CORRESPONDENCE DISTRIBUTION COVERSHEET

Author	Addressee	Correspondence No.
A. W. Conklin, WDOH	S. H. Wisness, RL	Incoming: 0006056 (AIR 00-1012) Xref: 0001195

Subject: NEW MAXIMALLY EXPOSED INDIVIDUAL DEFINITION

DISTRIBUTION

Approval	Date	Name	Location	w/att
		Correspondence Control	A3-01	
		Fluor Hanford		
		J. A. Bates	G1-37	
		J. E. Bramson	T5-54	
		L. E. Borneman	T6-16	
		R. C. Brunke	G1-37	
		S. B. Cherry	B3-15	
		B. L. Curn	G1-30	
		N. R. Dahl	N2-57	
		W. E. Davis	G1-37	
		L. P. Diediker	G1-27	
		R. H. Engelmann	G1-30	
		C. K. Girres	T3-01	
		R. H. Gurske	H8-73	
		J. W. Hales	A1-14	
		J. S. Hertzel	A1-14	
		N. A. Homan	G1-30	
		R. A. Kaldor	A1-14	
		R. L. Newell	B4-68	
		S. M. Price	H8-67	
		D. J. Rokkan	G1-27	
		J. D. Williams	H6-66	
		L. F. Willis	H8-73	
		RCRA File (D Jensen)	G1-27	
		File/LB	G1-27	
		Bechtel Hanford, Inc.		
		R. J. Landon	H0-02	
		J. G. Woolard	H0-02	
		CH2M HILL Hanford Group, Inc.		
		G. M. Crummel	R1-51	
		B. G. Erlandson	H4-20	
		J. S. Hill	H4-20	
		J. J. Luke	R1-51	
		DynCorp Tri-Cities Services, Inc.		
		B. J. Dixon	G3-26	
		Pacific Northwest National Laboratory		
		E. G. Damberg	P7-68	
		A. K. Ikenberry	P7-79	
		B. A. Napier	K3-54	
		K. Rhoads	K3-54	
		L. H. Staven	K3-54	

0006056
ATR 00-1012

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
7171 Cleanwater Lane, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827
TDD Relay 1-800-833-6388

October 18, 2000

Mr. Steven H. Wisness, Director
U. S. Department of Energy
Office of Site Services
Richland Operations Office
P. O. Box 550 MSIN A 5-18
Richland, Washington 99352

Dear Mr. Wisness:

By letter dated March ~~2, 1999~~ 1, 2000, the Department of Health (DOH) notified you that, due to the Department of Energy's (DOE) privatization efforts and the resulting public access to several locations on the Hanford Site, determination of compliance with air emission standards must take into consideration those locations wherever the public has unrestricted access on the Hanford Site. Attached to that letter was a copy of DOH's related position paper of the same date. At the meeting held on April 18, 2000 among representatives of DOE, the Environmental Protection Agency (EPA), and DOH, the DOE representatives expressed concerns regarding portions of the position paper. As a result of the concerns heard, we are writing to clarify certain details. This letter supercedes any prior correspondence containing policy guidance on this matter.

Of concern to DOE was the description in the position paper of the MEI as a "real or hypothetical person." This reference comes from the existing definition of "MEI" set forth in WAC 246-247. Consistent with these regulations, in response to the changing accessibility of certain locations on the Hanford Site, it is our intent to require that calculations for the MEI, for purposes of determining whether an emission source is a major or minor emission source, now include those businesses that are now located on DOE-owned, but unrestricted, land. CAP 88 runs for determination of annual compliance with standards must also now include those businesses that are now located at unrestricted areas within the Hanford Site. With respect to acute releases, calculations to determine resulting emissions may be required at any unrestricted area, now including the actual business locations at the Hanford Site. If future private businesses are located on DOE-owned but unrestricted land, the MEI may have to be recalculated at that time.

I would also like to restate my willingness to work with DOE and EPA on specific requirements for facilities that might become major emission units as a result of this recalculation, while ensuring the proper protection of the public. We are also open for discussions on appropriate dose calculations and or monitoring data that should be used in very close proximity to unrestricted businesses where CAP-88 is not useable (e.g. within 200 meters).

If you have any questions, please contact me at (360) 236-3261.

Sincerely,

Allen W. Conklin, Manager
Air Emissions and Defense Waste Section
Division of Radiation Protection

AWC/jr

cc: Jerry Leitch, EPA
Jerry Hensely, Ecology
Ron Skinnarland, Ecology
Doug Sherwood, EPA
John Erickson, WDOH
Lilia Lopez, AAG

FAXED: Paul Kruger - 10/19/00

Battelle
. . . Putting Technology To Work

Project No. 200 ADP

Internal Distribution
Hann, JE
Johnson, ML
Mapili, GM
Smith, MH
File/LB

Date January 31, 2002

To Glen Chronister

From Gabriel Mapili

Subject 224-T NDA of tanks in the cells

224-T Nondestructive Assay of Tanks in Cells A thru F

The Pacific Northwest National Laboratories Nondestructive Assay Center was contracted to perform nondestructive assay (NDA) of the tanks and other miscellaneous items in the cells of the 224-T building by the Fluor Hanford 200 Area Decommissioning Project. Due to safety concerns, the tanks were to be assayed by remote means. A High Purity Germanium (HPGe) detector was mounted on a crawler that was operated remotely and positioned the detector as necessary to perform the assay. A total of twenty-one tanks and boxes were assayed between August 14, 2001 and December 17, 2001.

One criticality control for manned entry into the cells is a cumulative rollup of 450 grams of Pu-239 in all of the tanks in the cell. Another control limited the detector to nominally 24 inches or greater to a tank until it was shown that the tank contained less than 450 grams of Pu-239. Therefore, a spreadsheet was developed that would calculate the amount of Pu-239 immediately after completion of the NDA count. Copies of the spreadsheet for each of the tanks are included as an attachment.

To ensure that accurate measurements were performed, the HPGe detection system was calibrated each day prior to performing any measurements. Included in the calibration were an energy calibration and an efficiency calibration. A NIST traceable source was used for the calibration. A control chart was also utilized to ensure that the system was functioning normally. A copy of the Certificate of Calibration for the source and the control chart are included as attachments to this letter.

Errors are reported at the 1-sigma level and are based on counting statistics alone. HPGe systems generally have between a 2 to 5% total error. A 95% confidence interval is represented by 1.96*sigma. A chart with the measured value for Pu-239 and Am-241, along with 1*sigma and 1.96*sigma are included as an attachment.

Reviewed by:

CERTIFICATE OF CALIBRATION
MULTINUCLIDE STANDARD SOURCE

Customer: CANBERRA INDUSTRIES
Catalog No.: GF-0003
Source No.: 446-103
P.O.No.: 48842
Reference Date: May 1 1994 12:00 PST.
Total Radioactivity: 12.51 µCi.
Total Radioactivity: 463 kBq.

Description of Source

a. Capsule type: M
b. Nature of active deposit: Evaporated Metallic Salts
c. Active diameter/volume: 5 mm
d. Backing: 9.23 mg/cm² kapton
e. Cover: 0.254 mm aluminized mylar

Nuclide	Activity. (µCi)	Gamma-Ray Energy(keV)	Branching Ratio (%)	Systematic. Uncert.	Random Uncert.	Overall Uncert.
Eu-154	5.69	123, 592, 723, 873, 996, 1005, 1275	40.5, 4.84, 19.7, 11.45, 10.29, 17.9, 35.5	3.0%	2.1%	3.7%
Eu-152	1.970	122, 344, 779, 964, 1112, 1408	28.4, 26.6, 12.98, 14.5, 13.6, 20.8	3.0%	1.4%	3.3%
Ba-133	4.85	81, 276, ~~303,~~ 303, 356, 384	37.38, 7.09, 17.787 18.4, 62.2, 8.92	3.0%	0.9%	3.1%

Method of Calibration

The source was assayed by gamma spectrometry.

NIST Traceability

This calibration is implicitly traceable to the National Institute of Standards and Technology.

Leak Test(s)

See reverse side for Leak Test(s) applied to this source.

Notes

1. Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia S. Shirley, 1986.
2. IPL participates in an NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
3. Overall uncertainty is calculated at the 99% confidence level.
4. Reference Half lives:

Eu-154 8.8 ± 0.1 years Eu-152 13.33 ± 0.04 years Ba-133 10.54 ± 0.03 years

ISOTOPE PRODUCTS LABORATORIES
1800 No. Keystone Street
Burbank, California 91504
(818) 843 - 7000

Amar U. Khan
QUALITY CONTROL

Apr. 25, 1994
Date Signed

IPL Ref No. 446-103

NDA Log #	Tank	Measured g Pu	1-sigma g Pu	1.96 sigma g Pu	Measured Ci Am-241	1 sigma Ci Am-241	1.96 sigma Ci Am-241	
A02020	A-1	6.32E-01	7.56E-01	8.75E-01	4.16E-03	4.76E-03	5.34E-03	
A02018	A-3	4.10E+00	4.31E+00	4.51E+00	1.10E-03	1.46E-03	1.80E-03	
A02019	A-4	8.65E-02	8.65E-02	8.65E-02	1.82E-03	2.09E-03	2.35E-03	
A02016	B-1	7.02E-01	8.33E-01	9.59E-01	1.67E-02	1.85E-02	2.02E-02	
A02013	B-3	2.64E-01	3.17E-01	3.68E-01	3.46E-02	3.82E-02	4.17E-02	
A02015	B-4	5.47E-01	6.18E-01	6.86E-01	2.09E-02	2.29E-02	2.48E-02	
A02014	B-6	1.74E-01	1.97E-01	2.20E-01	5.09E-02	5.57E-02	6.03E-02	
A02021	C-8	2.32E+00	2.47E+00	2.62E+00	1.29E-02	1.43E-02	1.56E-02	
A02003	D-1	3.41E-01	4.63E-01	5.80E-01	5.59E-02	6.13E-02	6.65E-02	
A02001	D-3	1.80E-03	1.80E-03	1.80E-03	2.00E-02	2.20E-02	2.39E-02	
A02002	D-4	2.11E-01	2.31E-01	2.50E-01	7.76E-02	8.48E-02	9.18E-02	
A01116	E-1	1.70E-02	1.70E-02	1.70E-02	3.50E-02	3.82E-02	4.13E-02	
A01114	E-3	1.70E-02	1.70E-02	1.70E-02	1.60E-02	1.30E-01	2.39E-01	
A01115	E-4	7.20E-01	8.20E-01	9.16E-01	2.20E-02	2.45E-02	2.69E-02	
A01127	F-1	6.40E-01	7.21E-01	7.99E-01	5.35E-02	5.87E-02	6.37E-02	
A02017	F-10	9.02E+00	9.65E+00	1.03E+01	5.56E-02	6.09E-01	1.14E+00	
A01126	F-7	4.90E-01	5.71E-01	6.49E-01	2.17E-01	2.39E-01	2.60E-01	
A01124	F-8	4.00E-01	4.58E-01	5.14E-01	4.89E-02	5.37E-02	5.83E-02	
A01125	F-9	3.80E-02	4.36E-01	8.18E-01	6.59E-03	7.30E-03	7.98E-03	
A01128	F-BOX	6.90E-01	7.55E-01	8.17E-01	2.00E-04	2.20E-04	2.39E-04	REMOVED
A01123	F-WT	4.00E-04	4.00E-04	4.00E-04	8.18E-03	8.98E-03	9.75E-03	
		2.14E+01	2.37E+01	2.60E+01	7.59E-01	1.50E+00	2.20E+00	

Indicates MDA values used

Item ID: 224T/E cell/E-3

Date: 8/28/2001

NDA Log: A01114

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity 17.13
Error				1.67

Is This an MDA? Y or N

Background Net peak Area

129.29	375.05	413.71
69.2	65.4	40

MDA Values

	129.29	375.05	413.71
uCi	1.61	11	11.7

Count Time (sec): 600

Total tank wall thickness, (in): 0.25

Calibration Distance (in): 24

Detector to tank distance (in): 37.25

Tank Diameter (in): 108

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	-0.0771	-0.293546	-0.200487
error =	-0.07287	-2.94E-01	-2.00E-01
sum =	-1.50E-01	-5.87E-01	-4.01E-01

	129.29	375.05	413.71
MDA g Pu-239	0.0017	0.0044	0.0049

Am-241 0.118782 Ci

error = 1.16E-02

sum = 1.30E-01

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID: 224T/E cell/E-4

Date: 8/28/2001

NDA Log: A01115

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	485	174	191	4.24
Error	53.12	31.53	25.46	0.451

Is This an MDA? Y or N: N

Background Net peak Area

129.29	375.05	413.71

MDA Values

	129.29	375.05	413.71
uCi	6.69	10.5	25.05

Count Time (sec): 600

Total tank wall thickness, (in): 0.25

Calibration Distance (in): 24

Detector to tank distance (in): 37.25

Tank Diameter (in): 84

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.4076	0.589088	0.722093
error =	0.0446436	1.07E-01	9.63E-02
sum =	4.52E-01	6.96E-01	8.18E-01

	129.29	375.05	413.71
MDA g Pu-239	0.005	0.0059	0.0071

Am-241 0.022177 Ci

error = 2.36E-03

sum = 2.45E-02

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID: **224T/E cell/E-1**

Date: 8/28/2001

NDA Log: A01116

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
				4.99
Error				0.5241

Is This an MDA? Y or N

MDA Values

	129.29	375.05	413.71
uCi			

Background Net peak Area

129.29	375.05	413.71
69.2	65.4	40

Count Time (sec): 600

Total tank wall thickness, (in): 0.25

Calibration Distance (in): 24

Detector to tank distance (in): 37.25

Tank Diameter (in): 108

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	-0.0771	-0.293546	-0.200487
error =	-0.07287	-2.94E-01	-2.00E-01
sum =	-1.50E-01	-5.87E-01	-4.01E-01

	129.29	375.05	413.71
MDA g Pu-239	0.0017	0.0043	0.0047

Am-241 0.034602 Ci

error = 3.63E-03

sum = 3.82E-02

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID **224T/F cell/Weigh Tank**

Date 9/10/2001

NDA Log A01123

Energy	129.29	375.05	413.71	59.54
Net peak area	0	0	0	13.41
Error	0	0	0	1.32

Activity

Is This an MDA? Y or N

MDA Values

	129.29	375.05	413.71
uCi	1.79	1.8	1.9

Background Net peak Area

129.29	375.05	413.71
0	0	0

Count Time (sec)

600

Total tank wall thickness, (in)

0.1875

Calibration Distance (in)

24

Detector to tank distance (in)

37.25

Tank Diameter (in)

30

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
2.97	1.49	1.46	128.66

	129.29	375.05	413.71
g Pu =	0.0000	0.000000	0.000000
error =	0	0.00E+00	0.00E+00
sum =	0.00E+00	0.00E+00	0.00E+00

	129.29	375.05	413.71
MDA g Pu-239	0.0004	0.0014	0.0015

Am-241 0.008178 Ci

error = 8.05E-04

sum = 8.98E-03

Analyzed by G Mapili

Reviewed by M Smith

Item ID: 224T/F cell/F-8

Date: 9/10/2001

NDA Log: A01124

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	632	202	175	15.64
Error	48.07	24.25	27.11	1.54

Is This an MDA? Y or N

MDA Values

Background Net peak Area	129.29	375.05	413.71
	0	0	0

	129.29	375.05	413.71
uCi	0	0	0

Count Time (sec): 600

Total tank wall thickness, (in): 0.25

Calibration Distance (in): 24

Detector to tank distance (in): 37.25

Tank Diameter (in): 48

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.3173	0.408504	0.395195
error =	0.0241318	4.90E-02	6.12E-02
sum =	3.41E-01	4.58E-01	4.56E-01

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.048863 Ci

error = 4.81E-03

sum = 5.37E-02

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID: 224T/F cell/F-9

Date: 9/10/2001

NDA Log: A01125

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	0	142	169	2.11
Error	0	27.07	24.18	0.2272

Is This an MDA? Y or N

MDA Values

Background Net peak Area	129.29	375.05	413.71
	0	0	0

	129.29	375.05	413.71
uCi	0	0	0

Count Time (sec)

600

Total tank wall thickness, (in)

0.25

Calibration Distance (in)

24

Detector to tank distance (in)

37.25

Tank Diameter (in)

48

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.0000	0.287166	0.381646
error =	0	5.47E-02	5.46E-02
sum =	0.00E+00	3.42E-01	4.36E-01

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.006592 Ci

error = 7.10E-04

sum = 7.30E-03

Analyzed by G Mapili

Reviewed by M Smith

Item ID: 224T/F cell/F-7

Date: 9/10/2001

NDA Log: A01126

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	574	154	216	69.59
Error	46.92	34.65	36.8	6.79

Is This an MDA? Y or N

Background Net peak Area

129.29	375.05	413.71
0	0	0

MDA Values

	129.29	375.05	413.71
uCi	0	0	0

Count Time (sec): 600

Total tank wall thickness, (in): 0.25

Calibration Distance (in): 24

Detector to tank distance (in): 37.25

Tank Diameter (in): 48

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.2882	0.311433	0.487784
error =	0.0235544	7.01E-02	8.31E-02
sum =	3.12E-01	3.82E-01	5.71E-01

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.217414 Ci

error = 2.12E-02

2.39E-01

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID: 224T/F cell/F-1

Date: 9/10/2001

NDA Log: A01127

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	458	208	283	17.13
Error	50.92	26.47	36.27	1.67

Is This an MDA? Y or N: N

MDA Values

	129.29	375.05	413.71
uCi	0	0	0

Background Net peak Area

129.29	375.05	413.71
0	0	0

Count Time (sec): 600

Total tank wall thickness, (in): 0.25

Calibration Distance (in): 24

Detector to tank distance (in): 37.25

Tank Diameter (in): 48

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.2299	0.420637	0.639087
error =	0.025562	5.35E-02	8.19E-02
sum =	2.55E-01	4.74E-01	7.21E-01

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241	0.0535 Ci
error =	5.22E-03
sum =	5.87E-02

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID **224T/F cell/Boxes**

Date 9/10/2001

NDA Log A01128

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	774	514	495	26
Error	54	51	49.5	2.53

Is This an MDA? Y or N

Background Net peak Area

129.29	375.05	413.71
0	0	0

MDA Values

	129.29	375.05	413.71
uCi			

Count Time (sec)

600

Total tank wall thickness, (in)

0.25

Calibration Distance (in)

24

Detector to tank distance (in)

37.25

Tank Diameter (in)

42

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
1.61	1.1	1.1	1.19

	129.29	375.05	413.71
g Pu =	0.1418	0.622977	0.686493
error =	9.89E-03	6.18E-02	6.86E-02
Sum	1.52E-01	6.85E-01	7.55E-01

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.0002 Ci

error = 2E-05

sum = 2.00E-04

Analyzed by G Mapili

Reviewed by M Smith

Item ID 224T/F-Cell/F-10

Date 12/17/2001

NDA Log A02017

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	1.58E+04			90.2
Error	1.11E+03			8.5

Is This an MDA? Y or N

Background Net peak Area

129.29	375.05	413.71

MDA Values

	129.29	375.05	413.71
uCi			

Count Time (sec)

1000

Total tank wall thickness, (in)

0.25

Calibration Distance (in)

24

Detector to tank distance (in)

58

Tank Diameter (in)

36

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
4.91	2.96	2.84	615

	129.29	375.05	413.71
g Pu =	9.0167	0.000000	0.000000
error =	0.6334506	0.00E+00	0.00E+00
sum =	9.65E+00	0.00E+00	0.00E+00

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.556271 Ci

error = 5.24E-02

sum = 6.09E-01

Analyzed by G Mapili

Reviewed by M Smith

Item ID **224T/D cell/D-3**

Date 10/3/2001

NDA Log A02001

Energy	129.29	375.05	413.71	59.54
Net peak area				
Error				

Activity 2.88 / 0.289

Is This an MDA? Y or N

Background Net peak Area

129.29	375.05	413.71

MDA Values

	129.29	375.05	413.71
uCi	1.85	10.4	11.3

Count Time (sec) 600

Total tank wall thickness, (in) 0.25

Calibration Distance (in) 24

Detector to tank distance (in) 37.25

Tank Diameter (in) 108

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.0000	0.000000	0.000000
error =	0	0.00E+00	0.00E+00
sum =	0.00E+00	0.00E+00	0.00E+00

	129.29	375.05	413.71
MDA g Pu-239	0.0018	0.0041	0.0046

Am-241 0.01997 Ci

error = 2.00E-03

sum = 2.20E-02

Analyzed by G Mapili

Reviewed by M Smith

Item ID: 224T/D cell/D-4

Date: 10/3/2001

NDA Log: A02002

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	382			22.56
Error	35.79			2.12

Is This an MDA? Y or N

Background Net peak Area

129.29	375.05	413.71

MDA Values

	129.29	375.05	413.71
uCi			

Count Time (sec): 600

Total tank wall thickness, (in): 0.25

Calibration Distance (in): 24

Detector to tank distance (in): 37.25

Tank Diameter (in): 54

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.2110	0.000000	0.000000
error =	0.0197702	0.00E+00	0.00E+00
sum =	2.31E-01	0.00E+00	0.00E+00

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.077556 Ci

error = 7.29E-03

sum = 8.48E-02

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID **224T/D cell/D-1**

Date 10/3/2001

NDA Log A02003

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	265	76	51	8.06
Error	51.09	27.26	16.37	0.778

Is This an MDA? Y or N

MDA Values

	129.29	375.05	413.71
uCi			

Background Net peak Area

129.29	375.05	413.71

Count Time (sec)

600

Total tank wall thickness, (in)

0.25

Calibration Distance (in)

24

Detector to tank distance (in)

37.25

Tank Diameter (in)

108

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.2953	0.341124	0.255621
error =	0.0569252	1.22E-01	8.20E-02
sum =	3.52E-01	4.63E-01	3.38E-01

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.055889 Ci

error = 5.39E-03

sum = 6.13E-02

Analyzed by G Mapili

Reviewed by M Smith

Item ID: 224T/B-Cell/B-3

Date: 12/4/2001

NDA Log: A02013

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	237			4.99
Error	47.37			0.5241

Is This an MDA? Y or N

MDA Values

	129.29	375.05	413.71
uCi			

Background Net peak Area

129.29	375.05	413.71

Count Time (sec)

600

Total tank wall thickness, (in)

0.25

Calibration Distance (in)

24

Detector to tank distance (in)

37.25

Tank Diameter (in)

108

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.2641	0.000000	0.000000
error =	0.0527803	0.00E+00	0.00E+00
sum =	3.17E-01	0.00E+00	0.00E+00

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.034602 Ci

error = 3.63E-03

sum = 3.82E-02

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID 224T/B-Cell/B-6

Date 12/4/2001

NDA Log A02014

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	314			14.8
Error	41.91			1.41

Is This an MDA? Y or N

MDA Values

	129.29	375.05	413.71
uCi			

Background Net peak Area

129.29	375.05	413.71

Count Time (sec)
600

Total tank wall thickness, (in)
0.25

Calibration Distance (in)
24

Detector to tank distance (in)
37.25

Tank Diameter (in)
54

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.1735	0.000000	0.000000
error =	0.0231508	0.00E+00	0.00E+00
sum =	1.97E-01	0.00E+00	0.00E+00

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.050879 Ci

error = 4.85E-03

sum = 5.57E-02

Analyzed by G Mapili

Reviewed by M Smith

Item ID: 224T/B-Cell/B-4

Date: 12/4/2001

NDA Log: A02015

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	441	207	220	6.08
Error	53.92	30.24	28.89	0.587

Is This an MDA? Y or N

Background Net peak Area

129.29	375.05	413.71

MDA Values

	129.29	375.05	413.71
uCi			

Count Time (sec)

600

Total tank wall thickness, (in)

0.25

Calibration Distance (in)

24

Detector to tank distance (in)

37.25

Tank Diameter (in)

54

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.2436	0.460627	0.546676
error =	0.0297851	6.73E-02	7.18E-02
sum =	2.73E-01	5.28E-01	6.18E-01

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.020902 Ci

error = 2.02E-03

sum = 2.29E-02

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID: 224T/B-Cell/B-1

Date: 12/4/2001

NDA Log: A02016

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	0	34.8	140	2.42
Error	0	32.48	26.12	0.245

Is This an MDA? Y or N

Background Net peak Area

129.29	375.05	413.71

MDA Values

	129.29	375.05	413.71
uCi			

Count Time (sec): 600

Total tank wall thickness, (in): 0.25

Calibration Distance (in): 24

Detector to tank distance (in): 37.25

Tank Diameter (in): 108

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.0000	0.156199	0.701706
error =	0	1.46E-01	1.31E-01
sum =	0.00E+00	3.02E-01	8.33E-01

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.016781 Ci	
error =	1.70E-03
sum =	1.85E-02

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID: 224T/A-Cell/A-3

Date: 12/11/2001

NDA Log: A02018

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	209	611	818	0.159
Error	50.8	44.3	41.63	0.052

Is This an MDA? Y or N

Background Net peak Area

129.29	375.05	413.71

MDA Values

	129.29	375.05	413.71
uCi			

Count Time (sec): 600

Total tank wall thickness, (in): 0.25

Calibration Distance (in): 24

Detector to tank distance (in): 37.25

Tank Diameter (in): 108

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.2329	2.742454	4.099967
error =	0.0566021	1.99E-01	2.09E-01
sum =	2.89E-01	2.94E+00	4.31E+00

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.001103 Ci

error = 3.61E-04

sum = 1.46E-03

Analyzed by: G Mapili

Reviewed by: M Smith

Item ID 224T/A-Cell/A-4

Date 12/11/2001

NDA Log A02019

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
				0.53
Error				0.077

Is This an MDA? Y or N

Background Net peak Area

	129.29	375.05	413.71

MDA Values

	129.29	375.05	413.71
uCi			

Count Time (sec)

600

Total tank wall thickness, (in)

0.25

Calibration Distance (in)

24

Detector to tank distance (in)

37.25

Tank Diameter (in)

54

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.0000	0.000000	0.000000
error =	0	0.00E+00	0.00E+00
sum =	0.00E+00	0.00E+00	0.00E+00

	129.29	375.05	413.71
MDA g Pu-239	0.0865	0.2101	0.2193

Am-241 0.001822 Ci

error = 2.65E-04

sum = 2.09E-03

Analyzed by G Mapili

Reviewed by M Smith

Item ID 224T/A-Cell/A-1

Date 12/11/2001

NDA Log A02020

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
		114	126	0.6
Error		25.12	24.89	0.086

Is This an MDA? Y or N

Background Net peak Area

129.29	375.05	413.71

MDA Values

	129.29	375.05	413.71
uCi			

Count Time (sec)

600

Total tank wall thickness, (in)

0.25

Calibration Distance (in)

24

Detector to tank distance (in)

37.25

Tank Diameter (in)

108

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	0.0000	0.511685	0.631535
error =	0	1.13E-01	1.25E-01
sum =	0.00E+00	6.24E-01	7.56E-01

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.004161 Ci

error = 5.96E-04

sum = 4.76E-03

Analyzed by G Mapili

Reviewed by M Smith

Item ID **224T/C-Cell/C-8**

Date 12/17/2001

NDA Log A02021

Energy	129.29	375.05	413.71	59.54
Net peak area				Activity
	966	487	462	1.86
Error	73.87	39.35	31.28	0.207

Is This an MDA? Y or N

MDA Values

	129.29	375.05	413.71
uCi			

Background Net peak Area

129.29	375.05	413.71

Count Time (sec)
600

Total tank wall thickness, (in)
0.25

Calibration Distance (in)
24

Detector to tank distance (in)
37.25

Tank Diameter (in)
108

Attenuation Correction Factor at Energy of Interest

129.29	375.05	413.71	59.54
3.99	1.66	1.62	479.68

	129.29	375.05	413.71
g Pu =	1.0763	2.185884	2.315629
error =	0.082307	1.77E-01	1.57E-01
sum =	1.16E+00	2.36E+00	2.47E+00

	129.29	375.05	413.71
MDA g Pu-239	0	0	0

Am-241 0.012898 Ci

error = 1.44E-03

sum = 1.43E-02

Analyzed by G Mapili

Reviewed by M Smith

Battelle
. . . Putting Technology To Work

Project No. 224-T Centrifuges

Internal Distribution
EN Dodd
File/LB

Date December 5, 2002

To JE Ham

From Gabriel Mapili Gabriel M Mapili

Subject NDA Summary Report

The centrifuges and tanks on the mezzanines of A, B, D, E, and F-Cells were NDA'd to determine the amount of nuclear material present in the systems. Due to various physical constraints, different NDA techniques were employed. The centrifuges in A, D, and E-Cells were assayed using a slab neutron detector. The slab neutron detector consists of five He-3 tubes encased within a high-density polyethylene block. The B-Cell centrifuge was assayed using a SNAP II neutron detector. The centrifuges and tanks in F-Cell were assayed using a High Purity Germanium detector (HPGe). The HPGe detects gamma radiation.

The following table summarizes the nuclear material in each cell.

Summary of Nuclear Material in the Centrifuges and Tanks in the 224-T Cells

			grams					Ci
CELL	Date	Assay Method	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242	Am-241
A	10/23/2002	SLAB	5.60E-04	2.62E+00	1.71E-01	9.52E-03	8.40E-04	
B	6/18/2002	SNAP II	1.78E-03	8.32E+00	5.44E-01	3.03E-02	2.67E-03	
D	8/20/2002	SLAB	2.25E-05	1.05E-01	6.87E-03	3.83E-04	3.38E-05	
E	7/31/2002	SLAB	4.82E-04	2.25E+00	1.47E-01	8.19E-03	7.23E-04	
→ F	7/23/2002	HPGe	2.68E-03	1.25E+01	8.19E-01	4.56E-02	4.02E-03	8.52E+00
	Assumed Isotopic		0.02	93.5	6.11	0.34	0.03	

In F-cell, only Pu-239, Am-241, and Pu-decay products were observed in the gamma spectra

Please contact me at 373-1305 if you have further questions.

Location	g Pu	Pu-238 g	Pu-239 g	Pu-240 g	Pu-241 g	Pu-242 g	Am-241 Ci	Am-241 g	
Cell A	2.81E+00	3.89E-04	2.63E+00	1.71E-01	1.00E-03	8.44E-04	2.94E-02	8.56E-03	
Cell B	8.93E+00	1.24E-03	8.35E+00	5.44E-01	3.19E-03	2.68E-03	9.33E-02	2.72E-02	
Cell D	1.13E-01	1.56E-05	1.06E-01	6.87E-03	4.03E-05	3.39E-05	1.18E-03	3.44E-04	
Cell E	2.41E+00	3.34E-04	2.26E+00	1.47E-01	8.63E-04	7.25E-04	2.53E-02	7.36E-03	
Cell F	2.12E+00	2.68E-03	1.25E+00	8.19E-01	4.56E-02	4.02E-03	8.52E+00	--	HPGe Data
Subtotal	1.64E+01	4.65E-03	1.64E+01	1.69E+00	5.07E-02	1.74E+00	8.67E+00	4.35E-02	
TOTAL(g)	**4.79E+01**	**9.02E-03**	**4.59E+01**	**3.61E+00**	**6.20E-02**	**1.75E+00**	**--**	**3.73E-01**	
TOTAL(Ci)		**1.55E-01**	**2.85E+00**	**8.31E-02**	**6.39E+00**	**6.89E-03**	**1.11E+01**		

224-T NDA RESULTS

((12/5/02 PNNL Letter, Mapili to Ham)

Cell	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242	Total	Am-241	Am-241	Method
	g	g	g	g	g	g	g	Ci	
A	5.60E-04	2.62E+00	1.71E-01	9.52E-03	8.40E-04	2.80E+00			SLAB
%	**0.02**	**93.51**	**6.10**	**0.34**	**0.03**				
	3.89E-04	2.63E+00	1.71E-01	1.00E-03	8.44E-04	2.80E+00			
	3.89E-04	*2.63E+00*	*1.71E-01*	*1.00E-03*	*8.44E-04*	*2.81E+00*	*8.56E-03*	*2.94E-02*	
B	1.78E-03	8.32E+00	5.44E-01	3.03E-02	2.67E-03	8.90E+00			SNAP II
%	**0.02**	**93.50**	**6.11**	**0.34**	**0.03**				
	1.24E-03	8.35E+00	5.44E-01	3.19E-03	2.68E-03	8.91E+00			
	1.24E-03	*8.35E+00*	*5.44E-01*	*3.19E-03*	*2.68E-03*	*8.93E+00*	*2.72E-02*	*9.34E-02*	

D	2.25E-05	1.05E-01	6.87E-03	3.83E-04	3.38E-05	1.12E-01			SLAB
%	**0.02**	**93.49**	**6.12**	**0.34**	**0.03**				
	1.56E-05	1.06E-01	6.87E-03	4.03E-05	3.39E-05	1.12E-01			
	1.56E-05	*1.06E-01*	*6.87E-03*	*4.03E-05*	*3.39E-05*	*1.13E-01*	*3.44E-04*	*1.18E-03*	

E	4.82E-04	2.25E+00	1.47E-01	8.19E-03	7.23E-04	2.41E+00			SLAB
%	**0.02**	**93.50**	**6.11**	**0.34**	**0.03**				
	3.34E-04	2.26E+00	1.47E-01	8.63E-04	7.25E-04	2.41E+00			
	3.34E-04	*2.26E+00*	*1.47E-01*	*8.63E-04*	*7.25E-04*	*2.41E+00*	*7.36E-03*	*2.52E-02*	
F	2.68E-03	1.25E+00	8.19E-01	4.56E-02	4.02E-03	2.12E+00			HpGe
%	**0.13**	**58.93**	**38.61**	**2.15**	**0.19**			8.52E+00	

Decay corrected isotopic fractions

WITHOUT Am-241	
Weight fraction of Pu-238	0.0001388
Weight fraction of Pu-239	0.938118
Weight fraction of Pu-240	0.061083
Weight fraction of Pu-241	0.0003585
Weight fraction of Pu-242	0.0003014

RESULTS IN GREEN UNDERLINE ABOVE

WITH Am-241	
Weight fraction of Pu-238 =	0.0001384
Weight fraction of Pu-239 =	0.9352585
Weight fraction of Pu-240 =	0.0608972
Weight fraction of Pu-241 =	0.0003574
Weight fraction of Pu-242 =	0.0003005
Weight fraction of Am-241=	0.0030481

RESULTS IN BLUE ITALICS ABOVE

SA, Am-241 =	3.431 Ci/g
SA, Pu-238 =	17.142
SA, Pu-239 =	0.062
SA, Pu-240 =	0.023
SA, Pu-241 =	103.098
SA, Pu-242 =	3.94E-03