IEM
Integrated Environmental Management, Inc.

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

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

October 3, 1994

Mr. C. Scott Eves
Vice President, Environmental Services
Shieldalloy Metallurgical Corporation, Inc.
West Boulevard, Post Office Box 768
Newfield, New Jersey 08344

Re: Slag Sampling Program Summary

Dear Mr. Eves:

In July of 1994, seven samples of ferrocolumbium slag were collected and analyzed for their radiological constituents pursuant to the instructions in my letter to you dated July 20, 1994. Attachment A contains copies of the completed "Sample Collection and Survey Forms". Attachment B contains a copy of the completed DHL Express Shipment Airwaybill. Attachment C contains a completed copy of the Chain of Custody Record showing that the samples are currently in the custody of EcoTek Laboratory Services Incorporated (EcoTek), in Atlanta.

The samples were analyzed by gamma spectroscopy for thorium daughters and uranium daughters. The results of these analyses, and the case narrative, are contained in Attachment D. In addition, isotopic thorium and uranium analyses were performed after total dissolution of a portion of each sample. The results of the two isotopic analyses, and their case narratives, are contained in Attachments E and F, respectively.

These results require a bit of interpretation since the gamma spectra associated with the uranium and thorium series are a bit complicated. The best indication of uranium and thorium content are obtained either from the yield-corrected count rates from direct measurement of certain daughters by gamma spectroscopy, or from the isotopic analyses. The following are <u>mean</u> values for the parents of each of the three series as determined by the two methodologies:

Thorium-232		Uranium-238		Uranium-235	
Representative Energy	**pCi/g**	**Representative Energy**	**pCi/g**	**Representative Energy**	**pCi/g**
Tl-208	319.33	Ac-228	390.00	U-238 (iso)	16.41
Pb-212	341.43	U-234 (iso)	361.43		
Th-228 (iso)	395.00	U-238 (iso)	366.57		
Th-232 (iso)	381.29	Th-230 (iso)	357.14		
AVERAGE	359.26	AVERAGE	358.79	AVERAGE	16.41

The results are consistent for all methodologies. However, the isotopic analyses provide the most conservative (highest) results because there is little-to-no competition from other radionuclides during counting. The following is a summary of the total source material content of the individual samples based upon the results of isotopic analysis only:

Sample No.	Thorium-232		Uranium-238		Uranium-235		Total Source Material
	Activity (pCi/g)	**ppm**	**Activity (pCi/g)**	**ppm**	**Activity (pCi/g)**	**ppm**	**ppm**
1	354	3220	347	1050	14.8	7.1	4280
2	470	4270	408	1240	19.4	9.2	5520
3	501	4550	409	1240	19.9	9.5	5800
4	317	2880	323	979	12.8	6.1	3870
5	322	2930	323	979	13.6	6.5	3910
6	401	3650	455	1380	22.4	10.7	5030
7	304	2760	301	912	12.0	5.7	3680
Avg	381	3470	367	1110	16.4	7.8	4580

For your information, the exempt quantity of source material, pursuant to 10 CFR 40, is 500 parts per million, or 0.05% by weight. These samples contain an average of 0.46% source material, by weight.

It has been a pleasure assisting you in collection and analysis of these data. I hope that the results will prove to be of benefit in the future. If I can answer any questions or provide you with additional information, please give me a call at (301) 762-0502.

Sincerely,

Carol D. Berger, C.H.P.

File 95005

ATTACHMENT A

(HEAT # 1113725)

SAMPLE COLLECTION AND SURVEY FORM

Name of Surveyor: JAMES P VALENTI

Today's Date: 7-29-94

Instrument Model No. EBERLINE ESP-1

Instrument Serial No. 03047

Probe Model No. EBERLINE HP210

Probe Serial No. 105796

Reading Number	Instrument Reading	Units
1	8.02×10^3	cpm
2	7.52×10^3	cpm
3	6.89×10^3	cpm
4	7.75×10^3	cpm
5	7.61×10^3	cpm
6	7.13×10^3	cpm
7	7.05×10^3	cpm
8	7.54×10^3	cpm
9	6.83×10^3	cpm
10	1.15×10^4	cpm

Sample No. SMC-7-29-94-1

(113705)

SAMPLE COLLECTION AND SURVEY FORM

Name of Surveyor: JAMES P. VALENTI

Today's Date: 7-29-94

Instrument Model No. EBERLINE E520-1

Instrument Serial No. 03047

Probe Model No. EBERLINE HP-210

Probe Serial No. 105796

Reading Number	Instrument Reading	Units
1	7.54×10^3	cpm
2	7.86×10^3	cpm
3	6.50×10^3	cpm
4	7.14×10^3	cpm
5	6.96×10^3	cpm
6	7.66×10^3	cpm
7	8.08×10^3	cpm
8	7.48×10^3	cpm
9	7.50×10^3	cpm
10	7.36×10^3	cpm

Sample No. SMC-7-29-94-2

(113705)

SAMPLE COLLECTION AND SURVEY FORM

Name of Surveyor: JAMES P. VALENTI

Today's Date: 7-29-94

Instrument Model No. EBERLINE ESP-1

Instrument Serial No. 03047

Probe Model No. EBERLINE HP-210

Probe Serial No. 705796

Reading Number	Instrument Reading	Units
1	6.52×10^3	cpm
2	7.48×10^3	cpm
3	7.31×10^3	cpm
4	7.40×10^3	cpm
5	7.52×10^3	cpm
6	7.17×10^3	cpm
7	7.38×10^3	cpm
8	7.46×10^3	cpm
9	7.33×10^3	cpm
10	7.63×10^3	cpm

Sample No. SMC-7-29-94-3

HEAT # 111376

SAMPLE COLLECTION AND SURVEY FORM

Name of Surveyor: JAMES P. VALENTI

Today's Date: 8-1-94

Instrument Model No. ESP-1

Instrument Serial No. 03047

Probe Model No. EBERLINE HP-210

Probe Serial No. 705796

Reading Number	Instrument Reading	Units
1	8.35×10^3	cpm
2	8.44×10^3	cpm
3	7.8×10^3	cpm
4	8.75×10^3	cpm
5	8.98×10^3	cpm
6	7.82×10^3	cpm
7	8.16×10^3	cpm
8	8.25×10^3	cpm
9	8.56×10^3	cpm
10	8.87×10^3	cpm

Sample No. SMC-8-1-94-1

SAMPLE COLLECTION AND SURVEY FORM

Name of Surveyor: JAMES P. VALENTI

Today's Date: 8-1-94

Instrument Model No. ESP-1

Instrument Serial No. 03047

Probe Model No. EBERLINE HP-210

Probe Serial No. 705796

Reading Number	Instrument Reading	Units
1	8.75×10^3	cpm
2	8.54×10^3	cpm
3	7.97×10^3	cpm
4	6.85×10^3	cpm
5	8.43×10^3	cpm
6	7.48×10^3	cpm
7	8.84×10^3	cpm
8	1.14×10^4	cpm
9	9.32×10^3	cpm
10	7.5×10^3	cpm

Sample No. SMC-8-1-94-2

2

SAMPLE COLLECTION AND SURVEY FORM

Name of Surveyor: JAMES P. VALENTI

Today's Date: 8-1-94

Instrument Model No. ESP-1

Instrument Serial No. 03047

Probe Model No. EBERLINE HP-210

Probe Serial No. 705796

Reading Number	Instrument Reading	Units
1	8.31×10^3	cpm
2	7.94×10^3	cpm
3	8.94×10^3	cpm
4	8.44×10^3	cpm
5	9.15×10^3	cpm
6	9.37×10^3	cpm
7	7.56×10^3	cpm
8	7.69×10^3	cpm
9	1.1×10^4	cpm
10	1.20×10^4	cpm

Sample No. SMC-8-1-94-3

3

SAMPLE COLLECTION AND SURVEY FORM

Name of Surveyor: JAMES P. VALENTI

Today's Date: 8-1-94

Instrument Model No. ESP-1

Instrument Serial No. 03047

Probe Model No. EBERLINE HP-210

Probe Serial No. 105796

Reading Number	Instrument Reading	Units
1	1.62×10^4	cpm
2	8.4×10^3	cpm
3	1.48×10^4	cpm
4	8.46×10^3	cpm
5	8.26×10^3	cpm
6	9.85×10^3	cpm
7	9.15×10^3	cpm
8	8.44×10^3	cpm
9	1.04×10^4	cpm
10	8.92×10^3	cpm

Sample No. SMC-8-1-94-4

ATTACHMENT B

REORDER 763357517-10 QTY 200

7/08/94 3

Shipment Airwaybill

(Non negotiable)

DHL WORLDWIDE EXPRESS

1-800-CALL-DHL *in USA only*

PPF
PPF 7466038635

Quote this shipment number in an inquiry

PP

ORIGIN	DESTINATION
PBW	

1 From (Shipper)

Account no.: 763357517

Shipper's reference:

Company name: SHIELDALLOY METALLURGICAL CORP

Shipper's name: Jim Valenti

Address: 12 WEST BLVD
NEWFIELD NJ

Zip code (required): 083449558

Phone/Fax/Telex *circle one*: (609)692-4200

2 To (Recipient)

Company name: EcoTek LSI

Attention: Mike Meiser

Delivery address *DHL cannot deliver to a PO Box*: 342 International Park Dr, SE
Atlanta, Georgia

Zip/Postcode (required): 30316

Phone/Fax/Telex *circle one*:

3 Shipment details

Services

- [x] U.S. DOMESTIC
- [ ] INTERNATIONAL DOCUMENT
- [ ] INTERNATIONAL NON DOCUMENT
- [ ] WORLDMAIL 1st / APM / 2nd *circle one*

Special Services *extra charges may apply*

- [ ] SATURDAY DELIVERY
- [ ] POD
- [ ] OTHER ..... *specify*

Payment Options *not all options available to all countries*

- [x] Shipper's account
- [ ] Recipient
- [ ] Third party

Acct. No. .....

- [ ] Cash/Check/Credit Card *circle one*

No. .....

Expires ..... Type .....

Shipment insurance *if desired, enter amount below*

U.S. $ ..... *Insured value*

Full description of contents

Samples-Approval # 94206

International non document shipments only

Attach original and three copies of a Commercial Invoice

Declared value for customs (In US $):

Export license no./Symbol *if applicable*:

Harmonized Sched. B no. *if applic.*:

Ultimate destination:

Shipper's EIN/SSN:

This shipment is licensed by the US for the ultimate destination named above. Diversion contrary to US Law is prohibited.

Destination duties/taxes *If left blank recipient pays duties/taxes*

- [ ] Recipient
- [ ] Shipper
- [ ] Other ..... *Specify destination approved account number*

4 Pcs/Weight/Size

No. of pieces: 1

Weight *if DHL Express Document packaging is used, enter XD*: lb

Dimensions *in inches*: x x
length width height

DIMENSIONAL/CHARGED WEIGHT: lb

CODES	CHARGES
	Services
	Special services
	Insurance
Drop Box/ Exp. Center	
TOTAL	

TRANSPORT COLLECT STICKER No.

PICKED UP BY

Time

Date

5 Shipper's authorization and signature

I/we agree that DHL's standard terms apply to this shipment and limit DHL's liability for loss or damage to US $ 100. The Warsaw Convention may also apply (see reverse). I/we authorize DHL to complete other documents necessary to export this shipment. I/we understand that insurance is available on request, for an extra charge. I/we agree to pay all charges if the recipient or third party does not pay. I/we understand that DHL DOES NOT TRANSPORT CASH.

Signature: L. Stasiuk

Date: 8/2/94

REV 2/94

Complete sections 1-5. You are making 5 copies, please type

DHL AIRWAYS, INC. • 333 TWIN DOLPHIN DRIVE, REDWOOD CITY, CA 94065

Original (DHL Billing) Copy

6946-0280 RUN 4/94

1A

1B-2

Uni-Image® MCP® PATENTED 6010

ATTACHMENT C

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

SHIELDALLOY METALLURGICAL CORPORATION
P.O. BOX 768, 12 WEST BOULEVARD
NEWFIELD, N.J. 08344 (609)692-4200

ANALYSES: 32403

Project No.

Purchase Order

Sampler: (Print Name) JAMES P. VALENTI

Chain of Custody Tape No.

Sample No./ Identification	Collection Date	Collection Time	Preserv.	Lab Sample Number	Sample Matrix (Liquid, Sludge, etc.)	AS DIRECTED BY T.E.M.						Number of Containers/ REMARKS
SMC 1-29-94-1	7/29/94	13:38			SLAG	X						1 BAGGIE
SMC 7-29-94-2	"	"			↓	↓						↓
SMC 7-29-94-3	"	"										
SMC 8-1-94-1	8-1-94	11:45										
SMC 8-1-94-2	"	"										
SMC 8-1-94-3	"	"										
SMC 8-1-94-4	"	"										

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
1. James P. Valenti	8-2-94	3:00pm			
2.			Don DeWitt	8-3-94	9:13
3.					
4.					
5.					

Sample Disposal Method

Disposed of by: (Signature) | Date | Time

SAMPLE COLLECTOR/WITNESS (Signature) James P. Valenti

ANALYTICAL LABORATORY AND CONTACT: ECOTEK / MIKE MEISER

Page 1 of 1

00919

ECOTEK Approval # 94206

Not Preserved at 4°C ± 2°C

ATTACHMENT D

EcoTek LSI
EcoTek Laboratory Services Incorporated

ECOTEK LSI'S FLAG DEFINITION LIST

B	This flag is used when the analyte is found in the blank.
C	See case narrative for further explanation.
D	Surrogate diluted out.
E	Analyte exceeds the calibration range.
EICP	Determination of the presence of this analyte is based upon the presence of a peak, searched for utilizing extracted ion current profiles, with a spectrum matching the NBS library reference spectrum for this analyte.
J	Indicates an estimated value.
M	Target MDA not achieved
N	The sample matrix spike's percent recovery was outside of the 75 - 125% control limits.
NA	Not Applicable
ND	Not Detected
P	Preliminary Data
*	The sample matrix duplicate's relative percent difference, RPD, was above the 0 - 20% control limits.
***	Surrogate recovery outside QC limits.

EcoTek LSI
EcoTek Laboratory Services Incorporated

CASE NARRATIVE FOR GAMMA ISOTOPICS

Client: Integrated Environmental Management

Project: IEM

LSDG: 32403

* The prepared sample is placed in a container and counted on a gamma spectrometry system which is calibrated with NIST traceable standards. A spectrum is collected and analyzed for the presence of gamma emitting radionuclides. The peaks present in the sample spectrum are compared to a nuclide library and the gamma emitters identified. The identified peaks are then quantified and isotopic concentrations calculated. Minimum Detectable Activities (MDAs) are then calculated for isotopes not identified in the sample.

* The detection limit or MDA for this analysis is dependent on sample size, detector efficiency, detector background, and count time.

* The following exceptions and/or considerations should be noted for the sample group contained within:

  The seven (7) non-soil solid samples submitted under Laboratory Sample Delivery Group (LSDG) No. 32403 for gamma analysis were received on August 3, 1994. They were analyzed between September 19 and 21, 1994. Sample 32403-03 (Client ID No. SMC-7-29-94-3) was counted twice on different detectors to represent a sample duplicate. The duplicate Relative Percent Differences (RPDs) for Tl-208, Bi-212, Pb-212, Ra-224, Ac-228, Th-229, Th-231 and Np-237 were 9%, 3%, 1%, 9%, 9%, 5%, 5% and 12%, respectively. The duplicate RPDs for Th-228 and Th-234 were not applicable since an MDA and activity less than five times the MDA were used in the calculations.

Joseph M. Rutkowski
Section Supervisor or designee

9/22/94
Date

EcoTek LSI
EcoTek Laboratory Services Incorporated

GAMMA SPEC

Client: Integrated Environmental Management
Client Reference No.: NA
LSDG: 32403
Date Received: 8/3/94
Method: RL-2151

Lab Sample ID	Client Sample ID	Date Analyzed	Analyte	Matrix	Units	Result	2 Sigma Error	Detection Limit	Qualifer
3240301	SMC-7-29-94-1	9/19/94	TL-208	NSS	pCi/g	1.03E+02	9.37E+00	2.25E+00	
3240301	SMC-7-29-94-1	9/19/94	BI-212	NSS	pCi/g	2.10E+02	2.89E+01	1.77E+01	
3240301	SMC-7-29-94-1	9/19/94	PB-212	NSS	pCi/g	3.14E+02	2.60E+01	3.08E+00	
3240301	SMC-7-29-94-1	9/19/94	BI-214	NSS	pCi/g	7.45E+01	7.40E+00	3.92E+00	
3240301	SMC-7-29-94-1	9/19/94	PB-214	NSS	pCi/g	7.36E+01	6.63E+00	7.18E+00	
3240301	SMC-7-29-94-1	9/19/94	RA-224	NSS	pCi/g	3.80E+02	6.48E+01	3.51E+01	
3240301	SMC-7-29-94-1	9/19/94	AC-228	NSS	pCi/g	3.54E+02	1.89E+01	6.79E+00	
3240301	SMC-7-29-94-1	9/19/94	TH-228	NSS	pCi/g	6.11E+02	1.52E+02	1.32E+02	
3240301	SMC-7-29-94-1	9/19/94	TH-231	NSS	pCi/g	1.08E+02	2.69E+01	2.34E+01	
3240301	SMC-7-29-94-1	9/19/94	TH-234	NSS	pCi/g	4.26E+02	6.55E+01	5.53E+01	
3240302	SMC-7-29-94-2	9/19/94	TL-208	NSS	pCi/g	1.33E+02	1.36E+01	3.20E+00	
3240302	SMC-7-29-94-2	9/19/94	BI-212	NSS	pCi/g	2.64E+02	3.89E+01	2.42E+01	
3240302	SMC-7-29-94-2	9/19/94	PB-212	NSS	pCi/g	4.02E+02	3.38E+01	5.17E+00	
3240302	SMC-7-29-94-2	9/19/94	RA-224	NSS	pCi/g	4.35E+02	7.76E+01	5.30E+01	
3240302	SMC-7-29-94-2	9/19/94	AC-228	NSS	pCi/g	3.86E+02	2.12E+01	9.82E+00	
3240302	SMC-7-29-94-2	9/19/94	TH-228	NSS	pCi/g	1.28E+03	2.37E+02	1.82E+02	
3240302	SMC-7-29-94-2	9/19/94	TH-229	NSS	pCi/g	8.66E+01	1.61E+01	1.23E+01	
3240302	SMC-7-29-94-2	9/19/94	TH-231	NSS	pCi/g	2.26E+02	4.19E+01	3.22E+01	
3240302	SMC-7-29-94-2	9/19/94	TH-234	NSS	pCi/g	4.95E+02	8.56E+01	1.01E+02	
3240302	SMC-7-29-94-2	9/19/94	NP-237	NSS	pCi/g	1.83E+02	2.38E+01	1.60E+01	
3240303	SMC-7-29-94-3	9/19/94	TL-208	NSS	pCi/g	1.47E+02	1.52E+01	3.53E+00	
3240303	SMC-7-29-94-3	9/19/94	BI-212	NSS	pCi/g	2.84E+02	4.29E+01	2.87E+01	
3240303	SMC-7-29-94-3	9/19/94	PB-212	NSS	pCi/g	4.17E+02	3.56E+01	5.05E+00	
3240303	SMC-7-29-94-3	9/19/94	RA-224	NSS	pCi/g	4.44E+02	7.85E+01	5.75E+01	
3240303	SMC-7-29-94-3	9/19/94	AC-228	NSS	pCi/g	4.08E+02	2.38E+01	1.07E+01	
3240303	SMC-7-29-94-3	9/19/94	TH-228	NSS	pCi/g	1.26E+03	2.38E+02	1.81E+02	
3240303	SMC-7-29-94-3	9/19/94	TH-229	NSS	pCi/g	8.57E+01	1.61E+01	1.23E+01	

ND = Not Detected Above MDA
NA = Not Applicable

EcoTek LSI
EcoTek Laboratory Services Incorporated

GAMMA SPEC

Client: Integrated Environmental Management
Client Reference No.: NA
LSDG: 32403
Date Received: 8/3/94
Method: RL-2151

Lab Sample ID	Client Sample ID	Date Analyzed	Analyte	Matrix	Units	Result	2 Sigma Error	Detection Limit	Qualifer
3240303	SMC-7-29-94-3	9/19/94	TH-231	NSS	pCi/g	2.23E+02	4.20E+01	3.20E+01	
3240303	SMC-7-29-94-3	9/19/94	TH-234	NSS	pCi/g	4.82E+02	7.99E+01	8.39E+01	
3240303	SMC-7-29-94-3	9/19/94	NP-237	NSS	pCi/g	1.86E+02	2.35E+01	1.60E+01	
3240304	SMC-8-1-94-1	9/19/94	TL-208	NSS	pCi/g	9.33E+01	1.08E+01	2.94E+00	
3240304	SMC-8-1-94-1	9/19/94	BI-212	NSS	pCi/g	2.07E+02	3.23E+01	2.46E+01	
3240304	SMC-8-1-94-1	9/19/94	PB-212	NSS	pCi/g	2.84E+02	2.47E+01	4.82E+00	
3240304	SMC-8-1-94-1	9/19/94	BI-214	NSS	pCi/g	8.06E+01	9.48E+00	5.25E+00	
3240304	SMC-8-1-94-1	9/19/94	PB-214	NSS	pCi/g	8.10E+01	8.70E+01	9.56E+00	
3240304	SMC-8-1-94-1	9/19/94	RA-226	NSS	pCi/g	6.64E+02	9.23E+01	5.06E+01	
3240304	SMC-8-1-94-1	9/19/94	AC-228	NSS	pCi/g	4.27E+02	2.38E+01	9.67E+00	
3240304	SMC-8-1-94-1	9/19/94	TH-229	NSS	pCi/g	6.26E+01	1.24E+01	1.19E+01	
3240304	SMC-8-1-94-1	9/19/94	TH-231	NSS	pCi/g	1.63E+02	3.23E+01	3.10E+01	
3240304	SMC-8-1-94-1	9/19/94	NP-237	NSS	pCi/g	1.27E+02	1.82E+01	1.55E+01	
3240305	SMC-8-1-94-2	9/19/94	TL-208	NSS	pCi/g	1.08E+02	1.17E+01	2.81E+00	
3240305	SMC-8-1-94-2	9/19/94	BI-212	NSS	pCi/g	2.21E+02	3.20E+01	2.21E+01	
3240305	SMC-8-1-94-2	9/19/94	PB-212	NSS	pCi/g	3.13E+02	2.77E+01	4.04E+00	
3240305	SMC-8-1-94-2	9/19/94	BI-214	NSS	pCi/g	6.82E+01	8.03E+00	5.10E+00	
3240305	SMC-8-1-94-2	9/19/94	PB-214	NSS	pCi/g	6.63E+01	7.54E+00	9.45E+00	
3240305	SMC-8-1-94-2	9/19/94	RA-224	NSS	pCi/g	3.76E+02	8.00E+01	4.60E+01	
3240305	SMC-8-1-94-2	9/19/94	AC-228	NSS	pCi/g	3.76E+02	2.18E+01	9.05E+00	
3240305	SMC-8-1-94-2	9/19/94	TH-229	NSS	pCi/g	5.61E+01	1.04E+01	9.83E+00	
3240305	SMC-8-1-94-2	9/19/94	TH-231	NSS	pCi/g	1.46E+02	2.71E+01	2.64E+01	
3240305	SMC-8-1-94-2	9/19/94	NP-237	NSS	pCi/g	1.36E+02	1.93E+01	1.28E+01	
3240306	SMC-8-1-94-3	9/19/94	TL-208	NSS	pCi/g	1.28E+02	1.28E+01	3.08E-01	
3240306	SMC-8-1-94-3	9/19/94	BI-212	NSS	pCi/g	2.43E+02	3.50E+01	2.48E+00	
3240306	SMC-8-1-94-3	9/19/94	PB-212	NSS	pCi/g	3.72E+02	3.12E+01	3.78E-01	
3240306	SMC-8-1-94-3	9/19/94	BI-214	NSS	pCi/g	9.03E+01	9.30E+00	5.94E-01	

ND = Not Detected Above MDA
NA = Not Applicable

EcoTek LSI
EcoTek Laboratory Services Incorporated

GAMMA SPEC

Client: Integrated Environmental Management
Client Reference No.: NA
LSDG: 32403
Date Received: 8/3/94
Method: RL-2151

Lab Sample ID	Client Sample ID	Date Analyzed	Analyte	Matrix	Units	Result	2 Sigma Error	Detection Limit	Qualifer
3240306	SMC-8-1-94-3	9/19/94	RA-224	NSS	pCi/g	4.22E+02	8.10E+01	5.25E+00	
3240306	SMC-8-1-94-3	9/19/94	RA-226	NSS	pCi/g	8.52E+02	9.64E+01	4.21E+00	
3240306	SMC-8-1-94-3	9/19/94	AC-228	NSS	pCi/g	4.77E+02	2.42E+01	9.25E-01	
3240306	SMC-8-1-94-3	9/19/94	TH-231	NSS	pCi/g	2.10E+02	3.52E+01	2.46E+00	
3240306	SMC-8-1-94-3	9/19/94	TH-234	NSS	pCi/g	5.15E+02	7.96E+01	1.24E+01	
3240306	SMC-8-1-94-3	9/19/94	NP-237	NSS	pCi/g	1.54E+02	1.98E+01	1.25E+00	
3240307	SMC-8-1-94-4	9/19/94	TL-208	NSS	pCi/g	9.24E+01	1.13E+01	2.95E+00	
3240307	SMC-8-1-94-4	9/19/94	BI-212	NSS	pCi/g	1.80E+02	3.42E+01	2.40E+01	
3240307	SMC-8-1-94-4	9/19/94	PB-212	NSS	pCi/g	2.88E+02	2.61E+01	4.18E+00	
3240307	SMC-8-1-94-4	9/19/94	BI-214	NSS	pCi/g	1.05E+02	1.05E+01	5.30E+00	
3240307	SMC-8-1-94-4	9/19/94	PB-214	NSS	pCi/g	1.01E+02	1.00E+01	9.47E+00	
3240307	SMC-8-1-94-4	9/19/94	AC-228	NSS	pCi/g	3.02E+02	1.91E+01	9.62E+00	
3240307	SMC-8-1-94-4	9/19/94	TH-229	NSS	pCi/g	4.20E+01	1.04E+01	1.07E+01	
3240307	SMC-8-1-94-4	9/19/94	TH-231	NSS	pCi/g	1.09E+02	2.69E+01	2.79E+01	
3240307	SMC-8-1-94-4	9/19/94	TH-234	NSS	pCi/g	3.45E+02	6.09E+01	6.83E+01	
3240307	SMC-8-1-94-4	9/19/94	NP-237	NSS	pCi/g	1.09E+02	1.81E+01	1.40E+01	

ND = Not Detected Above MDA
NA = Not Applicable

ATTACHMENT E

EcoTek LSI
EcoTek Laboratory Services Incorporated

CASE NARRATIVE
FOR ISOTOPIC THORIUM ANALYSIS (cont.)

Client: Integrated Environmental Management

Project ID: IEM

Batch ID: 32403

QA/QC Summary

A method blank, duplicate method spikes and a duplicate of sample 32403-03 (Client ID No. SWC-7-29-94-3) were also analyzed. The method blank Th-228 and Th-230 activities were less than 10% of the Th-228 and Th-230 activities in the samples, which was acceptable. The method blank yielded no measurable Th-232 activity greater than the MDA of 0.05 picoCuries (pCi). The method spike recoveries were 112% and 111% with a duplicate Relative Percent Difference (RPD) of 1%. The sample duplicate RPDs for Th-228, Th-230 and Th-232 were 2%, 5% and 3%, respectively, which were within the laboratory control limit of 50%.

General Discussion

Typical laboratory control limits for radiochemical tracer yield are 15% - 125%. The yield in sample 32403-02 (Client ID No. SMC-7-29-94-2) from the re-analysis was 10%, which was lower than the laboratory's minimum control limit. The results for this sample were flagged as estimated (J).

Joseph M. Rutkowski
Section Supervisor or designee

9/26/94
Date

EcoTek LSI
EcoTek Laboratory Services Incorporated

ISOTOPIC THORIUM

Client: Integrated Environmental Management
Client Reference No.: IEM
LSDG: 32403
Date Received: 8/3/94
Method: RL-2318

Lab Sample ID	Client Sample ID	Date Analyzed	Analyte	Matrix	Units	Result	2 Sigma Error	Detection Limit	Qualifier
32403-01	SMC-7-29-94-1	9/24/94	Th-228	NSS	pCi/g	3.65E+02	5.41E+01	1.87E+00	
32403-01	SMC-7-29-94-1	9/24/94	Th-230	NSS	pCi/g	3.20E+02	4.78E+01	1.68E+00	
32403-01	SMC-7-29-94-1	9/24/94	Th-232	NSS	pCi/g	3.54E+02	5.26E+01	1.15E+00	
32403-02	SMC-7-29-94-2	9/24/94	Th-228	NSS	pCi/g	4.75E+02	7.80E+01	5.34E+00	CJ
32403-02	SMC-7-29-94-2	9/24/94	Th-230	NSS	pCi/g	4.53E+02	7.46E+01	3.46E+00	CJ
32403-02	SMC-7-29-94-2	9/24/94	Th-232	NSS	pCi/g	4.70E+02	7.72E+01	2.98E+00	CJ
32403-03	SMC-7-29-94-3	9/24/94	Th-228	NSS	pCi/g	5.13E+02	6.68E+01	1.58E+00	
32403-03	SMC-7-29-94-3	9/24/94	Th-230	NSS	pCi/g	4.68E+02	6.11E+01	1.26E+00	
32403-03	SMC-7-29-94-3	9/24/94	Th-232	NSS	pCi/g	5.01E+02	6.54E+01	1.38E+00	
32403-04	SMC-8-1-94-1	9/24/94	Th-228	NSS	pCi/g	3.25E+02	4.31E+01	1.18E+00	
32403-04	SMC-8-1-94-1	9/24/94	Th-230	NSS	pCi/g	2.95E+02	3.92E+01	6.17E-01	
32403-04	SMC-8-1-94-1	9/24/94	Th-232	NSS	pCi/g	3.17E+02	4.21E+01	2.26E-01	
32403-05	SMC-8-1-94-2	9/24/94	Th-228	NSS	pCi/g	3.43E+02	4.34E+01	8.60E-01	
32403-05	SMC-8-1-94-2	9/24/94	Th-230	NSS	pCi/g	2.77E+02	3.52E+01	5.33E-01	
32403-05	SMC-8-1-94-2	9/24/94	Th-232	NSS	pCi/g	3.22E+02	4.08E+01	4.21E-01	
32403-06	SMC-8-1-94-3	9/24/94	Th-228	NSS	pCi/g	4.24E+02	5.60E+01	1.37E+00	
32403-06	SMC-8-1-94-3	9/24/94	Th-230	NSS	pCi/g	3.85E+02	5.10E+01	6.06E-01	
32403-06	SMC-8-1-94-3	9/24/94	Th-232	NSS	pCi/g	4.01E+02	5.30E+01	8.85E-01	
32403-07	SMC-8-1-94-4	9/24/94	Th-228	NSS	pCi/g	3.20E+02	3.97E+01	9.33E-01	
32403-07	SMC-8-1-94-4	9/24/94	Th-230	NSS	pCi/g	3.02E+02	3.75E+01	1.68E-01	
32403-07	SMC-8-1-94-4	9/24/94	Th-232	NSS	pCi/g	3.04E+02	3.78E+01	6.68E-01	

ND = Not Detected Above MDA
NA = Not Applicable

ATTACHMENT F

EcoTek LSI
EcoTek Laboratory Services Incorporated

CASE NARRATIVE
FOR ISOTOPIC URANIUM ANALYSIS (cont.)

Client: Integrated Environmental Management

Project ID: IEM

Batch ID: 32403

The method blank yielded no measurable U-235 or U-238 activity greater than the MDAs of 0.05 picocuries (pCi) and 0.05 pCi, respectively. The method blank U-234 activity was less than 10% of the U-234 sample activities, which was acceptable. The method spike recoveries were 115% and 104% with a duplicate Relative Percent Difference (RPD) of 10%. The sample duplicate RPDs for U-234, U-235 and U-238 were 3%, 73% and 0%, respectively. The U-235 RPD exceeded the laboratory control limit of 50%.

General Discussion

It was determined that the standard acid digestion would not be sufficient to dissolve the samples due to their unusual matrix. The samples were broken into small pieces and a portion of each was weighed, placed in a beaker, leached with concentrated nitric and hydrochloric acid and filtered before being analyzed. The high U-235 RPD was most likely caused by the inability to completely homogenize the sample.

Joseph M. Roberts Jr.
Section Supervisor or designee

9/26/94
Date

EcoTek LSI
EcoTek Laboratory Services Incorporated

CASE NARRATIVE
FOR ISOTOPIC THORIUM ANALYSIS

Client: Integrated Environmental Management

Project ID: IEM

Batch ID: 32403

Analytical Summary

Seven (7) non-soil solid samples were received on August 3, 1994. The samples were initially analyzed on September 16, 1994. Due to low yields, possibly from matrix interference, and spectral attenuation of all samples, a re-analysis was performed on September 24, 1994 using reduced sample volumes.

Procedural Summary

- Analysis - Aliquots of sample are traced with thorium-229 and analyzed for isotopic thorium (228, 230, and 232). The samples are loaded onto an anion exchange column using 9M hydrochloric acid. After rinsing the column, the effluent, containing the thorium, is converted to a nitrate form and loaded on a second column using 8N nitric acid. After rinsing, the thorium is selectively stripped from the column using a solution of 9M hydrochloric acid. The solution is electroplated and analyzed for alpha emitting thorium isotopes employing an alpha spectrometry system which uses pulse height analysis. All alpha spectrometers are calibrated with NIST traceable standards.

  Activity of each of the alpha emitting isotopes is accomplished by quantifying the observed peak area(s) of the isotope(s) of interest and the peak area of the tracer isotope added to the sample. The observed peak area of the tracer isotope is then used to calculate the chemical recovery of the sample. This chemical recovery is then applied to the peaks of interest, with the detector efficiency, count time, and sample volume/weight to calculate the specific activity of each of the thorium isotopes detected.

- Scope and Limitations - Detection limits, or Minimum Detectable Activities (MDAs), for this analysis are affected by many analysis parameters, including sample volume/weight, chemical recovery, detector efficiency, sample count time and instrument background.

EcoTek LSI
EcoTek Laboratory Services Incorporated

3342 International Park Drive, S.E.
Atlanta, Georgia 30316
(404) 244-0827
Fax # (404) 243-5355

September 22, 1994

Ms. Carol Berger
Integrated Environmental Management
1680 East Gude Drive
Suite 305
Rockville, MD 20850

Dear Ms. Berger:

Enclosed along with this letter are the Gamma Spec. results for the sample(s) received August 3, 1994. The remaining results will follow as soon as possible.

Please contact me at (404)244-0827 ext. 248 if you have any questions. Also, please refer to Batch ID 32403 in future correspondence.

Sincerely,

ECOTEK LABORATORY SERVICES, INC.

Craig Johnson

Craig C. Johnson
Manager, Project Management

Enclosures.
CCJ/crb

EcoTek LSI
EcoTek Laboratory Services Incorporated

ISOTOPIC URANIUM

Client: Integrated Environmental Management
Client Reference No.: IEM
LSDG: 32403
Date Received: 8/3/94
Method: RL-2322

Lab Sample ID	Client Sample ID	Date Analyzed	Analyte	Matrix	Units	Result	2 Sigma Error	Detection Limit	Qualifier
32403-01	SMC-7-29-94-1	9/24/94	U-234	NSS	pCi/g	3.42E+02	4.24E+01	3.39E-01	
32403-01	SMC-7-29-94-1	9/24/94	U-235	NSS	pCi/g	1.48E+01	2.21E+00	3.66E-01	
32403-01	SMC-7-29-94-1	9/24/94	U-238	NSS	pCi/g	3.47E+02	4.29E+01	4.31E-01	
32403-02	SMC-7-29-94-2	9/24/94	U-234	NSS	pCi/g	4.02E+02	5.00E+01	2.62E-01	
32403-02	SMC-7-29-94-2	9/24/94	U-235	NSS	pCi/g	1.94E+01	2.91E+00	3.85E-01	
32403-02	SMC-7-29-94-2	9/24/94	U-238	NSS	pCi/g	4.08E+02	5.07E+01	4.67E-01	
32403-03	SMC-7-29-94-3	9/24/94	U-234	NSS	pCi/g	4.00E+02	4.99E+01	6.01E-01	
32403-03	SMC-7-29-94-3	9/24/94	U-235	NSS	pCi/g	1.99E+01	3.03E+00	1.09E-01	
32403-03	SMC-7-29-94-3	9/24/94	U-238	NSS	pCi/g	4.09E+02	5.10E+01	5.64E-01	
32403-04	SMC-8-1-94-1	9/24/94	U-234	NSS	pCi/g	3.26E+02	4.04E+01	3.07E-01	
32403-04	SMC-8-1-94-1	9/24/94	U-235	NSS	pCi/g	1.28E+01	1.99E+00	3.44E-01	
32403-04	SMC-8-1-94-1	9/24/94	U-238	NSS	pCi/g	3.23E+02	4.01E+01	3.43E-01	
32403-05	SMC-8-1-94-2	9/24/94	U-234	NSS	pCi/g	3.14E+02	3.98E+01	8.42E-02	
32403-05	SMC-8-1-94-2	9/24/94	U-235	NSS	pCi/g	1.36E+01	2.15E+00	4.40E-01	
32403-05	SMC-8-1-94-2	9/24/94	U-238	NSS	pCi/g	3.23E+02	4.10E+01	2.29E-01	
32403-06	SMC-8-1-94-3	9/24/94	U-234	NSS	pCi/g	4.50E+02	5.68E+01	3.81E-01	
32403-06	SMC-8-1-94-3	9/24/94	U-235	NSS	pCi/g	2.24E+01	3.27E+00	2.95E-01	
32403-06	SMC-8-1-94-3	9/24/94	U-238	NSS	pCi/g	4.55E+02	5.74E+01	5.28E-01	
32403-07	SMC-8-1-94-4	9/24/94	U-234	NSS	pCi/g	2.96E+02	3.79E+01	3.79E-01	
32403-07	SMC-8-1-94-4	9/24/94	U-235	NSS	pCi/g	1.20E+01	2.17E+00	1.40E-01	
32403-07	SMC-8-1-94-4	9/24/94	U-238	NSS	pCi/g	3.01E+02	3.85E+01	3.79E-01	

ND = Not Detected Above MDA
NA = Not Applicable

EcoTek LSI
EcoTek Laboratory Services Incorporated

3342 International Park Drive, S.E.
Atlanta, Georgia 30316
(404) 244-0827
Fax # (404) 243-5355

September 26, 1994

Ms. Carol Berger
Integrated Environmental Management
1680 East Gude Drive
Suite 305
Rockville, MD 20850

Dear Ms. Berger:

Enclosed along with this letter are the Isotopic Uranium & Isotopic Thorium results for the sample(s) received August 3, 1994.

Please contact me at (404)244-0827 ext. 248 if you have any questions. Also, please refer to Batch ID 32403 in future correspondence.

Sincerely,

ECOTEK LABORATORY SERVICES, INC.

Craig C. Johnson
Manager, Project Management

Enclosures.
CCJ/lj