NES WALKTHROUGH SURVEY
OF ALCOA'S BUILDINGS 51 AND 60

NES WALKTHROUGH SURVEY
OF ALCOA'S BUILDINGS 51 AND 60

SCOPE OF WORK FOR WALKTHROUGH SURVEY

OF

ALCOA'S BUILDINGS 51 AND 60

NUCLEAR ENERGY SERVICES

SHELTER ROCK ROAD
DANBURY, CT 06810-7095
(203) 796-5200

September 20, 1990
Refer to: ES-2713

Mr. Richard King
Aluminum Company of America
1600 Harvard Avenue
Cleveland, OH 44105

Subject: Cost Proposal for a Walkthrough Survey of Buildings 51 and 60

Reference: Personal Correspondence between R. King and M. Callahan on 9/20/90

Dear Mr. King:

Pursuant to our telephone conversation on 9/20/90, I am providing you with a cost proposal for a walkthrough survey of ALCOA's buildings 51 and 60.

NES will provide ALCOA with one survey technician (Mr. Paul Terp) outfitted with 3 survey instruments (Ludlum Model 19 micro-R meter, Ludlum Model 2220 equipped with a "pancake" GM probe, and a Eberline PRS survey instrument equipped with an alpha scintillation probe) to accompany Mr. Todd Brady (Cuyahoga County Board of Health) and Mr. Mark Gradert (ALCOA) on a walkthrough survey of buildings 51 and 60 on 9/21/90. Mr. Terp will monitor all survey locations identified by either Mr. Brady or Mr. Gradert with his own instrumentation and record the results. Mr. Terp will acquire samples for further analysis from those locations that have survey readings greater than or equal to background radiation levels.

The samples will be analyzed for gross alpha using an Eberline SAC-4 scaler at the NES mobile laboratory by Mr. Terp (NES). No more than six of the samples that contain readings greater than or equal to background radiation levels will be sent to SCIENTECH, INC. for isotopic analysis and determination of the Thorium content.

Mr. Terp will provide ALCOA with a survey map(s) indicating the walkthrough survey results and sample locations by or on 9/24/90. Additionally, ALCOA will be provided with copies of the survey instrument calibrations, the gross alpha (SAC-4) counting data, and SCIENTECH, INC. results (if available from SCIENTECH) by or on 9/24/90.

The cost for the above-mentioned services is as follows:

ITEM	COST
Survey Technician	$ 55.00 per hour
Survey and Laboratory Instrument Rental. (4)	$200.00
Isotopic Analysis (SCIENTECH, INC.)	Cost Plus 20% (approximately $150.00 per sample)

If you agree with these terms and conditions, please provide acknowledgement by signing in the space provided and by returning a copy by fax (203-792-3168) today. The original copy of this letter will be sent to you for your signature and subsequent return by mail.

Sincerely,

MA Callahan

Mitchell A. Callahan
Project Manager
NUCLEAR ENERGY SERVICES, INC.
44 Shelter Rock Road
Danbury, CT 06810

I accept the terms and conditions stated herein.

_____ Date:_____
Mr. Richard King

ALUMINUM COMPANY OF AMERICA
1600 HARVARD AVENUE
CLEVELAND, OHIO 44105

ALCOA

September 21, 1990

Nuclear Energy Services, Inc.
44 Shelter Rock Road
Danbury, Ct. 06810-7096

Attn: Mr. Mitchell A. Callahan
Project Manager

Gentlemen:

Per our phone conversation, Alcoa Purchase Order No. CV335586CV will be forwarded to you authorizing a walk-through survey of Alcoa's Buildings 51 and 60, per your letter dated September 20, 1990. Work to be started on September 21, 1990.

Very truly yours,

J. R. Rettinger,
Procurement Manager

JRR/gv

NUCLEAR ENERGY SERVICES

SHELTER ROCK ROAD
DANBURY, CT 06810-7095
(203) 796-5200

September 25, 1990
Refer to: ES-2724

Mr. Richard King
Aluminum Company of America
1600 Harvard Avenue
Cleveland, OH 44105

Subject: Scope of Work Regarding the Walkthrough Survey of Buildings 51 and 60

Reference: NES Letter ES-2713

Dear Mr. King:

The scope of work performed by NES regarding the walkthrough survey of ALCOA's buildings 51 and 60 is described below.

NES provided ALCOA with one survey technician (Mr. Paul Terp) outfitted with 3 survey instruments (Ludlum Model 19 micro-R meter, Ludlum Model 2220 equipped with a "pancake" GM probe, and a Eberline PRS survey instrument equipped with an alpha scintillation probe) to accompany Mr. Todd Brady (Cuyahoga County Board of Health) and Mr. Mark Gradert (ALCOA) on a walkthrough survey of buildings 51 and 60 on 9/21/90. Mr. Terp monitored the survey locations identified by either Mr. Brady or Mr. Gradert with his own instrumentation and recorded the results.

Ten (10) smears were analyzed for gross alpha using an Eberline SAC-4 scaler at the NES mobile laboratory. One (1) tile chip and one (1) concrete chip were sent to SCIENTECH, INC. for isotopic analysis and determination of the Thorium content at the direction of Mr. Gradert and Mr. Brady.

NES provided ALCOA with the original copies of the survey maps indicating the walkthrough survey results and smear/chip sample locations. ALCOA was also provided with copies of the survey instrument calibrations, the gross alpha (SAC-4) counting data, and the SCIENTECH, INC. results.

If you have any questions regarding the scope of work, please do not hesitate to contact me.

Sincerely,

MA Callahan

Mitchell A. Callahan
Project Manager
Environmental Services

WALKTHROUGH SURVEY

OF

ALCOA'S BUILDINGS 51 AND 60

NUCLEAR ENERGY SERVICES

SHELTER ROCK ROAD
DANBURY, CT 06810-7095
(203) 796-5200

TABLE OF CONTENTS

NES NUCLEAR ENERGY SERVICES

SHELTER ROCK ROAD
DANBURY, CT 06810-7093
(203) 796-5200

September 25, 1990
Refer to: ES-2724

Mr. Richard King
Aluminum Company of America
1600 Harvard Avenue
Cleveland, OH 44105

Subject: Scope of Work Regarding the Walkthrough Survey of Buildings 51 and 60

Reference: NES Letter ES-2713

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If you have any questions regarding the scope of work, please do not hesitate to contact me.

Sincerely,

MA Callahan

Mitchell A. Callahan
Project Manager
Environmental Services

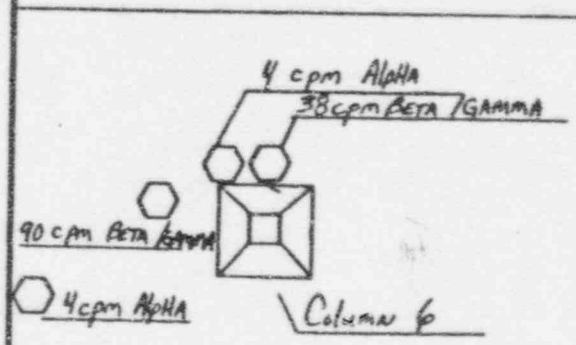
NUCLEAR ENERGY SERVICES

FIELD SURVEY MAP LOCATION BLDG. 51 / AREA BASEMENT

DATE 9-21-90 TIME 1010 REASON INFORMATIONAL SURVEY

INSTRUMENT USED Ln2220/PRS-2 SERIAL NO. 52833/549

REMARKS ALL READINGS IN CORRECTED COUNTS PER MINUTE



NORTH END OF BUILDING
GROUND FLOOR BASEMENT

BACKGROUND = 30 cpm BETA-GAMMA
0 cpm ALPHA

⬡ DIRECT READINGS

SURVEYED BY: Paul Sego REVIEWED BY: Michael E Zi 9-24-90

NUCLEAR ENERGY SERVICES

FIELD SURVEY MAP LOCATION BLDG. 51 / AREA BASEMENT
DATE 9-21-90 TIME 1045 REASON INFORMATIONAL
INSTRUMENT USED N/A SERIAL NO. N/A
REMARKS SURFACE SMEAR LOCATIONS

SURFACE SMEAR LOCATIONS

SURVEYED BY: Paul Jeyo REVIEWED BY: Michael E. Ford 9-24-90

NUCLEAR ENERGY SERVICES

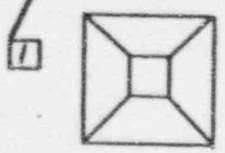
FIELD SURVEY MAP LOCATION BLDG. 51 / AREA BASEMENT

DATE 9-21-90 TIME 1110 REASON INFORMATIONAL

INSTRUMENT USED N/A SERIAL NO. N/A

REMARKS LOCATION OF SAMPLE TAKEN FOR ISOTOPIC ANALYSIS

DESIGNATED ON SCIENTECH'S RESULTS AS ALCOA #1



[#] SAMPLE FOR ISOTOPIC

[1] DENOTES GROUND FLOOR SAMPLE BASEMENT

[ ]

SURVEYED BY: Paul Jeff REVIEWED BY: Michael E Dixon 9-24-90

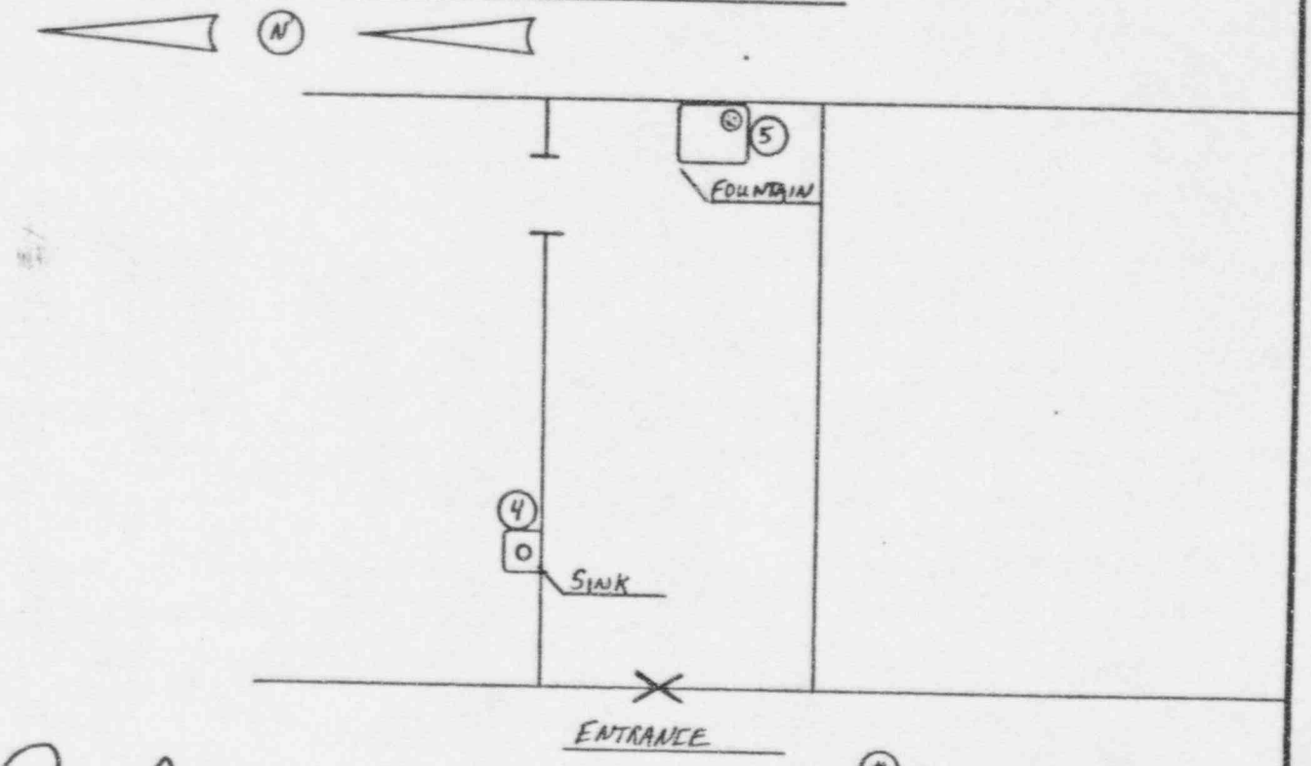
NUCLEAR ENERGY SERVICES

FIELD SURVEY MAP LOCATION BLDG. 511 AREA 1ST. FLOOR N. END

DATE 9-21-90 TIME 1145 REASON INFORMATIONAL

INSTRUMENT USED N/A SERIAL NO. N/A

REMARKS SURFACE SMEAR LOCATIONS



(#) SURFACE SMEAR LOCATION

SURVEYED BY: Paul Depp REVIEWED BY: Michael E. Sim 9-24-90

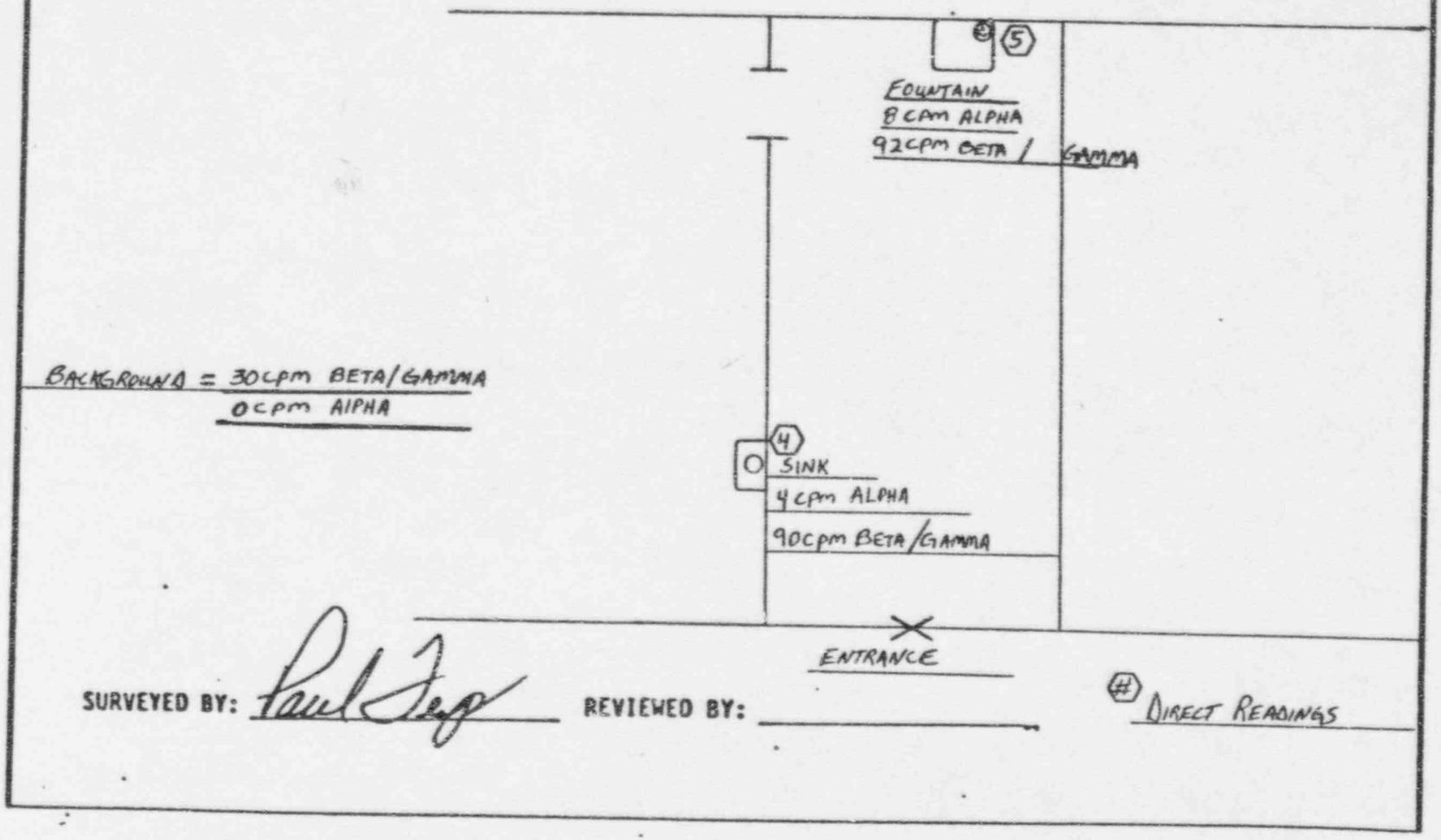
NUCLEAR ENERGY SERVICES

FIELD SURVEY MAP LOCATION BLDG. 51 / AREA 1ST. FLOOR

DATE 9-21-90 TIME 1200 REASON INFORMATIONAL

INSTRUMENT USED Lm2220/PRS-2 SERIAL NO. 52833/549

REMARKS ALL READINGS IN CORRECTED COUNTS PER MINUTE



SURVEYED BY: Paul Jeep REVIEWED BY: _____

DIRECT READINGS

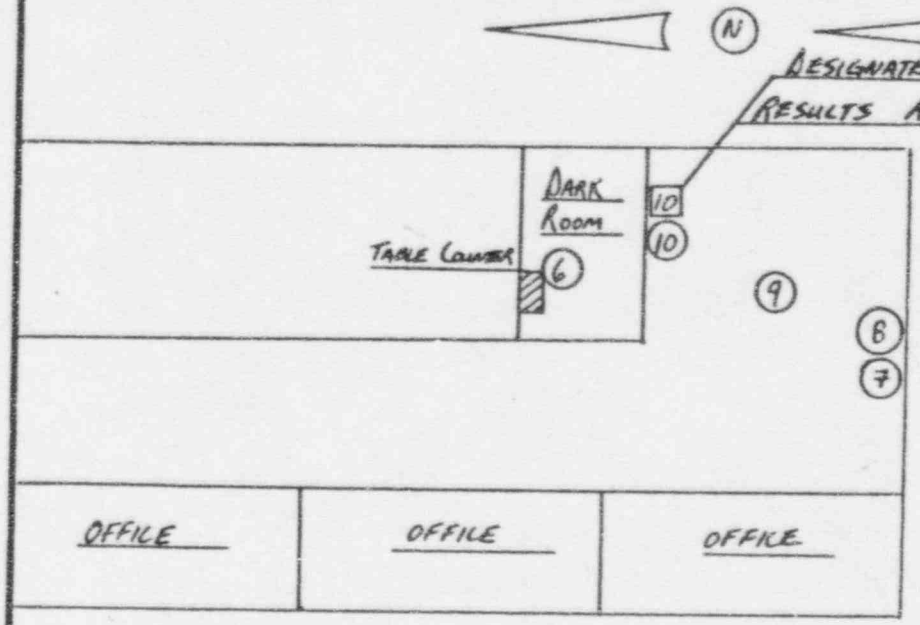
NUCLEAR ENERGY SERVICES

FIELD SURVEY MAP LOCATION Bldg. 51 / AREA 5TH. FLOOR S. END

DATE 9-21-90 TIME 1245 REASON INFORMATIONAL

INSTRUMENT USED N/A SERIAL NO. N/A

REMARKS SURFACE SMEAR AND ISOTOPIC SAMPLE LOCATIONS



[#] SAMPLE FOR ISOTOPIC

[10] DENOTES WALL SAMPLE 5TH FLOOR

(#) SMEAR SURFACE LOCATIONS

SURVEYED BY: Paul Jeys REVIEWED BY: Michael E Dyer 9-24-90

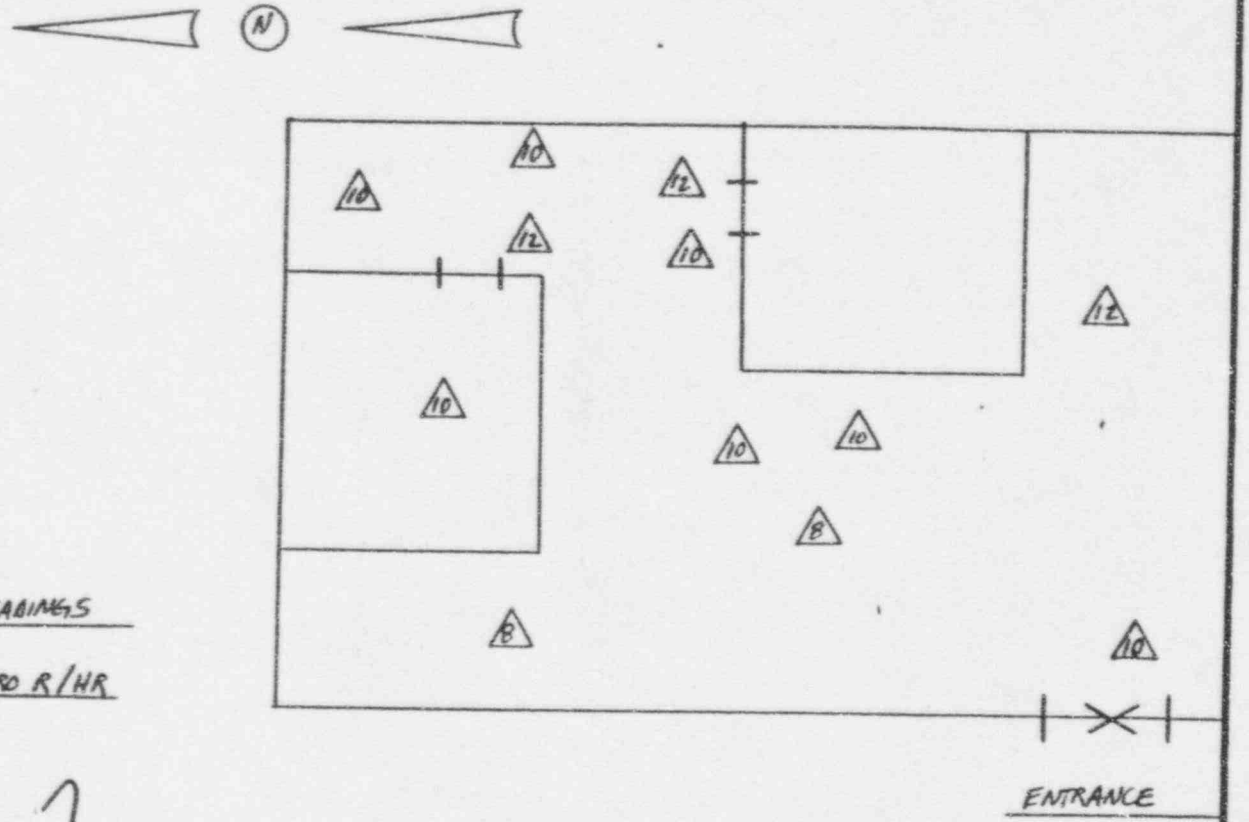
NUCLEAR ENERGY SERVICES

FIELD SURVEY MAP LOCATION BLDG. 60 / AREA BASEMENT

DATE 9-21-90 TIME 1410 REASON INFORMATIONAL

INSTRUMENT USED Lm-19 SERIAL NO. 062196

REMARKS



MICRO R/HR READINGS

BACKGROUND = 8 MICRO R/HR

SURVEYED BY: Paul Depp REVIEWED BY: Michael E Gin 9-24-90

NUCLEAR ENERGY SERVICES

See corrected copy attached to end of evaluation

Location: ALCOA BUILDING 51

Reason For Survey: INFORMATIONAL Surveyed By: Paul Zeyl

Date Counted: 9-22-90 Time Counted 1530 Counted By: R. Szabo / Goldyn

SMEAR RESULTS

SMEAR#	BETA/GAMMA	ALPHA	dpm/100 cm2	LOCATION
1	<MDA	1.3	dpm/100 cm²	BASEMENT
2	<MDA	<MDA	dpm/100 cm²	BASEMENT
3	41	<MDA	dpm/100cm²	BASEMENT
4	<MDA	<MDA	dpm/100cm²	1ST FLOOR - DRINKING FTN.
5	<MDA	<MDA	dpm/100cm²	1ST. FLOOR - SINK
6	<MDA	<MDA	dpm/100 cm²	5TH. FLOOR DARK ROOM
7	19	<MDA	dpm/100 cm²	5TH. FLOOR S. WALL CONDUIT
8	30	<MDA	dpm/100 cm²	5TH. FLOOR S. WALL CONDUIT
9	<MDA	<MDA	dpm/100 cm²	5TH. FLOOR S. END ON FLOOR
10	<MDA	<MDA	dpm/100 cm²	5TH. FLOOR S. END ON WALL

Beta/Gamma Instrument: Ludlum 1000 S/N 29495 Cal. Due: 8-29-91

BKG: 13.3 cpm EFF: .09 MDA: 12.6 cpm

Source Used: Tc99 S/N: 1096/87

Alpha Instrument: SAC-4 S/N 947 Cal. Due: 3-20-91

BKG: .05 cpm EFF: .43 MDA: .55 cpm

Source Used: Pu239 S/N 9797

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. (915) 235-4672
SWEETWATER, TEXAS 79556, U. S. A.

CUSTOMER NES ORDER NO 150353
Mfg Ludlum Model 2220 Serial No 52833
Mfg Ludlum Det. Model 44-9 Serial No PR066756
Cal. Date 5-24-90 Cal. Due Date 5-24-91 Cal. Interval 1yr METERFACE 202x159
Check mark (✓) applies to applicable instr. and/or detector IAW mfg. spec. s.
☐ Det. (Alpha) Bkgnd cpm ☑ Det. Oper. V 900 V at 65 MV ☐ New Instrument
T 75 °F RH 56 % Alt 699.8 mm Hg ☑ F/S Resp. ck ☑ Zero Reset ck. ☑ Audio ck. ☑ Meter Zeroed
☑ Bat. ck. (Min. Volt) 4.20 VDC ☐ Bat. Volt VDC Instrument Volt Set 900 V
☑ Threshold Dial 100 ± Input Sens 10 mV. ☐ Input Sens Linearity
☑ HV Readout (2 points) Ref./Inst 500 / 511 V Ref./Inst 2000 / 2007 V
☐ Alarm Setting ck. ☑ Window Operation ☐ Background subtract ☑ Mechanical ck.
Repair Instrument Received: ☐ Within Toler. + -10% ☐ 10-20% ☐ Out Toler. ☑ Requiring Repair

COMMENTS: Calibrated w/a 5 ft. cable.

Gamma Calibration: GM detectors positioned perpendicular to source except for M. 44-9 in which the back of probe faces source.

RANGE MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT METER READING	INSTRUMENT REC'D "AS FOUND READING"
X 1K	400K cpm	400	N/A
X "	100K "	100	
X 100	40K "	400	
X "	10K "	100	
X 10	4K "	400	
X "	1K "	100	
X 1	400 "	400	
X "	100 "	100	
X			
X			
X			

ALL Range(s) Calibrated Electronically

	Reference Cal. Point	Instrument Meter Reading	"As Found Reading"
Digital Readout	/ 400Kcpm / 40Kcpm / 4Kcpm / 400cpm /	/ 400,369 / 40,053 / 4,006 / 401 /	/ / / / /
Log Scale	/ 500Kcpm / 50Kcpm / 5Kcpm / 500cpm /	/ 530K / 50K / 5K / 500 /	/ / N/A / / /

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Bureau of Standards, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants, or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of MIL-STD-45662A and ANSI N323-1978.

☑ Cs137 Gamma s/n ~~7102~~ 6-112 ☐ Neutron Am-241 Be s/n T-304 State of Texas Calibration License No. LO-1562

☐ Alpha s/n ☐ Beta s/n ☐ Other

☑ M-500 s/n 54668 ☐ Oscilloscope s/n ☑ Multimeter s/n 35060861

Calibrated By: Bill Henson Date 5-24-90

Reviewed By: Debbie Gibson Date 5-24-90

Form 22 – 3-90

A DIVISION OF
Eberline Thermo Electron CORPORATION

CERTIFICATION OF CALIBRATION

Instrument PRS-2 / AC-3-8
Serial No. 549
Type of Source Pu-239 s/n 6913, 7188, 7189, 7123, 7124, 7125, 6226

High Voltage 982
Threshold 6mV
Window N/A
Multiplier 4.0
Decimal Place NONE
Legend CPM

Range	Calibration Point	Reading
A	1,250 cpm (2π)	1290 CPM
A	264 cpm (2π)	270 CPM
B	12,400 cpm (2π)	12,507 CPM
B	3,420 cpm (2π)	3,454 CPM
C	152,000 cpm (2π)	145,691 CPM
C	44,500 cpm (2π)	43,323 CPM
D	292,000 cpm (2π)	276,680 CPM

Calibration sources used have calibration traceable to the National Bureau of Standards.

Date JUN 1 4 1990 Signature Victor M Johnson

EIS TEST 3
EIS U.C. 1

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 FAX NO. (915) 235-4672
501 OAK STREET TELEX No. 466832 UD
SWEETWATER, TEXAS, U. S. A. PH. 915-235-5494

CUSTOMER McClellan AFB ORDER NO 89-4815

Mfg Ludlum Model 19 Serial No PR062176

Mfg Det. Model Serial No

Cal. Date 11-7-89 Cal. Due Date 11-7-90 Cal. Interval 1yr METERFACE 202-016

Check mark (✓) applies to applicable instr. and/or detector IAW mfg. spec, s.

☐ Det. (Alpha) Bkgnd cpm ☐ Det. Oper. V V at MV ☐ New Instrument

T 25 °F RH 30 % Alt 202.8 mm Hg ☑ F/S Resp. ck ☐ Zero Reset ck. ☑ Audio ck. ☐ Meter Zeroed

☑ Bat. ck. (Min. Volt) 2.2 VDC ☐ Bat. Volt VDC Instrument Volt Set 622 V

☐ Threshold Dial Input Sens 40 mV. ☐ Input Sens Linearity

☐ HV Readout (2 points) Ref./Inst / V Ref./Inst / V

☐ Alarm Setting ck. ☐ Window Operation ☐ Background subtract ☑ Mechanical ck.

Repair Instrument Received: ☐ Within Toler. + -10% ☐ 10-20% ☐ Out Toler. ☐ Requiring Repair

COMMENTS: Serial NO. on inside of can on outside of battery compartment

Gamma Calibration: GM detectors positioned perpendicular to source except for M. 44-9 in which the back of probe faces source.

RANGE MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT METER READING	INSTRUMENT REC'D "AS FOUND READING"
X 5000	4000 cpm ≈ 898 Kcpm	3850	
X "	1000 " ≈ 210 "	1100	
X 500	84.8 "	400	
X "	21.0 "	100	
X 250	42.2 "	200	
X "	10.1 "	50	
X 50	8.48 "	40	
X "	2.10 "	10	
X 25	4.25 "	20	
X "	1.08 "	5	
X			

500, 250, 50, 25 Range(s) Calibrated Electronically

	Reference Cal. Point	Instrument Meter Reading	"As Found Reading"
Digital Readout	/ / / / /	/ / / / /	/ / / / /
Log Scale	/ / / / /	/ / / / /	/ / / / /

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Bureau of Standards, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants, or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of MIL-STD-45662A and ANSI N323-1978.

☑ Cs137 Gamma s/n 1162 ☐ Neutron Am-241 Be s/n T-304 State of Texas Calibration License No. LO-1963

☐ Alpha s/n ☐ Beta s/n ☐ Other

☑ M-500 s/n 13663 ☑ Oscilloscope s/n 208226 ☑ Multimeter s/n A34 + A34153

Calibrated By: Thomas J. Lasser Date 11-7-89

Reviewed By: Larry Bell Date 11-7-89

Form 22 — 5/88

Eberline Instrument Corporation

CERTIFICATION OF CALIBRATION

Instrument SAC-4

Serial No. 947

Type of Source PIP-2 SIN 126
Pu-239 SIN 8319
FLUKE SIN 2435022

Time (in minutes)	Calibration Point	Reading
.1	1000 CPM	100 COUNTS
.2	1000 CPM	200 COUNTS
.5	1000 CPM	500 COUNTS
1	1000 CPM	1,000 COUNTS
10	1000 CPM	10,002 COUNTS
1	15,600 CPM (2π)	12,537 COUNTS

Calibration sources used have calibration traceable to the N.I.S.T.

Date SEP 20 1990 Signature Otis L. Broyles

NIS TEST

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810
501 OAK STREET
SWEETWATER, TEXAS 79556, U. S. A.
PH. 915-235-5494
FAX NO. (915) 235-4672

CUSTOMER W.E.S. ORDER NO 151314

Mfg Ludlum Model 1000 Serial No 39495

Mfg " Det. Model 44-7 Serial No AZ1 [illegible]

Cal. Date 8/29/90 Cal. Due Date 8/29/91 Cal. Interval 1 yr METERFACE

Check mark (✓) applies to applicable instr. and/or detector IAW mfg. spec. s.

☐ Det. (Alpha) Bkgnd ____ cpm ☑ Det. Oper. V 900 V at 46 MV ☐ New Instrument

T 76 °F RH 53 % Alt 703.8 mm Hg ☐ F/S Resp. ck ☑ Zero Reset ck. ☐ Audio ck. ☑ Meter Zeroed

☐ Bat. ck. (Min. Volt) ____ VDC ☐ Bat. Volt ____ VDC Instrument Volt Set 900 V

☐ Threshold Dial ____ Input Sens 46 mV. ☐ Input Sens Linearity

☑ HV Readout (2 points) Ref./Inst 496 / 500 V Ref./Inst 1494 / 1500 V

☐ Alarm Setting ck. ☐ Window Operation ☐ Background subtract ☑ Mechanical ck.

Repair Instrument Received: ☐ Within Toler. + -10% ☐ 10-20% ☐ Out Toler. ☑ Requiring Repair

COMMENTS: 44-7 S/N PR017209
" " PR026420
" " PR069175

Gamma Calibration: GM detectors positioned per manufacturer to receive exposure rate of Mf. 44-6 to which the back of probe faces source.

RANGE MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT METER READING	INSTRUMENT REC'D "AS FOUND READING"
X N/A			
X			
X			
X			
X			
X			
X			
X			
X			
X			
X			

Range(s) Calibrated Electronically

	Reference Cal. Point					Instrument Meter Reading					"As Found Reading"				
Digital Readout	400 kcpm	40 "	4 "	400 cpm	40 "	400 760	400 635	400 4	40	4	/ N/A	/	/	/	/
Log Scale	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Bureau of Standards, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants, or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of MIL-STD-45662A and ANSI N323-1978.

☐ Cs137 Gamma s/n 1162 s/n G112 ☐ Neutron Am-241 Be s/n T-304 State of Texas Calibration License No. LO-1563

☐ Alpha s/n ____ ☐ Beta s/n ____ ☐ Other ____

☑ M-500 s/n 57881 ☐ Oscilloscope s/n ____ ☑ Multimeter s/n A35250

Calibrated By: Heath A Schafer Date 8/29/90

Reviewed By: Debby Delaney Date 8-30-90

Form III — 5-80

TMA
Thermo Analytical Inc.

TMA/Eberline Albuquerque Laboratory
7021 Pan American Hwy. NE
Albuquerque, NM 87109
(505) 345-3461 • FAX (505) 761-5416

CERTIFICATE OF CALIBRATION

Electroplated Beta Standard

S.O. # S-02018
P.O. # N15599

Description of Standard:

Model No. DNS-18sp Serial No. 1095/87 Isotope Technetium-99

Electroplated on polished Ni disc. 0.79 mm thick.

Total diameter of 3.18 cm and an active diameter of 2.54 cm.

Radioactive material permanently fixed to the disc by heat treatment without any covering over the active surface.

Measurement Method:

The 2 π beta emission rate was measured using an internal gas flow proportional chamber. Absolute counting of beta particles emitted in the hemisphere above the active surface was verified by counting above, below and at the operating voltage. The calibration is traceable to NBS by reference to an NBS calibrated beta source. Intercomparisons testing between EAC-NBS show an agreement within 0.3%.

Measurement Result:

The total disintegration rate (dpm)

2,060 $\pm$ 206 (0.000928 uCi)

The uncertainty of the measurement is $\pm$ 10 % which is the sum of random counting error at the 99% confidence level and the estimated upper limit of systematic error in this measurement.

Calibrated by: Gloria Madrid (print) Reviewed by: Arthur Shanks (print)

Gloria Madrid (signature) Arthur Shanks Q.C. (signature)

Calibration Date: March 1, 1990 Date: March 1, 1990

Note: It is recommended that this source be recertified on an annual basis.

TMA
Thermo Analytical Inc.

TMA/Eberline Albuquerque Laboratory
7021 Pan American Hwy. NE
Albuquerque, NM 87109
(505) 345-3461

CERTIFICATE OF CALIBRATION

Electroplated Beta Standard

S.O. # S-02008
P.O. # N-15599

Description of Standard:

Model No. DNS-18sp Serial No. 1096/87 Isotope Technetium-99

Electroplated on polished Ni disc, 0.79 mm thick.

Total diameter of 3.18 cm and an active diameter of 2.54 cm.

Radioactive material permanently fixed to the disc by heat treatment without any covering over the active surface.

Measurement Method:

The 2 π beta emission rate was measured using an internal gas flow proportional chamber. Absolute counting of beta particles emitted in the hemisphere above the active surface was verified by counting above, below and at the operating voltage. The calibration is traceable to NBS by reference to an NBS calibrated beta source. Intercomparisons testing between EAC-NBS show an agreement within 0.3%.

Measurement Result:

The total number of beta particles emitted from the surface of the disc per minute (cpm) on the calibration date was

23,300 ± 699

The total disintegration rate (dpm) assuming 25% backscatter of beta particles from the surface of the disc, was

37,300 ± 1,120 (0.0168 uCi)

The uncertainty of the measurement is 3 % which is the sum of random counting error at the 99% confidence level and the estimated upper limit of systematic error in this measurement.

Calibrated by: Gloria Madrid (print) Reviewed by: Arthur Shanks (print)

(signature) (signature)

Calibration Date: February 21,1990 Date: February 21,1990

Note: It is recommended that this source be recertified on an annual basis.

TMA
·Thermo Analytical Inc.

TMA/Eberline Albuquerque Laboratory
7021 Pan American Hwy. NE
Albuquerque, NM 87109
(505) 345-3461 • FAX (505) 761-5416

CERTIFICATE OF CALIBRATION

Electroplated Alpha Standard

S.O. # S-02008
P.O. # NI5599

Description of Standard:

Model No. S94-1sp Serial No. 9797 Isotope Plutonium-239

Electroplated on polished Ni disc, 0.79 mm thick.

Total diameter of 3.18 cm and an active diameter of 2.56 cm

Radioactive material permanently fixed to the disc by heat treatment, without any covering over the active surface.

Measurement Method:

The 2 π alpha emission rate was measured using an internal gas flow proportional chamber. Absolute counting of alpha particles emitted in the hemisphere above the active surface was verified by counting above, below and at the operating voltage. The calibration is traceable to NBS by reference to an NBS calibrated alpha source. Intercomparisons testings between EAC-NBS show an agreement within 0.2%.

Measurement Result:

The total number of alpha particles emitted from the surface of the disc per minute (cpm) on the calibration date was

11,400 ± 456

The total disintegration rate (dpm)

22,800 ± 912 (0.0103 uCi)

The uncertainty of the measurement is ± 4 % which is the sum of random counting error at the 99% confidence level and the estimated upper limit of systematic error in this measurement.

Calibrated by: Gloria Madrid (print) Reviewed by: Arthur Shanks (print)

Gloria Madrid (signature) Arthur Shanks Q.C. (signature)

Calibration Date: February 21,1990 Date: February 21, 1990

Note: It is recommended that this source be recertified on an annual basis.

SCIENTECH INC.

ENGINEERING & MANAGEMENT SERVICES
2105 LUNA ROAD, SUITE 300
CARROLLTON, TEXAS 75006
214/247-1714
214/247-0288 FAX

REPORT OF ANALYSIS

ANL JOB# 90-0798

09/25/90

NUCLEAR ENERGY SERVICES 10113

2 SOIL SAMPLES, DATE RECEIVED 09/24/90

SAMPLE I. D.	ANALYSIS	CONCENTRATION	ERROR EST.	UNITS	LLD	UNITS
ALCOA #1	TH-228	6.70 E - 1	3.95 E - 1	pCi/g	8 E - 7	uCi/g
A.N.L. 12607	TH-232	0.00 E + 0	4.34 E - 1	pCi/g	1 E - 6	uCi/g
ALCOA #2	TH-228	2.97 E + 0	5.13 E - 1	pCi/g	2 E - 7	uCi/g
A.N.L. 12608	TH-232	2.11 E + 0	3.42 E - 1	pCi/g	2 E - 7	uCi/g

THESE ANALYSES WERE PERFORMED USING NBS TRACEABLE PROCEDURES AND STANDARDS.

M. L. Buvinghausen
Manager, Radiochemistry Laboratory

EVALUATION OF WALKTHROUGH SURVEY RESULTS

FOR

ALCOA'S BUILDINGS 51 AND 60

NUCLEAR ENERGY SERVICES

SHELTER ROCK ROAD
DANBURY, CT 06810-7095
(203) 796-5200

September 28, 1990
Refer to: ES-2739

Mr. Richard King
Aluminum Company of America
1600 Harvard Avenue
Cleveland, OH 44105

Subject: Evaluation of Walkthrough Survey Results for Buildings 51 and 60

Reference:
1) NES Letter ES-2713
2) NES Letter ES-2724
3) Regulatory Guide 1.86
4) 1981 NRC Branch Technical Position, "Disposal of Onsite Storage of Thorium or Uranium Wastes from Past Operations"

Dear Mr. King:

I have reviewed the results of the NES walkthrough survey of ALCOA's buildings 51 and 60. It is my dismay to inform you that page 9 of 18 is incorrect because of some mathematical errors. Attached to this letter please find a corrected copy of page 9 for replacement of the page submitted to you on 9/25/90.

I have also compared the NES survey results with the limits defined in References 3) and 4). My interpretation of these results is that the areas surveyed by Mr. Terp are eligible for unconditional release.

Please keep in mind that the results of this limited survey (the NES walkthrough survey) cannot be used to describe buildings 51 and 60 as eligible for unconditional release since only a few areas within these buildings were surveyed by NES.

Sincerely,

MA Callahan

Mitchell A. Callahan
Project Manager
Environmental Services

MAC/im
Attachments

NUCLEAR ENERGY SERVICES

Location: ALCOA BUILDING 51

Reason For Survey: INFORMATIONAL Surveyed By: Paul Jagger

Date Counted: 9-22-90 Time Counted 1530 Counted By: [illegible]

Note: Values listed were recalculated on 9-28-90 using the sample data from 9-22-90.

SMEAR RESULTS

SMEAR#	BETA/GAMMA	ALPHA	dpm/100 cm2	LOCATION
1	0 *	0 *	dpm/100cm2	Basement
2	0 *	0 *	dpm/100cm2	Basement
3	0 *	0 *	dpm/100cm2	Basement
4	0 *	0 *	dpm/100 cm2	1st Floor Drinking Fountain
5	0 *	0 *	dpm/100cm2	1st Floor Sink
6	0 *	0 *	dpm/100 cm2	5TH Floor Door Room
7	0 *	0 *	dpm/100cm2	5TH Floor So. Wall Conduit
8	0 *	0 *	dpm/100cm2	5TH Floor So. Wall Conduit
9	0 *	0 *	dpm/100cm2	5TH Floor So. End on Floor
10	0 *	0 *	dpm/100cm2	5TH Floor So. End on Wall

* Less than MDCR

Beta/Gamma Instrument: Ludlum 1000 S/N 2495 Cal. Due: 8-29-91

BKG: 13.3cpm EFF: .09 MDCR: 12.6 cpm

Source Used: Tc 99 S/N: 1096/87

Alpha Instrument: SAC 4 S/N 947 Cal. Due: 3-20-91

BKG: .05 EFF: .43 MDCR: .55 cpm

Source Used: Pu 239 S/N 9797

U.S. ATOMIC ENERGY COMMISSION

June 1974

REGULATORY GUIDE

DIRECTORATE OF REGULATORY STANDARDS

REGULATORY GUIDE 1.86

TERMINATION OF OPERATING LICENSES FOR NUCLEAR REACTORS

A. INTRODUCTION

Section 50.51, "Duration of license, renewal," of 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires that each license to operate a production and utilization facility be issued for a specified duration. Upon expiration of the specified period, the license may be either renewed or terminated by the Commission. Section 50.82, "Applications for termination of licenses," specifies the requirements that must be satisfied to terminate an operating license, including the requirement that the dismantlement of the facility and disposal of the component parts not be inimical to the common defense and security or to the health and safety of the public. This guide describes methods and procedures considered acceptable by the Regulatory staff for the termination of operating licenses for nuclear reactors. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

When a licensee decides to terminate his nuclear reactor operating license, he may, as a first step in the process, request that his operating license be amended to restrict him to possess but not operate the facility. The advantage to the licensee of converting to such a possession-only license is reduced surveillance requirements in that periodic surveillance of equipment important to the safety of reactor operation is no longer required. Once this possession-only license is issued, reactor operation is not permitted. Other activities related to cessation of operations such as unloading fuel from the reactor and placing it in storage (either onsite of offsite) may be continued.

A licensee having a possession-only license must retain, with the Part 50 license, authorization for special nuclear material (10 CFR Part 70, "Special Nuclear Material"), byproduct material (10 CFR Part 30, "Rules of General Applicability to Licensing of Byproduct Material"), and source material (10 CFR Part 40, "Licensing of Source Material"), until the fuel, radioactive components, and sources are removed from the facility. Appropriate administrative controls and facility requirements are imposed by the Part 50 license and the technical specifications to assure that proper surveillance is performed and that the reactor facility is maintained in safe condition and not operated.

A possession-only license permits various options and procedures for decommissioning, such as mothballing, entombment, or dismantling. The requirements imposed depend on the option selected.

Section 50.82 provides that the licensee may dismantle and dispose of the component parts of a nuclear reactor in accordance with existing regulations. For research reactors and critical facilities, this has usually meant the disassembly of a reactor and its shipment offsite, sometimes to another appropriately licensed organization for further use. The site from which a reactor has been removed must be decontaminated, as necessary, and inspected by the Commission to determine whether unrestricted access can be approved. In the case of nuclear power reactors, dismantling has usually been accomplished by shipping fuel offsite, making the reactor inoperable, and disposing of some of the radioactive components.

Radioactive components may be either shipped offsite for burial at an authorized burial ground or secured

on the site. Those radioactive materials remaining on the site must be isolated from the public by physical barriers or other means to prevent public access to hazardous levels of radiation. Surveillance is necessary to assure the long term integrity of the barriers. The amount of surveillance required depends upon (1) the potential hazard to the health and safety of the public from radioactive material remaining on the site and (2) the integrity of the physical barriers. Before areas may be released for unrestricted use, they must have been decontaminated or the radioactivity must have decayed to less than prescribed limits (Table I).

The hazard associated with the retired facility is evaluated by considering the amount and type of remaining contamination, the degree of confinement of the remaining radioactive materials, the physical security provided by the confinement, the susceptibility to release of radiation as a result of natural phenomena, and the duration of required surveillance.

C. REGULATORY POSITION

1. APPLICATION FOR A LICENSE TO POSSESS BUT NOT OPERATE (POSSESSION-ONLY LICENSE)

A request to amend an operating license to a possession-only license should be made to the Director of Licensing, U.S. Atomic Energy Commission, Washington, D.C. 20545. The request should include the following information:

a. A description of the current status of the facility.

b. A description of measures that will be taken to prevent criticality or reactivity changes and to minimize releases of radioactivity from the facility.

c. Any proposed changes to the technical specifications that reflect the possession-only facility status and the necessary disassembly/retirement activities to be performed.

d. A safety analysis of both the activities to be accomplished and the proposed changes to the technical specifications.

e. An inventory of activated materials and their location in the facility.

2. ALTERNATIVES FOR REACTOR RETIREMENT

Four alternatives for retirement of nuclear reactor facilities are considered acceptable by the Regulatory staff. These are:

a. **Mothballing.** Mothballing of a nuclear reactor facility consists of putting the facility in a state of protective storage. In general, the facility may be left intact except that all fuel assemblies and the radioactive fluids and waste should be removed from the site. Adequate radiation monitoring, environmental surveillance, and appropriate security procedures should be established under a possession-only license to ensure that the health and safety of the public is not endangered.

b. **In-Place Entombment.** In-place entombment consists of sealing all the remaining highly radioactive or contaminated components (e.g., the pressure vessel and reactor internals) within a structure integral with the biological shield after having all fuel assemblies, radioactive fluids and wastes, and certain selected components shipped offsite. The structure should provide integrity over the period of time in which significant quantities (greater than Table I levels) of radioactivity remain with the material in the entombment. An appropriate and continuing surveillance program should be established under a possession-only license.

c. **Removal of Radioactive Components and Dismantling.** All fuel assemblies, radioactive fluids and waste, and other materials having activities above accepted unrestricted activity levels (Table I) should be removed from the site. The facility owner may then have unrestricted use of the site with no requirement for a license. If the facility owner so desires, the remainder of the reactor facility may be dismantled and all vestiges removed and disposed of.

d. **Conversion to a New Nuclear System or a Fossil Fuel System.** This alternative, which applies only to nuclear power plants, utilizes the existing turbine system with a new steam supply system. The original nuclear steam supply system should be separated from the electric generating system and disposed of in accordance with one of the previous three retirement alternatives.

3. SURVEILLANCE AND SECURITY FOR THE RETIREMENT ALTERNATIVES WHOSE FINAL STATUS REQUIRES A POSSESSION-ONLY LICENSE

A facility which has been licensed under a possession-only license may contain a significant amount of radioactivity in the form of activated and contaminated hardware and structural materials. Surveillance and commensurate security should be provided to assure that the public health and safety are not endangered.

a. Physical security to prevent inadvertent exposure of personnel should be provided by multiple locked barriers. The presence of these barriers should make it extremely difficult for an unauthorized person to gain access to areas where radiation or contamination levels exceed those specified in Regulatory Position C.4. To prevent inadvertent exposure, radiation areas above 5 mR/hr, such as near the activated primary system of a power plant, should be appropriately marked and should not be accessible except by cutting of welded closures or the disassembly and removal of substantial structures

and/or shielding material. Means such as a remote-readout intrusion alarm system should be provided to indicate to designated personnel when a physical barrier is penetrated. Security personnel that provide access control to the facility may be used instead of the physical barriers and intrusion alarm systems.

b. The physical barriers to unauthorized entrance into the facility, e.g., fences, buildings, welded doors, and access openings, should be inspected at least quarterly to assure that these barriers have not deteriorated and that locks and locking apparatus are intact.

c. A facility radiation survey should be performed at least quarterly to verify that no radioactive material is escaping or being transported through the containment barriers in the facility. Sampling should be done along the most probable path by which radioactive material such as that stored in the inner containment regions could be transported to the outer regions of the facility and ultimately to the environs.

d. An environmental radiation survey should be performed at least semiannually to verify that no signficant amounts of radiation have been released to the environment from the facility. Samples such as soil, vegetation, and water should be taken at locations for which statistical data has been established during reactor operations.

e. A site representative should be designated to be responsible for controlling authorized access into and movement within the facility.

f. Administrative procedures should be established for the notification and reporting of abnormal occurrences such as (1) the entrance of an unauthorized person or persons into the facility and (2) a significant change in the radiation or contamination levels in the facility or the offsite environment.

g. The following reports should be made:

(1) An annual report to the Director of Licensing, U.S. Atomic Energy Commission, Washington, D.C. 20545, describing the results of the environmental and facility radiation surveys, the status of the facility, and an evaluation of the performance of security and surveillance measures.

(2) An abnormal occurrence report to the Regulatory Operations Regional Office by telephone within 24 hours of discovery of an abnormal occurrence. The abnormal occurrence will also be reported in the annual report described in the preceding item.

h. Records or logs relative to the following items should be kept and retained until the license is terminated, after which they may be stored with other plant records:

(1) Environmental surveys,

(2) Facility radiation surveys,

(3) Inspections of the physical barriers, and

(4) Abnormal occurrences.

4. DECONTAMINATION FOR RELEASE FOR UNRESTRICTED USE

If it is desired to terminate a license and to eliminate any further surveillance requirements, the facility should be sufficiently decontaminated to prevent risk to the public health and safety. After the decontamination is satisfactorily accomplished and the site inspected by the Commission, the Commission may authorize the license to be terminated and the facility abandoned or released for unrestricted use. The licensee should perform the decontamination using the following guidelines:

a. The licensee should make a reasonable effort to eliminate residual contamination.

b. No covering should be applied to radioactive surfaces of equipment or structures by paint, plating, or other covering material until it is known that contamination levels (determined by a survey and documented) are below the limits specified in Table I. In addition, a reasonable effort should be made (and documented) to further minimize contamination prior to any such covering.

c. The radioactivity of the interior surfaces of pipes, drain lines, or ductwork should be determined by making measurements at all traps and other appropriate access points, provided contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement should be assumed to be contaminated in excess of the permissable radiation limits.

d. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated in excess of the limits specified. This may include, but is not limited to, special circumstances such as the transfer of premises to another licensed organization that will continue to work with radioactive materials. Requests for such authorization should provide:

(1) Detailed, specific information describing the premises, equipment, scrap, and radioactive contaminants and the nature, extent, and degree of residual surface contamination.

(2) A detailed health and safety analysis indicating that the residual amounts of materials on surface areas, together with other considerations such as the prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

e. Prior to release of the premises for unrestricted use, the licensee should make a comprehensive radiation survey establishing that contamination is within the limits specified in Table I. A survey report should be filed with the Director of Licensing, U.S. Atomic Energy Commission, Washington, D.C. 20545, with a copy to the Director of the Regulatory Operations Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report should:

(1) Identify the premises;

(2) Show that reasonable effort has been made to reduce residual contamination to as low as practicable levels;

(3) Describe the scope of the survey and the general procedures followed; and

(4) State the finding of the survey in units specified in Table I.

After review of the report, the Commission may inspect the facilities to confirm the survey prior to granting approval for abandonment.

5. REACTOR RETIREMENT PROCEDURES

As indicated in Regulatory Position C.2, several alternatives are acceptable for reactor facility retirement. If minor disassembly or "mothballing" is planned, this could be done by the existing operating and maintenance procedures under the license in effect. Any planned actions involving an unreviewed safety question or a change in the technical specifications should be reviewed and approved in accordance with the requirements of 10 CFR §50.59.

If major structural changes to radioactive components of the facility are planned, such as removal of the pressure vessel or major components of the primary system, a dismantlement plan including the information required by §50.82 should be submitted to the Commission. A dismantlement plan should be submitted for all the alternatives of Regulatory Position C.2 except mothballing. However, minor disassembly activities may still be performed in the absence of such a plan, provided they are permitted by existing operating and maintenance procedures. A dismantlement plan should include the following:

a. A description of the ultimate status of the facility

b. A description of the dismantling activities and the precautions to be taken.

c. A safety analysis of the dismantling activities including any effluents which may be released.

d. A safety analysis of the facility in its ultimate status.

Upon satisfactory review and approval of the dismantling plan, a dismantling order is issued by the Commission in accordance with §50.82. When dismantling is completed and the Commission has been notified by letter, the appropriate Regulatory Operations Regional Office inspects the facility and verifies completion in accordance with the dismantlement plan. If residual radiation levels do not exceed the values in Table I, the Commission may terminate the license. If these levels are exceeded, the licensee retains the possession-only license under which the dismantling activities have been conducted or, as an alternative, may make application to the State (if an Agreement State) for a byproduct materials license.

TABLE I

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDE[a]	AVERAGE[b c]	MAXIMUM[b d]	REMOVABLE[b e]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm β-γ/100 cm^2	15,000 dpm β-γ/100 cm^2	1000 dpm β-γ/100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

NUCLEAR REGULATORY COMMISSION 7590-01

DISPOSAL OR ONSITE STORAGE OF THORIUM
OR URANIUM WASTES FROM PAST OPERATIONS

AGENCY: Nuclear Regulatory Commission (NRC)

ACTION: Discussion of Options for NRC Approval of Applications for Disposal or Onsite Storage of Thorium or Uranium Wastes - Interim Use and Public Comment

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SUMMARY: This notice discusses five options for NRC approval of disposal or onsite storage of thorium or uranium wastes from past nuclear operations. The options are contained in a Branch Technical Position for administration by the Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards.

DATES: Comments on the options for disposal or onsite storage of thorium or uranium are encouraged. Such comments will be considered in any subsequent revision of the Branch Technical Position. Comments are due _____.

Note: Comments received after the expiration date will be considered if it is practical to do so, but assurance of consideration cannot be given except as to comments filed on or before that date.

FOR ADDITIONAL INFORMATION CONTACT: Ralph G. Page, Chief, Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards, Washington, D.C. 20555, telephone 301-427-4309.

SUPPLEMENTARY INFORMATION:

I. Introduction

Some of the sites formerly used for processing thorium and uranium are known today to be contaminated with residual radioactive materials. Some are currently covered by NRC licenses. Others were once licensed, but the licenses to possess and use material have expired. In many cases, the total amount of contaminated soil is large, but the activity concentrations of radioactive materials are believed sufficiently low to justify their disposal on privately owned lands or storage onsite rather than their transport to a licensed radioactive materials disposal (commercial) site. In many instances packaging and transporting these wastes to a licensed disposal site would be too costly and not justified from the standpoints of risk to the public health or cost-benefit. Furthermore, because of the total volume of these wastes, limited commercial waste disposal capacity, and restrictions placed on receipt of long-lived wastes at commercial sites, it is not presently feasible to dispose of these wastes at commercial low-level waste disposal sites.

Effective January 28, 1981, NRC regulations in 10 CFR 20, "Standards for Protection Against Radiation", were amended (45 FR 71761-71762) to delete Section 20.304 which provided general authority for disposal of radioactive materials by burial in soil. Under the amended regulations, licensees

must apply for and obtain specific NRC approval to dispose of radioactive materials in this manner under the provisions of 10 CFR 20.302. A case-by-case review was believed needed to assure that burial of radioactive wastes would not present an unreasonable health hazard at some future date.

The deleted provisions of Section 20.304 previously permitted burial of up to 100 millicuries of thorium or natural uranium at any one time, with a yearly limitation of 12 burials for each type of material at each site. The only disposal standards specified were (1) burial at a minimum depth of four feet, and (2) successive burials separated by at least six feet. Thus a total of 1.2 curies of these materials were permitted to be disposed of each year by burial in a 12 foot by 18 foot or larger plot of ground.

Under the amended regulations, it is incumbent on an applicant who wants to bury radioactive wastes to demonstrate that local land burial is preferable to other disposal alternatives. The evaluation of the application takes into account the following information:

- Types and quantities of material to be buried
- Packaging of waste

- Burial location
- Characteristics of burial site
- Depth of burial
- Access restrictions to disposal site
- Radiation safety procedures during disposal operations
- Recordkeeping
- Local burial restrictions, if any

For applications involving disposal of soils contaminated with low level concentrations of thorium and uranium (other than concentrations not exceeding EPA cleanup standards), the matters of principal importance are:

- Concentrations of thorium and uranium (either in secular equilibrium with their daughters or without daughters present)
- Volume of contaminated soil
- Costs for offsite and onsite disposal
- Availability of offsite burial space
- Disposal site characteristics
- Depth of burial and accessibility of buried wastes
- State and local government views

II. Branch Technical Position

There are five acceptable options for disposal or onsite storage of thorium and uranium contaminated wastes. Applications for disposal or storage will be approved if the guidelines discussed under any option are met. Applications for other methods of

disposal may be submitted and these will be evaluated on their own merits.

1. Disposal of acceptably low concentrations (which meet EPA cleanup standards) of natural thorium with daughters in secular equilibrium, depleted or enriched uranium, and uranium ores with daughters in secular equilibrium with no restriction on burial method.

   Under this option, the concentrations of natural thorium and depleted or enriched uranium wastes are set sufficiently low that no member of the public is expected to receive a radiation dose commitment from the disposed materials in excess of 1 millirad per year to the lung or 3 millirads per year to the bone from inhalation and ingestion, under any foreseeable use of the material or property. These radiation dose guidelines were recommended by the Environmental Protection Agency (EPA) for protection against transuranium elements present in the environment as a result of unplanned contamination (42 FR 60956-60959). In addition, the concentrations are sufficiently low so that no individual may receive an external dose in excess of 10 microroentgens per hour above background. This is compatible with guidelines EPA proposed as cleanup standards for inactive uranium processing sites (46 FR 2556-2563).

For natural uranium ores having daughters in equilibrium, the concentration limit is equal to that set by the EPA (46 FR 2556-2563) for radium-226 (i.e., 5 pCi/gm, including background) and its decay products.

The concentrations specified below are believed appropriate to apply. It is expected, however, that currently licensed operations will be conducted in such a manner as to minimize the possibility of soil contamination and when such occurs the contamination will be reduced to levels as low as reasonably achievable.

Kind of Material	Concentration (pCi/gm)
Natural thorium (Th-232 plus Th-228) if all daughters are present and in equilibrium	10
Depleted Uranium	35
Enriched Uranium	30
Natural Uranium Ores (U-238 plus U-234) if all daughters are present and in equilibrium	10

The analysis upon which the Branch Technical Position is based is available for inspection at the Commission's Public Document Room at 1717 H St., N.W., Washington, D.C.

The concentrations specified under this option may be compared with naturally occurring thorium and uranium ore concentrations of 1.3 pCi/gm in igneous rock and uranium concentrations of 120 pCi/gm in Florida phosphate rock and 50-80 pCi/gm in Tennessee bituminous shale. Concentration limits for natural thorium and natural uranium ore wastes containing daughters not at secular equilibrium can be calculated on a case-by-case basis using the applicable isotopic activities data.

2. Disposal of certain low concentrations of natural thorium with daughters in secular equilibrium and depleted or enriched uranium with no daughters present when buried under prescribed conditions with no subsequent land use restrictions and no continuing NRC licensing of the material.

Under this option the concentrations of natural thorium and uranium are set sufficiently low so that no member of the public will receive a radiation dose exceeding those discussed under option 1 when the wastes are buried in an approved manner absent intrusion into the burial grounds. This option will require establishing prescribed conditions for disposal in the license, such as depth and distribution of material, to minimize the likelihood of intrusion. Burial will be permitted only if it can be demonstrated that the buried materials will be stabilized in place and not be transported away from the site.

Acceptability of the site for disposal will depend on topographical, geological, hydrological and meteorological characteristics of the site. At a minimum, burial depth will be at least four feet below the surface. In the event that there is an intrusion into the burial ground, no member of the public will likely receive a dose in excess of 170 millirems to a critical organ. An average dose not exceeding 170 millirems to the whole body for all members of a general population is recommended by international and national radiation expert bodies to limit population doses. With respect to limiting doses to individual body organs, the concentrations are sufficiently low that no individual will receive a dose in excess of 170 millirems to any organ from exposure to natural thorium, depleted uranium or enriched uranium.

The average activity concentration of radioactive material that may be buried under this option in the case of natural thorium (Th-232 plus Th-228) is 50 pCi/gm, if all daughters are present and in equilibrium; for enriched uranium it is 100 pCi/gm if the uranium is soluble and 250 pCi/gm if insoluble; for depleted uranium it is 100 pCi/gm if the uranium is soluble and 300 pCi/gm if insoluble. Natural uranium ores containing radium 226 and its daughters are not included under this option, because of possible radon 222 emanations and resultant higher than acceptable exposure of individuals in private residences if houses were built over buried materials.

3. Disposal of low concentrations of natural uranium ores, with all daughters in equilibrium, when buried under prescribed conditions in areas zoned for industrial use and the recorded title documents are amended to state that the specified land contains buried radioactive materials and are conditioned in a manner acceptable under state law to impose a covenant running with the land that the specified land may not be used for residential building. (There is no continuing NRC licensing of the material.)

   Disposal will be approved if the burial criteria outlined in option 2 (including burial at a minimum of 4 feet) are met. Depending upon local soil characteristics, burials at depths greater than 4 feet may be required. In order to assure protection against radon 222 releases (daughter in decay chain of uranium 238 and uranium 234), it is necessary that the recorded title documents be amended to state in the permanent land records that no residential building should be permitted over specified areas of land where natural uranium ore residues (U-238 plus U-234) in concentrations exceeding 10 pCi/gm has been buried. Industrial building is acceptable so long as the concentration of buried material does not exceed 40 pCi/gm of uranium (i.e., Ra-226 shall not exceed 20 pCi/gm).

4. Disposal of land-use-limited concentrations of natural thorium or natural uranium with daughters in secular equilibrium and depleted or enriched uranium without daughters present when

buried under prescribed conditions in areas zoned for industrial use and the recorded title documents are amended to state that the land contains buried radioactive material and are conditioned in a manner acceptable under state law to impose a covenant running with land that the land (1) may not be excavated below stated depths in specified areas of land unless cleared by appropriate health authorities, (2) may not be used for residential or industrial structures over specified areas where radioactive materials in concentrations higher than specified in options 2 and 3 are buried, and (3) may not be used for agricultural purposes in the specified areas. (There is no continuing NRC licensing of the disposal site.)

Under this option, conditions of burial will be such that no member of the public will receive radiation doses in excess of those discussed under option 1 absent intrusion into the burial ground. Criteria for disposal under these conditions is predicated upon the assumption that intentional intrusion is less likely to occur if a warning is given in land documents of record not to excavate below burial depths in specified areas of land without clearance by health authorities; not to construct residential or industrial building on the site; and not to use specified areas of land for agricultural purposes. Because of this, we believe it appropriate to apply a maximum critical organ exposure limit of 500 millirems per year to thorium

and uranium buried under this restriction instead of 170 millirems as used in options 2 and 3. In addition, any exposure to such materials is likely to be more transient than assumed (essentially continual exposure) under those options. These two factors combine to increase the activity concentration limits calculated under option 2 by about 10. Thus, the average concentration that may be buried under this option for thorium (Th-232 plus Th-228) is 500 pCi/gm if all daughters are present and in equilibrium; for enriched uranium it is 1000 pCi/gm if the uranium is soluble and 2500 pCi/gm if insoluble; and for depleted uranium it is 1000 pCi/gm if the uranium is soluble and 3000 pCi/gm if insoluble.

With respect to natural uranium with daughters present and in equilibrium, the concentration that may be buried under this option is 200 pCi/gm of U-238 plus U-234, i.e., 100 pCi/gm Ra-226. This concentration is based on a limited exposure of 2.4 hours per day to limit the radon dose to less than 0.5 working level month (WLM) which is equivalent to continuous exposure to 0.02 working level (WL). Depending upon local soil characteristics, burials at depths greater than 4 feet may be required.

5. Storage of licensed concentrations of thorium and uranium onsite pending the availability of an appropriate disposal site.

SUMMARY OF MAXIMUM CONCENTRATIONS PERMITTED UNDER DISPOSAL OPTIONS

Kind of Material	Disposal Options 1[a]	2[b]	3[c]	4[d]
Natural Thorium (Th-232 + Th-228) with daughters present and in equilibrium	10	50	-	500
Natural Uranium (U-238 + U-234) with daughters present and in equilibrium	10	-	40	200
Depleted Uranium				
o Soluble	35	100	-	1000
o Insoluble	35	300	-	3000
Enriched Uranium				
o Soluble	30	100	-	1000
o Insoluble	30	250	-	2500

a Based on EPA cleanup standards.

b Concentrations based on limiting individual doses to 170 mrem/yr.

c Concentration based on limiting equivalent exposure to 0.02 working level or less.

d Concentrations based on limiting individual doses to 500 mrem/yr and, in case of natural uranium, limiting exposure to 0.02 working level or less.

5. Storage of licensed concentrations of thorium and uranium onsite pending the availability of an appropriate disposal site.

When concentrations exceed those specified in option 4, long term disposal other than at a license disposal site will not normally be a viable option under the provisions of 10 CFR 20.302. In such cases, the thorium and uranium may be permitted to be stored onsite under an NRC license until a suitable method of disposal is found. License conditions will require that radiation doses not exceed those specified in 10 CFR Part 20 and be maintained as low as reasonably achievable.

Before approving an application to dispose of thorium or uranium under options 2, 3, or 4, NRC will solicit the view of appropriate State health officals within the State in which the disposal would be made.

Dated at Silver Spring, Maryland this 14th day of October, 1981.

Richard E. Cunningham
Director, Division of Fuel Cycle
and Material Safety
Office of Nuclear Material Safety
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