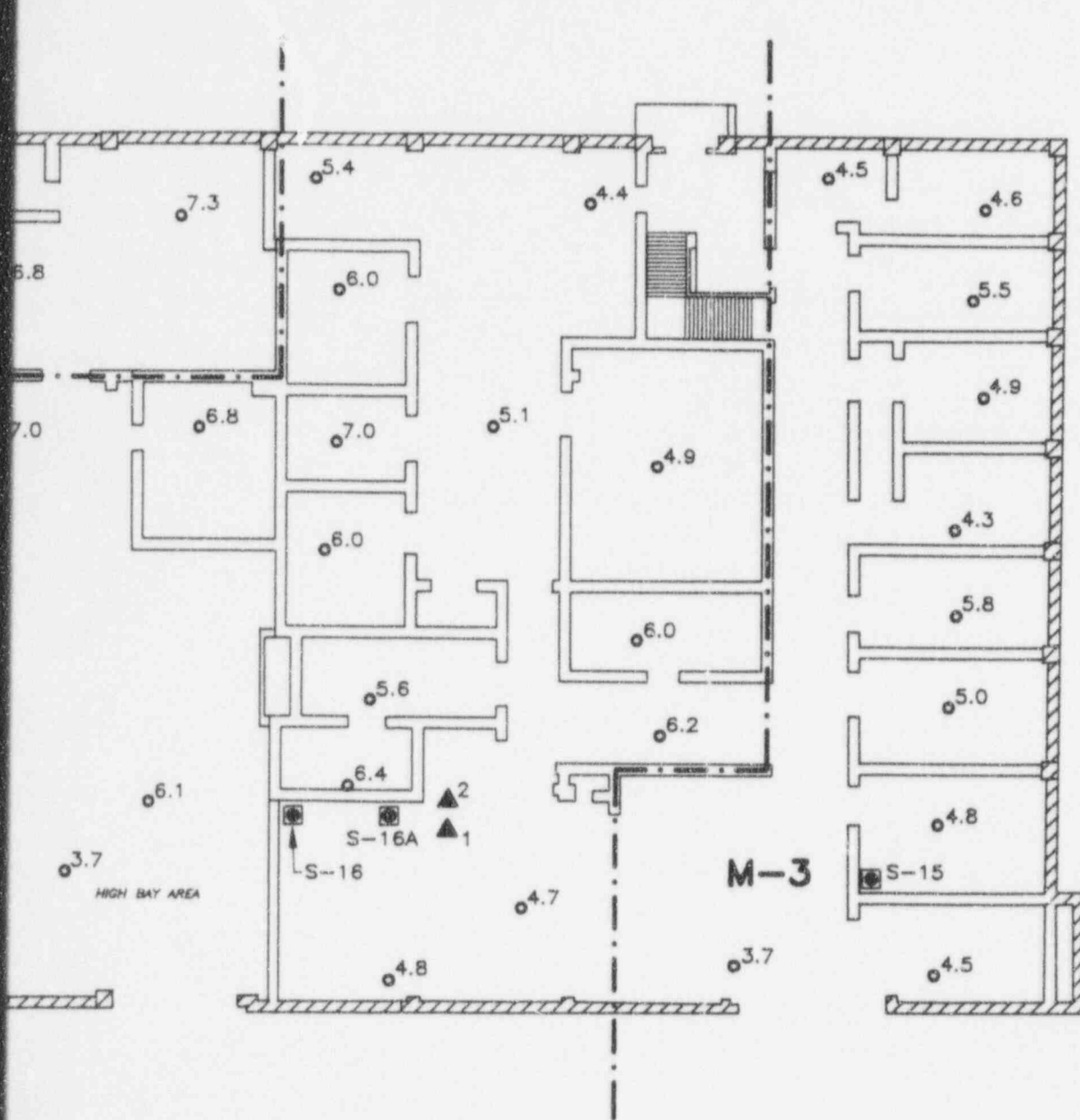
ALCOA
CLEVELAND, OHIO

REMCOR



REFERENCE:

ALCOA DRAWING NO. NUS-SK-65-2,
NOT DATED.



**ANSTEC
APERTURE
CARD**

Also Available on
Aperture Card

END

- 3 BOUNDARY FOR COMPOSITE
SAMPLE COLLECTION AREA
8. RADIATION SURVEY LOCATION AND RESULTS
(μ R/hr) 1 METER ABOVE FLOOR SURFACE
7. RADIATION SURVEY LOCATION AND RESULTS
(μ R/hr) 18 INCHES FROM WALL SURFACE
7. DIRECT AND REMOVABLE SAMPLE
LOCATION AND IDENTIFICATION
2. BULK SAMPLE LOCATION
AND IDENTIFICATION

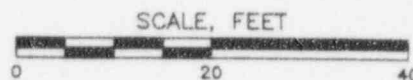


FIGURE 2

FIRST FLOOR
SAMPLE LOCATIONS

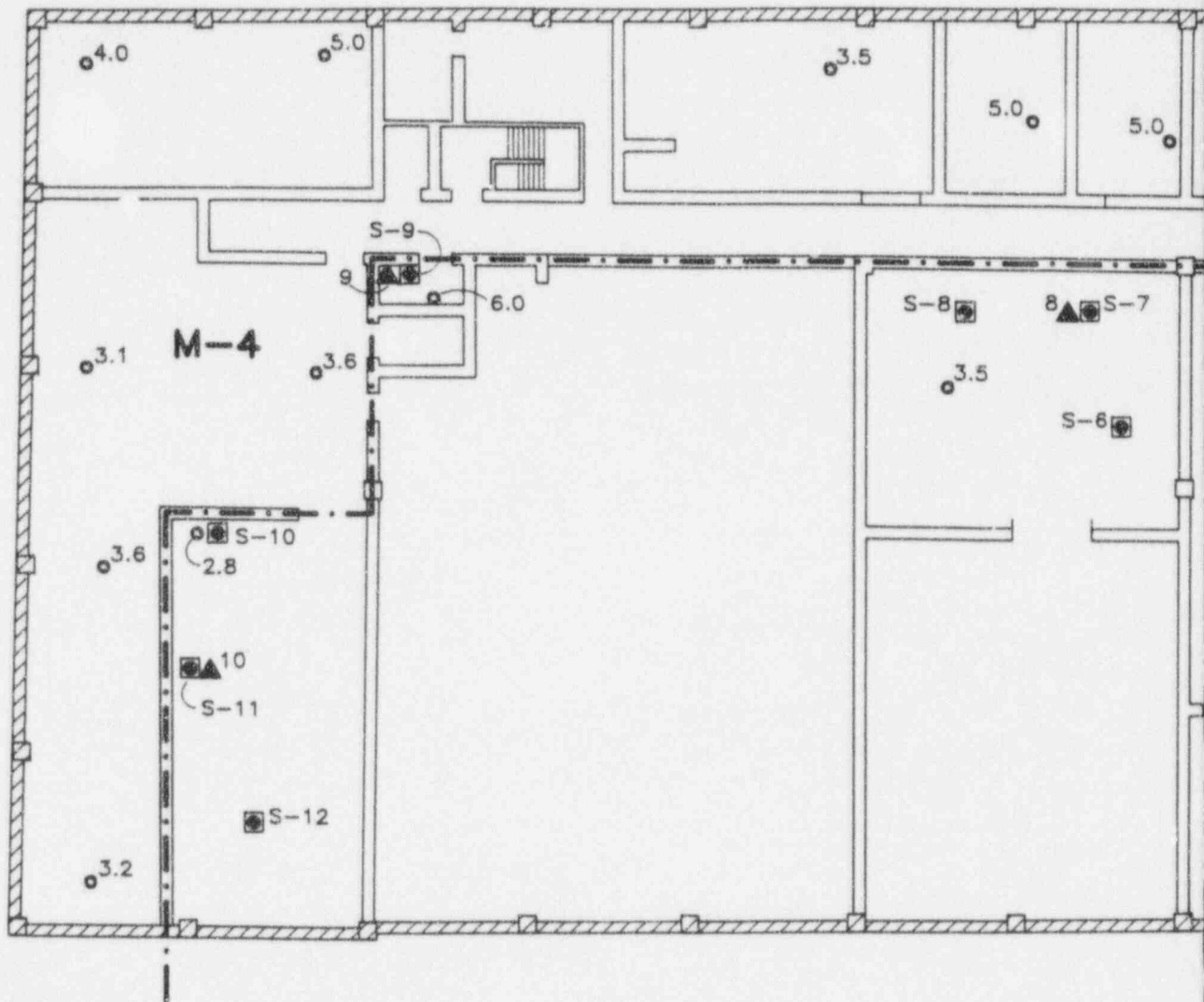
PRELIMINARY RADIATION SURVEY
AND SAMPLE LOCATIONS

PREPARED FOR
ALCOA
CLEVELAND, OHIO

REMCOR

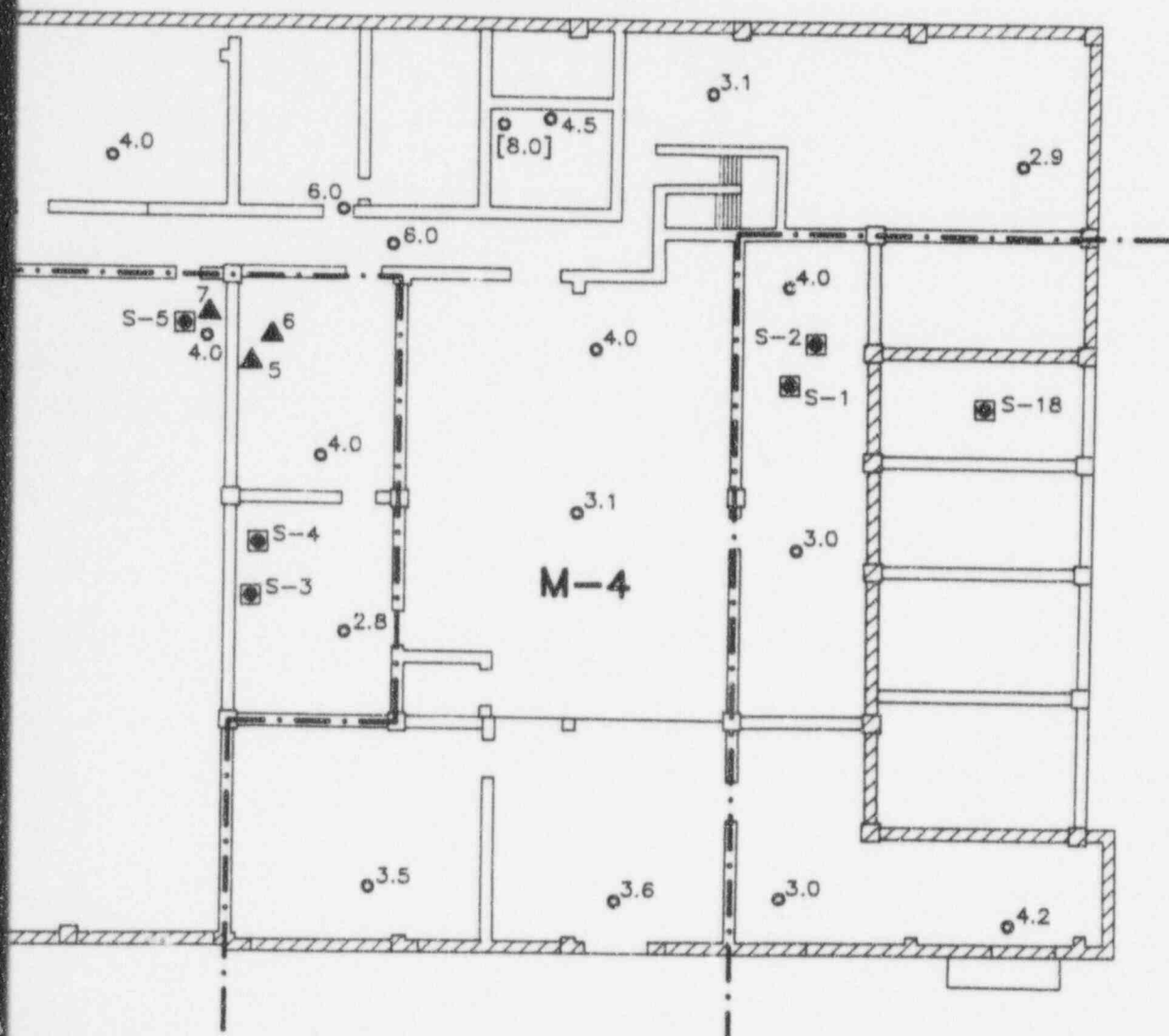
9707030260-01

1307-B8

DRAWING
NUMBERCHECKED
APPROVEDDRAWN
BYRAZ
030492

REFERENCE:

ALCOA DRAWING NO. NUS-SK-65-2,
NOT DATED.



**ANSTEC
APERTURE
CARD**

Also Available on
Aperture Card

BOUNDARY FOR COMPOSITE
SAMPLE COLLECTION AREA

RADIATION SURVEY LOCATION AND RESULTS
($\mu\text{R/hr}$) 1 METER ABOVE FLOOR SURFACE

RADIATION SURVEY LOCATION AND RESULTS
($\mu\text{R/hr}$) 18 INCHES FROM WALL SURFACE

DIRECT AND REMOVABLE SAMPLE
LOCATION AND IDENTIFICATION

BULK SAMPLE LOCATION
AND IDENTIFICATION

APPROXIMATE SCALE, FEET

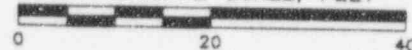


FIGURE 2A

SECOND FLOOR
SAMPLE LOCATIONS

PRELIMINARY RADIATION SURVEY
AND SAMPLE LOCATIONS

PREPARED FOR

ALCOA

CLEVELAND, OHIO

REMCOR

9707030260-02

ATTACHMENT 1

CHAIN-OF-CUSTODY FORMS FOR BULK SAMPLES

REMCOR

CHAIN OF CUSTODY RECORD

112 3654

PROJECT NO.: 11367		PROJECT NAME: Remcor			NO. OF CON- TAINERS	REMARKS										
SAMPLERS: See Sample 1 Date 6/11																
SAMPLE	DATE	TIME	SAMPLE MEDIUM	SAMPLE LOCATION												
Sample #1	10/15/81	1123	Soil		1	X										
20251C	10/16/81	0915			1											
20254	10/16/81	0915			1											
F152C	10/17/81	1200			1											
2F152C		1200			1											
M1C		1400	Dust		1											
M2C		1423			1											
M3C		1430			1											
M4C		1500			1											
1			file ground													
2			file													
3			brick													

RELINQUISHED BY: [Signature]	DATE/TIME 10/17/81 4:00	RECEIVED BY: F. J. [Signature]	RECEIVED BY: 314 6687692	RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
RELINQUISHED BY:	DATE/TIME	RECEIVED BY:	RECEIVED BY:	RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
RELINQUISHED BY:	DATE/TIME	RECEIVED FOR LAB BY:	RECEIVED FOR LAB BY:	RELINQUISHED BY:	DATE/TIME	POSSIBLE HAZARD:

REMCOR

CHAIN OF CUSTODY RECORD

N2 3664

PROJECT NO.:

91307

PROJECT NAME:

Remcor

SAMPLERS:

Joe Smith Dave Gill

NO.
OF
CON-
TAINERS

REMARKS

SAMPLE	DATE	TIME	SAMPLE MEDIUM	SAMPLE LOCATION	NO. OF CON- TAINERS															
4	10/17/91		Dust		bagged	X														
5																				
6																				
7																				
8																				
9																				
10																				
11																				

RELINQUISHED BY:

Joe Smith

DATE/TIME

10/17/91 4:00

RECEIVED BY:

Ted Sk 314687692

RELINQUISHED BY:

DATE/TIME

RECEIVED BY:

RELINQUISHED BY:

DATE/TIME

RECEIVED BY:

RELINQUISHED BY:

DATE/TIME

RECEIVED BY:

RELINQUISHED BY:

DATE/TIME

RECEIVED FOR LAB BY:

DATE/TIME

POSSIBLE HAZARD:

ATTACHMENT 2

LABORATORY ANALYSIS REPORTS FOR BULK SAMPLES

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #1 NON GLAZED WALL TILE

SAMPLE VOLUME IS 6.4 GMS

SAMPLE COUNT TIME IS 2000 SEC

SAMPLE TYPE IS PETRIE SAMPLE MARTRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
Th234* AT 0.093 MEV	17.7 +/- 7.434	10.32537
Ac228** AT 0.0933MEV	23.6 +/- 9.912	11.80042
Ra226* AT 0.186 MEV	4.9 +/- 4.9	12.48946
Cs137 AT 0.662 MEV	0 +/- 0	1.5337
Ac228** AT 0.911 MEV	4.2 +/- 2.31	1.384581
K40 AT 1.460 MEV	18.2 +/- 10.01	6.061684

Ac228 PHOTOPEAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES (U238) / ** THORIUM SERIES (Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #2 NONGLAZED/GLAZED W TILE

SAMPLE VOLUME IS 12.9 GMS

SAMPLE COUNT TIME IS 20000 SEC

SAMPLE TYPE IS PETRIE SAMPLE MARTRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.093 MEV	6.7 +/- 1.5745	2.195437
Ac228** AT 0.0933MEV	8.8 +/- 2.068	2.509071
Ra226* AT 0.186 MEV	5 +/- 1.355	1.858615
Cs137 AT 0.662 MEV	0 +/- 0	.2411264
Ac228** AT 0.911 MEV	2.8 +/- .7504	.8511078
K40 AT 1.460 MEV	10.7 +/- 2.4717	2.853882

Ac228 PHOTOPEAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #3 RED BRICK - FLOOR

SAMPLE VOLUME IS 6.3 GMS

SAMPLE COUNT TIME IS 20000 SEC

SAMPLE TYPE IS PETRIE SAMPLE MARTRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.093 MEV	12.4 +/- 2.604	3.549323
Ac228** AT 0.0933MEV	16.6 +/- 3.486	4.056369
Ra226* AT 0.186 MEV	8.62 +/- 2.23258	3.006184
Cs137 AT 0.662 MEV	0 +/- 0	.453756
Ac228** AT 0.911 MEV	1.7 +/- 1.2546	1.697606
K40 AT 1.460 MEV	44.4 +/- 5.4168	4.312455

Ac228 PHOTOPEAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #4 FLOOR DRAIN MATL

SAMPLE VOLUME IS 7.7 GMS

SAMPLE COUNT TIME IS 2000 SEC

SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.093 MEV	15.6 +/- 5.7096	7.446412
Ac228** AT 0.0933MEV	20.7 +/- 7.5762	8.510184
Ra226* AT 0.186 MEV	6 +/- 3.3	6.188971
Cs137 AT 0.662 MEV	0 +/- 0	1.536846
Ac228** AT 0.911 MEV	3 +/- 1.854	1.150821
K40 AT 1.460 MEV	8.41 +/- 5.5506	5.038284

Ac228 PHOTOPEAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #5 EXHAUST #2 DUST

SAMPLE VOLUME IS 2.7 GMS

SAMPLE COUNT TIME IS 21666 SEC

SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.093 MEV	58 +/- 5.8	7.066081
Ac228** AT 0.0933MEV	77 +/- 7.7	8.075521
Ra226* AT 0.186 MEV	16.5 +/- 5.379	7.388377
Cs137 AT 0.662 MEV	2.2 +/- .7832	1.063462
Ac228** AT 0.911 MEV	4.3 +/- 2.4725	3.120493
K40 AT 1.460 MEV	18.5 +/- 7.252	9.288649

Ac228 PHOTOPEAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #6 EXHAUST #4 DUST

SAMPLE VOLUME IS 2.2 GMS

SAMPLE COUNT TIME IS 2000 SEC

SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.093 MEV 96 +/- 21.6	26.06244	
Ac228** AT 0.0333MEV 128 +/- 28.8	29.78565	
Ra226* AT 0.186 MEV 36.5 +/- 13.578	19.93022	
Cs137 AT 0.662 MEV 54 +/- 7.668	6.58236	
Ac228** AT 0.911 MEV 19 +/- 6.707	4.027872	
K40 AT 1.460 MEV 1.5 +/- 1.2375	17.63399	

Ac228 PHOTOPEAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #7 SUPPLY #⁶₄ DUST

SAMPLE VOLUME IS 6.1 GMS

SAMPLE COUNT TIME IS 2000 SEC

SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.093 MEV	76 +/- 11.932	12.83993
Ac228** AT 0.0933MEV	101 +/- 15.857	14.6742
Ra226* AT 0.186 MEV	15.7 +/- 7.693	11.51858
Cs137 AT 0.662 MEV	3.4 +/- .9996001	.3603139
Ac228** AT 0.911 MEV	6.7 +/- 2.3651	1.452676
K40 AT 1.460 MEV	1.5 +/- 1.5	6.3598

Ac228 PHOTOPeAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #8 EXHAUST #3 DUST

SAMPLE VOLUME IS 4.2 GMS

SAMPLE COUNT TIME IS 2000 SEC

SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
Th234* AT 0.093 MEV	184 +/- 20.976	21.59306
Ac228** AT 0.0933MEV	245 +/- 27.93	24.67778
Ra226* AT 0.186 MEV	20 +/- 13.4	21.05983
Cs137 AT 0.662 MEV	10.3 +/- 2.8737	3.447903
Ac228** AT 0.911 MEV	5.4 +/- 1.9062	2.109838
K40 AT 1.460 MEV	1.5 +/- 1.2375	9.236852

Ac228 PHOTOPeAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES (U238) / ** THORIUM SERIES (Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #9 EXHAUST #7 DUST

SAMPLE VOLUME IS 1.9 GMS

SAMPLE COUNT TIME IS 30000 SEC

SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.093 MEV	71 +/- 7.171001	9.159691
Ac228** AT 0.0933MEV	94 +/- 9.494001	10.46822
Ra226* AT 0.186 MEV	24.8 +/- 5.0592	7.434876
Cs137 AT 0.662 MEV	6.8 +/- 1.1424	1.370097
Ac228** AT 0.911 MEV	0 +/- 0	5.008211
K40 AT 1.460 MEV	22.7 +/- 5.2437	1.36122

Ac228 PHOTOPeAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #10 EXHAUST #1 DUST

SAMPLE VOLUME IS 2.1 GMS

SAMPLE COUNT TIME IS 8225 SEC

SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
Th234* AT 0.093 MEV 70	+/- 11.83	15.09269
Ac228** AT 0.0933MEV 93	+/- 15.717	17.2488
Ra226** AT 0.186 MEV 19	+/- 8.948939	13.43391
Cs137 AT 0.662 MEV 3	+/- 1.695	2.265925
Ac228** AT 0.911 MEV 3.4	+/- 3.4	6.300804
K40 AT 1.460 MEV 33	+/- 6.633001	4.492086

Ac228 PHOTOPEAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES (U238) / ** THORIUM SERIES (Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS #11 MATL INSIDE SUMP

SAMPLE VOLUME IS 6 GMS

SAMPLE COUNT TIME IS 2000 SEC

SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.093 MEV 14 +/- 8.106	11.45402	
Ac228** AT 0.0933MEV 18 +/- 10.422	13.0903	
Ra226* AT 0.186 MEV 10 +/- 6.45	9.798969	
Cs137 AT 0.662 MEV 1.2 +/- .594	.3663192	
Ac228** AT 0.911 MEV 1.9 +/- 1.5675	1.476887	
K40 AT 1.460 MEV 11 +/- 7.26	6.465797	

Ac228 PHOTOPEAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

DATE OF REPORT: 10-23-1991

HILBERT ASSOCIATES, INC.

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS M-1-C

SAMPLE VOLUME IS 460 GMS

SAMPLE COUNT TIME IS 1000 SEC

SAMPLE TYPE IS MARINELLI/SOIL

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
Th234* AT 0.093 MEV 6.3 +/-	1.6695	2.185963
Ac228** AT 0.0933MEV 8.3 +/-	2.1995	2.498244
Ra226* AT 0.186 MEV 2.9 +/-	.9048001	1.403259
Ac228** AT 0.911 MEV .7 +/-	.231	9.792402E-02
Ac228** AT 0.969 MEV 0 +/-	0	.1762632
K40 AT 1.460 MEV 6 +/-	1.35	.41087

Ac228 PHOTOPEAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES (U238) / ** THORIUM SERIES (Th232)

DATE OF REPORT: 10-23-1991

HILBERT ASSOCIATES, INC.

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS M-2-C

SAMPLE VOLUME IS 512 GMS

SAMPLE COUNT TIME IS 1000 SEC

SAMPLE TYPE IS MARINELLI/SOIL

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
Th234* AT 0.093 MEV 4.8 +/- 1.5024	2.109733	
Ac228** AT 0.0933MEV 6.4 +/- 2.0032	2.411123	
Ra226* AT 0.186 MEV 1.4 +/- 1.0094	1.58895	
Ac228** AT 0.911 MEV .5 +/- .18	8.797861E-02	
Ac228** AT 0.969 MEV 0 +/- 0	.1583615	
K40 AT 1.460 MEV 5.9 +/- 1.416	.369141	

Ac228 PHOTOPeAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES (U238) / ** THORIUM SERIES (Th232)

DATE OF REPORT: 10-23-1991

HILBERT ASSOCIATES, INC.

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS M-3-C

SAMPLE VOLUME IS 574 GMS

SAMPLE COUNT TIME IS 1000 SEC

SAMPLE TYPE IS MARINELLI/SOIL

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.093 MEV	7.5 +/- 1.7625	2.326346
Ac228** AT 0.0933MEV	10 +/- 2.35	2.658681
Ra226* AT 0.186 MEV	2 +/- .84	1.280201
Ac228** AT 0.911 MEV	.6 +/- .18	.0784757
Ac228** AT 0.969 MEV	0 +/- 0	.1412562
K40 AT 1.460 MEV	3.9 +/- 1.0725	.3292686

Ac228 PHOTOPEAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

DATE OF REPORT: 10-23-1991

HILBERT ASSOCIATES, INC.

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

REMCOR CORPORATION AT ALCOA, CLEVELAND, OHIO

SAMPLE IDENTIFICATION IS M-4-C

SAMPLE VOLUME IS 508 GMS

SAMPLE COUNT TIME IS 1000 SEC

SAMPLE TYPE IS MARINELLI/SOIL

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
Th234* AT 0.093 MEV	16.3 +/- 2.2331	2.738995
Ac228** AT 0.0933MEV	21.7 +/- 2.9729	3.13028
Ra226* AT 0.186 MEV	4.6 +/- 1.104	1.446526
Ac228** AT 0.911 MEV	.9 +/- .2556	8.867136E-02
Ac228** AT 0.969 MEV	0 +/- 0	.1596084
K40 AT 1.460 MEV	5 +/- 1.235	.3720476

Ac228 PHOTOPeAK AT 0.911 MeV FOR Th232 CONFIRMATION

* URANIUM SERIES (U238) / ** THORIUM SERIES (Th232)



REMCOR, Inc. • 701 Alpha Drive • P.O. Box 38310 • Pittsburgh, PA 15238-8310 • 412-963-1106

March 16, 1992

Project No. 91307.67

Mr. Mark A. Gradert
Senior Environmental Scientist
Aluminum Company of America
1600 Harvard Avenue
Cleveland, Ohio 44105

Letter Report
General Radiological Survey of Ventilation Systems
Building 65
Aluminum Company of America
Cleveland, Ohio

Dear Mr. Gradert:

Remcor, Inc. (Remcor) is pleased to submit this letter report to the Aluminum Company of America (Alcoa) describing the radiological surveys of the interior surfaces of the ventilation systems in Building 65 conducted by Remcor to date. This work has been performed under Alcoa Purchase Order No. CE 475980 CV, Change Orders RI-7 and RI-8. The survey work was conducted in response to preliminary results obtained in October and November 1991 which are presented in Remcor's letter report entitled "Preliminary Radiological Survey of Building 65." This letter presents the results of the most recent survey readings and sample analyses in addition to the previously collected data. The most recent survey was performed during January 6 through 10, 1992.

The survey consisted of collecting two types of data at accessible points in the various ventilation systems as follows:

- Bulk samples of dust and loose scale were collected and analyzed, by gamma spectroscopy in an off-site laboratory, for activity due to uranium-238 (U-238) and thorium-232 (Th-232) content with results reported in picoCuries per gram (pCi/g) for each isotope in each sample. Bulk samples were collected to identify the dominant isotope so that the appropriate Nuclear Regulatory Commission (NRC) decontamination standard for fixed radiation could be determined.

- Direct contact measurements of surface activity, reported in disintegrations per minute per 100 square centimeters (dpm/100 cm²) on those portions of the interior surfaces of each system that could be reached from each access point, reported with an estimate of the interior surface area represented by each measurement.

The direct survey results were compared with the NRC decontamination standards that are presented in the regulatory background section of this letter.

The interior of each system was accessed through existing hatches and gratings and by cutting openings at strategic points in the system fan housings and duct work. The survey addressed 23 ventilation systems, including 6 supply systems, 15 exhaust systems, and 2 air conditioning systems. The ventilation systems and sample locations are shown in Figures 1 and 1A.

The building ventilation systems are divided into three zones. Each zone contains one or more supply systems and several exhaust units. In addition, there are two air conditioner systems in the East Zone (Zone C). The surveyed systems are distributed among the three zones as follows:

Zone	Supply Systems	Exhaust Systems	Air Conditioners
West (A)	1	4	-
Middle (B)	3	5	-
East (C)	<u>2</u>	<u>6</u>	<u>2</u>
Total	6	15	2

The 6 supply systems and 9 of the 15 exhaust systems have Alcoa-assigned reference numbers (S1 through S6 and E1 through E9). Reference numbers were assigned to the remaining 6 exhaust systems (EU1 through EU7, skipping EU3), which were assumed to be exhaust units. The two air conditioners (AC1 and AC2) were also assigned reference numbers by Remcor. The ventilation systems are listed by number and zone in Table 1.

The total area of the entire ventilation system is estimated to be 20,300 square feet (ft²). The estimated area of the entire ventilation system represented by this survey is 1,780 ft², or approximately 9 percent. The duct work is made of galvanized or painted sheet steel, except for brick flues extending into the basement at Supply No. 3, Exhaust No. 1, and Exhaust No. 2. The fan housings are located on the second floor and are made of painted steel sheets or plates.

Accumulations of dust were observed in fan houses, along the bottoms of horizontal runs of duct (particularly at bends), and on the vertical brick ducts. Generally, dust accumulations were relatively scarce on the tops and sides of ducts and along vertical runs of duct work.

REGULATORY BACKGROUND

The NRC publishes guidance on standards for unrestricted release of surfaces and bulk materials and surfaces contaminated with radioactive materials. These standards, as applicable to uranium and thorium, are summarized as follows:

- Surfaces - Standards are presented in the NRC guidance document entitled, "Guidelines for Decontamination of Facilities and Equipment Prior to Unrestricted Release or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" dated August 1987. These guidelines for fixed contamination are:
 - Uranium:
 - 5,000 dpm/100 cm² average over an area of 1 square meter (1 m²)
 - 15,000 dpm/100 cm² maximum over an area of 100 cm² or less per each 1 m²
 - Thorium:
 - 1,000 dpm/100 cm² average over an area of 1 m²
 - 3,000 dpm/100 cm² maximum over an area of 100 cm² or less per each 1 m²
- The guidelines for removable contamination are:
 - Thorium:
 - 200 dpm/100 cm²
 - Uranium:
 - 1,000 dpm/100 cm².

Wipe samples for removable contamination were not collected during the January 1992 survey discussed here. However removable contamination data was obtained during the preliminary radiological survey of Building 65.

- Bulk Materials - Standards are presented in the NRC Branch Technical Position (BTP) entitled, "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations," published in the Federal Register on October 23, 1981 (pages 52061 to 52063). Although the guidance presented here appears to apply to contaminated soils, it could also be considered for evaluation of loose dusts. If soil interpretation were used, the most stringent guidelines for unrestricted release contained in the BTP are:
 - U-238 - 35 pCi/g
 - Th-232 - 10 pCi/g.

SURVEY METHODS

Direct readings were taken with a Ludlum Model ESP-1 scaler counter with a Geiger-Mueller or "pancake" probe detector. This instrument records total counts over the period of measurement. Measurements were converted to disintegration per minute per 100 square centimeters (dpm/100 cm²) by making the following calculations:

- The total counts recorded were converted to corrected counts per minute (CCPM) by dividing the count time (in minutes) and subtracting the previously measured background count rate (50 CPM).
- CCPM were converted to dpm by dividing the reported value by the instrument counting efficiency as determined by counting a known check source. Instrument efficiency was 12 percent.
- The reading for dpm was converted to dpm/100 cm² by multiplying the reported dpm by 100 cm² divided by the net reading area of the instrument in cm².

To obtain an appropriate minimum detectable activity (MDA) with the pancake probe, each measurement was counted for 3.5 minutes. The MDA was calculated to be 998 dpm/100².

Bulk samples were collected by scraping accumulated dust and other material into a petri dish for transmittal to an off-site laboratory. Sample labeling, documentation, and chain-of-custody procedures were followed. The chain-of-custody forms are presented in Attachment 1. At the laboratory, samples were prepared and counted in a Germanium-Lithium crystal gamma spectroscopy system. Counting and results interpretation were done according to standard procedures. The laboratory reports are presented in Attachment 2.

SURVEY RESULTS

The direct survey and bulk sample results are presented in Table 2 and survey and sample locations are shown in Figures 1 and 1A. Please note that Table 2 also includes direct survey and bulk sample data from the previous surveys. The average U-238 activity is 107 pCi/g, and the average Th-232 activity is 5.1 pCi/g. Th-232 exceeded the 10 pCi/g release criteria in bulk samples from Exhaust No. 3 and Exhaust No. 4. U-238 activity exceeded the 35 pCi/g release criteria in each system sampled, except Exhaust Unknown No. 2 and Exhaust Unknown No. 7. Total sum difference values were calculated using bulk sample and direct survey data from some of the systems to determine the relative contribution of each isotope (i.e., U-238 and Th-232) to the recorded direct survey measurement. These are shown on Table 2 and indicate that U-238 is the dominant isotope. The total sum difference was calculated using the following equation:

Th-232 Total Sum Difference =

$$\left(\frac{\text{pCi/g Th-232}}{\text{pCi/g Th-232} + \text{pCi/g U-238}} \right) \times \text{net dpm/100 cm}^2$$

The U-238 sum difference was calculated by replacing the Th-232 activity with that of U-238 in the dividend position of the equation.

The direct survey measurements were less than 5,000 dpm/100 cm² at all but 24 locations. Exhaust No. 3 and Exhaust No. 4 were the only systems where direct survey measurements were greater than 5,000 dpm/100 cm² in the duct work. Other measurements that exceeded 5,000 dpm/100 cm² were located in the fan housings of Supply No. 1, Supply No. 2, Supply No. 4, Supply No. 5, and Supply No. 6 and of Exhaust No. 7.

CLOSING

We recommend that further evaluation of these data be postponed until Alcoa has obtained clear guidance and direction from the NRC. The principal issue for resolution by the NRC is determination of the isotope (U-238 or Th-232) that defines the applicable surface contamination limit. Remcor strongly recommends that the issue of applicable cleanup standards be fully and finally resolved before proceeding with additional surveys, data evaluation, or system cleaning.

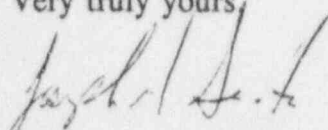
Mr. Mark A. Gradert

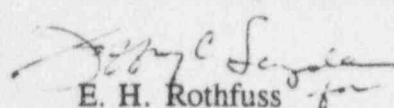
6

March 16, 1992

We trust that the information presented in this letter is clear, complete, and responsive to your needs. Please call us if you have any questions or comments.

Very truly yours,


Joseph A. Senita
Assistant Project Geologist


E. H. Rothfuss
Senior Project Manager

JAS:EHR:rmv
Attachments

TABLES

TABLE 1

**IDENTIFICATION OF VENTILATION SYSTEMS
BY ZONE AND NUMBERS WITH NUMBER OF READINGS
AND SAMPLES COLLECTED IN EACH**

ZONE	SYSTEM DESIGNATIONS	NO. OF DIRECT SURFACE RADIATION MEASUREMENTS	NO. OF BULK SAMPLES COLLECTED
West Zone (A)	Supply No. 1 (S1)	23	2
	Exhaust No. 1 (E1)	1	1
	Exhaust No. 7 (E7)	6	2
	Exhaust Unknown No. 1 (EU1)	2	-
	Exhaust Unknown No. 2 (EU2)	4	1
Middle Zone (B)	Supply No. 2 (S2)	3	1
	Supply No. 3 (S3)	2	1
	Supply No. 6 (S6)	3	1
	Exhaust No. 3 (E3)	24	7
	Exhaust No. 8 (E8)	4	-
	Exhaust No. 9 (E9)	2	-
	Exhaust Unknown No. 4 (EU4)	1	-
	Exhaust Unknown No. 5 (EU5)	2	-
East Zone (C)	Supply No. 4 (S4)	8	2
	Supply No. 5 (S5)	7	2
	Exhaust No. 2 (E2)	1	-
	Exhaust No. 4 (E4)	11	1
	Exhaust No. 5 (E5)	1	-
	Exhaust No. 6 (E6)	1	-
	Exhaust Unknown No. 6 (EU6)	-	-
	Exhaust Unknown No. 7 (EU7)	1	1
	Air Conditioner No. 1 (AC1)	1	-
	Air Conditioner No. 2 (AC2)	2	-

TABLE 2
ALCOA - CLEVELAND WORKS
BUILDING 65 RADIOLOGICAL SURVEY
SUMMARY OF DATA FROM VENTILATION SYSTEM

PAGE 1 OF 6

SAMPLE ID	NET DPM/ 100CM2	Th-232 (pCi/g)	U-238 (pCi/g)	BULK SAMPLE ID	LOCATION	APPROXIMATE AREA (M ²) (1)	% REP. OF AREA (2)
ZONE A - WEST SIDE OF BUILDING 65							
SUPPLY #1							
S1-1	3018				PFD (3)	1	75
S1-2	1470				PFD	1	75
S1-3	1145				PFD	1	75
S1-4	1393	0	24	S1-1A	PFD	1	75
S1-5	542				PFD	1	75
S1-6	712				PFD	1	75
S1-7	526				PFD	1	75
S1-8	681				PFD	1	75
S1-9	727				PFD	1	75
S1-10	851				PFD	1	75
S1-11	1625				PFD	1	75
S1-12	696				PFD	1	75
S1-13	ND (4)				PFD	1	75
S1-14	124				PFD	1	75
S1-15	2646				PFD	1	75
S1-16	310				PFD	1	75
S1-17	836				PFD	1	75
S-13	ND				PFD	1	75
S1-18	511				PFD	1	80
S1-19	480				PRE F D (5)	3	80
S-12	2640				FAN HOUS. (6)	3	80
S1-20	2182				FAN HOUS.	3	80
S1-21	7026	0	62	S1-21	FAN BLADE	3	80
AREA SURVEYED						32	
TOTAL AREA						544	
EXHAUST #1							
S-11	1320	3.4	70	#10	FAN HOUS.	3	80
AREA SURVEYED						3	
TOTAL AREA						63	
Th-232 SUM DIFF. (7) =	61						
U-238 SUM DIFF. =	1259						
EXHAUST UNKNOWN #1							
EU1-1	155				PRE FD	1	50
EU1-2	1207				DAMPER	1	5
AREA SURVEYED						2	
TOTAL AREA						11	

SEE NOTES AT END OF TABLE

TABLE 2
(CONTINUED)

PAGE 2 OF 6

SAMPLE ID	DPM/ 100CM2	Th-232 (pCi/g)	U-238 (pCi/g)	BULK SAMPLE ID	LOCATION	APPROXIMATE AREA (M ²) (1)	% REP. OF AREA (2)
<u>EXHAUST UNKNOWN #2</u>							
EU2-1	108	1.6	14	EU2-2	PRE FD	1	50
EU2-2	1625				FAN HOUS.	1	90
S-10	1320				FAN HOUS.	1	
EU2-3	0				PFD	1	75
AREA SURVEYED						4	
TOTAL AREA						37	
Th-232 SUM DIFF. =	167						
U-238 SUM DIFF. =	1458						
<u>EXHAUST #7</u>							
EX7-1	5943	1.4	19	EX7-1	FAN HOUS.	1	90
S-9	1320	0	71	#9	FAN HOUS.	1	90
EX7-2	1671				PRE FD	0.5	80
EX7-3	2863				PRE FD	0.5	80
EX7-4	2244				PRE FD	0.5	50
EX7-5	1439				PRE FD	0.5	50
AREA SURVEYED						3	
TOTAL AREA						33	
Th-232 SUM DIFF. =	406	(USING EX7-1 DATA)					
U-238 SUM DIFF. =	5535						
<u>ZONE B - MIDDLE OF BLDG 65</u>							
<u>SUPPLY #3</u>							
S3-1	3157	7.1	41	S3-1	FAN BLADE	3	80
S-8	4950				FAN HOUS.	3	80
AREA SURVEYED						6	
TOTAL AREA						67	
Th-232 SUM DIFF. =	731	(USING S-8 DIRECT AND S3-1 BULK DATA)					
U-238 SUM DIFF. =	4219						
<u>SUPPLY #2</u>							
S2-1	402	2.8	110	S2-2	FAN BLADE	3	80
S2-2	2012				FAN HOUS.	9	90
S-6	5940				FAN HOUS.	9	90
AREA SURVEYED						21	
TOTAL AREA						67	
Th-232 SUM DIFF. =	147	(USING S-6 DIRECT AND S2-2 BULK DATA)					
U-238 SUM DIFF. =	5793						

SEE NOTES AT END OF TABLE

TABLE 2
(CONTINUED)

SAMPLE ID	DPM/ 100CM2	Th-232 (pCi/g)	U-238 (pCi/g)	BULK SAMPLE ID	LOCATION	APPROXIMATE AREA (M ²) (1)	% REP. OF AREA (2)
<u>EXHAUST #9</u>							
EX9-1	ND				PFD	0.5	80
EX9-2	124				PRE FD	0.5	80
AREA SURVEYED						1	
TOTAL AREA						9	
<u>EXHAUST #8</u>							
EX8-1	1223				PRE FD	2	50
EX8-2	0				PFD	2	80
EX8-3	480				PRE FD	1	50
EX8-4	ND				PRE FD	1	60
AREA SURVEYED						6	
TOTAL AREA						32	
<u>EXHAUST UNKNOWN #4</u>							
S-17	0				PRE FD	0.5	90
AREA SURVEYED						0.5	
TOTAL AREA						5.6	
<u>EXHAUST UNKNOWN #5</u>							
EU5-1	1439				FAN BLADE	0.5	80
EU5-2	ND				PRE FD	1	80
AREA SURVEYED						1.5	
TOTAL AREA						4.4	
<u>SUPPLY #6</u>							
S6-1	248				PFD	1	90
S6-2	6593				FAN HOUS.	3	80
S-5	8580	7	76	#7	FAN HOUS.	3	80
AREA SURVEYED						7	
TOTAL AREA						13	
Th-232 SUM DIFF. =	724						
U-238 SUM DIFF. =	7856						

SEE NOTES AT END OF TABLE

TABLE 2
(CONTINUED)

SAMPLE ID	DPM/ 100CM2	Th-232 (pCi/g)	U-238 (pCi/g)	BULK SAMPLE ID	LOCATION	APPROXIMATE AREA (MP) (1)	% REP. OF AREA (2)
<u>EXHAUST #3</u>							
EX3-1	2450				PFD	1	80
EX3-2	3730				PFD	1	80
EX3-3	2300				PFD	1	80
EX3-4	6300				PFD	1	80
EX3-5	10300	14	145	E3-B4	PFD	1	80
EX3-6	7500				PFD	1	80
EX3-7	4000				PFD	1	80
EX3-8	4500	<24	137	E3-B3	PFD	1	80
EX3-9	2600				PFD	1	80
EX3-10	ND				PFD	1	80
EX3-11	9600				PFD	1	80
EX3-12	16000	24	309	E3-B6	PFD	1	80
EX3-13	8500				PFD	1	80
EX3-14	7300				PFD	1	80
EX3-15	8500				PFD	1	80
EX3-16	9800	13	190	E3-B5	PFD	1	80
EX3-17	6900				PFD	1	80
EX3-18	2800				PFD	1	80
EX3-19	9600	<29	271	E3-B1	PFD	1	80
EX3-20	3700				PFD	1	80
EX3-21	2600				PFD	1	80
EX3-22	11500	<18	185	E3-B2	PFD	1	80
EX3-23	11400				PFD	1	80
S-7	6600	71	184	#8	FAN HOUS.	3	80
AREA SURVEYED						26	
TOTAL AREA						150	
<u>ZONE C - EAST SIDE OF BLDG 65</u>							
<u>EXHAUST #2</u>							
S-3	2640	4	58	#5	FAN HOUS.	3	90
AREA SURVEYED						3	
TOTAL AREA						76	
Th-232 SUM DIFF. =	170						
U-238 SUM DIFF. =	2470						

SEE NOTES AT END OF TABLE

TABLE 2
(CONTINUED)

SAMPLE ID	DPM/ 100CM2	Th-232 (pCi/g)	U-238 (pCi/g)	BULK SAMPLE ID	LOCATION	APPROXIMATE AREA (M ²) (1)	% REP. OF AREA (2)
<u>EXHAUST #4</u>							
EX4-1	4952				PRE FD	1	50
EX4-2	4008				PRE FD	1	80
EX4-3	9487				PRE FD	0.5	30
EX4-4	2430				PRE FD	1	90
EX4-5	4008				FAN HOUS.	4	50
EX4-6	2987				PFD	2	40
EX4-7	743				PRE FD	1	80
EX4-8	ND				PRE FD	1	80
EX4-9	12149				PRE FD	2	90
EX4-10	ND				PRE FD	1	80
S-16A	3300				PRE FD	0.5	90
S-4	5280	19	96	#6	FAN HOUS.	4	50
AREA SURVEYED						19	
TOTAL AREA						175	
Th-232 SUM DIFF. =	2007	(USING EX4-9 DIRECT AND #6 BULK DATA)					
U-238 SUM DIFF. =	10142						
<u>SUPPLY #4</u>							
S4-1	743				PFD	2	75
S4-2	1888				PFD	1	60
S4-3	2182				PFD	2	90
S4-4	2554				PFD	0.5	90
S4-5	2058				PFD	2	90
S-16	ND				PFD	1	80
S4-6	9905	4.3	118	S4-6	FAN HOUS.	3	80
S-1	10000	0	72	S4-B1	FAN HOUS.	3	80
AREA SURVEYED						14.5	
TOTAL AREA						238	
Th-232 SUM DIFF. =	348	(USING S4-6 DATA)					
U-238 SUM DIFF. =	9557						
<u>SUPPLY #5</u>							
S5-1	12273	0.7	121	S5-1	FAN HOUS.	5	90
S5-2	1965				PFD	1	80
S5-3	2290				PFD	1	80
S5-4	279				PFD	1	80
S5-5	ND				PFD	2	80
S-15	ND				PFD		
S-2	6000	1	174	S5-B1	FAN HOUS.	5	90
AREA SURVEYED						10	
TOTAL AREA						220	
Th-232 SUM DIFF. =	71	(USING S5-1 DATA)					
U-238 SUM DIFF. =	12202						

SEE NOTES AT END OF TABLE

TABLE 2
(CONTINUED)

SAMPLE ID	DPM/ 100CM2	Th-232 (pCi/g)	U-238 (pCi/g)	BULK SAMPLE ID	LOCATION	APPROXIMATE AREA (M²) (1)	% REP. OF AREA (2)
<u>EXHAUST #5</u>							
EX5-1	139				PRE FD	2	90
AREA SURVEYED						2	
TOTAL AREA						19	
<u>EXHAUST #6</u>							
EX6-1	ND				PRE FD	2	90
AREA SURVEYED						2	
TOTAL AREA						19	
<u>AIR CONDITIONER #1</u>							
AC1-1	ND				AC UNIT (8)	2	90
AREA SURVEYED						2	
TOTAL AREA						35	
<u>AIR CONDITIONER #2</u>							
AC2-1	ND				AC UNIT	2	90
AC2-2	1842				CAR (9)	1.5	5
AREA SURVEYED						3.5	
TOTAL AREA						81	
<u>EXHAUST UNIT UNKNOWN #7</u>							
EU7-1	3560	1	24	EU7-1	PRE FD	2	80
AREA SURVEYED						2	
TOTAL AREA						20	
Th-232 SUM DIFF. =	142						
U-238 SUM DIFF. =	3417						

NOTES:

- (1) AREA (M²) - AREA ACCESSIBLE TO SURVEY IN SQUARE METERS
- (2) % REP OF AREA - PERCENT OF ACCESSIBLE AREA THAT SURVEY DATA REPRESENTS
- (3) PFD - POST FAN DUCT
- (4) ND - DETECTED ACTIVITY LESS THAN NATURAL BACKGROUND
- (5) PRE FD - PRE-FAN DUCT
- (6) FAN HOUS. - FAN HOUSING INCLUDING FILTERS OF HEATERS
- (7) SUM DIFF. - SUM DIFFERENCE
- (8) AC UNIT - AIR CONDITIONING UNIT
- (9) CAR - COLD AIR RETURN

FIGURES

ATTACHMENT 1
CHAIN-OF-CUSTODY FORMS

REMCOR

CHAIN OF CUSTODY RECORD

No 3703

PROJECT NO.: 91307-40			PROJECT NAME: Alcoa Bldg 65		NO. OF CONTAINERS	<div style="transform: rotate(-45deg); display: inline-block;">Gamma spec U-238, Th-232</div>							REMARKS
SAMPLERS: JAS / DG													
SAMPLE	DATE	TIME	SAMPLE MEDIUM	SAMPLE LOCATION									
E3-B1	12/13/91	0900	Dust		1	X						RUSH	
E3-B2		0925			1	X						Report results	
E3-B3		0930			1	X						to Dave Gill	
E3-B4		0935			1	X						@ Alcoa	
E3-B5		0940			1	X							
E3-B6		0943			1	X							
S4-B1		1135			1	X							
S5-B1		1130			1	X							
RELINQUISHED BY: [Signature]		DATE/TIME: 12/13/91		RECEIVED BY: 295311724		RELINQUISHED BY:		DATE/TIME:		RECEIVED BY:			
RELINQUISHED BY:		DATE/TIME:		RECEIVED BY:		RELINQUISHED BY:		DATE/TIME:		RECEIVED BY:			
RELINQUISHED BY:		DATE/TIME:		RECEIVED FOR LAB BY:		DATE/TIME:		POSSIBLE HAZARD:					

REMCOR

CHAIN OF CUSTODY RECORD

No 3667

PROJECT NO.: 91307		PROJECT NAME: A100a		NO. OF CON- TAINERS	REMARKS				
SAMPLERS: JAS/DG									
SAMPLE	DATE	TIME	SAMPLE MEDIUM	SAMPLE LOCATION					
S1-21	1/10/92		Dust						
S2-2									
Sx7-1									
S2-2									
S3-1									
S4-6									
S51									
SU7-1									

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:	RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
RELINQUISHED BY:	DATE/TIME	RECEIVED BY:	RELINQUISHED BY:	DATE/TIME	RECEIVED BY:
RELINQUISHED BY:	DATE/TIME	RECEIVED FOR LAB BY:	DATE/TIME	POSSIBLE HAZARD:	

ATTACHMENT 2
LABORATORY REPORTS

DATE: REPORT: 01-14-1992

HILBERT ASSOCIATES, INC.

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES
FORRENCOR, INC. AT ALCOA: CLEVELAND, OHIO, BLDG 6S

SAMPLE IDENTIFICATION IS EU7-1
SAMPLE VOLUME IS 6.3 GMS
SAMPLE COUNT TIME IS 10710 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.063 MEV	23.9 +/- 2.629	6.575551
Th234* AT 0.093 MEV	30.5 +/- 3.355	6.916155
Ra226* AT 0.186 MEV	11.4 +/- 3.762	5.145128
Cs137 AT 0.662 MEV	.7 +/- .504	.1611006
Ac228** AT 0.911 MEV	1 +/- 1	2.325903
Ac228** AT 0.969 MEV	2.3 +/- 2.024	3.173172

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

SAMPLE IDENTIFICATION IS EX-3 ~~EX-3~~ EX 7-1
SAMPLE VOLUME IS 11.1 GMS
SAMPLE COUNT TIME IS 3002 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.063 MEV	19.3 +/- 3.474	6.407051
Th234* AT 0.093 MEV	17.9 +/- 3.222	6.854657
Ra226* AT 0.186 MEV	5.1 +/- 3.927	5.970563
Cs137 AT 0.662 MEV	4.4 +/- .748	2.953398E-02
Ac228** AT 0.911 MEV	1.4 +/- .868	.5289663
Ac228** AT 0.969 MEV	1.8 +/- .9899999	.9449494

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

DATE OF REPORT: 01-14-1992

HILBERT ASSOCIATES, INC.

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES
FORRENCOR, INC. AT ALCOA: CLEVELAND, OHIO, BLDG 6S

SAMPLE IDENTIFICATION IS S5-1
SAMPLE VOLUME IS 6.8 GMS
SAMPLE COUNT TIME IS 2576 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.063 MEV	121 +/- 12.1	15.00777
Th234* AT 0.093 MEV	145 +/- 15.95	19.35312
Ra226* AT 0.186 MEV	18 +/- 9.539999	13.86849
Cs137 AT 0.662 MEV	19.5 +/- 2.535	.5002195
Ac228** AT 0.911 MEV	.7 +/- .7	6.629799
Ac228** AT 0.969 MEV	3.4 +/- 1.19	1.797577

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

SAMPLE IDENTIFICATION IS EU2-2
SAMPLE VOLUME IS 8.390001 GMS
SAMPLE COUNT TIME IS 3001 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.063 MEV	13.9 +/- 4.309	10.44102
Th234* AT 0.093 MEV	20.8 +/- 4.784	10.495
Ra226* AT 0.186 MEV	9.600001 +/- 5.568	7.901708
Cs137 AT 0.662 MEV	4.6 +/- 1.058	.257526
Ac228** AT 0.911 MEV	1.6 +/- .752	.7000575
Ac228** AT 0.969 MEV	0 +/- 0	1.250588

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

RENCOR, INC. AT ALCOA: CLEVELAND, OHIO, BLDG 65

SAMPLE IDENTIFICATION IS 81-21
 SAMPLE VOLUME IS 4.3 GMS
 SAMPLE COUNT TIME IS 3000 SEC
 SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.063 MEV	61.7 +/- 9.872	17.25197
Th234* AT 0.093 MEV	68.5 +/- 11.645	20.95448
Ra226* AT 0.186 MEV	28.0 +/- 10.08	13.53243
Cs137 AT 0.662 MEV	30.6 +/- 3.06	.0762897
Ac228** AT 0.911 MEV	0 +/- 0	10.83788
Ac228** AT 0.969 MEV	0 +/- 0	14.98909

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

SAMPLE IDENTIFICATION IS 82-2
 SAMPLE VOLUME IS 7.3 GMS
 SAMPLE COUNT TIME IS 2312 SEC
 SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.063 MEV	110 +/- 12.1	14.82528
Th234* AT 0.093 MEV	108 +/- 11.88	16.36713
Ra226* AT 0.186 MEV	25 +/- 8.75	11.78795
Cs137 AT 0.662 MEV	3.5 +/- .875	3.831025E-02
Ac228** AT 0.911 MEV	2.8 +/- 1.736	1.044362
Ac228** AT 0.969 MEV	0 +/- 0	11.88303

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES

FOR

RENCOR, INC. AT ALCOA: CLEVELAND, OHIO, BLDG 65

SAMPLE IDENTIFICATION IS 83-1
 SAMPLE VOLUME IS 4.8 GMS
 SAMPLE COUNT TIME IS 4003 SEC
 SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.063 MEV	41.4 +/- 7.038	12.15701
Th234* AT 0.093 MEV	36.6 +/- 6.954	15.59261
Ra226* AT 0.186 MEV	17 +/- 7.31	12.15632
Cs137 AT 0.662 MEV	9.5 +/- 1.615	.3374599
Ac228** AT 0.911 MEV	3.4 +/- 1.53	.9173496
Ac228** AT 0.969 MEV	7.1 +/- 2.698	1.638761

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

SAMPLE IDENTIFICATION IS 84-6
 SAMPLE VOLUME IS 5.7 GMS
 SAMPLE COUNT TIME IS 2617 SEC
 SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC(pCi/gm)
Th234* AT 0.063 MEV	115 +/- 14.95	20.86549
Th234* AT 0.093 MEV	118 +/- 14.16	21.47618
Ra226* AT 0.186 MEV	30 +/- 12.6	17.27684
Cs137 AT 0.662 MEV	27.6 +/- 3.036	.5874038
Ac228** AT 0.911 MEV	4.3 +/- 1.935	1.181634
Ac228** AT 0.969 MEV	16.4 +/- 4.756	2.110881

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)

DATE OF REPORT: 12-17-1991

HILBERT ASSOCIATES, INC.

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES
FOR
REMCOR / ALUMINUM COMPANY OF AMERICA / BUILDING 65

SAMPLE IDENTIFICATION IS E3B1
SAMPLE VOLUME IS 2.9 GMS
SAMPLE COUNT TIME IS 2611 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
--------------------	----------	---------------

Th234*	AT 0.063 MEV	246 +/- 29.274	32.08171
U Th234*	AT 0.093 MEV	271 +/- 30.081	34.07655
Ra226*	AT 0.186 MEV	49 +/- 20.482	28.51616
Cs137	AT 0.662 MEV	21.4 +/- 4.173	4.055735
Th Ac228**	AT 0.969 MEV	1 +/- 1	28.83598 -

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)
Th234 PHOTOPEAK(0.093) ELEVATED DUE TO Ac228(0.0933)

SAMPLE IDENTIFICATION IS E3B2
SAMPLE VOLUME IS 6.3 GMS
SAMPLE COUNT TIME IS 1905 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
--------------------	----------	---------------

Th234*	AT 0.063 MEV	149 +/- 18.476	21.38956
U Th234*	AT 0.093 MEV	185 +/- 18.13	38.06898
Ra226*	AT 0.186 MEV	30 +/- 10.5	14.24773
Cs137	AT 0.662 MEV	2.5 +/- 2.475	3.467365
Th Ac228**	AT 0.969 MEV	0 +/- 0	17.62853

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)
Th234 PHOTOPEAK(0.093) ELEVATED DUE TO Ac228(0.0933)

DATE OF REPORT: 12-17-1991

HILBERT ASSOCIATES, INC.

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES
FOR
REMCOR / ALUMINUM COMPANY OF AMERICA / BUILDING 65

SAMPLE IDENTIFICATION IS E3-B3
SAMPLE VOLUME IS 1.8 GMS
SAMPLE COUNT TIME IS 5002 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
U- Th234* AT 0.063 MEV	137 +/- 24.523	31.3375
Th234* AT 0.093 MEV	158 +/- 24.332	31.01611
Ra226* AT 0.186 MEV	29 +/- 17.922	26.09464
Cs137 AT 0.662 MEV	4.7 +/- 2.6696	3.410816
TV Ac228** AT 0.969 MEV	7.1 +/- 7.1	24.25065

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)
Th234 PHOTOPEAK(0.093) ELEVATED DUE TO Ac228(0.0933)

SAMPLE IDENTIFICATION IS E3-B4
SAMPLE VOLUME IS 3 GMS
SAMPLE COUNT TIME IS 4912 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
U Th234* AT 0.063 MEV	145 +/- 21.75	19.07212
Th234* AT 0.093 MEV	165 +/- 17.48	20.2843
Ra226* AT 0.186 MEV	27 +/- 14.31	20.25534
Cs137 AT 0.662 MEV	9 +/- 2.25	2.738276
TV Ac228** AT 0.969 MEV	14.5 +/- 4.785	12.86007

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)
Th234 PHOTOPEAK(0.093) ELEVATED DUE TO Ac228(0.0933)

DATE OF REPORT: 12-17-1991

HILBERT ASSOCIATES, INC.

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES
FOR
REMCOR / ALUMINUM COMPANY OF AMERICA / BUILDING 65

SAMPLE IDENTIFICATION IS E3-B5
SAMPLE VOLUME IS 3 GMS
SAMPLE COUNT TIME IS 2129 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY pCi/gram MDAC (pCi/gm)

U Th234* AT 0.063 MEV 190 +/- 28.5 30.58062
Th234* AT 0.093 MEV 229 +/- 29.312 32.67946
Ra2266* AT 0.186 MEV 46 +/- 20.01 26.77221
Cs137 AT 0.662 MEV 12.4 +/- 2.6908 .6865715
Th Ac228** AT 0.969 MEV 13.5 +/- 8.37 5.027607

* URANIUM SERIES (U238) / ** THORIUM SERIES (Th232)
Th234 PHOTOPEAK (0.093) ELEVATED DUE TO Ac228 (0.0933)

SAMPLE IDENTIFICATION IS E3-B6
SAMPLE VOLUME IS 4.3 GMS
SAMPLE COUNT TIME IS 1995 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY pCi/gram MDAC (pCi/gm)

U Th234* AT 0.063 MEV 309 +/- 30.9 31.44456
Th234* AT 0.093 MEV 339 +/- 29.154 30.07802
Ra2266* AT 0.186 MEV 54 +/- 19.98 27.38773
Cs137 AT 0.662 MEV 11.7 +/- 3.042 4.054558
Th Ac228** AT 0.969 MEV 23.6 +/- 8.024 3.743232

* URANIUM SERIES (U238) / ** THORIUM SERIES (Th232)
Th234 PHOTOPEAK (0.093) ELEVATED DUE TO Ac228 (0.0933)

DATE OF REPORT: 12-17-1991

HILBERT ASSOCIATES, INC.

RADIOACTIVITY CONCENTRATIONS AND MDAC VALUES
FOR
REMCOR / ALUMINUM COMPANY OF AMERICA / BUILDING 65

SAMPLE IDENTIFICATION IS S4-B1
SAMPLE VOLUME IS 7.2 GMS
SAMPLE COUNT TIME IS 5004 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
Th234* AT 0.063 MEV	80 +/- 7.8	9.072142
U - Th234* AT 0.093 MEV	71.5 +/- 7.865	8.806573
Ra226* AT 0.186 MEV	19 +/- .7	7.45858
Cs137 AT 0.662 MEV	17 +/- 1.7	1.583015
Ac228** AT 0.969 MEV	0 +/- 0	7.516545

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)
Th234 PHOTOPEAK(0.093) ELEVATED DUE TO Ac228(0.0933)

SAMPLE IDENTIFICATION IS S5-B1
SAMPLE VOLUME IS 2.1 GMS
SAMPLE COUNT TIME IS 25019 SEC
SAMPLE TYPE IS PETRIE SAMPLE MATRIX

NUCLIDE AND ENERGY	pCi/gram	MDAC (pCi/gm)
Th234* AT 0.063 MEV	153 +/- 9.945	11.43226
U - Th234* AT 0.093 MEV	174 +/- 9.743999	11.1063
Ra226* AT 0.186 MEV	36 +/- 8.28	11.04616
Cs137 AT 0.662 MEV	27.5 +/- 1.8425	1.586577
Ac228** AT 0.969 MEV	1 +/- .6	7.700339

* URANIUM SERIES(U238) / ** THORIUM SERIES(Th232)
Th234 PHOTOPEAK(0.093) ELEVATED DUE TO Ac228(0.0933)