Duratek

Bristol-Myers Squibb
Former Radiopharmaceutical Production Facility
Final Status Survey Report
Tritium Analysis Detailed Results

APPENDIX D
BOOK 4 of 4
September 2003

APPENDIX D
BRISTOL-MYERS SQUIBB
FORMER RADIOPHARMACEUTICAL PRODUCTION FACILITY
FINAL STATUS SURVEY
TRITIUM ANALYSIS DETAILED RESULTS

for the

Bristol-Myers Squibb
Former Radiopharmaceutical Production Facility
Characterization Report

REVISION 0
SEPTEMBER 2003

Prepared By:
Duratek, Inc.
Commercial Services
1009 Commerce Park Drive
Oak Ridge, TN 37830

TABLE OF CONTENTS

TAB 1

An AREVA and Siemens Company

DURATEK, INC.
DATA PACKETS

Samples
L5345-01 - L5345-16

FRAMATOME ANP
ENVIRONMENTAL LABORATORY
29 Research Drive
Westborough, MA 01581-3913
(508) 898-9970 Fax (508) 836-9815

FRAMATOME ANP DE&S ENVIRONMENTAL LABORATORY SAMPLE SUBMISSION FORM
(ENVIRONMENTAL/BIOASSAY SAMPLES)

Client Name: **Duratek Inc/Bristol-Myers Squibb**

Client Purchase Order/Contract:

Date of Shipment:

Program: **REMP** ☐ **Non-REMP** ☐

Requested Turnaround Time (TAT): ☒ Standard ☐ Rush (***COST MULTIPLIER MAY APPLY***)
___ Working Days (***SPECIFY NUMBER***)

Name/Address of Client Representative: Paul Ely

(Person(s) who should receive the results)

Phone: _____ Fax: _____

WEEK NO	YEAR	LSN	Sample Type	Station and Description	Collection Period (All Dates/Times Must Reflect EST or EDT) Start Date (If Applicable) Month	Start Date Day	Start Date Year	Start Date Hour	Stop Date (Required) Month	Stop Date Day	Stop Date Year	Stop Date Hour	Mid-point Date (If Applicable) Month	Mid-point Date Day	Mid-point Date Year	Mid-point Date Hour	Total Sample Amount Shipped (Specify Units)	Radiological Analyses (Check All That Apply) Gross Alpha	Gross Beta	I-131 in Charcoal	Ni-63	Fe-55	Gamma	H-3	I-131 LL - (Specify)	P-32	C-14	Am-241,Cm-242,243/244	Np-237	Pu -238,239/240	Pu-241	Ra-226 (Specify)	Ra-228 (Specify)	Sr-89,90	Tc-99	U-234, 235, 238	Uranium Total	Th-230,232	Other (Specify)	Quarterly Composite Sample belongs to Qtr (1,2,3,4)	Q H-3	Q Sr-89,90	Q Gamma	Other (Specify)
18	03	5445-01	*water*	**BMS-T-1**					04	30	03	12:00												X																		
18	03	02	*water*	**BMS-T-3**					04	30	03	12:00												X																		
18	03	03	*water*	**BMS-T-5**					04	30	03	12:00												X																		
18	03	04	*water*	**BMS-T-6**					04	30	03	12:00												X																		
18	03	05	*water*	**BMS-T-9**					04	30	03	12:00												X																		
18	03	06	*water*	**BMS-T-10**					04	30	03	12:00												X																		
18	03	07	*water*	**BMS-T-11**					04	30	03	12:00												X																		
18	03	08	*water*	**BMS-T-12**					04	30	03	12:00												X																		
18	03	09	*water*	**BMS-T-13**					04	30	03	12:00												X																		
18	03	10	*water*	**BMS-T-14**					04	30	03	12:00												X																		
18	03	11	*water*	**BMS-T-17** SP 5/14/03					04	30	03	12:00												X																		

Chain of Custody		Field Treatment/Comments	SPECIFY METHOD	ELAB ACCEPTANCE STAMP
Relinquished By:	Date:		*(Internal Lab Use ONLY)*	FRAMATOME ANP E-LAB ACCEPTED MAY 02 2003 MONITORED BY:
Collected By:	Phone Number:		___ RA-226 (A)	
Received By: SP	Date: 5/2/03		___ RADIUMA_EPA	
ELAB Comments: 5445			___ RA-228 (PROC. 1300)	
			___ RA-228_EPA (PROC. 1311)	
			___ I-131LL (BETA/GAMMA)	
			___ I-131LL (GAS PROPORTIONAL)	
			___ OTHER	

FRAMATOME ANP DE&S ENVIRONMENTAL LABORATORY SAMPLE SUBMISSION FORM
(ENVIRONMENTAL/BIOASSAY SAMPLES)

Client Name: **Duratek Inc/Bristol-Myers Squibb**

Client Purchase Order/Contract: _____

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Phone: _____ Fax: _____

WEEK NO	YEAR	LSN	Sample Type	Station and Description	Collection Period (All Dates/Times Must Reflect EST or EDT) Start Date (If Applicable) Month	Start Date Day	Start Date Year	Start Date Hour	Stop Date (Required) Month	Stop Date Day	Stop Date Year	Stop Date Hour	Mid-point Date (If Applicable) Month	Mid-point Date Day	Mid-point Date Year	Mid-point Date Hour	Total Sample Amount Shipped (Specify Units)	Radiological Analyses (Check All That Apply) Gross Alpha	Gross Beta	I-131 in Charcoal	Ni-63	Fe-55	Gamma	H-3	I-131 LL - (Specify)	P-32	C-14	Am-241,Cm-242,243/244	Np-237	Pu -238,239/240	Pu-241	Ra-226 (Specify)	Ra-228 (Specify)	Sr-89,90	Tc-99	U-234, 235, 238	Uranium Total	Th-230,232	Other (Specify)	Quarterly Composite Sample belongs to Qtr (1,2,3,4)	Q H-3	Q Sr-89,90	Q Gamma	Other (Specify)
18	03	12	*water*	**BMS-T-19**					04	30	03	12:00												X																	
18	03	13	*water*	**BMS-T-20**					04	30	03	12:00												X																	
18	03	14	*water*	**BMS-T-22**					04	30	03	12:00												X																	
18	03	15	*water*	**BMS-T-23**					04	30	03	12:00												X																	

Chain of Custody		Field Treatment/Comments	SPECIFY METHOD	ELAB ACCEPTANCE STAMP
Relinquished By:	Date:		*(Internal Lab Use ONLY)*	
Collected By:	Phone Number:		___ RA-226 (A)	
Received By: dp	Date: 5/2/03		___ RADIUMA_EPA	
ELAB Comments:			___ RA-228 (PROC. 1300)	
			___ RA-228_EPA (PROC. 1311)	
			___ I-131LL (BETA/GAMMA)	
			___ I-131LL (GAS PROPORTIONAL)	
			___ OTHER	

L5445

LeC 5/2/03

Client: **Duratek, Inc**
Project: **Bristol-Myers Squibb**

Duratek Purchase Order # 15313

Samples Collected by
Betty & Doug Kjos, Don Schumaker

CHAIN OF CUSTODY RECORD
BMS-005

SM DUR

Duratek, Inc.
1009 Commerce Park
Oak Ridge, TN 337830

Project Manager: Paul Ely
(865) 425-4590-Duratek Office
(865) 414-1973-cell

Sample ID	date	Sample turnaround time	matrix	preservative	number of containers	Tritium									Remarks
BMS-T-1	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-3	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-5	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-6	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-9	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-10	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-11	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-12	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-13	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-14	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-17	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:
	4-30-03						

Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Remarks:

Matrix codes: s-Soil, m-Misc Solid, V-Vegetation, L-Sludge, W-Water, G-Ground Water, D-Drinking Water, Z-Waste Water, M-Misc Liquid, F-Filter or Smear

Rec 5/2/03

Client: **Duratek, Inc**
Project: Bristol-Myers Squibb

Duratek Purchase Order # 15313

Samples Collected by
Betty & Doug Kjos, Don Schumaker

CHAIN OF CUSTODY RECORD
BMS-005

Duratek, Inc.
1009 Commerce Park
Oak Ridge, TN 337830

Project Manager: Paul Ely
(865) 425-4590-Duratek Office
(865) 414-1973-cell

Sample ID	date	Sample turnaround time	matrix	preservative	number of containers	Tritium									Remarks
BMS-T-19	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-20	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-22	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water
BMS-T-23	4/30/03	Std	W	N/A	1	X									Tritium Smear in DI Water

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:
	4-30-03						

Relinquished by:	Date:	Time:	Received by:	Date:	Time:	Remarks:

Matrix codes: s-Soil, m-Misc Solid, V-Vegetation, L-Sludge, W-Water, G-Ground Water, D-Drinking Water, Z-Waste Water, M-Misc Liquid, F-Filter or Smear

FRAMATOME ANP

Framatome ANP

Login Chain of Custody Report (ln01)

May. 14, 2003

01:18 PM

Login Number: L5445

Account: 00435 Duratek Inc

Project: OTHER ENVIRON-DUR Duratek Other Environmental

Laboratory Sample Number	Client Sample ID	Collect Date	Receive Date	Due Date	Start Date / Stop Date	Volume / Comments
L5445-01	BMS-T-1	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-02	BMS-T-3	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-03	BMS-T-5	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-04	BMS-T-6	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-05	BMS-T-9	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-06	BMS-T-10	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-07	BMS-T-11	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-08	BMS-T-12	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-09	BMS-T-13	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-10	BMS-T-14	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-11	BMS-T-17	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-12	BMS-T-19	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				

Signature : _____

Date : 5/14/03

FRAMATOME ANP

Framatome ANP

Login Chain of Custody Report (ln01)

May. 14, 2003

01:18 PM

Login Number: L5445

Account: 00435 Duratek Inc

Project: OTHER ENVIRON-DUR Duratek Other Environmental

Laboratory Sample Number	Client Sample ID	Collect Date	Receive Date	Due Date	Start Date / Stop Date	Volume / Comments
L5445-13	BMS-T-20	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-14	BMS-T-22	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				
L5445-15	BMS-T-23	30-APR-03 12:00	02-MAY-03		30-APR-03 12:00	
Smear	H-3	Hold:				

Signature : LP

Date : 5/14/03

FRAMATOME ANP

Environmental Laboratory
29 Research Drive
Westborough, MA 01581

July 07, 2003

Duratek Inc
1009 Commerce Park Drive
Suite 100
Oak Ridge, TN 37830

ATT: Paul Ely

Dear Paul Ely :

Framatome-ANP Environmental Laboratory received the samples listed below from your company on 02-MAY-03. Please verify that the data and requested analyses are correct. Analysis reports will be submitted when the requested analyses have been completed and the results approved.

Media	Client ID	Site	Reference Date	Lab Sample #	Analysis Requested
Smear	BMS-T-1		30-APR-03 12:00	L5445-01	H-3
Smear	BMS-T-3		30-APR-03 12:00	L5445-02	H-3
Smear	BMS-T-5		30-APR-03 12:00	L5445-03	H-3
Smear	BMS-T-6		30-APR-03 12:00	L5445-04	H-3
Smear	BMS-T-9		30-APR-03 12:00	L5445-05	H-3
Smear	BMS-T-10		30-APR-03 12:00	L5445-06	H-3
Smear	BMS-T-11		30-APR-03 12:00	L5445-07	H-3
Smear	BMS-T-12		30-APR-03 12:00	L5445-08	H-3
Smear	BMS-T-13		30-APR-03 12:00	L5445-09	H-3
Smear	BMS-T-14		30-APR-03 12:00	L5445-10	H-3
Smear	BMS-T-17		30-APR-03 12:00	L5445-11	H-3
Smear	BMS-T-19		30-APR-03 12:00	L5445-12	H-3
Smear	BMS-T-20		30-APR-03 12:00	L5445-13	H-3
Smear	BMS-T-22		30-APR-03 12:00	L5445-14	H-3
Smear	BMS-T-23		30-APR-03 12:00	L5445-15	H-3

If you have any questions regarding these samples, please contact me at (508)898-9970, ext. 2557 or email: Sakshi.Punjabi@Framatome-anp.com.

Sincerely,

Sakshi Punjabi
Sample Receipt Technician

Notes:

c:

CASE NARRATIVE

DURATEK DATA PACKET

H-3

1. Agitate samples for 4 hours

2. Filter samples through .45 um filter

3. Weigh filtrate

4. Take desired aliquot (1 mL), adjust to desired geometry and give to counting

5. Calculate the sample weight based on total weight received for analysis for reporting H-3 concentration on a per sample basis

FRAMATOME ANP

Environmental Laboratory Analysis Report

29 Research Drive
Westboro, MA 01581
508-898-9970

Customer

Duratek Inc
1009 Commerce Park Drive
Suite 100
Oak Ridge, TN 37830

Attn: Paul Ely

Product H-3

Report Date 07/11/03
Receipt Date 05/02/03

LSN	Client ID & Description	Reference Date	Analysis Date	Nuclide	Activity Concentration +/- 1-Sigma (pCi/sample)	TPU 1 Sigma (pCi/sample)	Measured MDC (pCi/sample)	Required MDC (pCi/sample)	Flags	Reporting Level Ratio
Smear										
L5445-01	BMS-T-1	04/30/2003	07/10/2003	H-3	-2.5E+01 +/- 2.1E+01	2.1E+01	6.4E+01	5.0E+03		
L5445-02	BMS-T-3	04/30/2003	07/10/2003	H-3	2E+00 +/- 2.3E+01	2.3E+01	7.1E+01	5.0E+03		
L5445-03	BMS-T-5	04/30/2003	07/10/2003	H-3	1.3E+01 +/- 2.4E+01	2.4E+01	7.3E+01	5.0E+03		
L5445-04	BMS-T-6	04/30/2003	07/10/2003	H-3	-7E+00 +/- 2.3E+01	2.3E+01	7.3E+01	5.0E+03		
L5445-05	BMS-T-9	04/30/2003	07/10/2003	H-3	1.6E+01 +/- 2.3E+01	2.3E+01	7.1E+01	5.0E+03		
L5445-06	BMS-T-10	04/30/2003	07/10/2003	H-3	-2.3E+01 +/- 2.2E+01	2.2E+01	6.7E+01	5.0E+03		
L5445-07	BMS-T-11	04/30/2003	07/10/2003	H-3	-2.7E+01 +/- 2.1E+01	2.1E+01	6.8E+01	5.0E+03		
L5445-08	BMS-T-12	04/30/2003	07/10/2003	H-3	-2.5E+01 +/- 2.1E+01	2.1E+01	6.6E+01	5.0E+03		
L5445-09	BMS-T-13	04/30/2003	07/10/2003	H-3	-1.7E+01 +/- 2.2E+01	2.2E+01	7.0E+01	5.0E+03		
L5445-10	BMS-T-14	04/30/2003	07/10/2003	H-3	-1.2E+01 +/- 1.2E+01	1.2E+01	3.8E+01	5.0E+03		

Flags:
a The measured MDC is greater than the required MDC.
b The activity concentration is greater than three times its one sigma counting uncertainty.

Approved by

J. M. Raimondi
Sample Control Manager

c:

MAILED
JUL 14 2003
FRAMATOME ANP
ENVIRONMENTAL LAB

FRAMATOME ANP

Environmental Laboratory Analysis Report

29 Research Drive
Westboro, MA 01581
508-898-9970

Customer

Duratek Inc
1009 Commerce Park Drive
Suite 100
Oak Ridge, TN 37830

Attn: Paul Ely

Product H-3

Report Date 07/11/03
Receipt Date 05/02/03

LSN	Client ID & Description	Reference Date	Analysis Date	Nuclide	Activity Concentration +/- 1-Sigma (pCi/sample)	TPU 1 Sigma (pCi/sample)	Measured MDC (pCi/sample)	Required MDC (pCi/sample)	Flags	Reporting Level Ratio
Smear										
L5445-11	BMS-T-17	04/30/2003	07/10/2003	H-3	-3E+00 +/- 2.7E+01	2.7E+01	8.3E+01	5.0E+03		
L5445-12	BMS-T-19	04/30/2003	07/10/2003	H-3	-7E+00 +/- 2.1E+01	2.1E+01	6.4E+01	5.0E+03		
L5445-13	BMS-T-20	04/30/2003	07/10/2003	H-3	-2.5E+01 +/- 2.0E+01	2.0E+01	6.4E+01	5.0E+03		
L5445-14	BMS-T-22	04/30/2003	07/10/2003	H-3	-1.1E+01 +/- 2.0E+01	2.0E+01	6.4E+01	5.0E+03		
L5445-15	BMS-T-23	04/30/2003	07/10/2003	H-3	-1.2E+01 +/- 2.1E+01	2.1E+01	6.6E+01	5.0E+03		

Flags:
a The measured MDC is greater than the required MDC.
b The activity concentration is greater than three times its one sigma counting uncertainty.

Approved by
7/14/03
J. M. Raimondi
Sample Control Manager

c:

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-1

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-01** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	7.8655	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0039	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By [illegible]

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

iired MDC(s): H-3,5000;

le Id : L5445-01 Product : H-3
nt Id : BMS-T-1 Matrix : SM03 Smear
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	7.8655		
uot Weight	g	1.0034		
L WEIGHT	sample	.127569766		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:07
LKBCALC.EXE Rev. 1.4

BATCH ID.....: H0710035.658
LAB SAMPLE NO: L5445-01

Radionuclide analyzed .: H-3
Analysis System .....: LKB Unit No. 2
Analysis Date/Time ....: 07/10/2003 1:24
Analysis Performed by .: emm

Sample Description: LIQUID
Sample Type: S

Spectrum File .....: PARAM02\H55
Position in Batch .....: 003
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.12756977 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3
Counting time (min.) .....:	9.889
G Factor .....:	1.65E+00
SQP_E .....:	427.53
Detector Efficiency .....:	0.3553
Cross talk ratio .....:	1.84E+00
Calibration Date .....:	01/15/2002
Background CPM ...+-(1 sigma):	17.19 +- 1.31
Gross CPM .....+-(1 sigma):	15.97 +- 1.27
Net CPM .....+-(1 sigma):	-2.48 +- 2.05
Activity Conc. ...+-(1 sigma):	-2.5E+01 +- 2.06E+01
Minimum Detectable Conc. ....:	6.44E+01
Total Propagated Uncertainty :	2.07E+01
Contamination Ratio % .....:	2.45E+01
Contamination Activ Ratio ...:	-3.0E-01
Concentration to Sigma Ratio :	-1.2E+00
Concentration to TPU Ratio ..:	-1.2E+00
Units .....:	pCi/sample

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-3

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-02** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	8.7246	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0097	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By EG

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

ired MDC(s): H-3,5000;

le Id : L5445-02 Product : H-3
nt Id : BMS-T-3 Matrix : SM03 Smear
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	8.7246		
uot Weight	g	1.0097		
L WEIGHT	sample	.115730234		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:08 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-02

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 1:35
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 004
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.11573023 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3
Counting time (min.)	9.889
G Factor	1.65E+00
SQP_E	426.71
Detector Efficiency	0.3537
Cross talk ratio	1.82E+00
Calibration Date	01/15/2002
Background CPM ...+-(1 sigma):	17.19 +- 1.31
Gross CPM .....+-(1 sigma):	17.39 +- 1.32
Net CPM .....+-(1 sigma):	0.20 +- 2.06
Activity Conc. ...+-(1 sigma):	2.22E+00 +- 2.30E+01
Minimum Detectable Conc. ....:	7.13E+01
Total Propagated Uncertainty :	2.30E+01
Contamination Ratio % .....:	4.50E+02
Contamination Activ Ratio ...:	4.35E-01
Concentration to Sigma Ratio :	9.67E-02
Concentration to TPU Ratio ..:	9.67E-02
Units	pCi/sample

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-5

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-03** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	8.8829	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1,0070	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By [illegible]

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

ired MDC(s): H-3,5000;

le Id : L5445-03 Product : H-3
nt Id : BMS-T-5 Matrix : SM03 Smear
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	8.8829		
uot Weight	g	1.007		
L WEIGHT	sample	.113363878		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:08 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-03

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 1:45
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 005
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.11336388 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3
Counting time (min.)	9.889
G Factor	1.65E+00
SQP_E	426.22
Detector Efficiency	0.3527
Cross talk ratio	1.81E+00
Calibration Date	01/15/2002
Background CPM ...+-(1 sigma):	17.19 +- 1.31
Gross CPM .....+-(1 sigma):	18.40 +- 1.36
Net CPM .....+-(1 sigma):	1.09 +- 2.10
Activity Conc. ...+-(1 sigma):	1.25E+01 +- 2.39E+01
Minimum Detectable Conc. ....:	7.30E+01
Total Propagated Uncertainty :	2.40E+01
Contamination Ratio % .....:	-2.8E+01
Contamination Activ Ratio ...:	-1.5E-01
Concentration to Sigma Ratio :	5.23E-01
Concentration to TPU Ratio ..:	5.23E-01
Units	pCi/sample

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-6

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-04** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	8.9324	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	10.0070	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By BJ

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

iired MDC(s): H-3,5000;

le Id : L5445-04 Product : H-3
nt Id : BMS-T-6 Matrix : SM03 Smear
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	8.9324		
uot Weight	g	1.007		
L WEIGHT	sample	.112735658		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:09 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-04

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 1:56
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 006
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.11273566 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3	
Counting time (min.)	9.889	
G Factor	1.65E+00	
SQP_E	427.13	
Detector Efficiency	0.3545	
Cross talk ratio	1.83E+00	
Calibration Date	01/15/2002	
Background CPM ...+-(1 sigma):	17.19 +-	1.31
Gross CPM .....+-(1 sigma):	16.58 +-	1.29
Net CPM .....+-(1 sigma):	-0.61 +-	2.04
Activity Conc. ...+-(1 sigma):	-7.0E+00 +- 2.33E+01	
Minimum Detectable Conc. ....:	7.30E+01	
Total Propagated Uncertainty :	2.33E+01	
Contamination Ratio % .....:	1.33E+02	
Contamination Activ Ratio ...:	-4.0E-01	
Concentration to Sigma Ratio :	-3.0E-01	
Concentration to TPU Ratio ..:	-3.0E-01	
Units	pCi/sample	

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-9

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-05** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	8.6622	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0097	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By [illegible]

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

ıired MDC(s): H-3,5000;

ɔle Id : L5445-05
ɛnt Id : BMS-T-9
ɜ :
ıents :
ɛnt : 00435 Duratek Inc
ject : OTHER ENVIRON-DUR
ˈt Date :
.ect Date : 04/30/03 12:00

Product : H-3
Matrix : SM03 Smear

ameter	Units	Numvalue	Textvalue	Datevalue
ANCE NUMBER			F30560	
ɔle Weight	g	8.6622		
quot Weight	g	1.0097		
AL WEIGHT	sample	.116563921		
TAINER			FSCN	
IVITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:09 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-05

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 2:07
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 007
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.11656392 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3
Counting time (min.)	9.889
G Factor	1.65E+00
SQP_E	427.02
Detector Efficiency	0.3543
Cross talk ratio	1.83E+00
Calibration Date	01/15/2002
Background CPM ...+-(1 sigma):	17.19 +- 1.31
Gross CPM .....+-(1 sigma):	18.60 +- 1.37
Net CPM .....+-(1 sigma):	1.41 +- 2.09
Activity Conc. ...+-(1 sigma):	1.55E+01 +- 2.31E+01
Minimum Detectable Conc. ....:	7.07E+01
Total Propagated Uncertainty :	2.31E+01
Contamination Ratio % .....:	3.55E+01
Contamination Activ Ratio ...:	2.43E-01
Concentration to Sigma Ratio :	6.73E-01
Concentration to TPU Ratio ..:	6.73E-01
Units	pCi/sample

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
EMS-T-10

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-06** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	8.1444	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	.9994	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By LG

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

ired MDC(s): H-3,5000;

le Id : L5445-06 Product : H-3
nt Id : BMS-T-10 Matrix : SM03 Smear
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	8.1444		
uot Weight	g	.9994		
L WEIGHT	sample	.122710083		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:10 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-06

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 2:17
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 008
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.12271008 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3
Counting time (min.)	9.889
G Factor	1.65E+00
SQP_E	427.39
Detector Efficiency	0.3550
Cross talk ratio	1.84E+00
Calibration Date	01/15/2002
Background CPM ...+-(1 sigma):	17.19 +- 1.31
Gross CPM .....+-(1 sigma):	16.48 +- 1.29
Net CPM .....+-(1 sigma):	-2.19 +- 2.06
Activity Conc. ...+-(1 sigma):	-2.3E+01 +- 2.16E+01
Minimum Detectable Conc. ....:	6.70E+01
Total Propagated Uncertainty :	2.17E+01
Contamination Ratio % .....:	1.06E+02
Contamination Activ Ratio ...:	-1.2E+00
Concentration to Sigma Ratio :	-1.1E+00
Concentration to TPU Ratio ..:	-1.1E+00
Units	pCi/sample

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-11

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-07** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	8.3286	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0097	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By BH

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

ired MDC(s): H-3,5000;

le Id : L5445-07 Product : H-3
nt Id : BMS-T-11 Matrix : SM03 Smear
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	8.3286		
uot Weight	g	1.0097		
L WEIGHT	sample	.121232860		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:10 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-07

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 2:28
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 009
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.12123286 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3
Counting time (min.)	9.889
G Factor	1.65E+00
SQP_E	428.03
Detector Efficiency	0.3562
Cross talk ratio	1.85E+00
Calibration Date	01/15/2002
Background CPM ...+-(1 sigma):	17.19 +- 1.31
Gross CPM .....+-(1 sigma):	15.26 +- 1.24
Net CPM .....+-(1 sigma):	-2.58 +- 2.02
Activity Conc. ...+-(1 sigma):	-2.7E+01 +- 2.14E+01
Minimum Detectable Conc. ....:	6.76E+01
Total Propagated Uncertainty :	2.14E+01
Contamination Ratio % .....:	-3.9E+01
Contamination Activ Ratio ...:	4.88E-01
Concentration to Sigma Ratio :	-1.3E+00
Concentration to TPU Ratio ..:	-1.3E+00
Units	pCi/sample

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-12

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-08** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	8.0522	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0038	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By GB

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

ired MDC(s): H-3,5000;

le Id : L5445-08 Product : H-3
nt Id : BMS-T-12 Matrix : SM03 Smear
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	8.0522		
uot Weight	g	1.0038		
L WEIGHT	sample	.124661583		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:11 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-08

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 2:38
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 010
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.12466158 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3
Counting time (min.)	9.889
G Factor	1.65E+00
SQP_E	427.35
Detector Efficiency	0.3549
Cross talk ratio	1.83E+00
Calibration Date	01/15/2002
Background CPM ...+-(1 sigma):	17.19 +- 1.31
Gross CPM .....+-(1 sigma):	15.57 +- 1.25
Net CPM .....+-(1 sigma):	-2.44 +- 2.03
Activity Conc. ...+-(1 sigma):	-2.5E+01 +- 2.10E+01
Minimum Detectable Conc. ....:	6.59E+01
Total Propagated Uncertainty :	2.10E+01
Contamination Ratio % .....:	6.21E+01
Contamination Activ Ratio ...:	-7.6E-01
Concentration to Sigma Ratio :	-1.2E+00
Concentration to TPU Ratio ..:	-1.2E+00
Units	pCi/sample

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-13

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-09** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	8.5539	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0019	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By [illegible]

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

ired MDC(s): H-3,5000;

le Id : L5445-09
nt Id : BMS-T-13
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

Product : H-3
Matrix : SM03 Smear

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	8.5539		
uot Weight	g	1.0019		
L WEIGHT	sample	.117127859		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:11 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-09

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 2:49
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 011
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.11712786 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3	
Counting time (min.)	9.889	
G Factor	1.65E+00	
SQP_E	427.59	
Detector Efficiency	0.3554	
Cross talk ratio	1.84E+00	
Calibration Date	01/15/2002	
Background CPM ...+-(1 sigma):	17.19 +-	1.31
Gross CPM .....+-(1 sigma):	15.77 +-	1.26
Net CPM .....+-(1 sigma):	-1.58 +-	2.03
Activity Conc. ...+-(1 sigma):	-1.7E+01 +-	2.22E+01
Minimum Detectable Conc. ....:	7.01E+01	
Total Propagated Uncertainty :	2.23E+01	
Contamination Ratio % .....:	4.47E+01	
Contamination Activ Ratio ...:	-3.5E-01	
Concentration to Sigma Ratio :	-7.8E-01	
Concentration to TPU Ratio ..:	-7.8E-01	
Units	pCi/sample	

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-14

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-10** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	4.5887	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	_____	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0050	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By EH

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

iired MDC(s): H-3,5000;

ole Id : L5445-10
ent Id : BMS-T-14
: :
ients :
ent : 00435 Duratek Inc
ject : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

Product : H-3
Matrix : SM03 Smear

ameter	Units	Numvalue	Textvalue	Datevalue
ANCE NUMBER			F30560	
ole Weight	g	4.5887		
quot Weight	g	1.005		
AL WEIGHT	sample	.219016279		
TAINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:12 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-10

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 2:59
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 012
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.21901628 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3
Counting time (min.)	9.889
G Factor	1.65E+00
SQP_E	427.00
Detector Efficiency	0.3542
Cross talk ratio	1.83E+00
Calibration Date	01/15/2002
Background CPM ...+-(1 sigma):	17.19 +- 1.31
Gross CPM .....+-(1 sigma):	16.17 +- 1.27
Net CPM .....+-(1 sigma):	-2.01 +- 2.05
Activity Conc. ...+-(1 sigma):	-1.2E+01 +- 1.21E+01
Minimum Detectable Conc. ....:	3.76E+01
Total Propagated Uncertainty :	1.21E+01
Contamination Ratio % .....:	1.21E+02
Contamination Activ Ratio ...:	-1.2E+00
Concentration to Sigma Ratio :	-9.8E-01
Concentration to TPU Ratio ..:	-9.8E-01
Units	pCi/sample

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-17

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-11** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	10.010	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0058	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By _____

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

ired MDC(s): H-3,5000;

le Id : L5445-11
nt Id : BMS-T-17
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

Product : H-3
Matrix : SM03 Smear

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	10.0101		
uot Weight	g	1.0058		
L WEIGHT	sample	.100478516		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:12 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-11

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 3:10
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 013
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.10047852 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3
Counting time (min.)	9.889
G Factor	1.65E+00
SQP_E	425.66
Detector Efficiency	0.3516
Cross talk ratio	1.80E+00
Calibration Date	01/15/2002
Background CPM ...+-(1 sigma):	17.19 +- 1.31
Gross CPM .....+-(1 sigma):	18.10 +- 1.35
Net CPM .....+-(1 sigma):	-0.21 +- 2.11
Activity Conc. ...+-(1 sigma):	-2.8E+00 +- 2.72E+01
Minimum Detectable Conc.	8.26E+01
Total Propagated Uncertainty :	2.72E+01
Contamination Ratio %	-6.6E+02
Contamination Activ Ratio ...:	6.78E-01
Concentration to Sigma Ratio :	-1.0E-01
Concentration to TPU Ratio ..:	-1.0E-01
Units	pCi/sample

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-19

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-12** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	7.8077	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0107	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By [illegible]

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

iired MDC(s): H-3,5000;

ole Id : L5445-12
ent Id : BMS-T-19
e :
ments :
ent : 00435 Duratek Inc
ject : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

Product : H-3
Matrix : SM03 Smear

ameter	Units	Numvalue	Textvalue	Datevalue
ANCE NUMBER			F30560	
ole Weight	g	7.8077		
quot Weight	g	1.0107		
AL WEIGHT	sample	.129449133		
TAINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:13
LKBCALC.EXE Rev. 1.4

BATCH ID.....: H0710035.658
LAB SAMPLE NO: L5445-12

Radionuclide analyzed .: H-3
Analysis System .....: LKB Unit No. 2
Analysis Date/Time ....: 07/10/2003 3:21
Analysis Performed by .: emm

Sample Description: LIQUID
Sample Type: S

Spectrum File .....: PARAM02\H55
Position in Batch .....: 014
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.12944913 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3
Counting time (min.)	9.889
G Factor	1.65E+00
SQP_E	426.41
Detector Efficiency	0.3531
Cross talk ratio	1.81E+00
Calibration Date	01/15/2002
Background CPM ...+-(1 sigma):	17.19 +- 1.31
Gross CPM .....+-(1 sigma):	17.49 +- 1.32
Net CPM .....+-(1 sigma):	-0.70 +- 2.09
Activity Conc. ...+-(1 sigma):	-7.0E+00 +- 2.08E+01
Minimum Detectable Conc.	6.38E+01
Total Propagated Uncertainty :	2.08E+01
Contamination Ratio %	5.83E+01
Contamination Activ Ratio ...	-2.0E-01
Concentration to Sigma Ratio :	-3.4E-01
Concentration to TPU Ratio ..	-3.4E-01
Units	pCi/sample

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-20

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-13** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	7.8881	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0080	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 5/10/03 LKB # 2 Counted By SJ

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

ired MDC(s): H-3,5000;

le Id : L5445-13 Product : H-3
nt Id : BMS-T-20 Matrix : SM03 Smear
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	7.8881		
uot Weight	g	1.008		
L WEIGHT	sample	.127787426		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY

• LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:13 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-13

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 3:31
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 015
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.12778743 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3	
Counting time (min.)	9.889	
G Factor	1.65E+00	
SQP_E	427.80	
Detector Efficiency	0.3558	
Cross talk ratio	1.84E+00	
Calibration Date	01/15/2002	
Background CPM ...+-(1 sigma):	17.19 +-	1.31
Gross CPM .....+-(1 sigma):	14.66 +-	1.21
Net CPM .....+-(1 sigma):	-2.53 +-	1.99
Activity Conc. ...+-(1 sigma):	-2.5E+01 +- 2.00E+01	
Minimum Detectable Conc. ....:	6.42E+01	
Total Propagated Uncertainty :	2.01E+01	
Contamination Ratio % .....:	4.35E+00	
Contamination Activ Ratio ...:	-5.4E-02	
Concentration to Sigma Ratio :	-1.3E+00	
Concentration to TPU Ratio ..:	-1.3E+00	
Units	pCi/sample	

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-22

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-14** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	7.7487	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	7.9980	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By [illegible]

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

ired MDC(s): H-3,5000;

le Id : L5445-14 Product : H-3
nt Id : BMS-T-22 Matrix : SM03 Smear
:
ents :
nt : 00435 Duratek Inc
ect : OTHER ENVIRON-DUR
t Date :
ect Date : 04/30/03 12:00

meter	Units	Numvalue	Textvalue	Datevalue
NCE NUMBER			F30560	
le Weight	g	7.7487		
uot Weight	g	.998		
L WEIGHT	sample	.128795798		
AINER			FSCN	
VITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:14 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-14

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 3:42
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 016
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.12879580 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3	
Counting time (min.)	9.889	
G Factor	1.65E+00	
SQP_E	427.00	
Detector Efficiency	0.3542	
Cross talk ratio	1.83E+00	
Calibration Date	01/15/2002	
Background CPM ...+-(1 sigma):	17.19 +-	1.31
Gross CPM .....+-(1 sigma):	16.17 +-	1.27
Net CPM .....+-(1 sigma):	-1.07 +-	2.04
Activity Conc. ...+-(1 sigma):	-1.1E+01 +-	2.04E+01
Minimum Detectable Conc. ....:	6.40E+01	
Total Propagated Uncertainty :	2.04E+01	
Contamination Ratio % .....:	-6.5E+01	
Contamination Activ Ratio ...:	3.39E-01	
Concentration to Sigma Ratio :	-5.3E-01	
Concentration to TPU Ratio ..:	-5.3E-01	
Units	pCi/sample	

NOTES:

Required MDC is 5000.00 pCi/sample

Duratek Inc
OTHER ENVIRON-DUR
BMS-T-23

THE DETERMINATION OF H-3 IN ENVIRONMENTAL MATRICES

Lab Sample Number **L5445-15** Sample Type **Smear** **SM03**

Prepared By _____ on _____ Reference Date/Time **APR-30-2003 12:00**

LIQUID SAMPLE

Balance Number:

1. Density of Original Sample*	(d)	_____	g/mL
2. Aliquot Taken for H-3 Analysis	(A1)	_____	g
3. Volume of Aliquot A2 = (A1/d)	(A2)	8.0433	mL
4. Volume of H_2O Added to Aliquot (if aliquot < 25mL)	(A3)	_____	mL
5. Final Volume in Flask (A2 + A3)	(A4)	1.0040	mL

*Required for DOE, Analytics, NU, or non-affiliate samples

SOLID SAMPLE

Balance Number: _____

1. Aliquot taken for H-3 Analysis (use 1 for pipes)	(B1)	_____	g
2. Weight of H_2O added to Aliquot	(B2)	_____	g
3. Weight of acids added to Aliquot	(B3)	_____	g
4. Final Weight of liquid in Flask (B2 + B3)	(B4)	_____	g

TRANSFER OF H-3

Balance Number: **F30560**

1. Weight of Vial and H-3	(W1)	_____	g
2. Weight of Empty Vial	(W2)	_____	g
3. Weight of H-3 (W1 - W2)	(W3)	_____	g

WEIGHT OF ORIGINAL RAW MATERIAL TO BE USED FOR REPORTING PURPOSES:

1. DOE, Analytics, NU or non-affiliate Liquid	(W3/d)	_____	mL
2. Liquid (Undiluted)#	(W3*F)	_____	g
3. Liquid (Diluted)	(W3*A2/A4)	_____	g
4. Solid	(B1*W2/B4)	_____	g
5. Liquid (Direct Aliquot)	(W3/F or d)	_____	g/mL

LIQUID SCINTILLATION ANALYSIS

Count Date 7/10/03 LKB # 2 Counted By [illegible]

Recount Date _____ LKB # _____ Counted By _____

# F = 0.98 for undiluted liquid samples preserved with 80 mL of acid per gallon;
F = 1 for untreated liquid samples

Framatome ANP
Results Data Report

Required MDC(s): H-3,5000;

Sample Id : L5445-15
Client Id : BMS-T-23
Site :
Comments :
Client : 00435 Duratek Inc
Project : OTHER ENVIRON-DUR
Start Date :
Collect Date : 04/30/03 12:00

Product : H-3
Matrix : SM03 Smear

Parameter	Units	Numvalue	Textvalue	Datevalue
BALANCE NUMBER			F30560	
Sample Weight	g	8.0433		
Aliquot Weight	g	1.004		
FINAL WEIGHT	sample	.124824387		
CONTAINER			FSCN	
ACTIVITY UNITS	pCi			

ENVIRONMENTAL LABORATORY
LIQUID SCINTILLATION ACTIVITY CONCENTRATION REPORT

Printed on: 07/10/2003 15:43:14 BATCH ID.....: H0710035.658
LKBCALC.EXE Rev. 1.4 LAB SAMPLE NO: L5445-15

Radionuclide analyzed .: H-3 Sample Description: LIQUID
Analysis System .....: LKB Unit No. 2 Sample Type: S
Analysis Date/Time ....: 07/10/2003 3:52
Analysis Performed by .: emm

Spectrum File .....: PARAM02\H55
Position in Batch .....: 017
Recovery Percentage ...: 100.0
Sample Volume/weight ..: 0.12482439 sample

Decay Factor .....: 9.89E-01
Reference Date .....: 04/30/2003
Reference Time .....: 12:00

	H-3	
Counting time (min.)	9.889	
G Factor	1.65E+00	
SQP_E	427.60	
Detector Efficiency	0.3554	
Cross talk ratio	1.84E+00	
Calibration Date	01/15/2002	
Background CPM ...+-(1 sigma):	17.19 +-	1.31
Gross CPM .....+-(1 sigma):	16.07 +-	1.27
Net CPM .....+-(1 sigma):	-1.17 +-	2.03
Activity Conc. ...+-(1 sigma):	-1.2E+01 +-	2.09E+01
Minimum Detectable Conc. ....:	6.58E+01	
Total Propagated Uncertainty :	2.09E+01	
Contamination Ratio % .....:	4.34E+01	
Contamination Activ Ratio ...:	-2.5E-01	
Concentration to Sigma Ratio :	-5.8E-01	
Concentration to TPU Ratio ..:	-5.8E-01	
Units	pCi/sample	

NOTES:

Required MDC is 5000.00 pCi/sample

TAB 2

CALIBRATION INFORMATION

CALIBRATION DATE 10/15/94

SOFTWARE VERSION APT

DETECTOR DESCRIPTION Detector 2

EFFICIENCY FILE ARS1S002.EFF

POSITION N/A

GEOMETRY DESCRIPTION 47 mm diameter single air filter in petri dish

CALIBRATION STANDARD ID R42054-M

ENERGY RANGE OF CAL. 59.54 to 1836.01 keV

PERFORMED BY E. Moreno

REVIEWED BY C Lawrenz DATE 10/95

```
************************************
*  YANKEE ATOMIC ELECTRIC COMPANY  *
*       GAMMA ANALYSIS SYSTEM      *
*  EFFICIENCY CALIBRATION PROGRAM  *
************************************

File Name:  288802
Run Description:   AIRS-1 CALIBRATION
Operator:   EMM
Analysis performed using 'CALIBRATE' Rev. 1
```

Detector # 2

ENERGY CALIBRATION

(S t o r e d v a l u e s)

Zero offset: A0 = -.24568 keV
Slope: A1 = 1.00022 keV/channel
Energy calibration date = 101594

BACKGROUND CORRECTION DATA

Counted on 10893

ENERGY (keV)	145	352	911	1461	0
NET CPS	1.44E-03	6.36E-03	6.80E-04	2.22E-03	0.00E+00
VARIANCE	1.23E-02	1.44E-02	2.96E-03	3.65E-03	0.00E+00
ENERGY (keV)	0	0	0	0	0
NET CPS	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
VARIANCE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CALIBRATION SOURCE DATA

Count Date: 10/15/94 19:51
Reference date: 2/ 1/94 700
Elapsed hours: 6.1569E+03

Source I.D. Number: SSD2.01116

Peak Number	Energy (keV)	Std. Rate (gam/sec)	Corr. Rate (gam/sec)	Half Life (Days)
1	59.54	10970	122	157861.05
2	88.03	6230	47	464.00
3	122.06	5730	33	270.90
4	165.85	6120	19	137.66
5	391.69	20060	48	115.10
6	661.65	24100	265	11019.59
7	898.02	60580	128	106.60
8	1173.22	33090	337	1925.23
9	1836.01	64200	135	106.60

C A L I B R A T I O N D A T A

PEAK SEARCH PARAMETERS

Sensitivity = 7.00 Peak Sensitivity
Max_pkwidth = 12 Max. # of channels in peak
Termination = 1.10 Peak termination fraction
Tolerance = 5.00 keV tolerance for library match

COUNTING TIME = 5499 SEC DETECTOR 2

Peak #	Address Channel	Energy (keV)	Net Count	Baseline Count	Variance	# Of Channels	% Diff. from Hand-Calculated Area
1	58.95	58.72	69534	12517	94568	6	+2.2
2	87.78	87.55	39441	6669	51668	5	+2.6
3	121.85	121.63	28956	5080	38269	5	+0.5
4	165.65	165.44	13053	4764	21787	5	-0.67
5	391.67	391.51	16308	3991	24290	6	+0.28
6	661.66	661.56	55959	2790	61539	6	-0.08
7	898.06	898.01	18596	2631	23858	6	+0.34
8	1173.22	1173.23	37607	1400	40640	7	+0.16
9	1835.84	1836.01	10158	251	10743	8	+0.16

CENTROIDS ADDED

Peak No.	Energy (keV)	Net Count	Baseline Count	Centroid Channel	Variance Net Cts
1	58.72	68036	12510	59.14	93056
2	87.55	38449	4168	87.96	44701

EFFICIENCY CALIBRATION COEFFICIENTS

EFF. = 1/[.02314*E^(-2.04570) + 40.78539*E^(1.02292)]

Energy (keV)	Observed Efficiency	Standard Deviation	One-sigma % error	Calculated Efficiency	% Diff
58.72	1.012E-01	4.536E-04	.448	1.012E-01	.01
87.55	1.475E-01	8.112E-04	.550	1.481E-01	-.40
122.06	1.587E-01	1.072E-03	.676	1.549E-01	2.38
165.85	1.264E-01	1.430E-03	1.131	1.350E-01	-6.81
391.69	6.207E-02	5.932E-04	.956	6.332E-02	-2.00
661.65	3.845E-02	1.705E-04	.443	3.733E-02	2.91
898.02	2.651E-02	2.202E-04	.831	2.735E-02	-3.16
1173.22	2.031E-02	1.089E-04	.536	2.081E-02	-2.48
1836.01	1.367E-02	1.394E-04	1.020	1.317E-02	3.64

ABOVE CALIBRATION IN USE FROM 10/15/94 TO _____.

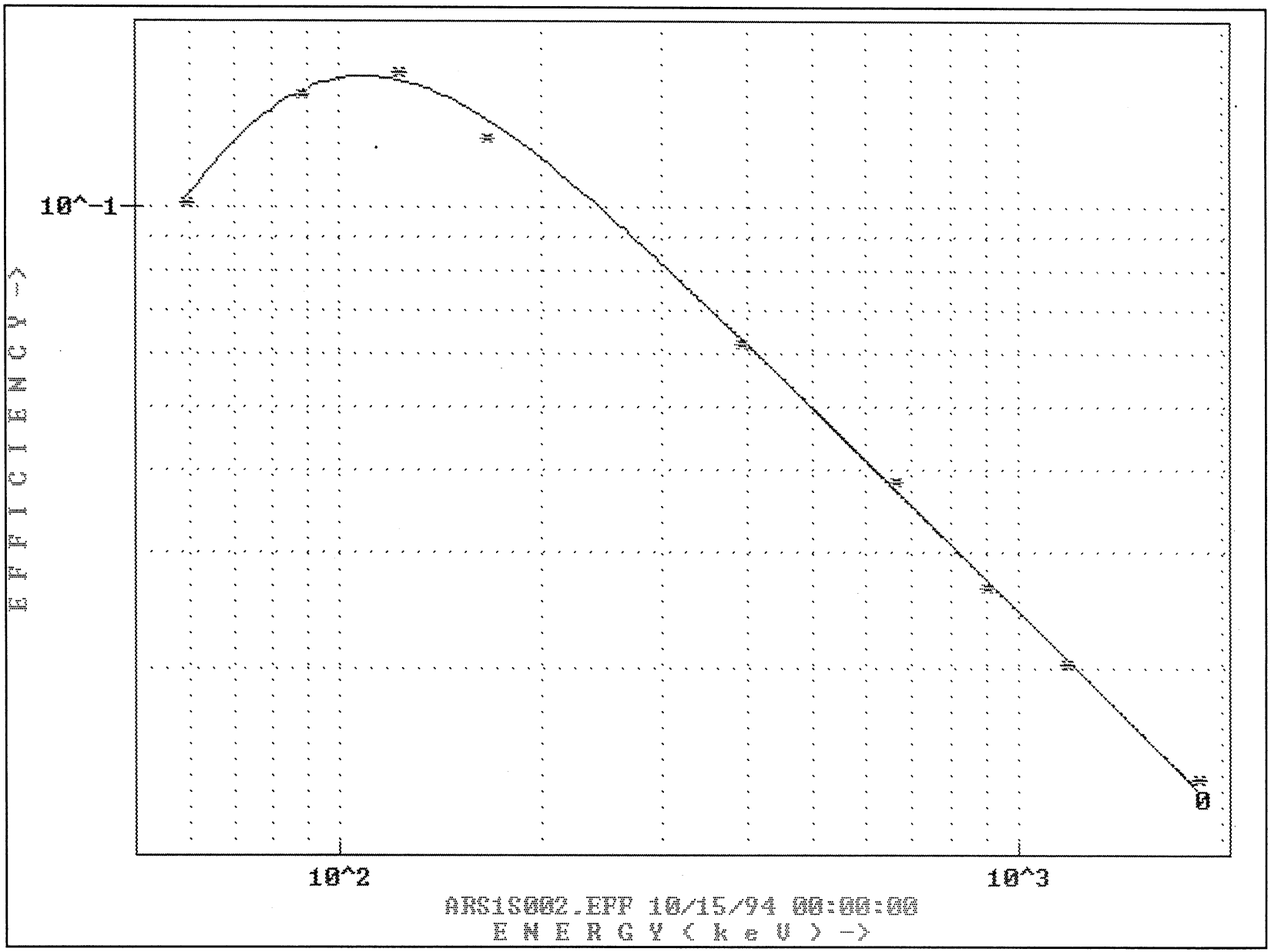
Efficiency coefficients and date stored under geometry code AIRS-1

EWW Note: -6.81% eff. tolerance is acceptable as calibration source was a solid geometry source counted above the detector end-cap.

EFFICIENCY FILE: ARS1S002.EFF
ID.: 47 mm glass fiber filter in petri dish

E =1/[2.31e-002*En^-2.05e+000 + 4.08e+001*En^1.02e+000] 10/15/94 00:00
(Where En = Energy in MeV)

Energy	Efficiency
59.5400	1.0120E-001
88.0300	1.4750E-001
122.1000	1.5870E-001
165.8500	1.2640E-001
391.6900	6.2070E-002
661.6500	3.8450E-002
898.0200	2.6510E-002
1173.2200	2.0310E-002
1836.0100	1.3670E-002


10^-1
0
10^2
10^3
EFFICIENCY
ARS1S002.EFF 10/15/94 00:00:00
ENERGY (keV) ->
EFFICIENCY

CERTIFICATE OF CONTENT
MIXED GAMMA SOURCE
AIRS-1 CALIBRATION SOURCE
R42054-M
[1-3.5 cm glass fiber filter in a plastic petri dish]

==========

Source Solution No: R4/20/54
Manufacturer: AMERSHAM
Primary/Secondary: primary
Licensed/Exempt: licensed
Reference Date: 02/01/94 07:00EST
Preparation Date: 08/12/94
Time Elapsed: 192 Days

Fraction of Total Activity Utilized: (1) 02.01116

Beginning Source Wt: 3.23279 G
Ending Source Wt: 3.12120 G
Net Weight: 0.11159 G

AIRS-1
R42054-M
3.23279 g
3.12120 g

Radionuclide	Energy (Mev)	Tot Gam/S 10G Primary	Gamma/ dis	Half Life (Days)	dpm, This Source on 02/01/94	dpm, This Source on 08/12/94	±Percent Uncertainty (1 σ)
Am-241	0.060	10970	0.3590	157861.05	20459	20442	1.217
Cd-109	0.088	6230	0.0372	464.00	112130	84170	1.528
Co-57	0.122	5730	0.8551	270.90	4487	2745	1.217
Ce-139	0.166	6120	0.8035	137.66	5100	1939	1.131
Hg-203	0.279	19830	0.7730	46.60	17176	988	1.236
Sn-113	0.392	20060	0.6490	115.10	20695	6512	1.736
Sr-85	0.514	38770	0.9927	64.84	26149	3358	1.236
Cs-137	0.662	24100	0.8512	11019.59	18957	18729	1.217
Y-88	0.898	60580	0.9340	106.60	43427	12461	1.553
Co-60	1.173	33090	1.0000	1925.23	22155	20675	1.019
Co-60	1.333	33120	1.0000	1925.23	22175	20694	1.019
Y-88	1.836	64200	0.9938	106.60	43253	12411	1.528

NOTES

1. The whole number portion depicts the data file utilized by the calibration program which reflects the data for the original source and the fractional part of the total activity in ten grams of primary standard solution.

2. The Hg-203 279 keV line should not be used for quantitative analysis.

3. Isotope abundance and half-life obtained from D. C. Kocher (DOE-TIC-11026)

An AIRS-1 calibration source was prepared by spiking a 47 mm diameter styrofoam filter with the mixed gamma standard. The spike was delivered with the Rainin pipet set at 100 ul pickup and 50 2 ul droplet delivery. After drying under a heat lamp for 0.75 h, the styrofoam was placed on a 47mm diameter glass fiber filter (Gelman type A/E) which was resting in a petri dish. The styrofoam was placed with the spiked side facing the glass fiber filter. A rubber O-ring was then placed over both filters to prevent movement. The petri dish was sealed shut with electrician's tape.

Susan E. Sommella 8/12/94
Name: Date
Environmental Laboratory

Note: The spiked styrofoam filter is NOT covered with clear plastic type. Extreme caution must be exercised when handling the styrofoam filter. If the filter is

Amersham International plc
Amersham UK

Opened on 3/9/94

NAMAS
CALIBRATION
No. 0146

Certificate of calibration of mixed radionuclide gamma-ray reference solution

M 27047

Description

Product code: QCY.48 Solution number: R4/20/54

This mixed radionuclide gamma-ray reference standard consists of a solution in 4M HCl of the ten radionuclides listed below.

Measurement and Accuracy

Reference time: 1200 GMT on 1 February 1994

Mass of solution: 5.3305 grams Density: 1.073 g/ml at 20°C

Parent radionuclide	Gamma-ray energy (keV)	Gamma-rays per second per gram of solution	Random uncertainty	Systematic uncertainty	Overall uncertainty
Americium-241	59.54	1097	± 0.2 %	± 1.9 %	± 2.1 %
Cadmium-109	88.03	623	± 0.3 %	± 3.2 %	± 3.5 %
Cobalt-57	122.1	573	± 0.2 %	± 1.9 %	± 2.1 %
Cerium-139	165.9	612	± 0.3 %	± 1.3 %	± 1.6 %
Mercury-203	279.2	1983	± 0.2 %	± 2.0 %	± 2.2 %
Tin-113	391.7	2006	± 0.1 %	± 4.2 %	± 4.3 %
Strontium-85	514.0	3877	± 0.3 %	± 1.9 %	± 2.2 %
Caesium-137	661.7	2410	± 0.2 %	± 1.9 %	± 2.1 %
Yttrium-88	898.0	6058	± 0.1 %	± 3.5 %	± 3.6 %
Cobalt-60	1173	3309	± 0.2 %	± 0.4 %	± 0.6 %
Cobalt-60	1333	3312	± 0.2 %	± 0.4 %	± 0.6 %
Yttrium-88	1836	6420	± 0.1 %	± 3.4 %	± 3.5 %

Purity

At the reference time the solution also contained the following impurities:

Chlorine-36 less than 3 becquerels (0.1 nanocuries) per gram.

Remarks

Further details, including composition of the solution, methods of measurement, decay scheme assumptions, decay tables and definitions of uncertainties, are given in the data sheet accompanying this certificate.

This product meets the quality assurance requirements of NRC Regulatory Guide 4.15 for achieving explicit NIST traceability as defined in NCRP58 (1985).

Approved Signatory

B D D Singleton

Amersham

CALIBRATION INFORMATION

CALIBRATION DATE: Feb. 6, 1998

SOFTWARE VERSION: GDRP Version 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Det. 2

EFFICIENCY FILE: WT155ϕϕ2.EFF

POSITION: ϕ

GEOMETRY DESCRIPTION: Sand in a 4 oz. Poly Jar (1.6 g/cc)

CALIBRATION STANDARD ID: 54921-162 (Analytics)

ENERGY RANGE OF CAL.: 59 Kev to 1836 KeV

PERFORMED BY: Milton Thisell

REVIEWED BY: JM Raimondi DATE 2/26/98

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Yankee Atomic Electric Company
Environmental Laboratory

Sample ID : 54921-162 SOIL STD. (WAT1)

Sampling Start. . . 10/01/97 12:00:00	Counting Start. . . . 02/06/98 12:03:26
Sampling Stop . . . 10/01/97 12:00:00	Decay Time. . . . . 3.07e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 1500 Sec
Sample Size . . . . 1.00e+000 SAMPLE	Real Time . . . . . 1544 Sec
Collection Efficiency 1.0000	Spectrum File 03750102.SPC

Detector #: 2

Energy(keV)= 1.88 + 0.660*Ch + 2.94e-007*Ch^2 +-5.25e-011*Ch^3 02/06/98 12:03

FWHM(keV) = 1.00 + 0.007*En + 4.61e-004*En^2 + 0.00e+000*En^3 01/29/96 12:43
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 72 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.53	87.32	43959 ✓	322	429	25529	1.32	
2	88.03	130.50	93983 ✓	387	414	23750	1.41	
3	122.07	182.06	45178 ✓	286	336	15675	1.17	
4	136.49	203.90	5772	173	266	11167	1.23	
5	165.86	248.37	42932 ✓	263	285	11231	1.37	
6	255.18	383.65	1105	137	233	7525	1.33	
7	279.14	419.94	17021	180	219	6637	1.29	
8	391.68	590.36	27085 ✓	193	179	4435	1.48	
9	513.99	775.55	21957	180	184	4158	1.62	
10	661.63	999.07	25099 ✓	188	186	3827	1.52	
11	814.02	1229.75	542	73	118	2276	1.74	
12	898.05	1356.96	31915 ✓	196	141	2956	1.65	
13	1173.22	1773.47	28736 ✓	179	104	1460	2.00	
14	1325.16	2003.45	780	68	118	1292	3.46	a
15	1332.48	2014.53	26134 ✓	166	67	727	1.91	b
16	1836.01	2776.74	19655 ✓	142	40	264	2.22	
17	2440.45	3692.06	1	8	12	34	0.20	NET< CL
18	2505.26	3790.23	316	20	16	48	2.58	

Yankee Atomic Electric Company
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: 54921-162 SOIL STD. (WAT1)

Stds Match Tolerance(keV) . . . 1.00	Spectrum File 03750102.SPC
Number of Grams . . . . . 1.00e+000	Counting Start. . . . 02/06/98 12:03:26
Current Date. . . . 02/24/98 12:20:59	Decay Time. . . . . 3.07e+003 Hrs
Standards File. GDRSTD23.STD	Assay Date 10/01/97 12:00

ID.: Analytics 54921-162,WAT1 SAND

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm
1	Am-241	59.54	3.789e+006	1.00000	1703.00
2	Cd-109	88.03	1.114e+004	1.00000	2527.00
3	Co-57	122.06	6.502e+003	1.00000	1338.00
4	Ce-139	165.85	3.304e+003	1.00000	1887.00
5	Sn-113	391.69	2.762e+003	1.00000	2522.00
6	Sr-85	513.99	1.556e+003	1.00000	4672.00
7	Cs-137	661.65	2.645e+005	1.00000	1652.00
8	Y-88	898.02	2.558e+003	1.00000	6473.00
9	Co-60	1173.22	4.621e+004	1.00000	3190.00
10	Co-60	1332.49	4.621e+004	1.00000	3215.00
11	Y-88	1836.01	2.558e+003	1.00000	6813.00

Geometry File WT1SS002.EFF	ID. . . . Sand in a 4 oz. Jar: 1.6 g/cc
Detector Number 2	Calibration Date. . . 02/06/98 12:03:26

Eff = 1 / [1.49e-002*En^-2.83e+000 + 1.39e+002*En^8.08e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	1.72e-002	0.70	1.73e-002	0.00	0.00e+000
2	88.03	3.00e-002	-1.85	2.95e-002	0.00	0.00e+000
3	122.06	3.12e-002	2.63	3.21e-002	0.00	0.00e+000
4	165.85	2.89e-002	-1.20	2.85e-002	0.00	0.00e+000
5	391.69	1.55e-002	-1.40	1.53e-002	0.00	0.00e+000
6	513.99	1.23e-002	-0.23	1.23e-002	0.00	0.00e+000
7	661.65	1.02e-002	-1.90	1.00e-002	0.00	0.00e+000
8	898.02	7.55e-003	3.55	7.83e-003	0.00	0.00e+000
9	1173.22	6.29e-003	0.38	6.31e-003	0.00	0.00e+000
10	1332.49	5.67e-003	0.37	5.70e-003	0.00	0.00e+000
11	1836.01	4.42e-003	-0.53	4.40e-003	0.00	0.00e+000

EFFIC. COEFFICIENTS STORED ON WT1SS002.EFF.

ANALYTICS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

54921-162

Sand in Four Ounce Poly Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. Am-241 was calibrated by 4 pi alpha liquid scintillation counting. The Sr-85 was calibrated in an ion chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using germanium gamma spectroscopy. At the calibration time no interfering gamma-ray emitting impurities were detected. Emission rates for the most intense gamma-rays are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979.

Calibration date: October 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1703	5.0
Cd-109	88.0	462.6	d	2527	4.8
Co-57	122.0	271.79	d	1338	4.9
Ce-139	166.0	137.64	d	1887	4.6
Hg-203	279.0	46.595	d	3764	4.8
Sn-113	392.0	115.09	d	2522	4.6
Sr-85	514.0	64.85	d	4672	5.0
Cs-137	662.0	30.0	y	1652	4.4
Y-88	898.0	106.63	d	6473	4.7
Co-60	1173.0	5.2714	y	3190	4.7
Co-60	1332.0	5.2714	y	3215	4.6
Y-88	1836.0	106.63	d	6813	4.6

Filled to 6.2 cm height. 192.6 grams of sand.
P O NUMBER 85626, 10/22/97 Release, Item 3

SOURCE PREPARED BY: Robert J. Haslett
R. J. Haslett, Production Manager

Q A APPROVED: W. M. Ch 12-1-97

This standard will expire one year after the calibration date.

CALIBRATION INFORMATION

CALIBRATION DATE: Feb. 6, 1998

SOFTWARE VERSION: GDRP Version 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Detector 2

EFFICIENCY FILE: WT5 55 ϕ ϕ 2. EFF

POSITION: ϕ

GEOMETRY DESCRIPTION: A 450 ml Sand in a WAT5 container (1.6 g/cc)

CALIBRATION STANDARD ID: 53858-162 (Analytics)

ENERGY RANGE OF CAL.: 59 Kev to 1836 Kev

PERFORMED BY: Milton Thisell

REVIEWED BY: JMRaimondi DATE 2/26/98

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Yankee Atomic Electric Company
Environmental Laboratory

Sample ID : 53858-162 SOIL STD. (WAT5)

Sampling Start. . . 04/01/97 12:00:00	Counting Start. . . . 02/06/98 13:57:14
Sampling Stop . . . 04/01/97 12:00:00	Decay Time. . . . . 7.47e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 6000 Sec
Sample Size . . . . 1.00e+000 SAMPLE	Real Time . . . . . 6058 Sec
Collection Efficiency 1.0000	Spectrum File 03758002.SPC

Detector #: 2

Energy(keV)= 1.86 + 0.660*Ch + 2.92e-007*Ch^2 +-5.34e-011*Ch^3 02/06/98 13:57

FWHM(keV) = 1.00 + 0.007*En + 4.61e-004*En^2 + 0.00e+000*En^3 01/29/96 12:43
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 72 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.53	87.35	62763 ✓	393	532	39272	1.35	
2	88.04	130.53	120020 ✓	446	495	33918	1.37	
3	122.07	182.08	47991 ✓	308	381	20160	1.16	
4	136.44	203.84	5829	191	300	14217	1.18	
5	165.86	248.39	30161 ✓	250	317	13948	1.38	
6	279.19	420.02	2288	149	247	8479	1.28	
7	391.68	590.35	17048 ✓	179	215	6404	1.46	
8	661.63	999.05	51856 ✓	251	192	4559	1.52	
9	898.05	1356.92	19676 ✓	169	160	4200	1.65	
10	1173.22	1773.41	54534 ✓	245	129	2241	1.93	
11	1325.66	2004.14	603	72	132	1361	4.22	a
12	1332.47	2014.45	50421 ✓	228	63	645	1.89	b
13	1836.01	2776.66	12362 ✓	113	30	150	2.26	
14	2505.14	3789.96	443	23	14	35	2.25	
15	2613.85	3954.67	84	11	9	15	1.94	

Yankee Atomic Electric Company
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: 53858-162 SOIL STD. (WAT5)

Stds Match Tolerance(keV) . . . 1.00	Spectrum File 03758002.SPC
Number of Grams . . . . . 1.00e+000	Counting Start. . . . 02/06/98 13:57:14
Current Date. . . . 02/19/98 15:57:17	Decay Time. . . . . 7.47e+003 Hrs
Standards File. GDRSTD24.STD	Assay Date 04/01/97 12:00

ID.: Analytics 53858-162,WAT5 SAND

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm
1	Am-241	59.54	3.789e+006	1.00000	1275.00
2	Cd-109	88.03	1.114e+004	1.00000	1988.00
3	Co-57	122.06	6.502e+003	1.00000	1018.00
4	Ce-139	165.85	3.304e+003	1.00000	1481.00
5	Sn-113	391.69	2.762e+003	1.00000	1992.00
6	Cs-137	661.65	2.645e+005	1.00000	1376.00
7	Y-88	898.02	2.558e+003	1.00000	5068.00
8	Co-60	1173.22	4.621e+004	1.00000	2492.00
9	Co-60	1332.49	4.621e+004	1.00000	2511.00
10	Y-88	1836.01	2.558e+003	1.00000	5336.00

Geometry File WT5SS002.EFF	ID. . . 450 ml Sand in a WAT5 1.6 g
Detector Number 2	Calibration Date. . . 02/06/98 13:57:14

Eff = 1 / [1.15e-002*En^-3.19e+000 + 2.16e+002*En^7.29e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	8.22e-003	0.75	8.28e-003	0.00	0.00e+000
2	88.03	1.60e-002	-1.73	1.57e-002	0.00	0.00e+000
3	122.06	1.74e-002	2.30	1.78e-002	0.00	0.00e+000
4	165.85	1.63e-002	-0.63	1.61e-002	0.00	0.00e+000
5	391.69	9.28e-003	-1.64	9.13e-003	0.00	0.00e+000
6	661.65	6.41e-003	-2.62	6.24e-003	0.00	0.00e+000
7	898.02	4.89e-003	2.14	5.00e-003	0.00	0.00e+000
8	1173.22	4.08e-003	0.77	4.11e-003	0.00	0.00e+000
9	1332.49	3.74e-003	0.09	3.75e-003	0.00	0.00e+000
10	1836.01	2.92e-003	1.62	2.97e-003	0.00	0.00e+000

EFFIC. COEFFICIENTS STORED ON WT5SS002.EFF.

ANALYTICS

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Phone (404) 352-8677
Fax (404) 352-2837

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

53858-162

450 mL Sand in 500 mL Clear Plastic Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: April 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1275	5.0
Cd-109	88	462.6	d	1988	5.0
Co-57	122	271.79	d	1018	5.0
Ce-139	166	137.64	d	1481	4.4
Hg-203	279	46.595	d	3160	4.7
Sn-113	392	115.09	d	1992	4.9
Cs-137	662	30.0	y	1376	4.5
Y-88	898	106.63	d	5068	4.5
Co-60	1173	5.2714	y	2492	4.7
Co-60	1332	5.2714	y	2511	4.6
Y-88	1836	106.63	d	5336	4.2

720 grams of sand.
P O NUMBER 85626, 3/3/97 Release, Item 2

SOURCE PREPARED BY: M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED: D M Mat 5-27-97

This standard will expire one year after the calibration date.

CALIBRATION INFORMATION

CALIBRATION DATE: April 30, 1998

SOFTWARE VERSION: GDRP Version 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Detector 3

EFFICIENCY FILE: WT5SS$\phi\phi$3.EFF

POSITION: ϕ

GEOMETRY DESCRIPTION: A 450 ml Sand in a WAT-5 Container (1.6 g/cc)

CALIBRATION STANDARD ID: 53858-162 (Analytics)

ENERGY RANGE OF CAL.: 59 KeV to 1836 KeV

PERFORMED BY: Milton Thisell

REVIEWED BY: _____ DATE _____

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Duke Engineering & Services
Environmental Laboratory

Sample ID : Analytics Soil in WATT-5 Calibration

Sampling Start. . . 04/01/97 12:00:00	Counting Start. . . . 04/30/98 17:59:40
Sampling Stop . . . 04/01/97 12:00:00	Decay Time. . . . . 9.46e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 25000 Sec
Sample Size . . . . 1.00e+000 sample	Real Time . . . . . 25224 Sec
Collection Efficiency 1.0000	Spectrum File 12074803.SPC

Detector #: 3

Energy(keV)= 1.62 + 0.660*Ch + 0.00e+000*Ch^2 + 0.00e+000*Ch^3 04/30/98 17:59

FWHM(keV) = 0.95 + 0.007*En + 5.83e-004*En^2 + 0.00e+000*En^3 01/28/95 14:29
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 40 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

#	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.52	87.70	305733 ✓	810	1040	149952	1.01	
2	88.04	130.89	466701 ✓	832	810	103855	0.95	
3	122.06	182.41	169191 ✓	576	710	69907	1.22	
4	136.47	204.22	20587	389	635	55912	1.04	
5	165.86	248.74	84746 ✓	420	517	42300	1.08	
6	391.67	590.71	41356 ✓	325	456	25640	1.28	
7	661.62	999.53	195228 ✓	483	349	15038	1.61	
8	898.06	1357.61	41652 ✓	273	307	15460	1.71	
9	1173.24	1774.34	191201 ✓	456	231	7195	1.93	
10	1326.00	2005.69	1733	125	233	3812	4.60	a HiResid
11	1332.48	2015.51	174715 ✓	422	100	1634	1.94	b HiResid
12	1764.34	2669.54	177	37	61	534	2.82	
13	1836.00	2778.06	25160 ✓	163	62	550	2.34	
14	2505.13	3791.41	1374	39	21	69	2.69	
15	2614.30	3956.75	326	20	13	29	2.56	

Duke Engineering & Services
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: Analytics Soil in WATT-5 Calibration

Stds Match Tolerance(keV) . . . 1.00	Spectrum File 12074803.SPC
Number of Grams . . . . . 1.00e+000	Counting Start. . . . 04/30/98 17:59:40
Current Date. . . . 05/01/98 10:40:26	Decay Time. . . . . 9.46e+003 Hrs
Standards File. GDRSTD24.STD	Assay Date 04/01/97 12:00

ID.: Analytics 53858-162,WAT5 SAND

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm
1	Am-241	59.54	3.789e+006	1.00000	1275.00
2	Cd-109	88.03	1.114e+004	1.00000	1988.00
3	Co-57	122.06	6.502e+003	1.00000	1018.00
4	Ce-139	165.85	3.304e+003	1.00000	1481.00
5	Sn-113	391.69	2.762e+003	1.00000	1992.00
6	Cs-137	661.65	2.645e+005	1.00000	1376.00
7	Y-88	898.02	2.558e+003	1.00000	5068.00
8	Co-60	1173.22	4.621e+004	1.00000	2492.00
9	Co-60	1332.49	4.621e+004	1.00000	2511.00
10	Y-88	1836.01	2.558e+003	1.00000	5336.00

Geometry File WT5SS003.EFF	ID. . . 450 ml Sand in a WAT5 1.6 g/cc
Detector Number 3	Calibration Date. . . 04/30/98 17:59:40

Eff = 1 / [3.20e-002*En^-2.77e+000 + 2.47e+002*En^8.30e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	9.61e-003	0.53	9.66e-003	0.00	0.00e+000
2	88.03	1.69e-002	-1.26	1.67e-002	0.00	0.00e+000
3	122.06	1.82e-002	1.56	1.85e-002	0.00	0.00e+000
4	165.85	1.67e-002	-0.36	1.66e-002	0.00	0.00e+000
5	391.69	8.92e-003	-1.52	8.78e-003	0.00	0.00e+000
6	661.65	5.82e-003	-2.00	5.70e-003	0.00	0.00e+000
7	898.02	4.27e-003	3.69	4.43e-003	0.00	0.00e+000
8	1173.22	3.54e-003	0.32	3.55e-003	0.00	0.00e+000
9	1332.49	3.21e-003	-0.47	3.19e-003	0.00	0.00e+000
10	1836.01	2.45e-003	0.01	2.45e-003	0.00	0.00e+000

1 .C. COEFFICIENTS STORED ON WT5SS003.EFF.

ANALYTICS

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Phone (404) 352-8677
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CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

53858-162

450 mL Sand in 500 mL Clear Plastic Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: April 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1275	5.0
Cd-109	88	462.6	d	1988	5.0
Co-57	122	271.79	d	1018	5.0
Ce-139	166	137.64	d	1481	4.4
Hg-203	279	46.595	d	3160	4.7
Sn-113	392	115.09	d	1992	4.9
Cs-137	662	30.0	y	1376	4.5
Y-88	898	106.63	d	5068	4.5
Co-60	1173	5.2714	y	2492	4.7
Co-60	1332	5.2714	y	2511	4.6
Y-88	1836	106.63	d	5336	4.2

720 grams of sand.
P O NUMBER 85626, 3/3/97 Release, Item 2

SOURCE PREPARED BY: M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED: D M. Mat 5-27-97

This standard will expire one year after the calibration date.

CALIBRATION INFORMATION

CALIBRATION DATE: Feb. 9, 1998

SOFTWARE VERSION: GDRP Version 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Det. 4

EFFICIENCY FILE: WT155004.EFF

POSITION: 0

GEOMETRY DESCRIPTION: Sand in a 4 oz. Poly Jar (1.6 g/cc)

CALIBRATION STANDARD ID: 54921-162 (Analytics)

ENERGY RANGE OF CAL.: 59 KeV to 1836 KeV

PERFORMED BY: Milton Thisell

REVIEWED BY: JMRaimondi DATE 2/24/98

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Yankee Atomic Electric Company
Environmental Laboratory

Sample ID : 54921-162 SOIL STD. (WAT1)

Sampling Start. . . 10/01/97 12:00:00	Counting Start. . . . 02/09/98 09:27:17
Sampling Stop . . . 10/01/97 12:00:00	Decay Time. . . . . 3.14e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 1500 Sec
Sample Size . . . . 1.00e+000 SAMPLE	Real Time . . . . . 1548 Sec
Collection Efficiency 1.0000	Spectrum File 04039204.SPC

Detector #: 4

Energy(keV)= 1.68 + 0.660*Ch + 2.29e-007*Ch^2 +-4.38e-011*Ch^3 02/09/98 09:27

FWHM(keV) = 0.91 + 0.009*En + 5.52e-004*En^2 + 0.00e+000*En^3 01/28/95 14:29
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 72 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.53	87.63	45720 ✓	317	412	23553	1.17	
2	88.04	130.83	92025 ✓	366	351	19474	1.08	
3	122.06	182.36	44992 ✓	281	325	14657	1.25	
4	136.51	204.24	5491	185	298	12311	1.15	
5	165.85	248.69	40311 ✓	256	281	10916	1.21	
6	254.92	383.59	1216	132	224	6965	1.26	
7	279.14	420.27	15173	171	209	6035	1.28	
8	391.69	590.73	24631 ✓	190	192	4539	1.37	
9	513.99	775.93	19113	169	175	3776	1.38	
10	661.62	999.47	21821 ✓	173	163	3281	1.69	
11	814.14	1230.41	569	77	126	2353	1.48	
12	898.05	1357.46	27304 ✓	183	136	2715	1.81	
13	1173.22	1774.07	24514 ✓	166	99	1321	1.86	
14	1325.38	2004.44	741	68	122	1215	3.89	a
15	1332.48	2015.18	22422 ✓	154	61	608	1.95	b
16	1836.01	2777.60	16352 ✓	130	40	225	2.30	
17	2505.32	3791.44	252	19	17	44	2.60	

Yankee Atomic Electric Company
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: 54921-162 SOIL STD. (WAT1)

Stds Match Tolerance(keV) . . . 1.00	Spectrum File 04039204.SPC
Number of Grams . . . . . 1.00e+000	Counting Start. . . . 02/09/98 09:27:17
Current Date. . . . 02/24/98 12:43:29	Decay Time. . . . . 3.14e+003 Hrs
Standards File. GDRSTD23.STD	Assay Date 10/01/97 12:00

ID.: Analytics 54921-162,WAT1 SAND

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm
1	Am-241	59.54	3.789e+006	1.00000	1703.00
2	Cd-109	88.03	1.114e+004	1.00000	2527.00
3	Co-57	122.06	6.502e+003	1.00000	1338.00
4	Ce-139	165.85	3.304e+003	1.00000	1887.00
5	Sn-113	391.69	2.762e+003	1.00000	2522.00
6	Sr-85	513.99	1.556e+003	1.00000	4672.00
7	Cs-137	661.65	2.645e+005	1.00000	1652.00
8	Y-88	898.02	2.558e+003	1.00000	6473.00
9	Co-60	1173.22	4.621e+004	1.00000	3190.00
10	Co-60	1332.49	4.621e+004	1.00000	3215.00
11	Y-88	1836.01	2.558e+003	1.00000	6813.00

Geometry File WT1SS004.EFF	ID. . . Sand in 4 oz Poly Jar: 1.6 g/cc
Detector Number 4	Calibration Date. . . 02/09/98 09:27:17

Eff = 1 / [2.12e-002*En^-2.69e+000 + 1.61e+002*En^8.72e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	1.79e-002	0.16	1.79e-002	0.00	0.00e+000
2	88.03	2.95e-002	-0.37	2.94e-002	0.00	0.00e+000
3	122.06	3.13e-002	0.37	3.14e-002	0.00	0.00e+000
4	165.85	2.75e-002	0.20	2.76e-002	0.00	0.00e+000
5	391.69	1.43e-002	-2.16	1.40e-002	0.00	0.00e+000
6	513.99	1.10e-002	0.32	1.11e-002	0.00	0.00e+000
7	661.65	8.88e-003	0.24	8.90e-003	0.00	0.00e+000
8	898.02	6.59e-003	3.45	6.82e-003	0.00	0.00e+000
9	1173.22	5.37e-003	0.60	5.40e-003	0.00	0.00e+000
10	1332.49	4.87e-003	-0.80	4.84e-003	0.00	0.00e+000
11	1836.01	3.75e-003	-2.50	3.66e-003	0.00	0.00e+000

EFFIC. COEFFICIENTS STORED ON WT1SS004.EFF.

ANALYTICS

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Phone (404) 352-8677
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CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

54921-162

Sand in Four Ounce Poly Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. Am-241 was calibrated by 4 pi alpha liquid scintillation counting. The Sr-85 was calibrated in an ion chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using germanium gamma spectroscopy. At the calibration time no interfering gamma-ray emitting impurities were detected. Emission rates for the most intense gamma-rays are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979.

Calibration date: October 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1703	5.0
Cd-109	88.0	462.6	d	2527	4.8
Co-57	122.0	271.79	d	1338	4.9
Ce-139	166.0	137.64	d	1887	4.6
Hg-203	279.0	46.595	d	3764	4.8
Sn-113	392.0	115.09	d	2522	4.6
Sr-85	514.0	64.85	d	4672	5.0
Cs-137	662.0	30.0	y	1652	4.4
Y-88	898.0	106.63	d	6473	4.7
Co-60	1173.0	5.2714	y	3190	4.7
Co-60	1332.0	5.2714	y	3215	4.6
Y-88	1836.0	106.63	d	6813	4.6

Filled to 6.2 cm height. 192.6 grams of sand.
P O NUMBER 85626, 10/22/97 Release, Item 3

SOURCE PREPARED BY: Robert J. Haslett Jr.
R. J. Haslett, Production Manager

Q A APPROVED: D.M. Ch 12-1-97

This standard will expire one year after the calibration date.

CALIBRATION INFORMATION

CALIBRATION DATE: Feb. 9, 1998

SOFTWARE VERSION: EDRP Ver. 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Detector 4

EFFICIENCY FILE: WT5550004.EFF

POSITION: 0

GEOMETRY DESCRIPTION: A 450 ml Sand in a WAT5 container (1.6 g/cc)

CALIBRATION STANDARD ID: 53858-162 (Analytics)

ENERGY RANGE OF CAL.: 59 Kev to 1836 KeV

PERFORMED BY: Milton Thisell

REVIEWED BY: JMCalcinondi DATE 2/24/98

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Yankee Atomic Electric Company
Environmental Laboratory

Sample ID : 53858-162 SOIL STD. CHECK

Sampling Start. . . 04/01/97 12:00:00	Counting Start. . . . 02/09/98 16:52:53
Sampling Stop . . . 04/01/97 12:00:00	Decay Time. . . . . 7.54e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 8000 Sec
Sample Size . . . . 1.00e+000 SAMPLE	Real Time . . . . . 8082 Sec
Collection Efficiency 1.0000	Spectrum File 04070104.SPC

Detector #: 4

Energy(keV)= 1.57 + 0.660*Ch + 2.43e-007*Ch^2 +-4.67e-011*Ch^3 02/09/98 10:46

FWHM(keV) = 0.91 + 0.009*En + 5.52e-004*En^2 + 0.00e+000*En^3 01/28/95 14:29
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 72 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.51	87.77	81454 ✓	417	520	42827	1.08	
2	88.00	130.93	152124 ✓	480	478	36186	1.05	
3	122.03	182.48	60856 ✓	345	423	24827	1.39	
4	136.48	204.35	7781	233	378	19848	1.23	
5	165.82	248.81	37386 ✓	265	309	15096	1.15	
6	279.11	420.39	2625	164	274	10400	1.38	
7	391.66	590.84	19877 ✓	195	238	7841	1.28	
8	661.61	999.62	59819 ✓	270	207	5268	1.61	
9	898.03	1357.58	21851 ✓	185	194	5566	1.77	
10	1173.21	1774.20	61134 ✓	259	137	2509	1.87	
11	1325.73	2005.12	682	82	154	1670	4.56	a HiResid
12	1332.47	2015.31	55456 ✓	239	66	716	1.94	b HiResid
13	1764.68	2669.71	40	23	38	228	1.46	
14	1836.01	2777.74	13362 ✓	118	37	196	2.25	
15	2103.60	3182.99	23	16	26	107	2.23	NET< CL
16	2505.22	3791.43	402	22	16	39	2.82	
17	2614.16	3956.53	112	12	9	11	2.01	

Yankee Atomic Electric Company
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: 53858-162 SOIL STD. CHECK

Stds Match Tolerance(keV) . . . 1.00	Spectrum File 04070104.SPC
Number of Grams . . . . . 1.00e+000	Counting Start. . . . 02/09/98 16:52:53
Current Date. . . . 02/10/98 09:00:35	Decay Time. . . . . 7.54e+003 Hrs
Standards File. GDRSTD24.STD	Assay Date 04/01/97 12:00

ID.: Analytics 53858-162,WAT5 SAND

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm
1	Am-241	59.54	3.789e+006	1.00000	1275.00
2	Cd-109	88.03	1.114e+004	1.00000	1988.00
3	Co-57	122.06	6.502e+003	1.00000	1018.00
4	Ce-139	165.85	3.304e+003	1.00000	1481.00
5	Sn-113	391.69	2.762e+003	1.00000	1992.00
6	Cs-137	661.65	2.645e+005	1.00000	1376.00
7	Y-88	898.02	2.558e+003	1.00000	5068.00
8	Co-60	1173.22	4.621e+004	1.00000	2492.00
9	Co-60	1332.49	4.621e+004	1.00000	2511.00
10	Y-88	1836.01	2.558e+003	1.00000	5336.00

Geometry File WT5SS004.EFF	ID. . . . . .450 ml in a WAT5 1.6 g,
Detector Number 4	Calibration Date. . . 02/09/98 16:52:53

Eff = 1 / [1.58e-002*En^-3.09e+000 + 2.56e+002*En^7.93e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	8.00e-003	0.55	8.04e-003	0.00	0.00e+000
2	88.03	1.53e-002	-1.27	1.51e-002	0.00	0.00e+000
3	122.06	1.67e-002	1.80	1.70e-002	0.00	0.00e+000
4	165.85	1.53e-002	-0.76	1.52e-002	0.00	0.00e+000
5	391.69	8.27e-003	-0.88	8.20e-003	0.00	0.00e+000
6	661.65	5.54e-003	-2.23	5.42e-003	0.00	0.00e+000
7	898.02	4.16e-003	2.37	4.26e-003	0.00	0.00e+000
8	1173.22	3.43e-003	0.30	3.44e-003	0.00	0.00e+000
9	1332.49	3.09e-003	0.72	3.11e-003	0.00	0.00e+000
10	1836.01	2.41e-003	0.06	2.41e-003	0.00	0.00e+000

EFFIC. COEFFICIENTS STORED ON WT5SS004.EFF.

ANALYTICS

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Phone (404) 352-8677
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CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

53858-162

450 mL Sand in 500 mL Clear Plastic Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: April 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1275	5.0
Cd-109	88	462.6	d	1988	5.0
Co-57	122	271.79	d	1018	5.0
Ce-139	166	137.64	d	1481	4.4
Hg-203	279	46.595	d	3160	4.7
Sn-113	392	115.09	d	1992	4.9
Cs-137	662	30.0	y	1376	4.5
Y-88	898	106.63	d	5068	4.5
Co-60	1173	5.2714	y	2492	4.7
Co-60	1332	5.2714	y	2511	4.6
Y-88	1836	106.63	d	5336	4.2

720 grams of sand.
P O NUMBER 85626, 3/3/97 Release, Item 2

SOURCE PREPARED BY: M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED: D.M. Mattingly 5-27-97

This standard will expire one year after the calibration date.

CALIBRATION INFORMATION

CALIBRATION DATE: Feb. 6, 1998

SOFTWARE VERSION: GDRP Version 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Det. 5

EFFICIENCY FILE: WT1SSΦΦ5.EFF

POSITION: Φ

GEOMETRY DESCRIPTION: Sand in a 4 oz. Poly Jar (1.6 g/cc)

CALIBRATION STANDARD ID: 54921-162 (Analytics)

ENERGY RANGE OF CAL.: 59 Kev to 1836 KeV

PERFORMED BY: Milton Thisell

REVIEWED BY: JM Raimondi DATE 2/26/98

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Yankee Atomic Electric Company
Environmental Laboratory

Sample ID : 54921-162 SOIL STD. (WAT1)

Sampling Start. . . 10/01/97 12:00:00	Counting Start. . . . 02/06/98 14:35:22
Sampling Stop . . . 10/01/97 12:00:00	Decay Time. . . . . 3.07e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 1500 Sec
Sample Size . . . . 1.00e+000 SAMPLE	Real Time . . . . . 1567 Sec
Collection Efficiency 1.0000	Spectrum File 03760605.SPC

Detector #: 5

Energy(keV)= 1.04 + 0.660*Ch + 0.00e+000*Ch^2 + 0.00e+000*Ch^3 02/06/98 14:35

FWHM(keV) = 0.93 + 0.011*En + 4.54e-004*En^2 + 0.00e+000*En^3 12/05/95 14:17
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 72 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.51	88.55	33281 ✓	291	400	22129	1.27	
2	88.04	131.76	94548 ✓	375	366	21228	1.14	
3	122.08	183.31	51216 ✓	303	354	17403	1.22	
4	136.51	205.16	6399	186	286	12935	1.12	
5	165.88	249.64	50793 ✓	284	305	12849	1.30	
6	255.05	384.68	1288	164	289	10278	1.06	
7	279.14	421.16	20813	198	238	7837	1.23	
8	391.66	591.56	34615 ✓	222	218	5850	1.51	
9	513.98	776.80	29194	204	202	5051	1.43	
10	661.64	1000.42	33387 ✓	212	199	4400	1.68	
11	814.22	1231.48	511	86	144	3065	1.36	
12	898.02	1358.39	42861 ✓	224	149	3290	1.82	
13	1173.24	1775.18	38797 ✓	207	114	1742	1.91	
14	1324.96	2004.94	963	68	112	1321	3.04	a
15	1332.49	2016.35	35126 ✓	192	72	849	1.97	b
16	1836.00	2778.86	27254 ✓	167	47	308	2.25	
17	2505.14	3792.20	548	26	18	63	2.66	
18	2613.27	3955.95	14	6	7	11	2.16	

Yankee Atomic Electric Company
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: 54921-162 SOIL STD. (WAT1) ✓

Stds Match Tolerance(keV) . . .	1.00 ✓	Spectrum File	.03760605.SPC
Number of Grams	1.00e+000 ✓	Counting Start. . . .	02/06/98 14:35:22
Current Date. . . .	02/24/98 13:07:55 ✓	Decay Time.	3.07e+003 Hrs
Standards File.	.GDRSTD23.STD ✓	Assay Date	10/01/97 12:00

ID.: Analytics 54921-162,WAT1 SAND

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm ✓
1	Am-241	59.54	3.789e+006	1.00000	1703.00
2	Cd-109	88.03	1.114e+004	1.00000	2527.00
3	Co-57	122.06	6.502e+003	1.00000	1338.00
4	Ce-139	165.85	3.304e+003	1.00000	1887.00
5	Sn-113	391.69	2.762e+003	1.00000	2522.00
6	Sr-85	513.99	1.556e+003	1.00000	4672.00
7	Cs-137	661.65	2.645e+005	1.00000	1652.00
8	Y-88	898.02	2.558e+003	1.00000	6473.00
9	Co-60	1173.22	4.621e+004	1.00000	3190.00
10	Co-60	1332.49	4.621e+004	1.00000	3215.00
11	Y-88	1836.01	2.558e+003	1.00000	6813.00

Geometry File	.WT1SS005.EFF
ID. . .	Sand in 4 oz Poly Jar: 1.6 g/cc
Detector Number	5
Calibration Date. . .	02/06/98 14:35:22

Eff = 1 / [5.28e-003*En^-3.33e+000 + 1.03e+002*En^7.42e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	1.30e-002	1.66	1.33e-002	0.00	0.00e+000
2	88.03	3.02e-002	-2.91	2.93e-002	0.00	0.00e+000
3	122.06	3.54e-002	2.93	3.65e-002	0.00	0.00e+000
4	165.85	3.42e-002	-0.05	3.42e-002	0.00	0.00e+000
5	391.69	1.98e-002	-1.98	1.94e-002	0.00	0.00e+000
6	513.99	1.64e-002	-3.11	1.59e-002	0.00	0.00e+000
7	661.65	1.36e-002	-3.07	1.32e-002	0.00	0.00e+000
8	898.02	1.02e-002	3.39	1.05e-002	0.00	0.00e+000
9	1173.22	8.49e-003	1.48	8.62e-003	0.00	0.00e+000
10	1332.49	7.63e-003	2.73	7.84e-003	0.00	0.00e+000
11	1836.01	6.13e-003	0.78	6.18e-003	0.00	0.00e+000

EFFIC. COEFFICIENTS STORED ON WT1SS005.EFF.

ANALYTICS

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Phone (404) 352-8677
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CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

54921-162

Sand in Four Ounce Poly Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. Am-241 was calibrated by 4 pi alpha liquid scintillation counting. The Sr-85 was calibrated in an ion chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using germanium gamma spectroscopy. At the calibration time no interfering gamma-ray emitting impurities were detected. Emission rates for the most intense gamma-rays are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979.

Calibration date: October 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1703	5.0
Cd-109	88.0	462.6	d	2527	4.8
Co-57	122.0	271.79	d	1338	4.9
Ce-139	166.0	137.64	d	1887	4.6
Hg-203	279.0	46.595	d	3764	4.8
Sn-113	392.0	115.09	d	2522	4.6
Sr-85	514.0	64.85	d	4672	5.0
Cs-137	662.0	30.0	y	1652	4.4
Y-88	898.0	106.63	d	6473	4.7
Co-60	1173.0	5.2714	y	3190	4.7
Co-60	1332.0	5.2714	y	3215	4.6
Y-88	1836.0	106.63	d	6813	4.6

Filled to 6.2 cm height. 192.6 grams of sand.
P O NUMBER 85626, 10/22/97 Release, Item 3

SOURCE PREPARED BY: Robert J. Haslett
R. J. Haslett, Production Manager

Q A APPROVED: W. Ruby 12-1-97

This standard will expire one year after the calibration date.

CALIBRATION INFORMATION

CALIBRATION DATE: Feb. 6, 1998

SOFTWARE VERSION: GDRP Version 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Detector 5

EFFICIENCY FILE: WT5SS$\phi\phi$5.EFF

POSITION: ϕ

GEOMETRY DESCRIPTION: 450 ml Sand in a WAT5 container (1.6 g/cc)

CALIBRATION STANDARD ID: 53858-162 (Analytics)

ENERGY RANGE OF CAL.: 59 Kev to 1836 KeV

PERFORMED BY: Milton Thisell

REVIEWED BY: JMRaimondi DATE 2/26/98

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Yankee Atomic Electric Company
Environmental Laboratory

Sample ID : 53858-162 SOIL STD. (WAT5)

Sampling Start. . . 04/01/97 12:00:00	Counting Start. . . . 02/06/98 12:08:09
Sampling Stop . . . 04/01/97 12:00:00	Decay Time. . . . . 7.46e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 5000 Sec
Sample Size . . . . 1.00e+000 SAMPLE	Real Time . . . . . 5171 Sec
Collection Efficiency 1.0000	Spectrum File 03750405.SPC

Detector #: 5

Energy(keV)= 1.07 + 0.660*Ch + 0.00e+000*Ch^2 + 0.00e+000*Ch^3 02/06/98 12:08

FWHM(keV) = 0.93 + 0.011*En + 4.54e-004*En^2 + 0.00e+000*En^3 12/05/95 14:17
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 72 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.51	88.49	42163 ✓	326	445	27479	1.34	
2	88.04	131.70	104823 ✓	399	397	25020	1.18	
3	122.07	183.24	46360 ✓	302	372	19219	1.17	
4	136.50	205.09	5577	190	299	14125	1.08	
5	165.88	249.57	31039 ✓	251	315	13751	1.35	
6	279.11	421.04	2566	152	252	8783	1.38	
7	391.67	591.49	19077 ✓	193	243	7280	1.51	
8	661.65	1000.33	60099 ✓	271	213	5007	1.59	
9	898.01	1358.26	22454 ✓	182	180	4813	1.70	
10	1173.24	1775.05	64077 ✓	263	124	2075	1.86	
11	1325.40	2005.47	538	61	106	1114	3.28	a
12	1332.50	2016.22	59034 ✓	246	64	668	1.97	b
13	1836.00	2778.69	14993 ✓	124	38	201	2.31	
14	2505.01	3791.80	718	28	14	36	2.56	
15	2614.01	3956.85	131	13	9	13	2.99	

Yankee Atomic Electric Company
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: 53858-162 SOIL STD. (WAT5)

Stds Match Tolerance(keV) . . . 1.00	Spectrum File 03750405.SPC
Number of Grams . . . . . 1.00e+000	Counting Start. . . . 02/06/98 12:08:09
Current Date. . . . 02/20/98 16:11:11	Decay Time. . . . . 7.46e+003 Hrs
Standards File. GDRSTD24.STD	Assay Date 04/01/97 12:00
ID.: Analytics 53858-162,WAT5 SAND	

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm
1	Am-241	59.54	3.789e+006	1.00000	1275.00
2	Cd-109	88.03	1.114e+004	1.00000	1988.00
3	Co-57	122.06	6.502e+003	1.00000	1018.00
4	Ce-139	165.85	3.304e+003	1.00000	1481.00
5	Sn-113	391.69	2.762e+003	1.00000	1992.00
6	Cs-137	661.65	2.645e+005	1.00000	1376.00
7	Y-88	898.02	2.558e+003	1.00000	5068.00
8	Co-60	1173.22	4.621e+004	1.00000	2492.00
9	Co-60	1332.49	4.621e+004	1.00000	2511.00
10	Y-88	1836.01	2.558e+003	1.00000	5336.00

Geometry File WT5SS005.EFF	ID. . . 450 ml Sand in a WAT5 1.6
Detector Number 5	Calibration Date. . . 02/06/98 12:08:09

Eff = 1 / [5.46e-003*En^-3.56e+000 + 1.55e+002*En^6.66e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	6.62e-003	2.04	6.76e-003	0.00	0.00e+000
2	88.03	1.68e-002	-3.39	1.62e-002	0.00	0.00e+000
3	122.06	2.02e-002	3.51	2.09e-002	0.00	0.00e+000
4	165.85	2.01e-002	-0.35	2.00e-002	0.00	0.00e+000
5	391.69	1.25e-002	-3.44	1.20e-002	0.00	0.00e+000
6	661.65	8.91e-003	-4.68	8.51e-003	0.00	0.00e+000
7	898.02	6.69e-003	3.64	6.95e-003	0.00	0.00e+000
8	1173.22	5.75e-003	1.06	5.81e-003	0.00	0.00e+000
9	1332.49	5.26e-003	1.53	5.34e-003	0.00	0.00e+000
10	1836.01	4.24e-003	1.64	4.31e-003	0.00	0.00e+000

EFFIC. COEFFICIENTS STORED ON WT5SS005.EFF.

ANALYTICS

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Phone (404) 352-8677
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CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

53858-162

450 mL Sand in 500 mL Clear Plastic Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: April 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1275	5.0
Cd-109	88	462.6	d	1988	5.0
Co-57	122	271.79	d	1018	5.0
Ce-139	166	137.64	d	1481	4.4
Hg-203	279	46.595	d	3160	4.7
Sn-113	392	115.09	d	1992	4.9
Cs-137	662	30.0	y	1376	4.5
Y-88	898	106.63	d	5068	4.5
Co-60	1173	5.2714	y	2492	4.7
Co-60	1332	5.2714	y	2511	4.6
Y-88	1836	106.63	d	5336	4.2

720 grams of sand.
P O NUMBER 85626, 3/3/97 Release, Item 2

SOURCE PREPARED BY: M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED: D M. Mat 5-27-97

This standard will expire one year after the calibration date.

CALIBRATION INFORMATION

CALIBRATION DATE: Feb. 6, 1998

SOFTWARE VERSION: GDRP Version 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Det. 6

EFFICIENCY FILE: WT1SSϕϕ6.EFF

POSITION: ϕ

GEOMETRY DESCRIPTION: Sand in a 4 oz. Poly Jar (1.6 g/cc)

CALIBRATION STANDARD ID: 54921-162 (Analytics)

ENERGY RANGE OF CAL.: 59 KeV to 1836 KeV

PERFORMED BY: Milton Thisell

REVIEWED BY: JMRaimondi DATE 2/26/98

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Yankee Atomic Electric Company
Environmental Laboratory

Sample ID : 54921-162 SOIL STD. (WAT1)

Sampling Start. . . 10/01/97 12:00:00	Counting Start. . . . 02/06/98 12:39:54
Sampling Stop . . . 10/01/97 12:00:00	Decay Time. . . . . 3.07e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 1500 Sec
Sample Size . . . . 1.00e+000 SAMPLE	Real Time . . . . . 1594 Sec
Collection Efficiency 1.0000	Spectrum File 03752606.SPC

Detector #: 6

Energy(keV)= 0.98 + 0.659*Ch +-2.37e-008*Ch^2 + 0.00e+000*Ch^3 02/06/98 12:39

FWHM(keV) = 1.04 + -0.001*En + 7.87e-004*En^2 + 0.00e+000*En^3 12/05/95 15:50
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 72 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.53	88.81	36785	✓	290	371	21746	1.13	
2	88.03	132.03	100111	✓	397	422	24730	1.13	
3	122.07	183.65	53306	✓	308	358	17783	1.25	
4	136.51	205.56	6525		204	330	15061	1.37	
5	165.88	250.11	51579	✓	287	309	13241	1.18	
6	255.15	385.51	1180		151	258	9243	1.13	
7	279.14	421.89	21759		201	239	7912	1.27	
8	391.66	592.56	35383	✓	219	196	5325	1.53	
9	513.99	778.12	29648		206	203	5090	1.43	
10	661.64	1002.07	34112	✓	216	205	4678	1.56	
11	814.39	1233.76	533		93	159	3391	1.71	
12	898.01	1360.61	43742	✓	226	150	3310	1.84	
13	1173.24	1778.09	39593	✓	209	114	1741	1.96	
14	1325.11	2008.46	1018		70	114	1491	3.58	a HiResid
15	1332.49	2019.66	36275	✓	195	64	839	2.08	b HiResid
16	1836.00	2783.47	27739	✓	169	44	337	2.47	
17	2505.06	3798.47	633		28	21	73	2.86	

Yankee Atomic Electric Company
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: 54921-162 SOIL STD. (WAT1)

Stds Match Tolerance(keV) . . . 1.00	Spectrum File 03752606.SPC
Number of Grams . . . . . 1.00e+000	Counting Start. . . . 02/06/98 12:39:54
Current Date. . . . 02/24/98 14:11:00	Decay Time. . . . . 3.07e+003 Hrs
Standards File. GDRSTD23.STD	Assay Date 10/01/97 12:00

ID.: Analytics 54921-162,WAT1 SAND

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm
1	Am-241	59.54	3.789e+006	1.00000	1703.00
2	Cd-109	88.03	1.114e+004	1.00000	2527.00
3	Co-57	122.06	6.502e+003	1.00000	1338.00
4	Ce-139	165.85	3.304e+003	1.00000	1887.00
5	Sn-113	391.69	2.762e+003	1.00000	2522.00
6	Sr-85	513.99	1.556e+003	1.00000	4672.00
7	Cs-137	661.65	2.645e+005	1.00000	1652.00
8	Y-88	898.02	2.558e+003	1.00000	6473.00
9	Co-60	1173.22	4.621e+004	1.00000	3190.00
10	Co-60	1332.49	4.621e+004	1.00000	3215.00
11	Y-88	1836.01	2.558e+003	1.00000	6813.00

Geometry File WT1SS006.EFF	ID. . . Sand in 4 oz Poly Jar: 1.6 g/cc
Detector Number 6	Calibration Date. . . 02/06/98 12:39:54

Eff = 1 / [4.58e-003*En^-3.34e+000 + 1.01e+002*En^7.37e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	1.44e-002	1.28	1.46e-002	0.00	0.00e+000
2	88.03	3.20e-002	-2.31	3.13e-002	0.00	0.00e+000
3	122.06	3.69e-002	2.31	3.77e-002	0.00	0.00e+000
4	165.85	3.47e-002	0.47	3.49e-002	0.00	0.00e+000
5	391.69	2.02e-002	-2.43	1.97e-002	0.00	0.00e+000
6	513.99	1.66e-002	-2.73	1.62e-002	0.00	0.00e+000
7	661.65	1.39e-002	-3.27	1.34e-002	0.00	0.00e+000
8	898.02	1.04e-002	3.50	1.07e-002	0.00	0.00e+000
9	1173.22	8.66e-003	1.68	8.81e-003	0.00	0.00e+000
10	1332.49	7.88e-003	1.83	8.02e-003	0.00	0.00e+000
11	1836.01	6.24e-003	1.52	6.34e-003	0.00	0.00e+000

EFFIC. COEFFICIENTS STORED ON WT1SS006.EFF.

ANALYTICS

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Phone (404) 352-8677
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CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

54921-162

Sand in Four Ounce Poly Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. Am-241 was calibrated by 4 pi alpha liquid scintillation counting. The Sr-85 was calibrated in an ion chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using germanium gamma spectroscopy. At the calibration time no interfering gamma-ray emitting impurities were detected. Emission rates for the most intense gamma-rays are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979.

Calibration date: October 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1703	5.0
Cd-109	88.0	462.6	d	2527	4.8
Co-57	122.0	271.79	d	1338	4.9
Ce-139	166.0	137.64	d	1887	4.6
Hg-203	279.0	46.595	d	3764	4.8
Sn-113	392.0	115.09	d	2522	4.6
Sr-85	514.0	64.85	d	4672	5.0
Cs-137	662.0	30.0	y	1652	4.4
Y-88	898.0	106.63	d	6473	4.7
Co-60	1173.0	5.2714	y	3190	4.7
Co-60	1332.0	5.2714	y	3215	4.6
Y-88	1836.0	106.63	d	6813	4.6

Filled to 6.2 cm height. 192.6 grams of sand.
P O NUMBER 85626, 10/22/97 Release, Item 3

SOURCE PREPARED BY: Robert J. Haslett
R. J. Haslett, Production Manager

Q A APPROVED: W. Ruff 12-1-97

This standard will expire one year after the calibration date.

CALIBRATION INFORMATION

CALIBRATION DATE: Feb. 6, 1998

SOFTWARE VERSION: GDRP Version 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Detector 6

EFFICIENCY FILE: WT5500006.EFF

POSITION: 0

GEOMETRY DESCRIPTION: 450 ml Sand in a WAT5 container (1.6 g/cc)

CALIBRATION STANDARD ID: 53858-162 (Analytics)

ENERGY RANGE OF CAL.: 59 Kev to 1836 Kev

PERFORMED BY: Milton Thisell

REVIEWED BY: JmRaimondi DATE 2/26/98

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Yankee Atomic Electric Company
Environmental Laboratory

Sample ID : 53858-162 SOIL STD. (WAT5)

Sampling Start. . . 04/01/97 12:00:00	Counting Start. . . . 02/06/98 16:33:31
Sampling Stop . . . 04/01/97 12:00:00	Decay Time. . . . . 7.47e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 6000 Sec
Sample Size . . . . 1.00e+000 SAMPLE	Real Time . . . . . 6155 Sec
Collection Efficiency 1.0000	Spectrum File 03768906.SPC

Detector #: 6

Energy(keV)= 1.02 + 0.659*Ch + 0.00e+000*Ch^2 + 0.00e+000*Ch^3 02/06/98 16:33

FWHM(keV) = 1.04 + -0.001*En + 7.87e-004*En^2 + 0.00e+000*En^3 12/05/95 15:50
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 72 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.50	88.71	57148	376	511	36251	1.19	
2	88.04	132.01	129277	462	511	36195	1.11	
3	122.09	183.65	56287	334	414	23743	1.26	
4	136.50	205.51	7391	228	371	19125	1.47	
5	165.90	250.11	37305	275	345	16499	1.20	
6	279.09	421.80	2536	151	244	9399	1.19	
7	391.65	592.55	22721	202	236	7696	1.54	
8	661.64	1002.09	72648	297	231	5903	1.56	
9	898.00	1360.63	27090	199	195	5646	1.83	
10	1173.23	1778.12	77539	290	142	2714	1.95	
11	1325.32	2008.83	828	63	100	1233	3.38	a HiResid
12	1332.48	2019.69	70923	269	60	740	2.08	b HiResid
13	1764.25	2674.63	94	30	51	339	2.81	
14	1836.03	2783.52	17924	136	40	266	2.46	
15	2505.09	3798.41	874	31	15	39	2.66	
16	2614.36	3964.16	165	14	10	19	3.57	

Yankee Atomic Electric Company
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: 53858-162 SOIL STD. (WAT5)

Stds Match Tolerance(keV) . . . 1.00	Spectrum File 03768906.SPC
Number of Grams . . . . . 1.00e+000	Counting Start. . . . 02/06/98 16:33:31
Current Date. . . . 02/23/98 14:25:56	Decay Time. . . . . 7.47e+003 Hrs
Standards File. GDRSTD24.STD	Assay Date 04/01/97 12:00

ID.: Analytics 53858-162,WAT5 SAND

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm
1	Am-241	59.54	3.789e+006	1.00000	1275.00
2	Cd-109	88.03	1.114e+004	1.00000	1988.00
3	Co-57	122.06	6.502e+003	1.00000	1018.00
4	Ce-139	165.85	3.304e+003	1.00000	1481.00
5	Sn-113	391.69	2.762e+003	1.00000	1992.00
6	Cs-137	661.65	2.645e+005	1.00000	1376.00
7	Y-88	898.02	2.558e+003	1.00000	5068.00
8	Co-60	1173.22	4.621e+004	1.00000	2492.00
9	Co-60	1332.49	4.621e+004	1.00000	2511.00
10	Y-88	1836.01	2.558e+003	1.00000	5336.00

Geometry File WT5SS006.EFF	ID. . . 450 ml Sand in a WAT5 1.6
Detector Number 6	Calibration Date. . . 02/06/98 16:33:31

Eff = 1 / [8.71e-003*En^-3.34e+000 + 1.54e+002*En^6.70e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	7.48e-003	1.58	7.60e-003	0.00	0.00e+000
2	88.03	1.73e-002	-2.81	1.68e-002	0.00	0.00e+000
3	122.06	2.04e-002	2.89	2.10e-002	0.00	0.00e+000
4	165.85	2.01e-002	-0.22	2.01e-002	0.00	0.00e+000
5	391.69	1.24e-002	-2.19	1.21e-002	0.00	0.00e+000
6	661.65	8.97e-003	-5.02	8.54e-003	0.00	0.00e+000
7	898.02	6.74e-003	3.28	6.96e-003	0.00	0.00e+000
8	1173.22	5.80e-003	0.39	5.82e-003	0.00	0.00e+000
9	1332.49	5.27e-003	1.53	5.35e-003	0.00	0.00e+000
10	1836.01	4.23e-003	1.87	4.31e-003	0.00	0.00e+000

OK MWT 2/24/98

EFFIC. COEFFICIENTS STORED ON WT5SS006.EFF.

ANALYTICS

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Atlanta, Georgia 30318 · U.S.A.

Phone (404) 352-8677
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CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

53858-162

450 mL Sand in 500 mL Clear Plastic Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: April 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1275	5.0
Cd-109	88	462.6	d	1988	5.0
Co-57	122	271.79	d	1018	5.0
Ce-139	166	137.64	d	1481	4.4
Hg-203	279	46.595	d	3160	4.7
Sn-113	392	115.09	d	1992	4.9
Cs-137	662	30.0	y	1376	4.5
Y-88	898	106.63	d	5068	4.5
Co-60	1173	5.2714	y	2492	4.7
Co-60	1332	5.2714	y	2511	4.6
Y-88	1836	106.63	d	5336	4.2

720 grams of sand.
P O NUMBER 85626, 3/3/97 Release, Item 2

SOURCE PREPARED BY: M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED: D.M. Mathews 5-27-97

This standard will expire one year after the calibration date.

CALIBRATION INFORMATION

CALIBRATION DATE: Feb. 6, 1998

SOFTWARE VERSION: GDRP Version 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Detector 8

EFFICIENCY FILE: WT1SS$\phi\phi$8.EFF

POSITION: ϕ

GEOMETRY DESCRIPTION: Sand in a 4 oz. Poly Jar (1.6 g/cc)

CALIBRATION STANDARD ID: 54921-162 (Analytics)

ENERGY RANGE OF CAL.: 59 Kev to 1836 Kev

PERFORMED BY: Milton Thisell

REVIEWED BY: JMRaimondi DATE 2/26/98

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Yankee Atomic Electric Company
Environmental Laboratory

Sample ID : 54921-162 SOIL STD. (WAT1)

Sampling Start. . . 10/01/97 12:00:00	Counting Start. . . . 02/06/98 15:25:28
Sampling Stop . . . 10/01/97 12:00:00	Decay Time. . . . . 3.08e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 1500 Sec
Sample Size . . . . 1.00e+000 SAMPLE	Real Time . . . . . 1574 Sec
Collection Efficiency 1.0000	Spectrum File 03764108.SPC

Detector #: 8

Energy(keV)= 0.83 + 0.660*Ch + 0.00e+000*Ch^2 + 0.00e+000*Ch^3 02/06/98 15:25

FWHM(keV) = 0.86 + 0.014*En + 4.09e-004*En^2 + 0.00e+000*En^3 02/26/96 14:28
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 72 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.53	88.92	43647	✓	298	363	20820	1.15	
2	70.64	105.75	-347		155	230	14613	2.50	NET< CL Wide Pk
3	88.04	132.11	109737	✓	412	430	25671	1.16	
4	122.08	183.69	57781	✓	304	317	15958	1.26	
5	136.48	205.50	7372		208	334	15463	1.47	
6	165.88	250.04	56048	✓	297	314	13672	1.20	
7	255.07	385.17	1747		153	260	9349	1.30	
8	279.13	421.61	23578		206	242	8128	1.43	
9	391.65	592.08	38034	✓	226	201	5607	1.35	
10	513.97	777.39	32080		214	210	5418	1.55	
11	661.65	1001.11	37080	✓	223	208	4785	1.54	
12	813.97	1231.89	399		82	135	2972	1.23	
13	898.01	1359.21	47055	✓	234	152	3436	1.71	
14	1173.24	1776.16	42600	✓	217	118	1882	1.84	
15	1325.02	2006.11	1022		65	104	1229	2.80	a Wide Pk
16	1332.49	2017.43	39206	✓	203	72	851	1.93	b
17	1836.01	2780.25	30156	✓	176	44	302	2.24	
18	2505.20	3794.06	714		30	22	81	2.74	
19	2664.86	4035.94	53		16	26	97	3.00	

Yankee Atomic Electric Company
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: 54921-162 SOIL STD. (WAT1)

Stds Match Tolerance(keV) . . . 1.00	Spectrum File 03764108.SPC
Number of Grams . . . . . 1.00e+000	Counting Start. . . . 02/06/98 15:25:28
Current Date. . . . 02/24/98 14:24:29	Decay Time. . . . . 3.08e+003 Hrs
Standards File. GDRSTD23.STD	Assay Date 10/01/97 12:00

ID.: Analytics 54921-162,WAT1 SAND

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm
1	Am-241	59.54	3.789e+006	1.00000	1703.00
2	Cd-109	88.03	1.114e+004	1.00000	2527.00
3	Co-57	122.06	6.502e+003	1.00000	1338.00
4	Ce-139	165.85	3.304e+003	1.00000	1887.00
5	Sn-113	391.69	2.762e+003	1.00000	2522.00
6	Sr-85	513.99	1.556e+003	1.00000	4672.00
7	Cs-137	661.65	2.645e+005	1.00000	1652.00
8	Y-88	898.02	2.558e+003	1.00000	6473.00
9	Co-60	1173.22	4.621e+004	1.00000	3190.00
10	Co-60	1332.49	4.621e+004	1.00000	3215.00
11	Y-88	1836.01	2.558e+003	1.00000	6813.00

Geometry File WT1SS008.EFF	ID. . . Sand in 4 oz Poly Jar: 1.6 g/cc
Detector Number 8	Calibration Date. . . 02/06/98 15:25:28

Eff = 1 / [7.49e-003*En^-3.10e+000 + 9.34e+001*En^7.45e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	1.71e-002	1.08	1.73e-002	0.00	0.00e+000
2	88.03	3.51e-002	-2.07	3.43e-002	0.00	0.00e+000
3	122.06	4.00e-002	2.04	4.08e-002	0.00	0.00e+000
4	165.85	3.77e-002	0.24	3.78e-002	0.00	0.00e+000
5	391.69	2.17e-002	-1.33	2.15e-002	0.00	0.00e+000
6	513.99	1.80e-002	-2.54	1.76e-002	0.00	0.00e+000
7	661.65	1.51e-002	-3.63	1.46e-002	0.00	0.00e+000
8	898.02	1.11e-002	3.86	1.16e-002	0.00	0.00e+000
9	1173.22	9.32e-003	1.87	9.50e-003	0.00	0.00e+000
10	1332.49	8.51e-003	1.48	8.64e-003	0.00	0.00e+000
11	1836.01	6.79e-003	0.25	6.80e-003	0.00	0.00e+000

EFFIC. COEFFICIENTS STORED ON WT1SS008.EFF.

ANALYTICS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

54921-162

Sand in Four Ounce Poly Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. Am-241 was calibrated by 4 pi alpha liquid scintillation counting. The Sr-85 was calibrated in an ion chamber that was calibrated by the National Physical Laboratory, Teddington, U.K., and is directly traceable to national standards. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using germanium gamma spectroscopy. At the calibration time no interfering gamma-ray emitting impurities were detected. Emission rates for the most intense gamma-rays are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979.

Calibration date: October 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1703	5.0
Cd-109	88.0	462.6	d	2527	4.8
Co-57	122.0	271.79	d	1338	4.9
Ce-139	166.0	137.64	d	1887	4.6
Hg-203	279.0	46.595	d	3764	4.8
Sn-113	392.0	115.09	d	2522	4.6
Sr-85	514.0	64.85	d	4672	5.0
Cs-137	662.0	30.0	y	1652	4.4
Y-88	898.0	106.63	d	6473	4.7
Co-60	1173.0	5.2714	y	3190	4.7
Co-60	1332.0	5.2714	y	3215	4.6
Y-88	1836.0	106.63	d	6813	4.6

Filled to 6.2 cm height. 192.6 grams of sand.
P O NUMBER 85626, 10/22/97 Release, Item 3

SOURCE PREPARED BY: Robert J. Haslett
R. J. Haslett, Production Manager

Q A APPROVED: D.M. Rhyne 12-1-97

This standard will expire one year after the calibration date.

CALIBRATION INFORMATION

CALIBRATION DATE: Feb. 9, 1998

SOFTWARE VERSION: GDRP Version 3.1

DETECTOR DESCRIPTION: Environmental Gamma Spec. Detector 8

EFFICIENCY FILE: WT55ϕϕ8.EFF

POSITION: ϕ

GEOMETRY DESCRIPTION: 450 ml Sand in a WAT5 Container (1.6 g/cc)

CALIBRATION STANDARD ID: 53858-162 (Analytics)

ENERGY RANGE OF CAL.: 59 Kev to 1836 KeV

PERFORMED BY: Milton Thisell

REVIEWED BY: J.M. Raimondi DATE 2/26/98

GDR/P G A M M A A N A L Y S I S R E S U L T S Version 3.1

Yankee Atomic Electric Company
Environmental Laboratory

Sample ID : 53858-162 SOIL STD. (WAT5)

Sampling Start. . . 04/01/97 12:00:00	Counting Start. . . . 02/09/98 09:29:18
Sampling Stop . . . 04/01/97 12:00:00	Decay Time. . . . . 7.53e+003 Hrs
Buildup Time. . . . . 0.00e+000 Hrs	Live Time . . . . . 5000 Sec
Sample Size . . . . 1.00e+000 SAMPLE	Real Time . . . . . 5116 Sec
Collection Efficiency 1.0000	Spectrum File 04039408.SPC

Detector #: 8

Energy(keV)= 0.76 + 0.660*Ch + 0.00e+000*Ch^2 + 0.00e+000*Ch^3 02/09/98 09:29

FWHM(keV) = 0.86 + 0.014*En + 4.09e-004*En^2 + 0.00e+000*En^3 02/26/96 14:28
Where En = Sqrt(Energy in keV)

Search Sensitivity 0.30	Search Start / End. . . . . 72 / 4095
Sigma Multiplier. 1.00	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN-CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)		FLAG
1	59.54	89.03	52865	✓	307	351	18260	1.11 a	MANU HiResid
2	66.06	98.92	0		257	438	30368	1.49 b	NET< CL HiResid Wide Pk
3	88.05	132.23	118150	✓	435	469	30432	1.22	
4	122.10	183.81	51020	✓	297	328	17071	1.20	
5	136.53	205.67	6143		192	299	14165	1.28	
6	165.89	250.16	32493	✓	256	320	14181	1.20	
7	279.09	421.63	2264		154	257	9159	1.24	
8	391.66	592.17	20047	✓	188	218	6615	1.37	
9	661.65	1001.18	64273	✓	279	214	5067	1.55	
10	898.02	1359.27	23917	✓	187	183	4946	1.71	
11	1173.23	1776.17	68621	✓	272	129	2241	1.87	
12	1325.19	2006.39	548		58	99	1031	3.07 a	
13	1332.48	2017.43	63723	✓	255	64	663	1.93 b	
14	1836.01	2780.23	16058	✓	128	35	192	2.31	
15	2505.13	3793.89	903		31	14	34	2.50	
16	2614.17	3959.07	125		12	8	12	2.34	
17	2663.81	4034.28	26		9	12	28	2.41	
18	59.46	88.92	45740	ok	273	250	17353	0.87 a	DELETED HiResid

Yankee Atomic Electric Company
Environmental Laboratory
GDR/P DETECTOR CALIBRATION

SAMPLE ID: 53858-162 SOIL STD. (WAT5)

Stds Match Tolerance(keV) . . . 1.00	Spectrum File 04039408.SPC
Number of Grams . . . . . 1.00e+000	Counting Start. . . . 02/09/98 09:29:18
Current Date. . . . 02/23/98 14:55:52	Decay Time. . . . . 7.53e+003 Hrs
Standards File. GDRSTD24.STD	Assay Date 04/01/97 12:00

ID.: Analytics 53858-162,WAT5 SAND

Pk #	Name	Energy	Halflife (hrs)	Br.Ratio	dps/gm
1	Am-241	59.54	3.789e+006	1.00000	1275.00
2	Cd-109	88.03	1.114e+004	1.00000	1988.00
3	Co-57	122.06	6.502e+003	1.00000	1018.00
4	Ce-139	165.85	3.304e+003	1.00000	1481.00
5	Sn-113	391.69	2.762e+003	1.00000	1992.00
6	Cs-137	661.65	2.645e+005	1.00000	1376.00
7	Y-88	898.02	2.558e+003	1.00000	5068.00
8	Co-60	1173.22	4.621e+004	1.00000	2492.00
9	Co-60	1332.49	4.621e+004	1.00000	2511.00
10	Y-88	1836.01	2.558e+003	1.00000	5336.00

Geometry File WT5SS008.EFF	ID. . . 450 ml Sand in a WAT5 1.6 g
Detector Number 8	Calibration Date. . . 02/09/98 09:29:18

Eff = 1 / [5.18e-003*En^-3.49e+000 + 1.43e+002*En^6.59e-001]
(Where En = Energy in MeV))

Pk. #	Energy (kev)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.54	8.30e-003	1.12	8.40e-003	0.00	0.00e+000
2	88.03	1.90e-002	-1.98	1.86e-002	0.00	0.00e+000
3	122.06	2.24e-002	1.96	2.28e-002	0.00	0.00e+000
4	165.85	2.13e-002	0.59	2.14e-002	0.00	0.00e+000
5	391.69	1.33e-002	-3.28	1.29e-002	0.00	0.00e+000
6	661.65	9.53e-003	-4.17	9.15e-003	0.00	0.00e+000
7	898.02	7.26e-003	2.91	7.48e-003	0.00	0.00e+000
8	1173.22	6.17e-003	1.71	6.27e-003	0.00	0.00e+000
9	1332.49	5.68e-003	1.49	5.77e-003	0.00	0.00e+000
10	1836.01	4.63e-003	0.83	4.67e-003	0.00	0.00e+000

EFFIC. COEFFICIENTS STORED ON WT5SS008.EFF.

ANALYTICS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 · U.S.A.

Phone (404) 352-8677
Fax (404) 352-2837

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

53858-162

450 mL Sand in 500 mL Clear Plastic Jar

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: April 1, 1997 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE		GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432	y	1275	5.0
Cd-109	88	462.6	d	1988	5.0
Co-57	122	271.79	d	1018	5.0
Ce-139	166	137.64	d	1481	4.4
Hg-203	279	46.595	d	3160	4.7
Sn-113	392	115.09	d	1992	4.9
Cs-137	662	30.0	y	1376	4.5
Y-88	898	106.63	d	5068	4.5
Co-60	1173	5.2714	y	2492	4.7
Co-60	1332	5.2714	y	2511	4.6
Y-88	1836	106.63	d	5336	4.2

720 grams of sand.
P O NUMBER 85626, 3/3/97 Release, Item 2

SOURCE PREPARED BY: M. D. Currie
M. D. Currie, Radiochemist

Q A APPROVED: D.M. Mattingly 5-27-97

This standard will expire one year after the calibration date.

LIQUID SCINTILLATION CALIBRATION FORM

Date of Calibration 01/15/2002
Detector Number 2
Single/Dual Label Single

Calibrated by B.C. Gilmartin
Analysis of Interest H-3
Cocktail Type Ultima Gold AB

Reviewed by [signature]
Parameter/Protocol No. 102
Sample/Cocktail Ratio 05:15

Window 1 Nuclide H-3
Channel Setting 10-225
Background cpm 19.365

Window 2 Nuclide
Channel Setting
Background cpm

Source ID	Nuclide	Standard Reference Date/Time	Standard Activity (DPM) on Reference Date	Carrier (mg)	Quenching Agent	Count Date/Time	Percent Dead Time	SQP(E) Value	Window 1 Gross CPM	Window 1 Efficiency (c/d)	Window 2 Gross CPM	Window 2 Efficiency (c/d)
H090401-A	H-3	03/01/96 07:00	243100	0.0	None	01/15/02 14:58	2.663	429.69	62355.49	0.357266		
H090401-B	H-3	03/01/96 07:00	231500	0.0	None	01/15/02 15:09	2.601	429.29	59590.36	0.358527		
H090401-C	H-3	03/01/96 07:00	230600	0.0	Nitromethane	01/15/02 15:19	2.508	416.42	55521.79	0.335461		
H090401-D	H-3	03/01/96 07:00	221000	0.0	Nitromethane	01/15/02 15:30	2.446	415.62	52698.64	0.332235		
H090401-E	H-3	03/01/96 07:00	226700	0.0	Nitromethane	01/15/02 15:40	2.400	404.70	50700.97	0.311605		
H090401-G	H-3	03/01/96 07:00	213000	0.0	Nitromethane	01/15/02 15:51	2.186	383.98	41120.14	0.268977		
H090401-H	H-3	03/01/96 07:00	250000	0.0	Nitromethane	01/15/02 16:01	2.289	373.75	45751.50	0.254980		
H090401-I	H-3	03/01/96 07:00	222700	0.0	Nitromethane	01/15/02 16:12	2.094	362.08	37039.45	0.231732		
H090401-J	H-3	03/01/96 07:00	242200	0.0	Nitromethane	01/15/02 16:22	2.007	344.12	33101.10	0.190419		

Window 1 Nuclide 1 Efficiency See graph
Window 1 Nuclide 2 Efficiency
Window 1 Cross Talk (Nuclide 2 in Nuclide 1 Window)
Window 2 Cross Talk (Nuclide 1 in Nuclide 2 Window)

Window 2 Nuclide 1 Efficiency
Window 2 Nuclide 2 Efficiency

TUE 15 JAN 2002 14:37

PARAMETER GROUP: 2
(PARAM02\H01)
H090401 STDS

ID: LKB #2 H-3 and C-14

POS	CTIME	DTIME%	DATE	TIME		SQP(E)	CPM1	CPM2	CPM3	WINDOW1	WINDOW2	
001	00600	1.263	15-JAN-2002	14:47	9.885	428.75	19.12	13.15	21.41	10- 225	300- 470	Bkgd.
002	00600	2.663	15-JAN-2002	14:58	9.749	429.69	62355.49	17.43	21.78	10- 225	300- 470	H090401-A
003	00600	2.601	15-JAN-2002	15:09	9.751	429.29	59590.36	14.25	18.91	10- 225	300- 470	H090401-B
004	00600	2.508	15-JAN-2002	15:19	9.764	416.42	55521.79	12.90	17.96	10- 225	300- 470	H090401-C
005	00600	2.446	15-JAN-2002	15:30	9.771	415.62	52698.64	13.91	18.77	10- 225	300- 470	H090401-D
006	00600	2.400	15-JAN-2002	15:40	9.775	404.70	50700.97	13.29	19.58	10- 225	300- 470	H090401-E
007	00600	2.186	15-JAN-2002	15:51	9.797	383.98	41120.14	15.71	18.26	10- 225	300- 470	H090401-G
008	00600	2.289	15-JAN-2002	16:01	9.786	373.75	45751.50	15.32	17.14	10- 225	300- 470	H090401-H
009	00600	2.094	15-JAN-2002	16:12	9.806	362.08	37039.45	12.84	16.21	10- 225	300- 470	H090401-I
010	00600	2.007	15-JAN-2002	16:22	9.815	344.12	33101.10	16.20	17.11	10- 225	300- 470	H090401-J

POS	CTIME	DTIME%	DATE	TIME		SQP(E)	CPM1	CPM2	CPM3	WINDOW1	WINDOW2	
011	00600	1.263	15-JAN-2002	16:33	9.889	426.81	19.61	12.84	22.22	10- 225	300- 470	Bkgd.

TOTAL COUNT RATE 1: 437918.2 CPM
2: 157.8 CPM

CERTIFICATE OF CONTENT (PAGE 1/2)

Nuclide:	H-3
Nuclide ID:	TRY44112
Licensed/Exempt:	Exempt
Reference date of Primary @T0:	03/01/1996 07:00EST
Reference Concentration (C0):	(1.294)E0 ±2.50% uCi/gm
Date of Preparation of Sample (T1):	09/04/2001 07:00EST
Elapsed Time (Delta T):	5.51 YEARS
Half Life (t1/2):	12.2800 Year(s)
Decay Correction (DC):	0.7327
Concentration @T1 (Ct):	(948 ± 24)E-03 uCi/gm
Source Supplier/Media:	AEA TECH/glass liq scin v
Last Date Of Verification:	07/01/2001
Final Matrix Media Type:	LKB CALS
Preparer's Name:	KRM

==========

Weight of Primary Reference Standard — Mettler AE163 Analytical Balance SN: F33394

a) Container+reference standard weight:	3.36390 g
b) Container weight:	2.55012 g
c) Net reference standard weight (Wr):	0.81378 g

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Preservatives added:

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Total Weight of Source Matrix — Mettler AE163 Balance SN: F33394

a) Container + source matrix + preservative + Reference Standard Weight:	3.36390 g
b) Container weight:	2.55012 g
c) Net source matrix weight (Ws):	0.81378 g

==========

Estimated Uncertainty (in %) of Radioactivity Source Matrix (@ 1-Sigma)

Source Standard:	2.50
Pippetting:	0.00
Weighing Error:	1.00
Internal Lab Standardization:	0.00
Other:	0.00
Total:	3.50 %
Uncertainty Conversion:	0.0269

Total Activity of Primary Reference Standard Added

At0 = Wr * C0 = (2338 ± 63)E 03 dpm Act @ Ref. Date (t0)
At1 = Wr * C0 * DC = (1713 ± 46)E 03 dpm Act @ Prep. Date (t1)

==========

Final Source Matrix Concentration

Cm = At0/(Ws) = (2873 ± 77)E 03 dpm/gm Conc. @ (t0)
Cm = At1/(Ws) = (2105 ± 57)E 03 dpm/gm Conc. @ (t1)

==========

Special Notes/Directions

10 liquid scintillation cal sources were prepared by spiking approximately 5 grams of DI H2O in glass lsv's with H-3 from an exempt primary standard. Each of these sources will have Ultima Gold AB added (15mls) plus an increa sing amount of Nitromethane as quenching agent.

==========

ID of Source Just Prepared: H090401-A to J

Split Identification	Beginning Weight	Ending Weight	Difference	Total dpm Act @ t0	Total dpm Act @ t1
H090401-A	3.3639g	3.27929g	0.08461g	(2431 ± 65)E 02	(1781 ± 48)E 02
H090401-B	3.27929g	3.19871g	0.08058g	(2315 ± 62)E 02	(1696 ± 46)E 02
H090401-C	3.19871g	3.11842g	0.08029g	(2306 ± 62)E 02	(1690 ± 45)E 02
H090401-D	3.11842g	3.04149g	0.07693g	(2210 ± 59)E 02	(1619 ± 44)E 02
H090401-E	3.04149g	2.96257g	0.07892g	(2267 ± 61)E 02	(1661 ± 45)E 02
H090401-F	2.96257g	2.87311g	0.08946g	(2570 ± 69)E 02	(1883 ± 51)E 02
H090401-G	2.87311g	2.79898g	0.07413g	(2130 ± 57)E 02	(1560 ± 42)E 02
H090401-H	2.79898g	2.71195g	0.08703g	(2500 ± 67)E 02	(1832 ± 49)E 02
H090401-I	2.71195g	2.63443g	0.07752g	(2227 ± 60)E 02	(1632 ± 44)E 02
H090401-J	2.63443g	2.55012g	0.08431g	(2422 ± 65)E 02	(1775 ± 48)E 02

TR444112 H-3 1°

3.36390 g > H090401-A
3.27929 g > -B
3.19871 g > -C
3.11842 g > -D
3.04149 g > -E
2.96257 g > -F
2.87311 g > -G
2.79898 g > -H
2.71195 g > -I
2.63443 g > -J
2.55012 g

Kenneth R Martin 09/04/2001
PREPARER'S SIGNATURE DATE

Amersham International plc
Amersham Laboratories

Certificate of calibration of standardized tritium labelled water

K 6228

NAMAS
CALIBRATION
No. 0146

Description

Radionuclide: TRITIUM (HYDROGEN-3)

Product code: TRY·44

Chemical form: water

Batch: 112

Measurement

Reference time: 1200 GMT on 1 March 1996

Radioactive concentration of tritium:	47.89	kilobecquerels per gram of water
which is equivalent to:	1.294	microcuries per gram of water
or:	2.87×10^6	disintegrations per minute per gram of water

Method of Measurement
This reference material was calibrated by direct comparison with a standard of tritium-labelled water obtained from the National Institute of Standards and Technology, USA.

Accuracy

The OVERALL UNCERTAINTY of the result quoted above is estimated to be less than ±2.5%

This estimate of uncertainty was calculated in accordance with the recommendations of the International Commission on Radiation Units and Measurements (ICRU Report 12). The limits of uncertainty were taken as the arithmetic sum of the uncertainty due to random variations, calculated at the 99·7% confidence level, and the estimated systematic uncertainties.

Purity

No radioactive impurities were detected. (Impurities with total activity greater than 0.001% of the activity of the tritium would have been detected).

Physical Data

Half-life of tritium: 12·43 ± 0·11 years

Maximum beta energy of tritium: 18·6 keV

Remarks:

The S.I. unit of radioactivity is the becquerel.

1 becquerel (Bq) = 1 nuclear transformation per second, therefore
1 curie (Ci) = $3{\cdot}7 \times 10^{10}$ becquerels exactly.

Useful conversion factors are:

1 microcurie (μCi) = $3{\cdot}7 \times 10^4$ Bq = 37 kilobecquerels (kBq)

1 kilobecquerel (kBq) = 27·027 nanocuries (nCi)

This product meets the quality assurance requirements of NRC Regulatory Guide 4.15 for achieving implicit NIST (NBS) traceability as defined in NCRP58 (1985).

Approved signatory

W. F. Cass

Amersham

Decay tables for tritium labelled water (Batch 112)

The half-life used in calculating the decay was 12·43 years:

Table 1. Activity expressed in dpm per gram of water.

Year / Month	1996	1997	1998	1999
1st January		2.74×10^6 dpm/g	2.59×10^6 dpm/g	2.45×10^6 dpm/g
1st February		2.73×10^6	2.58×10^6	2.44×10^6
1st March	2.87×10^6 dpm/g	2.71×10^6	2.57×10^6	2.43×10^6
1st April	2.86×10^6	2.70×10^6	2.56×10^6	2.42×10^6
1st May	2.84×10^6	2.69×10^6	2.54×10^6	2.41×10^6
1st June	2.83×10^6	2.68×10^6	2.53×10^6	2.39×10^6
1st July	2.82×10^6	2.66×10^6	2.52×10^6	2.38×10^6
1st August	2.80×10^6	2.65×10^6	2.51×10^6	2.37×10^6
1st September	2.79×10^6	2.64×10^6	2.50×10^6	2.36×10^6
1st October	2.78×10^6	2.63×10^6	2.48×10^6	2.35×10^6
1st November	2.76×10^6	2.61×10^6	2.47×10^6	2.34×10^6
1st December	2.75×10^6	2.60×10^6	2.46×10^6	2.33×10^6

Table 2. Activity expressed in μCi per gram of water.

Year / Month	1996	1997	1998	1999
1st January		1.235 μCi/g	1.168 μCi/g	1.105 μCi/g
1st February		1.229	1.162	1.099
1st March	1.294 μCi/g	1.224	1.158	1.095
1st April	1.288	1.218	1.152	1.090
1st May	1.282	1.213	1.147	1.085
1st June	1.276	1.207	1.141	1.080
1st July	1.270	1.201	1.136	1.075
1st August	1.264	1.196	1.131	1.070
1st September	1.258	1.190	1.125	1.064
1st October	1.252	1.185	1.120	1.060
1st November	1.246	1.179	1.115	1.055
1st December	1.241	1.174	1.110	1.050

Note:
Standardized tritium labelled water should not be left exposed to the atmosphere because the specific activity of the material will progressively decrease as its vapour equilibrates with atmospheric water vapour.

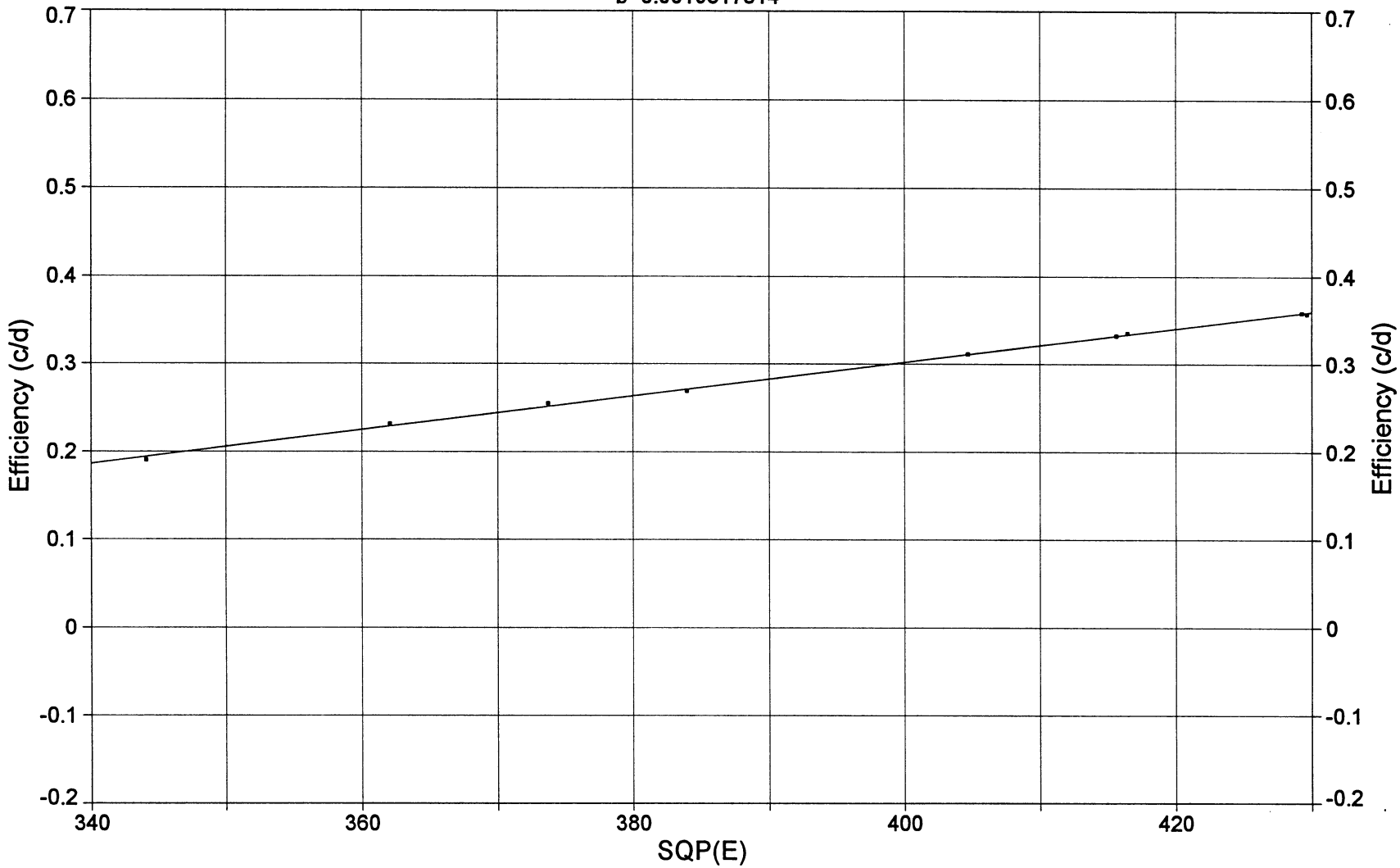
LKB LSC #2: H-3 CALIBRATION CURVE

Rank 1 Eqn 1 y=a+bx

r^2=0.99832592 DF Adj r^2=0.99776789 FitStdErr=0.0026065865 Fstat=4174.4014

a=-0.470573

b=0.0019317514



Rank 1 Eqn 1 y=a+bx

r^2 Coef Det	DF Adj r^2	Fit Std Err	F-value
0.9983259201	0.9977678935	0.0026065865	4174.4013915

Parm	Value	Std Error	t-value	95% Confidence Limits		P>|t|
a	-0.47057300	0.011857360	-39.6861512	-0.49861120	-0.44253479	0.00000
b	0.001931751	2.98988e-05	64.60960758	0.001861052	0.002002451	0.00000

Area Xmin-Xmax	Area Precision		
23.688453446	0.0000000000		
Function min	X-Value	Function max	X-Value
0.1941820705	344.12039636	0.3594812742	429.69000000
1st Deriv min	X-Value	1st Deriv max	X-Value
0.0019317514	344.12054446	0.0019317514	344.12039636
2nd Deriv min	X-Value	2nd Deriv max	X-Value
0.0000000000	344.12039636	0.0000000000	344.97626568

Soln Vector	Covar Matrix		
Direct	LUDecomp		
r^2 Coef Det	DF Adj r^2	Fit Std Err	Max Abs Err
0.9983259201	0.9977678935	0.0026065865	0.0037623049

Source	Sum of Squares	DF	Mean Square	F Statistic	P>F
Regr	0.028362107	1	0.028362107	4174.4	0.00000
Error	4.7560052e-05	7	6.7942931e-06		
Total	0.028409667	8			

Date	Time	File Source
Mar 8, 2002	11:14:26 AM	c:\tablecurve2dv5\h3_unit2.prn

Rank 1 Eqn 1 y=a+bx

XY	*	X Value	Y Value	Y Predict	Residual	Residual%	95% Confidence Limits		95% Prediction Limits		Weights
1		344.12000	0.1904190	0.1941813	-0.003762	-1.975803	0.1900070	0.1983556	0.1867372	0.2016254	1
2		362.08000	0.2317320	0.2288756	0.0028564	1.2326479	0.2257436	0.2320076	0.2219619	0.2357893	1
3		373.75000	0.2549800	0.2514191	0.0035609	1.3965411	0.2488521	0.2539861	0.2447423	0.2580959	1
4		383.98000	0.2689770	0.2711809	-0.002204	-0.819370	0.2689704	0.2733914	0.2646329	0.2777289	1
5		404.70000	0.3116050	0.3112068	0.0003982	0.1277880	0.3090521	0.3133615	0.3046774	0.3177362	1
6		415.62000	0.3322350	0.3323015	-6.65e-05	-0.020025	0.3298033	0.3347998	0.3256509	0.3389522	1
7		416.42000	0.3354610	0.3338469	0.0016141	0.4811490	0.3313161	0.3363778	0.3271840	0.3405099	1
8		429.29000	0.3585270	0.3587086	-0.000182	-0.050644	0.3555586	0.3618586	0.3517867	0.3656305	1
9		429.69000	0.3572660	0.3594813	-0.002215	-0.620063	0.3563098	0.3626528	0.3525496	0.3664130	1

LKB LSC #2: H-3 CALIBRATION CURVE

Rank 1 Eqn 1 y=a+bx

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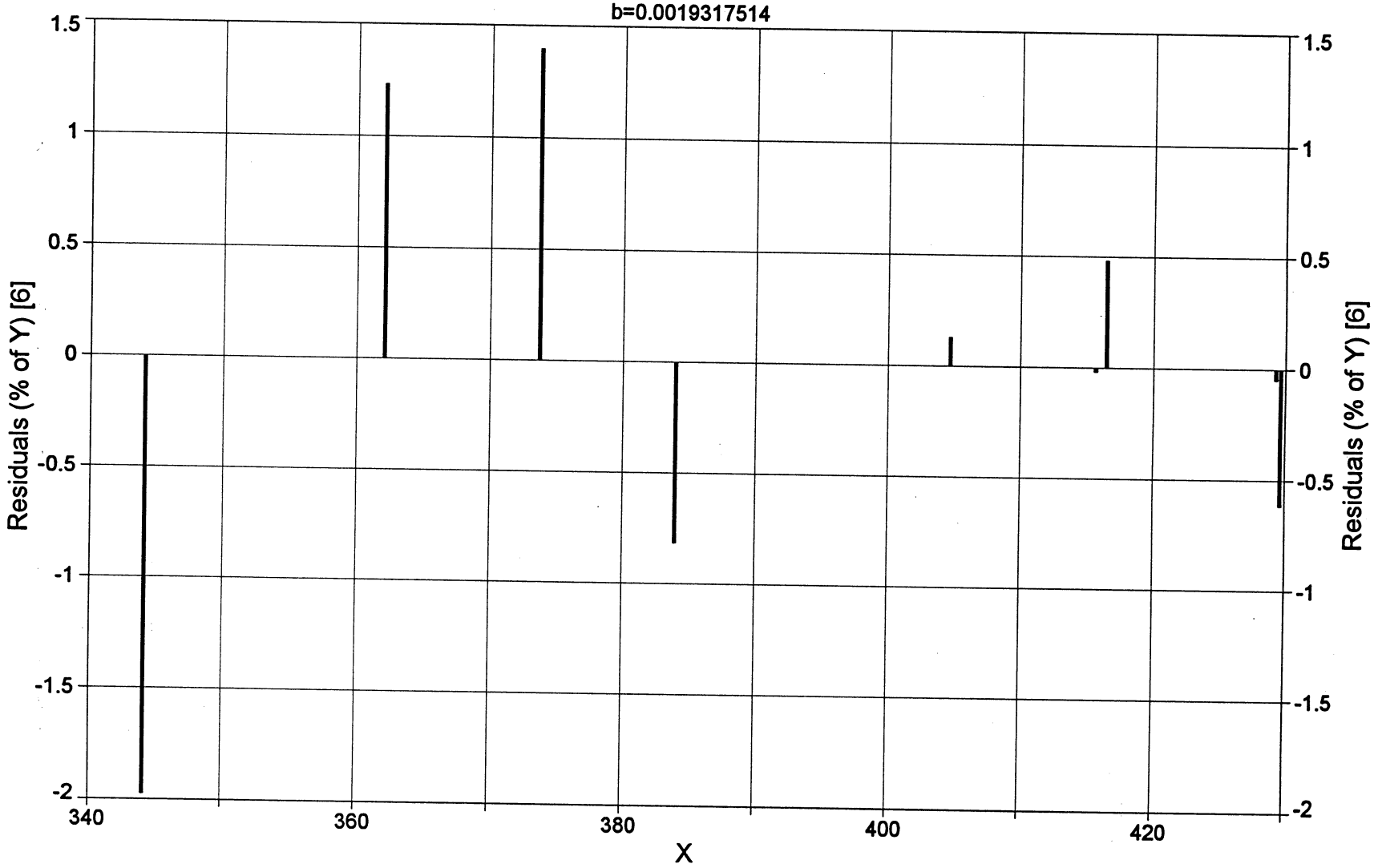
b=0.0019317514



Indx	X	Resid(%ofY)
1	344.12000000	-1.975803285
2	362.08000000	1.2326478709
3	373.75000000	1.3965410793
4	383.98000000	-0.819369918
5	404.70000000	0.1277880219
6	415.62000000	-0.020025490
7	416.42000000	0.4811489784
8	429.29000000	-0.050644346
9	429.69000000	-0.620062985