01895

Background Sample Analyses for Plutonium-239/240 at SEAD-12
Seneca Army Depot Activity
Romulus, NY

DEPARTMENT OF THE ARMY
SENECA ARMY DEPOT ACTIVITY
5786 STATE RTE 96
ROMULUS, NEW YORK 14541-5001

REPLY TO ATTENTION OF

June 14, 1999

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL	# of pages ► 2
To See Dist	From S. Absolom
Dept./Agency	Phone #
Fax #	Fax #
NSN 7540-01-317 7368 5099-101	GENERAL SERVICES ADMINISTRATION

Engineering and
Environmental Division

Ms. Carla M. Struble, P.E.
U.S. Environmental Protection Agency
Emergency and Remedial Response Division
290 Broadway
18th Floor, E-3
New York, New York 10007-1866

CF
Kevin
Keith
Mike
Tom E
John Buck
El Agg-

Mr. James A. Quinn
NYS Department of Environmental Conservation
Division of Hazardous Waste Remediation
Bureau of Eastern Remedial Action
50 Wolfe Road, Room 208
Albany, New York 12233-7010

Dear Ms. Struble/Mr. Quinn:

In response to your letter dated May 28, 1999, and May 24, 1999 regarding your concerns about leasing of the North Depot Area, we have reviewed all available data and are convinced there is no cause for concern. We will forward to you the Quality Control and Quality Assurance reports from the Laboratory; the Lab Standard Operating Procedures; Laboratory Validating criteria which comes from the Generic Work Plan; and a proposed resampling plan which will provide rationale for the new sampling.

We have reinterviewed all available sources and reaffirmed the original EBS findings - no issues of concern. Seneca Army Depot used to be a nuclear capable depot and did have an Alpha team prepared to respond to a nuclear accident anywhere in the country. That team trained at various sites in and around the installation. We did confirm that they might have trained on the ball field on more than one occasion, although our research indicates this was not common place. Radioactive check sources were used to calibrate the radiac equipment used by the Alpha team. These check sources were in sealed packages, licensed by the Nuclear Regulatory Commission and controlled administratively by the Army. All check sources were properly accounted for and turned in to other Army installations at the end of their use - no check sources were lost or stolen. Additionally, even though the Alpha team used radium dials at a few very specific locations, all training of this type was conducted within the confines of the triple fenced area - outside the proposed lease area. Again, the routine training conducted by the Alpha team did not use radium dials, the check sources were not used in the ball field as simulators, and all check sources were properly turned in and accounted for. Seneca's Alpha team trained as all national emergency response teams did at the time.

In your letter you criticized the Environmental Baseline Study as not identifying some other use of the ball field such as the Alpha team training. The EBS addressed the environmental condition of the property and identified where contamination might have been released. There was and still is no indication that there was any kind of release at the ball field. The EBS is still accurate.

The locations where sampling results showed a positive result and are in question are inside the triple fence area, which is being investigated as part of SEAD 12 Operable Unit. Other locations that have questionable sample results are in restricted areas that the are not accessible to the lessee.

If you have any questions, please contact Mr. Stephen Absolom, at (607) 869-1309.

Donald C Olson
LTC, U.S. Army
Commanding Officer

169

SEAD 12 BACKGROUND/Ballfield Issue

SOW for add'l Volga chem (EECA 2)
"mid July"

⇒ RE issue

8.7

1 June 99 Conf Call Seda - EPA [Sead 12]
- DEC

Mary Ann "~~[illegible]~~" — Parsons' Validator
Koscieewicz Syracuse Ofc

Jim Q, Carla, Dan Geraghty,
Eric Simpson (EPA), ~~Ms~~ Amelia Jackson
(EPA), Mike, Jackie

Background samples / QA / RAD / Pu
Steve summarized background Pu "hits"

.1 - .2 pCi/g ⇒ QA
Lab statistics -
"hits" are false positives
according to lab + Parsons + they are
confirming
" Pu hits in + around the site too "
(α spectroscopy)
Calcium - heavy precipitate + interference
- in method blank too
α from the sample can become embedded
+ "rebound" as a false positive

5.

① T-Test
② Resamplg w/ 10g of soil
To lower det. limit

③ Addl Samplg at other "backgrnd" locatns

(4) Reanalysis @ another lab? splits?

MRD?

Mary Ann — .1 — .8 pCi/g Pu phase I data

No blank Contamination
U, undetect due to contam. in method blank
J estimated

— they need summary of blank analyses

Dan G — No concern at those levels

"Pu analysis is very problematic @ labs"
"CORE labs has a spotty reputation"
{"MikeD — "MRD says opposite"}
Dan — Brookhaven eg 0.2 pCi/g reported

EPA splits
EPA position on Dan's CMTS + background
+ Anthropogenic

Jim Q - Assoc. errors + count time is needed too for RAD

Carla November 1997? ⇒ "1998"

97 is phase I data

98 is phase II data

Carla - proposal ~~to~~ resolve in writing

Amalia - wants Lab's SOP's + qualifying actions

Send 12 complete RI — Next December per Steve

Army to send Ltr w/ plan of action

SOPs

QA/QC data

raw data? blank data

Validation criteria in scoping plan

(reference it)

associated errors + count time

1. Lab procedures
2. QA/QC data
3. "RAW" data itself + blanks + background

Jim's LTR — Residuals

- Wants QUICK ANSWER
- Training exercises

WP finalization - eco risk →

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

MAY 28 1999

EXPRESS MAIL

Stephen M. Absolom
BRAC Environmental Coordinator
Directorate of Engineering and Housing
Seneca Army Depot Activity (SEDA)
Romulus, New York 14541-5001

Re: Finding of Suitability to Lease (FOSL) - North End Property

This is regarding the baseball field at the North End Property. During our May 19, 1999 BCT meeting, the regulatory agencies were informed that background samples for SEAD-12 remedial investigations were collected at the baseball field. Unexpectedly, the results showed that plutonium was detected. During our May 20 telephone conversation, EPA requested copies of the sample data. The Army's contractor is currently investigating the possibility of laboratory error. If the plutonium result is confirmed, further investigation is expected of the Army.

Also discussed during our May 19 meeting, is the possibility of historical uses of the baseball field that were not previously disclosed. SEDA's nuclear accident response team may have trained on the same baseball field using radioactive check sources or radium dials. This information was not included in the Environmental Baseline Survey or the FOSL for the North End Property. EPA requests SEDA perform a complete archive search to accurately determine if such alternate activities occurred at this baseball field and the frequency of such activities.

For purposes of this FOSL and the upcoming lease, EPA recommends restricting access to the baseball field until the regulatory agencies are given the opportunity to review the information which has been requested of SEDA and results from any further investigation that may be dictated by confirmation of the plutonium result from the baseball field samples. The FOSL should discuss the potential hazardous substances, the cleanup and/or security measures that may be necessary to protect the institutional residents and employees from the hazards and who will be providing these measures before the institutional use can begin.

A facsimile of this letter will be sent to you today. If you have any questions, please call me at (212) 637-4322.

Sincerely yours,

C. Struble

Carla M. Struble, P.E.
Federal Facilities Section

cc: J. Quinn, NYSDEC
D. Geraghty, NYSDOH
R. Scott, NYSDEC-Avon
R. Battaglia, USACE-NY
G. Cooke, Seneca County IDA
P. Jones, Seneca County IDA
T. Grasek, SEDA

New York State Department of Environmental Conservation
Division of Environmental Remediation
Bureau of Eastern Remedial Action, Room 242
50 Wolf Road, Albany, New York 12233-7010
Phone: (518) 457-4349 FAX: (518) 457-4198

John P. Cahill
Commissioner

gva
FAX
Mike D
Randy
Kevin
Tom E

May 24, 1999

Mr. Stephen Absolom
Chief, Engineering and Environmental Division
Seneca Army Depot Activity (SEDA)
5786 State Route 96
Romulus, NY 14541-5001

Dear Mr. Absolom:

Re: North End Ball Field
Seneca Army Depot, Site ID No. 850006

In response to Base Conversion Team meeting discussions on May 19, 1999, the New York State Department of Environmental Conservation (NYSDEC) requests clarification on potential past uses of the ball field at the "North End" property. Please forward to the NYSDEC information on any known personnel training or equipment calibration exercises, if any, held on or around the ball field by the Army, with an emphasis on whether any activities here may have utilized material having the capacity to leave residual environmental contamination if mismanaged.

Your timely reply would be greatly appreciated. If you have any comments or questions on this matter, please contact me by telephone at (518)457-3976 or by e-mail at jaquinn@gw.dec.state.ny.us.

Sincerely,

James C. Quinn

James A. Quinn
Bureau of Eastern Remedial Action
Division of Environmental Remediation

c: C. Struble
D. Geraghty
M. Peachey
R. Scott
K. Healy

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL # of pages ▶ 2

To Su Dist	From
Dept./Agency	Phone #
Fax #	Fax #

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

bc: S. Ervolina
M. Chen/File
J. Quinn

ballfield.wpd

SENECA ARMY DEPOT ACTIVITY

SERVICE EXCELLENCE DEPENDABILITY ACHIEVEMENT

SENECA ARMY DEPOT ACTIVITY

BLDG 123
ROMULUS, N.Y.
14541

MISSION FIRST PEOPLE ALWAYS

ENGINEERING/ENVIRONMENTAL DIVISION

DATE: 5/27/99 **TIME:** 1115 **# of PAGES W/ COVER SHT:** ~~3~~ 4

TO: See Below

OFFICE/CO. NYSDEC / USEPA
NYSDOH.

FAX#

FROM: S M. ABSOLOM
SENECA ARMY DEPOT ACTIVITY
FAX# (607) 869-1362
PHONE# (607) 869-1532

COMMENTS: ATTACHED is the Summary table for the Result of Sampling AT the Ball Field

Mr Duchesneau spoke without DATA infront of him AND THIS Represented the info/DATA

I have ALSO included the DATA Qualifier Definitions.

Stephen M Absolom

CF. CARLA STRUBLE
DAN Geraghty
Jim QUINN
ROB SCOTT
TOM ENROTH
KEVIN HEALY

DATA QUALIFIERS

EPA - defined qualifiers for Organic Analyses are as follows:

B - This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

C - This flag applies to pesticide results where the identification has been confirmed by GC/MS.

D - This flag identifies all compounds identified in an analysis at a secondary dilution factor. If a sample or extract is re-analyzed at a higher dilution factor, as in the "E" flag above, the "DL" suffix is appended to the sample number for the diluted sample, and all concentration values reported are flagged with the "D" flag.

E - This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis.

J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data identification criteria but the result is less than the sample quantitation limit but greater than zero.

L - The analyte is a suspected laboratory contaminant. It's presence in the sample is unlikely (applies to volatile and semi-volatile organic results).

S - The compound was detected above instrument saturation levels (applies to semi-volatile organic results).

U - Indicates compound was analyzed for but not detected.

X - The reported result was derived from instrument response outside the calibration range (applies to pesticide/PCB results).

Y - The reported result is below the specified reporting limit (applies to pesticide/PCB results).

EPA - qualifiers for inorganic analyses are as follows:

B - Concentration qualifier which indicates that the reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).

U - The analyte was analyzed for but not detected.

STEVE
ABSOLOM

Samples Collected in Ballfield Area
SEAD-12

CoreLab Sample ID #		976293-8	976293-11	976293-7	976273-1	976273-13	976273-12	976273-9
SDG:		976293	976293	976293	976293	976293	976293	976293
LOC ID:		SS12-11	SS12-12	SS12-14	SS12-2	SS12-9	SS12-10	SS12-13
SAMP ID:		12542	12544	12541	12535	12546	12545	12212
QC CODE:		SA	SA	SA	SA	SA	SA	DU
SAMP. DETH TOP:		0	0	0	0	0	0	0
SAMP. DEPTH BOT:		0.2	0.2	0.2	0.2	0.2	0.2	0.2
MATRIX:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
DATE:		18-Nov-97	18-Nov-97	18-Nov-97	17-Nov-97	18-Nov-97	18-Nov-97	18-Nov-97
PARAMETER	UNIT	VALUE Q	VALUE Q	VALUE Q	VALUE Q	VALUE Q	VALUE Q	VALUE Q
Bismuth-214	pCi/g	1.2 UJ	1.4 J	1.5 UJ	1.7 J	2.5 UJ	1.4 UJ	1.3 J
Cobalt-57	pCi/g	.1 U	.1 U	.1 U	.1 U	.1 U	.1 U	.1 U
Cobalt-60	pCi/g	.5 U	.3 U	.3 U	.3 U	.4 U	.2 U	.3 U
Cesium-137	pCi/g	.6	.9 U	.3 U	.2 U	1.1 U	.7	.5 J
Tritium	pCi/g	.1 UJ	.1 UJ	.1 UJ	.8 J	9.6 J	.1 UJ	60.4 J
Lead-210	pCi/g	42.2 U	4.8 U	3.7	5. U	6.3 U	23.6 U	21.7 U
Lead-211	pCi/g	3.9	.9 U	3.5 U	8.3 U	21.5 U	1.3 U	1.2 U
Lead-214	pCi/g	1.2	2.2	1.5	2.5	2.2	2.	1.9
Plutonium-239/240	pCi/g	.3 UJ	.4 UJ	.3 UJ	.2 UJ	.2 U	.2 U	.3 UJ
Radium-223	pCi/g	.3 U	.4 U	.5 U	.5 U	.4 U	.4 U	.4 U
Radium-226	pCi/g	1.2 UJ	1.4 J	1.5 UJ	1.7 J	2.5 UJ	1.4 UJ	1.3 J
Thorium-227	pCi/g	.5 U	.5 U	.8 UJ	.2 U	.7 U	.3 U	.3 U
Thorium-230	pCi/g	1.1 UJ	1.3 UJ	.8 UJ	1.6 J	1.5 UJ	1.7 J	1. UJ
Thorium-232	pCi/g	.8	.9	.5 J	.5	1.	1.5	.9 J
Uranium-233/234	pCi/g	.8 UJ	1.1	.7 J	1.9 J	.9	1.1	.7
Uranium-235	pCi/g	.4 UJ	.2	.4 J	.3 J	.2	.2	.1
Uranium-238	pCi/g	.8 J	.7 U	1.2 J	1.4 J	1.	1.	.7
Radium-228	pCi/g	1.7 J	1.9 J	2.3 J	2.1 J	2.3 UJ	1.8 J	1.4 J
Promethium 147	pCi/g	15.2 U	17.8	9.5 UJ	12.8	11.5 U	7.8 U	10.5 U
Moisture (@ 104 deg. C)	% by Wt	30.3	35.8	28.2	22.4	32.7	38.2	29.8

J - Estimated

(1) Sample data not validated.

(2) Plutonium data only validated for this sample.

Samples Collected in Ballfield Area
SEAD-12

CoreLab Sample ID #		976273-10			
SDG:		976293	986113	986113	986113
LOC ID:		SS12-13	MW12-6	MW12-6	MW12-6
SAMP ID:		12543	123190(1)	123191(1)	123192(2)
QC CODE:		SA	SA	SA	SA
SAMP. DETH TOP:		0	0	4	6
SAMP. DEPTH BOT:		0.2	0.2	6	8
MATRIX:		SOIL	SOIL	SOIL	SOIL
DATE:		18-Nov-97	30-Oct-98	30-Oct-98	30-Oct-98
PARAMETER	UNIT	VALUE Q	VALUE Q	VALUE Q	VALUE Q
Bismuth-214	pCi/g	1.6 UJ	1.7	1.2	1.4
Cobalt-57	pCi/g	.1 U	.1 U	.1	.1
Cobalt-60	pCi/g	.4 U	.1	.2	.1
Cesium-137	pCi/g	.8 UJ	.6	.3	.4
Tritium	pCi/g	.1 UJ	14.2	.1 U	.1 U
Lead-210	pCi/g	4.3 U	4.3	1.5 U	2.6
Lead-211	pCi/g	10. U	1.8 U	10.	1.5 U
Lead-214	pCi/g	2.	1.3	1.5	1.2
Plutonium-239/240	pCi/g	.2 U	.2 U	.2 U	.1 U
Radium-223	pCi/g	.5 U	.4 U	.4 U	.3 U
Radium-226	pCi/g	1.6 UJ	1.7	1.2	1.4
Thorium-227	pCi/g	.1 U	C.N.	C.N.	C.N.
Thorium-230	pCi/g	1.4 UJ	1.	.6	.2
Thorium-232	pCi/g	1.7 J	1.1	.5	.7
Uranium-233/234	pCi/g	.9	1.	.6	.5
Uranium-235	pCi/g	.1	.1	.1	.1
Uranium-238	pCi/g	.7	1.2	.8	.4
Radium-228	pCi/g	1.7 J	1.2	1.5	1.5
Promethium 147	pCi/g	7.7 U			
Moisture (@ 104 deg. C)	% by Wt	27.2	24.7	10.5	10.4

J - Estimated
(1) Sample data not validated.
(2) Plutonium data only validated for thi

h:\eng\seneca\s12ri\corerad\Radchcm.xls 5/25/99

Memo to Carla,

In response to your letter dated 28 May 1999, regarding the leasing of the North Depot Area, The Army is will be forwarding to you the Quality control and Quality Assurance reports from the Laboratory, The Lab Standard Operating Procedures, Laboratory Validating criteria which comes from the Generic Work Plan and a proposed resampling plan which will provide rational for the new sampling.

We have also gone back and interviewed and reaffirmed the original EBS findings. Seneca Army depot has been a nuclear capable Depot and had an Alpha team prepared to respond to a nuclear accident anywhere in the country. The Alpha team trained at various sites in and around the installation. They may have trained on the Ball Field on more than one occasion although the research indicated this was not common place. The ball field may have been used as a staging area has well. Check Sources are used to calibrate the radiac equipment used by the Alpha team. These check sources are in sealed packages, licensed by the Nuclear Regulatory commission and controlled administratively by the Army. No interviewee recalls any check source being lost or stolen. Radium dials were used at very specific Alpha team testing requirements. This testing was done inside the Special weapons Storage site. Again the routine training done by the Alpha team did not use radium dials and check sources were not used in the field as simulators. Seneca's Alpha team trained as all national emergency response teams do.

In your letter you criticized the Environmental Baseline Study as not showing that there was some other use of the ball field such as the Alpha team training. The EBS address' the environmental condition of the property and where contamination might have been released. There was and still is no indication that there was any kind of release at the ball field. The EBS is still believed to be accurate.

If you have any questions, please contact Mr. Stephen Absolom, at .....

Memo to Jim Quinn,

In response to your letter dated 24 May 1999, regarding training activities that may have occurred at the ball field and other locations, further and confirmatory discussions with various personnel including retirees has been done.

At least one Alpha team training exercise had occurred at the ball field. This area was not a normal training location. The Alpha team was Seneca's nuclear capable response team. As part of the nation response team Seneca performed training as all agencies including the NYSDEC and NYSDOH re required to do as part of the certifications. As part of the training protocol, the radiac equipment used check sources to calibrate the instruments. The check sources are licensed and controlled commodities that were not used in the field for training purposes. None of the interviewees had any knowledge of any check sources being lost or stolen. Also discussed was the use of radium dials during training exercises. The only time any dials were used was during specific exercises that were performed inside the Special Weapons Storage site. This was not a common action for routine training exercises.

The review we have performed confirms that there is no indication that any material used in training in and around the ball field had any potential to leave residual contamination by being mismanaged. If you have any questions please contact SMA ....

CF
CARLA
TomE
Tom B
Pat Jones
John Cleary
Dan Gerhaty

DIRECTORATE OF SPECIAL WEAPONS
SENECA ARMY DEPOT
ROMULUS, NEW YORK 14541-5001

DSW PROCEDURE
NO. 73

17 January 1990

ALPHA TEAM

1. PURPOSE: To establish procedures to:

a. Outline the controls and procedures for the detection of and minimizing the possible hazardous effects of radioactive contamination resulting from a nuclear/radiological accident/incident.

b. Establish minimal procedures for service response and initial entry response after duty hours.

c. Delineate areas of responsibility in conjunction with Alpha Team Operations to include salvage appraisal (Appendix C) operations.

2. RESPONSIBILITIES: a. TEAM CHIEF will:

(1) Be listed on Alpha Monitoring Team Roster.

(2) Ensure that each team member is aware of their assigned duties and is properly trained.

(3) Appoint a Training Coordinator and Equipment Manager.

(4) Inform the OSC/NAICO as to the nature of the hazard upon arrival at the accident site and assist in controlling the spread of contamination.

(5) Throughly brief all team members as to the circumstances surrounding the accident or incident.

(6) Assure each team member is trained to perform assigned duties as well as the duties of other Alpha Team Operations.

b. Air sampler team will be as listed on Alpha Team Assignment Sheet.

c. Supervisor of the Contamination Control Station (CCS) and the ground monitor crews will be as listed on the Alpha Team Assignment Roster.

d. The Calibration Section, Maintenance Division, will oversee the maintenance/calibration of team instruments. A sign out/sign in register will be maintained to assure positive accountability of all radioactive check sources.

e. Supervisor, Support Section, Maintenance Division, will provide supply support as required.

f. The plotting/recording team will assure that all data is passed to the EOC as soon as possible over the GRID network in a format agreed upon by all GRID users.

This procedure supersedes DSW Procedure No. 73, 18 July 1989

g. Training records will be maintained by the assigned Alpha Team Training Coordinator.

h. Team equipment will be maintained and accounted for by the Alpha Team Equipment Manager.

i. The salvage appraisal team chiefs will train and maintain a ten (10) person team to accomplish efforts required by Appendix C.

j. When Alpha Team members report to Bldg 806, they will load vehicles, start the background Staplex and load the boundary Staplex vehicle which is the number one priority. If additional vehicles are required, supervisors present will notify NAICO.

(1) Pre-operational checks of all radiac instruments will be accomplished prior to loading (see Appendix A and B).

(2) To assure proper operation of radiac instruments in use, a periodic operational check will be accomplished utilizing the check source. This periodic operational check will be accomplished every hour or after a 0 (zero) reading has been obtained on an instrument.

(3) Team leaders and supervisors will assure that the above checks are accomplished.

k. Supervisors present will assume control of the Alpha Team and assure that the above actions are accomplished quickly.

3. CAPABILITIES: a. Depart a local assembly area prepared to begin assigned tasks within one (1) hour after notification during normal duty hours. This requirement will be met with a minimum of a leader and five (5) team members.

b. Perform alpha and beta-gamma radiation monitoring and surveys; both ground and air.

c. Perform limited personnel decontamination, as required.

d. Perform Initial Entry and monitoring in the event that an EOD team has not arrived at the scene and conditions are such that an immediate analysis of the situation is required. Situation analysis will be accomplished by the NAICO/OSC and direction will be given to the Alpha Team Chief.

e. Advise on the utilization of other emergency response teams and locations of control points and command posts.

f. Collect water samples for analysis by the RADCON Team as deemed necessary.

4. PROCEDURES: a. Air Sample Team will:

NOTE

BOUNDARY STAPLEXES ARE THE NUMBER ONE PRIORITY.

(1) Set up two staplexes at the downwind depot boundary. The staplexes will be at least 50 feet and up to 1500 feet apart. The team will not leave the depot unless specific permission is given by the NAICO, Deputy NAICO or Alpha Team Chief. Unless it is geographically impractical, this team will also operate the downwind staplex based on wind speed, IAW TC 3-15. Locations of all staplexes will be as directed by the Alpha Team Chief or the Operations Officer.

(2) Hot Line (CCS) personnel will take the background sample and operate the air samplers at the CCS.

(3) The initial CCS background staplex reading will be taken by an Alpha Team Member who accompanies the EOD unit.

(a) A ten minute reading will be taken. The results will be radioed back to the plotters (517).

(b) The next reading will be for 30 minutes or until 1000 cubic feet of air is passed thru the staplex. The results of this reading will be transmitted to the plotters (517) to determine if the selected CCS is in a clean area.

b. Initial Entry: Required only if EOD cannot respond and a situation analysis is required, para 3d.

(1) The Initial Entry Team will consist of two individuals equipped with a vehicle, a BARK and a alpha measuring instrument, a beta-gamma instrument and a camera.

(2) The team will be aware of the following safety precautions:

(a) The area of the accident is extremely hazardous. All forms of radioactivity may be present as well as chunks of explosives. Great care must be taken when near the accident site.

(b) Do not step or drive on anything suspicious.

(c) Make NO RADIO TRANSMISSIONS after departing the CCS until you arrive back at the CCS.

(d) Close all windows and vents. Turn off heater/defroster.

(3) The team will approach the accident site in a sealed vehicle. The team will not exceed 10m/rad (.01 cGy) when approaching the accident site unless previously directed. At first sign of debris in the road, the team will leave the vehicle and proceed on foot.

(4) The following information will be obtained during Initial Entry:

(a) Note physical characteristics and condition of the item/items.

(b) Note condition of the immediate area.

(c) Take photographs of the item. Attempt to include a comparative object for scale.

(d) Obtain radiac meter readings during the initial entry.

(e) If any accident victims are present, attempt to rescue them.

(5) After gathering all necessary data, the Initial Entry team will proceed back to the CCS. After processing thru the CCS, they will immediately brief the Alpha Team Chief.

(a) Initial entry duties required after duty hours will be on a rapid round-up basis. Personnel will assemble at Bldg 806, or other designated area, and be dressed out ready to respond within one (1) hour of notification. The responding team chief will, upon arrival, establish radio contact and obtain as much information as possible, coordination will be made with the NAICO as to the proper response.

(6) The rapid round-up roster will be initiated. As team members arrive, primary functions will be to establish boundary staplexes and if time allows, a hot line (CCS). If EOD has a line establish, assist their CCS personnel until the remainder of the Alpha Team arrives.

c. Ground Monitoring:

(1) The ground monitoring segment will be divided into two teams, team 511 and 512, equipped with vehicles, alpha monitoring instruments and beta-gamma monitoring instruments. In addition, one team will be equipped with a staplex, generator, gasoline and associated equipment.

(2) Area monitoring within the 610 meter (or EOD assigned) exclusion area of the accident site will be done only after the EOD team has completed render safe procedures.

(3) The teams will proceed to the CCS where they will be processed thru. The Alpha Team Chief may direct entry elsewhere on the perimeter. In this instance, team 511 or 512 respectively will log personnel data with the CCS. They can then proceed to the prearranged entry point. The team leader will check-out each team member to assure each member, including oneself, is properly dressed-out. Once this has been accomplished, they will radio the CCS with time of entry. Exit will be through the CCS.

(4) Teams will carry maps of the area and to the best of their ability mark the map with the location of each marker and contamination noted.

(a) A rough point survey will be conducted with a Fidler probe and a beta-gamma instrument. Each team will monitor in until three times background is noted. They will exit back to their start point and go to their next radial monitor into three times background and then back out to their start point.

(b) Team 511 will do the downwind radial and mark three times background. They will start 90 degree radial counterclockwise from the downwind radial.

(c) Team 512 will monitor the other two radials of the rough point survey. They will start 90 degrees clockwise from Team 511 and proceed, if possible, in a clockwise direction.

(5) After conclusion of the rough point survey, all teams will leave the area. Evaluation of the rough survey will be made by the NAICO and Alpha Team Chief, the advanced party of the RADCON Team should be present and available for counsel. Re-entry by the Alpha Team will only be necessary if required by the NAICO/OSC or RADCON Rep to obtain more data.

(6) If re-entry is required for a more detailed survey and RADCON team has not arrived:

NOTE

THE FOLLOWING PROCEDURES WILL ONLY BE USED IF DEEMED NECESSARY BY THE NAICO, DEPUTY NAICO, SAFETY (RPO) AND ALPHA TEAM IN THE ABSENCE OF THE RADCON TEAM.

(a) Teams 511 and 512 will monitor in together until they locate the three times background marker on the upwind radial. Both teams will then monitor in to the 1000mg 239Pu/m2 or 10 mrad/hr point on the upwind radial.

(b) Team 512 will then, using the isocon method as described in TC 3-15, monitor clockwise until they reach the downwind marker of team 511 or intercept team 511.

(c) Team 511 will then, using the isocon method as above, monitor counterclockwise until they reach the downwind marker of team 512 or intercept team 512.

(d) Both teams will then back out on the downwind radial and return to the CCS by the most expeditious route available, that stays clear of the contaminated area.

(e) The contaminated area will be define by the 1000mg 239Pu/m2 perimeter unless the 10 mrad/hr (.01 cGy/h) beta-gamma contour line extends out farther from the accident site. To accomplish this, both teams will lead with the gamma instrument at all times.

(f) On the downwind leg, Team 511 will be required to emplace the 25 meter staplex only if their survey takes them to the 25 meter mark. If operations are required in the accident area, team 511 will be responsible to place the 25 meter staplex in service. This staplex will be operated continuously while operation at the accident site are in progress.

Monitoring in solely to place the 25 meter staplex will not be authorized unless this point can be reached prior to the turnaround point of 1000mg 239Pu/m2 or 10 mrad/hr.

(7) Both teams will notify the plotters (517) when they have reached their predetermined three times background and 1000mg 239Pu/m2 or 10 mrad/hr points.

d. Contamination Control Station:

(1) The Contamination Control Station (CCS) is a facility or area designed to prevent the further spread of contamination.

(2) All personnel and equipment entering or leaving the accident scene will be channeled thru the CCS.

(3) The CCS will be set up as suggested in TC 3-15. If the situation is such, the CCS will be modified to suit the operational needs.

(a) Initially the EOD CCS will be utilized for processing of material and equipment. The EOD CCS will be checked to assure it complies with TC 3-15, if not, equipment will be added to assure compliance.

(b) After EOD has declared the area safe, the alpha team may monitor in until contamination is noted which is above the established background. When this point is reached, the team will back off approximately 50 meters and established a new CCS.

1 Care should be taken to assure compliance with TC 3-15 and that line of sight, if possible, can be maintained with the accident site.

(4) All personnel entering the accident site will undergo inspection by CCS personnel or survey team leaders for proper taping of clothing and functioning equipment. In addition, the CCS recorder will obtain names, film badge numbers and time in and out of the area for each individual.

(5) Processing personnel returning from the accident site.

(a) Injured personnel will normally receive priority thru the CCS. It is not very probable that injured personnel will still be present, but if they are:

1 Seriously injured personnel will be evacuated directly to the Health Clinic or a local hospital.

2 Any injured personnel who remain to be processed thru the CCS will be handled in one of two ways:

a One, placed on litter on hot side of Hot Line, monitored and any contamination present will be contained by placing a blanket over the litter.

b Second, processed thru the CCS normally, if, in the opinion of the medics at the scene, this is possible.

(b) Team members will be processed thru the CCS IAW TC 3-15.

(6) All injured personnel who have been processed thru the CCS will report to the Health Clinic for further examination as soon as possible, escorts will be provided if required.

(7) The CCS will be periodically checked, each hour as a minimum, for contamination during operations. If noted, decontamination will be initiated, if this cannot remove the contamination, a new area will be considered.

e. Medical Facilities Monitoring Team:

(1) Monitoring Team will report to the Medical Facility, garage area, with their protective clothing and instruments. Dress-out will be done upon arrival.

(2) Team will assist medical staff and provide monitoring to confine contamination to smallest area possible.

(3) Team will also provide monitoring for injured personnel before and after decontamination.

(4) Maintain control of contaminated areas until arrival of RADCON or RAMT Team, and assist if required.

(5) Team will utilize Appendix D for operation of the Medical Facility Decontamination Area.

LAURENCE M. ORNDORFF
Acting Director of Special Weapons

APPENDIX A

LUDLUM MODEL 3

Pre-Operating Procedures

1. Check calibration label:

a. Calibration is in date.

b. Probe matches meter and that meter has a 90 day label.

c. If labels are missing, calibration is out, or probe does not match meter, "Do not use the instrument". Set the instrument aside for calibration.

2. Inspect cable for loose or damaged connectors and cuts or tears in the insulation sleeving.

3. Inspect probe for damage to:

a. Connector.

b. Case.

c. Probe face (cuts, punctures, tears).

4. Insulation of Batteries:

a. Slide, do not twist, the battery box button to the rear and swing the lid open.

b. Install 2 each "D" size batteries matching batteries polarity marked on lid. (NOTE: Center post of battery is positive "+".)

c. Close battery lid

5. Switch range selector switch to battery position.

a. Meter should deflect to the "bat test" area.

b. If not, double check battery polarity.

c. If meter still fails to deflect to the "bat test" area, replace batteries with new batteries.

d. If meter still does not deflect to the "bat test" area, reject meter for calibration/repair.

e. Turn meter off.

6. Connect cable to instrument then to probe.

7. Turn meter selector switch to the X100 position and expose the meter to a known check source.

8. Turn audio switch to the "on" position. An audible click should result.

9. Move selector switch thru the lower scales until a meter reading is indicated.

a. If used as an alpha meter with alpha scintillator probe, read to scale to assure meter is operating properly on selected factor.

b. If the meter is marked properly and is to be used for gamma detection, place the selector switch in the X10 position and record reading directly from the middle scale only (MR/HR). A reading of 1.0 on this scale will be the 10 MR/HR turn-around point.

10. Depress "RES" button to zero the meter.

11. The instrument is ready for use.

APPENDIX B

LUDLUM MODEL 2220 WITH FIDLER PROBE

Pre-Operating Procedures

1. Check calibration label to assure:

a. Calibration is in date.

b. Probe is matched to meter.

c. If label is missing, calibration is out, or probe does not match meter, "Do not use the instrument". Set instrument aside for calibration.

2. Inspect cable for loose or damaged connectors, cuts or tears in the insulation sleeving.

3. Installation of Batteries:

CAUTION

WHEN REMOVING/INSTALLING METER, ASSURE
DAMAGE DOES NOT OCCUR TO SPEAKER CABLE.

a. Unsnap latches and remove meter from case.

b. Install four "D" size batteries. Batteries must be aligned as indicated on the battery holder.

c. Place meter back into the case and close latches.

4. Inspect fidler probe for obvious damage, housing, probe face, connector, etc.

5. Connect cable to the probe then to the meter.

6. Meter is now ready for standardization.

STANDARDIZATION

1. Turn range selector switch to the "LOG" position. The meter will peg and then return to approximately 50 on the top ratemeter scale. The LCD (Liquid Crystal Display) should come on.

2. Press count button, the colons should disappear in a short time.

3. Set window in/out to "in".

4. Set count time to 0.1 minutes.

5. Remove two screws securing the plate next to the window/threshold/HV buttons.

6. Depress the window button and adjust screw if needed to obtain a reading of 300 on the LCD. Release button.

7. Depress threshold button and adjust screw if needed to obtain a reading of 450 on the LCD. Release button.

8. Expose the fidler probe to an Am 241 source. Assure that the probe is located approximately 6 inches from the source. Depress HV button and adjust srew to obtain maximum needle deflection on meter. Release button.

9. Install plate back over the screws and secure. The instrument is now ready for use.

NOTE

THE STANDARDIZATION LISTED ABOVE WILL ALLOW THE INSTRUMENT TO FUNCTION AS AN EXTREMELY QUICK ACTING DETECTION INSTRUMENT. METER DEFLECTIONS INDICATE DETECTION OF ACTIVITY BUT DOES NOT INDICATE INTENSITY OR DISCRIMINATE THE ENERGY. ONCE A DETECTION IS NOTED, INTENSITY CAN BE MEASURED BY USE OF A MODEL 3 WITH ITS ASSOCIATED PROBE. THE MODEL 2220 WITH FIDLER SHOULD BE USED JUST AS THE REPLACED PRM-5 WITH FIDLER WAS USED FOR GROSS DETECTION.

10. Turn range selector switch to X1K setting. Meter will peg and then return to a reading of approximately 50. Slowly rotate range selector switch from X1K SETTING TO X100, X10 TO X1 as required until a reading is obtained.

11. The meter is ready for use.

APPENDIX C

ORDNANCE SALVAGE APPRAISAL TEAM (OSAT)

1. PURPOSE. To establish procedures to augment EOD, upon completion of their Render Safe Operations, in locating, identifying and removing classified/-unclassified materials from an accident/incident site.

2. RESPONSIBILITIES.

a. OSAT Team Chiefs will:

(1) Be listed on the Alpha Team and Rapid Round-up Rosters.

(2) Provide a training schedule to the Alpha Team Chief each FY NLT 10 October.

(3) Brief team members as to the extent of operations required after meeting with the EOD Officer and the Alpha Team Chief.

(4) Establish a recall roster for respective teams and alternates.

b. Support Branch, Maintenance Division, DSW will provide needed expendables and supplies as required to perform their assigned mission.

c. Training records will be maintained by the assigned Alpha Team Training Officer.

d. Vehicular support will be provided through Alpha Team assets.

e. Alpha Team Chief will:

(1) Provide radiac equipment as required.

(2) Provide for control over the OSAT to assure proper utilization.

3. CAPABILITIES.

a. Depart local assembly area to begin assigned tasks in conjunction with Alpha Team after notification. This requirement will be met within the required time allocations specified in the basic procedure. A minimum of two (2) Team Leaders, MOS 911A or 55G (E-7 or above) and ten (10) team members, [illegible], two (2) minimum grade of E-6, will respond. These personnel will be [illegible]lized in two separate teams to support necessary operations.

b. Perform Alpha and Beta-Gamma radiation monitoring and surveys; on ground and air as needed to perform their assigned salvage appraisal [illegible]port.

c. Perform limited decontamination as required only if the alpha team cannot provide support.

d. Identify munition hazards and conduct component identification and evacuation as required.

e. Be aware of the presence of other emergency response teams and the locations of control points and command posts.

f. To be available to assist in Alpha Team operations as directed by the Alpha Team Chief. This requirement will be on a limited basis consistent level of training and operational needs.

4. PROCEDURES.

a. Salvage Appraisal Teams will proceed downwind along with EOD personnel after render safe operations have been completed. Identify and mark hazards and components for evacuation.

b. The on scene EOD Officer will brief the Alpha Team Chief and the Salvage Teams Chiefs as to the extent of assistance required. Three (3) main tasks could be needed:

(1) Search and find any major items that could be located some distance from the accident site.

(2) Locate and evacuate classified materials.

(3) Locate and evacuate any remaining weapon materials.

c. Monitoring and Survey procedures as required by Alpha Team Chief.

d. Radio communications equipment will be provided by the alpha team. Procedures and NET call signs will be provided by the Alpha Team Chief.

APPENDIX D

ALPHA MONITORING TEAM - MEDICAL FACILITY

1. PURPOSE. a. The primary purpose of the Medical Clinic Alpha Team is to detect, decontaminate and prevent the further spread of contamination. The facility, although unique in construction, shall be used for this purpose and will be operated as close as possible to established hotline procedures in TC 3-15. After life saving and medical steps have been taken by qualified medical personnel, monitoring/decontamination is the next in importance.

b. The decontamination of personnel at the Medical Facility (Health Clinic) in the event of a Nuclear or Radiological Accident/Incident (A/I).

c. Outline the details to facilitate control and prevent the unnecessary spreading of radioactive contamination.

2. RESPONSIBILITIES. a. Alpha Team Chief will:

(1) Assure that sufficient numbers of trained personnel are assigned to the south side team.

(2) In conjunction with the south side leader, inspect the equipment and facilities to assure full readiness.

(3) Review procedures to assure full compliance with pertinent regulations and manuals.

b. Team Leader (South Depot Alpha Team) will:

(1) Assure personnel protective equipment and supplies are maintained in a ready status.

(2) Coordinate efforts during NAIC exercises.

(3) Update or make recommendations for changing this appendix as necessary to conform to current objectives.

(4) Assist at other locations of the Depot if and when called upon.

c. Team Members will:

(1) Perform duties as outlined in this Appendix under the direction of the Alpha Team Chief and/or Team Leader.

(2) Maintain personal protective equipment in a ready status, perform weekly/monthly maintenance checks on radiac equipment and dosimeters as scheduled by the Team Chief and keep him/her informed of status of equipment or any problems which may affect individual performance. Finally, make recommendations for improving current Alpha Team operations and procedures at the Health Clinic.

(3) Assist at other locations of the Depot if and when called upon.

3. <u>On-Site Preparation (Medical Facility).</u> Members will:

a. Report immediately to the facility upon notification from DSW Office or from other team members.

b. Sign in and dress out (see Tab A).

c. Inspect monitoring equipment for proper operation. Notify Alpha Team Leader if equipment malfunctions. Leader will call for replacements.

d. Cover CRA floor with kraft paper.

e. Place Staplex Air Sampler into operation, downwind of clinic garage.

f. Establish boundaries with engineering tape, caution signs (Radiation Placards) and poles as required.

g. Place Monitoring Instruments as follows:

(1) CRA - lea alpha, lea gamma.

(2) DC - 2ea alpha (1 - backup).

(3) Health Clinic - lea alpha, lea gamma.

4. <u>SPECIFIC DUTIES.</u> a. Team Leader will:

(1) Brief all response personnel regarding the nature of the Accident/Incident and assign duties to accomplish objectives. All activities will be coordinated with the NCOIC Health Clinic to assure life saving measures are taken.

(2) Assure operations within the Decontamination Chamber, CRA and Health Clinic are operating properly.

(3) Provide status reports to Alpha Team Chief/or EOC, as necessary, in regard to casualties/personnel being processed thru CRA and DC, and periodically relay staplex reading results.

(4) Request additional personnel/equipment whenever situation warrants same.

(5) Assure all persons are monitored and proven clean prior to leaving areas of suspected contamination.

b. Person Operating Within Contamination Reduction Area will:

(1) After initial monitoring to ascertain contamination levels, instruct all personnel entering the CRA to remove and deposit outer clothing into containers provided (i.e., jackets, hats, gloves, coveralls, boots, etc). NOTE: Clothing to be bagged and monitored at a later time. Disposition will be made at a later time.

(2) Instruct personnel in possession of weapons to clear same and place in area provided. Individual may keep weapon if they so desire provided the weapon is not contaminated. Radios and other instruments will also be placed within this area.

NOTE: Casualties who are stable but due to extent of injuries are confined to litters (stretchers) will be processed, if possible, after all ambulatory persons have been processed.

(3) Record individuals name and SSN, instruct person to deposit personal items into plastic bag provided, i.e., watches, wallet, jewelry, etc. NOTE: Priority of persons processed will be at the discretion of the medical support personnel in the CRA.

(4) Notify Alpha Team Members located within DeCon-Chamber, gender of person entering Decon Chamber and instruct person to remove all clothing except for skivvies (underwear) and place into container provided.

(5) Instruct individual to proceed into next chamber, remove all clothing and prepare for monitoring.

(6) Repeat steps for remainder of casualties, support personnel and Alpha Team Members.

NOTE 1: lea gamma instrument operational and placed on table within CRA for detection of presence of gamma emitters within surrounding area (monitor occasionally).

NOTE 2: lea alpha instrument operational and used to determine the presence of or level of alpha contamination an Alpha Team Member's hands or within processing area.

c. Persons Operating Within the Decontamination Chamber will:

NOTE: Gender match required at this point. Person not required can perform other duties as assigned, i.e., staplex (but must stay in a clean area).

(1) Monitor persons thoroughly:

(a) Persons who are monitored and found clean may bypass shower, dress and proceed to front entrance of Health Clinic after nose swipe has been taken (call for escort if required).

(b) If contamination is detected, instruct person to take soap and shower denoting areas that are known to be contaminated (i.e., hair and lower right leg, for instance).

(2) Instruct person to dry thoroughly and stand for monitoring:

(a) If not contaminated, instruct person to dress and proceed to Clinic.

(b) If contaminated, instruct person to return to shower. (Repeat steps as necessary).

(3) Maintain vigilance over all casualties and call for emergency medical assistance if required.

d. Person Operating Within Health Clinic will:

(1) Provides assistance to medical staff by performing monitoring procedures of personnel, equipment and surrounding area.

(2) Reports meter readings (contamination levels) to medical staff personnel at their request. NOTE: Life support takes precedence over Alpha monitoring.

(3) Assist medical staff with other duties requested.

(4) Assists team leader when requested, monitoring aside and outside Health Clinic.

5. Emergency/Critical Casualty Cases. a. Individuals who have been determined to be in a critical/unstable condition by a medical technician at the arrival site and whose condition warrants immediate medical attention will be taken directly into the Health Clinic Emergency Room.

b. Medical Staff personnel will stabilize casualities after which monitoring for radioactive contamination will be performed under the direction of the Emergency Room person in charge.

c. In cases where casualty must be taken immediately to Geneva General Hospital for treatment and there remains significant radioactive contamination levels, the subject casualities will be wrapped/covered with sheets/blankets or placed in a body bag, in order to contain contaminants during transport.

d. Geneva General Hospital will be informed of the incoming casualities and of the existing degree of radioactive contamination.

6. Additional Notes: a. All personnel who process through Contamination Reduction Area and Decontamination Chamber will be decontaminated to the lowest level possible, unless:

(1) Individuals begin to show signs of physical or emotional conditions which could lead to shock, severe bleeding or unconsciousness and where medical attention becomes vital.

(2) Medical authority directs otherwise.

b. Permissible contamination levels will be determined on site by Department and Agency level personnel (e.g., DOE, DNA, DA) after consideration of current established permissible levels, radiological threat, site characteristics and other considerations.

c. Monitoring of personnel, material and terrain for attainment of permissible levels will be under the direct supervision of the highest alpha team leader present.

d. Upon completion, the areas surrounding the Health Clinic will require monitoring and decontamination. Consideration will be given to surface type and condition, i.e., concrete, soil, plywood, smooth (wet or dry).

e. Prior to starting operations, the team chief will physically check valve indicators to waste holding tank drain located on west side of the Decon facility. When valve indicator is perpendicular to pipe, it is in the closed position. Both valves MUST be closed.

DSW PROCEDURE
NO. 73 17 January 1990

TAB A

EQUIPMENT AND SUPPLIES

	ITEM	QTY	LOCATION	REMARKS
1.	Gamma instruments	As Req	Health Clinic Garage	Measures low gamma- Detects Beta
2.	Alpha instruments	As Req	Health Clinic Garage	Measures Alpha, 200,000 CPM Max.
3.	Staplexes (Extra Filters)	As Req	Health Clinic Garage	
4.	Chairs	3	Health Clinic Garage	
5.	Receptacles (plastic)			
	Waste	3	Health Clinic Garage	
	Clothing	7		
	Linen	2		
6.	Bags, plastic large, waste Medium	1 (box ea)	Storage Cabinets	Place in receptacles and use for air sampler date
7.	Kraft Paper	1 (roll)	Storage Cabinets	Outline steps throughout CRA.
8.	Tables, folding	2		
9.	Linens Towels, bath Wash Cloths Blankets	Min 6 ea	Storage Cabinets	Use in Decon Chamber.
10.	Soap - flakes/bars	1 Box ea	Storage Cabinet	Use in Decon Chamber.
11.	Clothing Booties Coveralls, outside boots, head covers	(Min) 6 pr. 6 sets	Storage Cabinet	
12.	Tape, Masking	3 (roll)	Storage Cabinet	
13.	Cotton Swabs	3 (Pkgs)	Storage Cabinet	
14.	Lockers	9	Health Clinic Garage	For Team members clothing and personal equipment.

15.	Storage Cabinets	2	Health Clinic Garage	1 - Linens 1 - DeCon Suits, Blankets, Towels, etc.
16.	Drinking Water Containers, Large (for wash-down purpose)	2	Storage Cabinets - Garage	

DSW PROCEDURE
NO. 73

17 January 1990

TAB B

SIGN IN/DOSIMETER RECORD

POSITION	NAME	Arrival Time	Pocket Dosimeter Readings IM9E-MR Initial-Final	IM147 RADS Initial-Final
Team Leader				
CRA Operator				
DC Operator #1				
DC Operator #2				
HC Operator				

Tom Smith

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RADIATION AND INDOOR AIR
National Air and Radiation Environmental Laboratory
540 South Morris Avenue, Montgomery, AL 36115-2601
(334) 270-3400

January 7, 2000

MEMORANDUM

SUBJECT: Radiochemical Results for
Seneca Army Depot Samples

FROM: John Griggs, Chief John Griggs
Monitoring and Analytical Services Branch

TO: Eric Simpson, Coordinator
Radiation Monitoring and Analytical Programs
Region 2

Attached is a data package for gamma analysis of soil samples collected from the Seneca Army Depot site in Romulus, NY. The samples constitute NAREL batch number 9900096. The results of further analyses will be sent as they are completed.

Radiochemical analyses usually require the subtraction of an instrument background measurement from a gross sample measurement. Both values are positive, but when the sample activity is low, random variations in the two measurements can cause the gross value to be less than the background, resulting in a measured activity less than zero. Although negative activities have no physical significance, they do have statistical significance, as for example in the evaluation of trends or the comparison of two groups of samples.

For all analyses except gamma spectroscopy, it is the policy of NAREL to report results as generated, whether positive, negative, or zero, together with the 2-sigma measurement uncertainty and a sample-specific estimate of the minimum detectable concentration (MDC). The activity, uncertainty, and MDC are given in the same units. The activity and 2-sigma uncertainty for a radionuclide measured by gamma spectroscopy are reported only if the nuclide is detected; so, the results of gamma analyses are never zero or negative. Nuclides that are not detected do not appear in the report, with the exception of Ba-140, Cs-137, I-131, K-40, Ra-226, and Ra-228. If one of these six nuclides is undetected, NAREL reports it as "Not Detected," or "ND," and provides a sample-specific estimate of the MDC.

Specific information concerning all aspects of the radiological analysis of the samples is contained in the batch case narrative of the data package. If you have any questions concerning the analytical results, please contact me at (334)270-3450.

Attachments

cc: Paul Giardina, Region 2, w/o attachments
Mary Clark, (6601J), w/o attachments
Ed Sensintaffar, NAREL

CERTIFICATION

I certify that this data report complies with the terms and conditions of the Quality Assurance Project Plan, except as noted above. Release of the data contained in this report has been authorized by the Chief of the Monitoring and Analytical Services Branch and the NAREL Quality Assurance Coordinator, or their designees, as verified by the following signatures.

James B. Moore 1/7/00

James B. Moore — Date
Quality Assurance Coordinator

John Griggs 1/7/00

John Griggs, Ph.D. — Date
Chief, Monitoring and Analytical Services Branch

GENERAL INFORMATION (CONTINUED)

GAMMA ANALYSIS

The reporting format lists the gamma emitters in alphabetical order. The activity and 2-sigma uncertainty for radionuclides measured by gamma spectroscopy are reported only if the nuclide is detected. Nuclides that are not detected do not appear in the report, with the exception of Ba-140, Co-60, Cs-137, I-131, K-40, Ra-226 and Ra-228. If one of these seven nuclides is undetected, NAREL reports it as "Not Detected" or "ND", and provides a sample-specific estimate of the MDC.

Due to potential spectral interferences and other possible problems associated with the determination of the activity of certain radionuclides, the activities for Th-234, Pa-234m, Ra-226, and U-235 are subject to greater possible error than other commonly reported radionuclides. It should be noted that this potential error is not included in the two-sigma counting error which is reported with each activity. Although in this report we do provide the calculated activities for these radionuclides, we recommend that the results be used only as a qualitative means of indicating the presence of these radionuclides and not as a quantitative measure of their concentration. The results for these nuclides are not used in the evaluation of quality control samples. Furthermore, because of mutual interference between Ra-226 and U-235, NAREL's gamma analysis software tends to overestimate the amounts of these nuclides whenever both are present in a sample. Lower estimates for Ra-226 activities can be obtained from the reported activities of its decay products, Pb-214 and Bi-214, which are likely to be somewhat less than the Ra-226 activity because of the potential escape of radon gas.

NAREL's gamma spectroscopy software corrects activities and MDCs for decay between collection and analysis, but only up to a limit of ten half-lives. So, if the decay time for a sample is more than ten half-lives of a radionuclide, that nuclide will almost always be undetected and the reported MDC will be meaningless. This is usually a problem only for short-lived radionuclides, such as I-131 and Ba-140, when there is a long delay between collection and analysis.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

ANALYSIS SUMMARY

Analysis Procedure: GAMMA
Title: Gamma spectroscopy

NAREL Sample #	QC Type	Preparation Procedure	Date Completed	Prep Batch #	QC Batch #
99.07313Y		N/A	12/29/1999	0003518Q	0001323M
99.07314Z		N/A	12/29/1999	0003518Q	0001323M
99.07315A		N/A	12/30/1999	0003518Q	0001323M
99.07316B		N/A	12/30/1999	0003518Q	0001323M
99.07317C		N/A	01/04/2000	0003518Q	0001323M
99.07318D		N/A	01/03/2000	0003518Q	0001323M
99.07319E		N/A	01/05/2000	0003527R	0001323M
99.07320X		N/A	01/05/2000	0003527R	0001323M
99.07320X	DUP	N/A	01/06/2000	0003527R	0001323M
99.07321Y		N/A	01/05/2000	0003527R	0001323M
99.07322Z		N/A	01/05/2000	0003527R	0001323M
99.07323A		N/A	01/05/2000	0003527R	0001323M
99.07324B		N/A	01/05/2000	0003527R	0001323M
99.07325C		N/A	01/06/2000	0003538V	0001323M
99.07326D		N/A	01/06/2000	0003538V	0001323M
99.07327E		N/A	01/06/2000	0003538V	0001323M
99.07328F		N/A	01/05/2000	0003538V	0001323M
99.07329G		N/A	01/06/2000	0003538V	0001323M
99.07330Z		N/A	01/05/2000	0003538V	0001323M
99.07331A		N/A	01/06/2000	0003538V	0001323M
99.07332B		N/A	01/06/2000	0003538V	0001323M

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07313Y	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003518Q
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	4.970e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
12/29/1999 13:37	300.0	GE14	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		3.8e-01	PCI/GDRY	12/07/1999
Bi212		8.54e-01	2.1e-01		PCI/GDRY	12/07/1999
Bi214		8.41e-01	3.9e-02		PCI/GDRY	12/07/1999
Co60		ND		3.5e-02	PCI/GDRY	12/07/1999
Cs134		ND		6.6e-02	PCI/GDRY	12/07/1999
Cs137		3.33e-01	2.2e-02		PCI/GDRY	12/07/1999
I131		ND		2.4e-01	PCI/GDRY	12/07/1999
K40		2.34e+01	4.1e-01		PCI/GDRY	12/07/1999
Pb212		1.22e+00	5.2e-02		PCI/GDRY	12/07/1999
Pb214		9.25e-01	4.6e-02		PCI/GDRY	12/07/1999
Ra226	*	2.18e+00	5.1e-01		PCI/GDRY	12/07/1999
Ra228		8.84e-01	5.7e-02		PCI/GDRY	12/07/1999
Tl208		3.09e-01	2.2e-02		PCI/GDRY	12/07/1999

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07314Z	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003518Q
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.430e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
12/29/1999 18:40	300.0	GE14	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		3.8e-01	PCI/GDRY	12/07/1999
Bi212		8.47e-01	2.0e-01		PCI/GDRY	12/07/1999
Bi214		8.91e-01	3.5e-02		PCI/GDRY	12/07/1999
Co60		ND		3.2e-02	PCI/GDRY	12/07/1999
Cs134		ND		6.4e-02	PCI/GDRY	12/07/1999
Cs137		1.29e-01	1.7e-02		PCI/GDRY	12/07/1999
I131		ND		2.4e-01	PCI/GDRY	12/07/1999
K40		2.35e+01	4.0e-01		PCI/GDRY	12/07/1999
Pb212		1.31e+00	5.2e-02		PCI/GDRY	12/07/1999
Pb214		1.01e+00	4.7e-02		PCI/GDRY	12/07/1999
Ra226	*	2.73e+00	5.3e-01		PCI/GDRY	12/07/1999
Ra228		8.63e-01	5.2e-02		PCI/GDRY	12/07/1999
Tl208		3.12e-01	1.9e-02		PCI/GDRY	12/07/1999

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07315A	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003518Q
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.140e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
12/29/1999 23:43	300.0	GE14	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		4.2e-01	PCI/GDRY	12/07/1999
Bi212		9.31e-01	2.1e-01		PCI/GDRY	12/07/1999
Bi214		8.15e-01	3.7e-02		PCI/GDRY	12/07/1999
Co60		ND		3.2e-02	PCI/GDRY	12/07/1999
Cs134		ND		6.3e-02	PCI/GDRY	12/07/1999
Cs137		2.68e-01	1.9e-02		PCI/GDRY	12/07/1999
I131		ND		2.5e-01	PCI/GDRY	12/07/1999
K40		2.28e+01	4.0e-01		PCI/GDRY	12/07/1999
Pb212		1.27e+00	5.2e-02		PCI/GDRY	12/07/1999
Pb214		8.73e-01	4.5e-02		PCI/GDRY	12/07/1999
Ra226	*	1.82e+00	4.7e-01		PCI/GDRY	12/07/1999
Ra228		8.29e-01	5.0e-02		PCI/GDRY	12/07/1999
Tl208		3.10e-01	2.1e-02		PCI/GDRY	12/07/1999

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07316B	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003518Q
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.420e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
12/30/1999 04:46	300.0	GE14	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		3.5e-01	PCI/GDRY	12/07/1999
Bi212		6.87e-01	1.8e-01		PCI/GDRY	12/07/1999
Bi214		6.54e-01	3.2e-02		PCI/GDRY	12/07/1999
Co60		ND		3.2e-02	PCI/GDRY	12/07/1999
Cs134		ND		5.7e-02	PCI/GDRY	12/07/1999
Cs137		1.83e-01	1.8e-02		PCI/GDRY	12/07/1999
I131		ND		2.3e-01	PCI/GDRY	12/07/1999
K40		1.89e+01	3.6e-01		PCI/GDRY	12/07/1999
Pb212		9.46e-01	4.7e-02		PCI/GDRY	12/07/1999
Pb214		7.49e-01	4.1e-02		PCI/GDRY	12/07/1999
Ra226	*	1.85e+00	4.5e-01		PCI/GDRY	12/07/1999
Ra228		6.50e-01	4.7e-02		PCI/GDRY	12/07/1999
Tl208		2.28e-01	1.8e-02		PCI/GDRY	12/07/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07317C	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003518Q
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.460e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/03/2000 15:18	1000.0	GE02	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		4.2e-01	PCI/GDRY	12/07/1999
Bi212		9.51e-01	2.3e-01		PCI/GDRY	12/07/1999
Bi214		8.54e-01	3.9e-02		PCI/GDRY	12/07/1999
Co60		ND		4.3e-02	PCI/GDRY	12/07/1999
Cs137		1.90e-02	1.6e-02		PCI/GDRY	12/07/1999
I131		ND		2.2e-01	PCI/GDRY	12/07/1999
K40		1.99e+01	5.4e-01		PCI/GDRY	12/07/1999
Pb212		9.44e-01	3.3e-02		PCI/GDRY	12/07/1999
Pb214		9.03e-01	3.2e-02		PCI/GDRY	12/07/1999
Ra224		8.74e-01	3.2e-01		PCI/GDRY	12/07/1999
Ra226	*	2.10e+00	2.5e-01		PCI/GDRY	12/07/1999
Ra228		8.41e-01	5.0e-02		PCI/GDRY	12/07/1999
Tl208		3.10e-01	2.0e-02		PCI/GDRY	12/07/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07318D	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003518Q
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	4.750e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/03/2000 15:38	300.0	GE14	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		4.8e-01	PCI/GDRY	12/07/1999
Bi212		6.75e-01	1.8e-01		PCI/GDRY	12/07/1999
Bi214		7.80e-01	3.5e-02		PCI/GDRY	12/07/1999
Co60		ND		3.0e-02	PCI/GDRY	12/07/1999
Cs134		ND		6.6e-02	PCI/GDRY	12/07/1999
Cs137		5.65e-01	2.5e-02		PCI/GDRY	12/07/1999
I131		ND		3.4e-01	PCI/GDRY	12/07/1999
K40		2.12e+01	3.9e-01		PCI/GDRY	12/07/1999
Pb212		1.07e+00	4.9e-02		PCI/GDRY	12/07/1999
Pb214		8.64e-01	4.2e-02		PCI/GDRY	12/07/1999
Ra226	*	1.58e+00	4.6e-01		PCI/GDRY	12/07/1999
Ra228		7.11e-01	4.6e-02		PCI/GDRY	12/07/1999
Tl208		2.77e-01	1.9e-02		PCI/GDRY	12/07/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07319E	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003527R
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.710e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/04/2000 12:56	1000.0	GE04	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		4.1e-01	PCI/GDRY	12/07/1999
Bi212		1.09e+00	1.7e-01		PCI/GDRY	12/07/1999
Bi214		8.54e-01	3.3e-02		PCI/GDRY	12/07/1999
Co60		ND		3.6e-02	PCI/GDRY	12/07/1999
Cs137		2.25e-01	1.8e-02		PCI/GDRY	12/07/1999
I131		ND		2.3e-01	PCI/GDRY	12/07/1999
K40		2.21e+01	4.5e-01		PCI/GDRY	12/07/1999
Pb212		1.03e+00	3.0e-02		PCI/GDRY	12/07/1999
Pb214		9.38e-01	3.0e-02		PCI/GDRY	12/07/1999
Ra223		1.10e-01	6.2e-02		PCI/GDRY	12/07/1999
Ra224		5.05e-01	2.5e-01		PCI/GDRY	12/07/1999
Ra226	*	2.27e+00	3.0e-01		PCI/GDRY	12/07/1999
Ra228		8.95e-01	4.6e-02		PCI/GDRY	12/07/1999
Tl208		3.38e-01	1.8e-02		PCI/GDRY	12/07/1999
U235	*	1.33e-01	1.7e-02		PCI/GDRY	12/07/1999

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07320X	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003527R
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.810e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/04/2000 12:56	1000.0	GE05	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		2.5e-01	PCI/GDRY	12/07/1999
Bi212		5.90e-01	1.2e-01		PCI/GDRY	12/07/1999
Bi214		5.64e-01	2.5e-02		PCI/GDRY	12/07/1999
Co60		ND		2.3e-02	PCI/GDRY	12/07/1999
Cs137		1.67e-01	1.2e-02		PCI/GDRY	12/07/1999
I131		ND		1.7e-01	PCI/GDRY	12/07/1999
K40		1.45e+01	3.1e-01		PCI/GDRY	12/07/1999
Pb212		6.83e-01	2.5e-02		PCI/GDRY	12/07/1999
Pb214		6.09e-01	2.4e-02		PCI/GDRY	12/07/1999
Ra224		5.21e-01	2.4e-01		PCI/GDRY	12/07/1999
Ra226	*	1.40e+00	2.7e-01		PCI/GDRY	12/07/1999
Ra228		5.78e-01	3.3e-02		PCI/GDRY	12/07/1999
Th234	*	4.60e-01	1.8e-01		PCI/GDRY	12/07/1999
Tl208		2.02e-01	1.3e-02		PCI/GDRY	12/07/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07320X	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003527R
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.810e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	DUP

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/05/2000 13:36	1000.0	GE02	MHW

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		3.7e-01	PCI/GDRY	12/07/1999
Bi212		6.01e-01	1.9e-01		PCI/GDRY	12/07/1999
Bi214		6.14e-01	3.1e-02		PCI/GDRY	12/07/1999
Co60		ND		3.1e-02	PCI/GDRY	12/07/1999
Cs137		1.53e-01	1.6e-02		PCI/GDRY	12/07/1999
I131		ND		2.3e-01	PCI/GDRY	12/07/1999
K40		1.41e+01	4.3e-01		PCI/GDRY	12/07/1999
Pb212		6.52e-01	2.7e-02		PCI/GDRY	12/07/1999
Pb214		6.62e-01	2.7e-02		PCI/GDRY	12/07/1999
Ra224		3.42e-01	2.7e-01		PCI/GDRY	12/07/1999
Ra226	*	1.83e+00	2.4e-01		PCI/GDRY	12/07/1999
Ra228		5.79e-01	4.3e-02		PCI/GDRY	12/07/1999
Tl208		2.12e-01	1.7e-02		PCI/GDRY	12/07/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07321Y	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003527R
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.750e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/04/2000 12:57	1000.0	GE06	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		3.2e-01	PCI/GDRY	12/07/1999
Bi212		8.40e-01	1.3e-01		PCI/GDRY	12/07/1999
Bi214		8.16e-01	2.7e-02		PCI/GDRY	12/07/1999
Co60		ND		2.5e-02	PCI/GDRY	12/07/1999
Cs137		6.62e-02	1.1e-02		PCI/GDRY	12/07/1999
I131		ND		2.1e-01	PCI/GDRY	12/07/1999
K40		1.97e+01	3.2e-01		PCI/GDRY	12/07/1999
Pb212		9.58e-01	2.8e-02		PCI/GDRY	12/07/1999
Pb214		8.90e-01	2.7e-02		PCI/GDRY	12/07/1999
Ra224		1.02e+00	2.6e-01		PCI/GDRY	12/07/1999
Ra226	*	1.89e+00	2.7e-01		PCI/GDRY	12/07/1999
Ra228		8.40e-01	3.4e-02		PCI/GDRY	12/07/1999
Th234	*	6.54e-01	2.4e-01		PCI/GDRY	12/07/1999
Tl208		3.00e-01	1.4e-02		PCI/GDRY	12/07/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07322Z	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003527R
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.170e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/04/2000 12:57	1000.0	GE07	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		3.7e-01	PCI/GDRY	12/07/1999
Bi212		1.32e+00	2.1e-01		PCI/GDRY	12/07/1999
Bi214		1.01e+00	3.6e-02		PCI/GDRY	12/07/1999
Co60		ND		3.1e-02	PCI/GDRY	12/07/1999
Cs137		4.45e-01	1.9e-02		PCI/GDRY	12/07/1999
I131		ND		2.5e-01	PCI/GDRY	12/07/1999
K40		2.95e+01	4.5e-01		PCI/GDRY	12/07/1999
Pb212		1.51e+00	3.7e-02		PCI/GDRY	12/07/1999
Pb214		1.16e+00	3.5e-02		PCI/GDRY	12/07/1999
Ra223		1.62e-01	7.5e-02		PCI/GDRY	12/07/1999
Ra224		9.08e-01	3.5e-01		PCI/GDRY	12/07/1999
Ra226	*	2.44e+00	3.3e-01		PCI/GDRY	12/07/1999
Ra228		1.27e+00	5.0e-02		PCI/GDRY	12/07/1999
Tl208		4.58e-01	1.9e-02		PCI/GDRY	12/07/1999
U235	*	1.48e-01	2.0e-02		PCI/GDRY	12/07/1999

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07323A	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003527R
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	4.450e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/04/2000 22:45	500.0	GE13	MHW

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		3.8e-01	PCI/GDRY	12/07/1999
Bi212		9.53e-01	1.8e-01		PCI/GDRY	12/07/1999
Bi214		7.76e-01	3.4e-02		PCI/GDRY	12/07/1999
Co60		ND		2.8e-02	PCI/GDRY	12/07/1999
Cs134		ND		3.1e-02	PCI/GDRY	12/07/1999
Cs137		5.46e-01	2.3e-02		PCI/GDRY	12/07/1999
I131		ND		2.6e-01	PCI/GDRY	12/07/1999
K40		2.48e+01	4.7e-01		PCI/GDRY	12/07/1999
Pb212		1.13e+00	3.7e-02		PCI/GDRY	12/07/1999
Pb214		8.02e-01	3.3e-02		PCI/GDRY	12/07/1999
Ra224		8.40e-01	3.6e-01		PCI/GDRY	12/07/1999
Ra226	*	1.94e+00	3.4e-01		PCI/GDRY	12/07/1999
Ra228		1.02e+00	4.7e-02		PCI/GDRY	12/07/1999
Th234	*	5.50e-01	3.1e-01		PCI/GDRY	12/07/1999
Tl208		3.76e-01	1.9e-02		PCI/GDRY	12/07/1999

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07324B	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003527R
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	4.930e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/04/2000 12:57	1000.0	GE08	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		4.5e-01	PCI/GDRY	12/07/1999
Bi212		8.54e-01	2.3e-01		PCI/GDRY	12/07/1999
Bi214		7.79e-01	3.6e-02		PCI/GDRY	12/07/1999
Co60		ND		3.5e-02	PCI/GDRY	12/07/1999
Cs137		4.11e-01	2.2e-02		PCI/GDRY	12/07/1999
I131		ND		2.9e-01	PCI/GDRY	12/07/1999
K40		2.06e+01	4.3e-01		PCI/GDRY	12/07/1999
Pb212		1.16e+00	4.0e-02		PCI/GDRY	12/07/1999
Pb214		9.35e-01	3.8e-02		PCI/GDRY	12/07/1999
Ra224		1.21e+00	4.5e-01		PCI/GDRY	12/07/1999
Ra226	*	2.09e+00	3.7e-01		PCI/GDRY	12/07/1999
Ra228		9.09e-01	5.0e-02		PCI/GDRY	12/07/1999
Th234	*	1.28e+00	1.7e-01		PCI/GDRY	12/07/1999
Tl208		3.44e-01	2.1e-02		PCI/GDRY	12/07/1999

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07325C	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003538V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	6.370e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/05/2000 13:36	1000.0	GE06	MHW

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		2.0e-01	PCI/GDRY	12/13/1999
Bi212		6.15e-01	1.1e-01		PCI/GDRY	12/13/1999
Bi214		6.60e-01	2.3e-02		PCI/GDRY	12/13/1999
Co60		ND		2.2e-02	PCI/GDRY	12/13/1999
Cs137		3.46e-02	1.1e-02		PCI/GDRY	12/13/1999
I131		ND		1.2e-01	PCI/GDRY	12/13/1999
K40		1.49e+01	2.7e-01		PCI/GDRY	12/13/1999
Pb212		6.90e-01	2.4e-02		PCI/GDRY	12/13/1999
Pb214		7.35e-01	2.3e-02		PCI/GDRY	12/13/1999
Ra224		5.90e-01	2.3e-01		PCI/GDRY	12/13/1999
Ra226	*	1.50e+00	2.4e-01		PCI/GDRY	12/13/1999
Ra228		6.01e-01	2.9e-02		PCI/GDRY	12/13/1999
Tl208		2.16e-01	1.2e-02		PCI/GDRY	12/13/1999
U235	*	9.05e-02	1.4e-02		PCI/GDRY	12/13/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07326D	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003538V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	6.390e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/05/2000 13:36	1000.0	GE07	MHW

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		2.6e-01	PCI/GDRY	12/13/1999
Bi212		1.11e+00	1.6e-01		PCI/GDRY	12/13/1999
Bi214		9.25e-01	3.0e-02		PCI/GDRY	12/13/1999
Co60		ND		2.6e-02	PCI/GDRY	12/13/1999
Cs137		2.89e-01	1.5e-02		PCI/GDRY	12/13/1999
I131		ND		1.4e-01	PCI/GDRY	12/13/1999
K40		3.07e+01	4.1e-01		PCI/GDRY	12/13/1999
Pb212		1.31e+00	3.1e-02		PCI/GDRY	12/13/1999
Pb214		1.02e+00	2.9e-02		PCI/GDRY	12/13/1999
Ra224		7.40e-01	3.0e-01		PCI/GDRY	12/13/1999
Ra226	*	2.17e+00	3.0e-01		PCI/GDRY	12/13/1999
Ra228		1.20e+00	4.1e-02		PCI/GDRY	12/13/1999
Th234	*	9.14e-01	2.8e-01		PCI/GDRY	12/13/1999
Tl208		4.07e-01	1.7e-02		PCI/GDRY	12/13/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07327E	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003538V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.740e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/05/2000 13:36	1000.0	GE08	MHW

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		3.4e-01	PCI/GDRY	12/13/1999
Bi212		1.17e+00	1.9e-01		PCI/GDRY	12/13/1999
Bi214		8.84e-01	3.5e-02		PCI/GDRY	12/13/1999
Co60		ND		3.3e-02	PCI/GDRY	12/13/1999
Cs137		1.64e-02	1.1e-02		PCI/GDRY	12/13/1999
I131		ND		1.8e-01	PCI/GDRY	12/13/1999
K40		2.49e+01	4.2e-01		PCI/GDRY	12/13/1999
Pb212		1.31e+00	3.6e-02		PCI/GDRY	12/13/1999
Pb214		1.04e+00	3.4e-02		PCI/GDRY	12/13/1999
Ra223		7.78e-02	7.4e-02		PCI/GDRY	12/13/1999
Ra224		1.13e+00	3.8e-01		PCI/GDRY	12/13/1999
Ra226	*	2.66e+00	3.7e-01		PCI/GDRY	12/13/1999
Ra228		1.09e+00	4.7e-02		PCI/GDRY	12/13/1999
Th234	*	1.23e+00	1.8e-01		PCI/GDRY	12/13/1999
Tl202		5.86e-02	4.8e-02		PCI/GDRY	12/13/1999
Tl208		3.93e-01	1.8e-02		PCI/GDRY	12/13/1999
U235	*	1.59e-01	2.2e-02		PCI/GDRY	12/13/1999

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07328F	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003538V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	4.320e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/05/2000 13:37	300.0	GE14	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		3.8e-01	PCI/GDRY	12/13/1999
Bi212		8.19e-01	2.0e-01		PCI/GDRY	12/13/1999
Bi214		7.10e-01	3.7e-02		PCI/GDRY	12/13/1999
Co60		ND		3.4e-02	PCI/GDRY	12/13/1999
Cs134		ND		6.2e-02	PCI/GDRY	12/13/1999
Cs137		1.25e-01	1.8e-02		PCI/GDRY	12/13/1999
I131		ND		2.4e-01	PCI/GDRY	12/13/1999
K40		2.28e+01	4.2e-01		PCI/GDRY	12/13/1999
Pb212		1.15e+00	5.1e-02		PCI/GDRY	12/13/1999
Pb214		7.19e-01	4.2e-02		PCI/GDRY	12/13/1999
Ra226	*	1.57e+00	4.9e-01		PCI/GDRY	12/13/1999
Ra228		9.15e-01	5.5e-02		PCI/GDRY	12/13/1999
Tl208		2.70e-01	1.9e-02		PCI/GDRY	12/13/1999

* An asterisk indicates a result whose value may be significantly over or underestimated.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07329G	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003538V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.160e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/05/2000 13:37	1000.0	GE10	MHW

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		2.5e-01	PCI/GDRY	12/13/1999
Bi212		8.73e-01	1.5e-01		PCI/GDRY	12/13/1999
Bi214		7.91e-01	2.9e-02		PCI/GDRY	12/13/1999
Co60		ND		2.5e-02	PCI/GDRY	12/13/1999
Cs137		5.90e-01	1.9e-02		PCI/GDRY	12/13/1999
I131		ND		1.4e-01	PCI/GDRY	12/13/1999
K40		1.94e+01	3.4e-01		PCI/GDRY	12/13/1999
Pb212		9.92e-01	2.9e-02		PCI/GDRY	12/13/1999
Pb214		8.97e-01	2.8e-02		PCI/GDRY	12/13/1999
Ra224		6.74e-01	2.9e-01		PCI/GDRY	12/13/1999
Ra226	*	1.91e+00	2.7e-01		PCI/GDRY	12/13/1999
Ra228		8.59e-01	3.8e-02		PCI/GDRY	12/13/1999
Tl208		3.20e-01	1.6e-02		PCI/GDRY	12/13/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07330Z	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003538V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	4.460e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/05/2000 18:40	300.0	GE14	KNG

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		3.9e-01	PCI/GDRY	12/13/1999
Bi212		8.35e-01	1.8e-01		PCI/GDRY	12/13/1999
Bi214		7.86e-01	3.8e-02		PCI/GDRY	12/13/1999
Co60		ND		3.3e-02	PCI/GDRY	12/13/1999
Cs134		ND		6.2e-02	PCI/GDRY	12/13/1999
Cs137		6.35e-01	2.6e-02		PCI/GDRY	12/13/1999
I131		ND		2.6e-01	PCI/GDRY	12/13/1999
K40		2.37e+01	4.2e-01		PCI/GDRY	12/13/1999
Pb212		1.26e+00	5.1e-02		PCI/GDRY	12/13/1999
Pb214		7.64e-01	4.1e-02		PCI/GDRY	12/13/1999
Ra226	*	2.45e+00	4.9e-01		PCI/GDRY	12/13/1999
Ra228		8.45e-01	4.9e-02		PCI/GDRY	12/13/1999
Tl208		2.99e-01	2.0e-02		PCI/GDRY	12/13/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07331A	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003538V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.190e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/05/2000 13:37	1000.0	GE11	MHW

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		2.2e-01	PCI/GDRY	12/13/1999
Bi212		9.66e-01	1.2e-01		PCI/GDRY	12/13/1999
Bi214		7.94e-01	2.4e-02		PCI/GDRY	12/13/1999
Co60		ND		1.9e-02	PCI/GDRY	12/13/1999
Cs137		3.53e-01	1.4e-02		PCI/GDRY	12/13/1999
I131		ND		1.1e-01	PCI/GDRY	12/13/1999
K40		2.07e+01	3.0e-01		PCI/GDRY	12/13/1999
Pa234m	*	1.78e+00	1.0e+00		PCI/GDRY	12/13/1999
Pb212		9.79e-01	2.5e-02		PCI/GDRY	12/13/1999
Pb214		8.88e-01	2.3e-02		PCI/GDRY	12/13/1999
Ra224		9.02e-01	2.3e-01		PCI/GDRY	12/13/1999
Ra226	*	2.30e+00	2.5e-01		PCI/GDRY	12/13/1999
Ra228		8.70e-01	3.2e-02		PCI/GDRY	12/13/1999
Th234	*	1.25e+00	1.9e-01		PCI/GDRY	12/13/1999
Tl208		3.02e-01	1.3e-02		PCI/GDRY	12/13/1999
U235	*	1.38e-01	1.5e-02		PCI/GDRY	12/13/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07332B	QC batch #:	0001323M
Matrix:	SOIL	Prep batch #:	0003538V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	5.420e+02 GDRY	Analysis procedure:	GAMMA
Dry/wet weight:	N/A	Analyst:	N/A
Ash/dry weight:	N/A	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/05/2000 13:37	1000.0	GE12	MHW

ANALYTICAL RESULTS

Analyte		Activity	± 2σ Uncertainty	MDC	Unit	Date
Ba140		ND		2.9e-01	PCI/GDRY	12/13/1999
Bi212		7.88e-01	1.6e-01		PCI/GDRY	12/13/1999
Bi214		7.65e-01	3.0e-02		PCI/GDRY	12/13/1999
Co60		ND		2.9e-02	PCI/GDRY	12/13/1999
Cs137		1.20e-01	1.3e-02		PCI/GDRY	12/13/1999
I131		ND		1.7e-01	PCI/GDRY	12/13/1999
K40		2.07e+01	3.5e-01		PCI/GDRY	12/13/1999
Pb212		8.85e-01	3.0e-02		PCI/GDRY	12/13/1999
Pb214		8.48e-01	2.9e-02		PCI/GDRY	12/13/1999
Ra224		5.52e-01	3.0e-01		PCI/GDRY	12/13/1999
Ra226	*	1.81e+00	3.1e-01		PCI/GDRY	12/13/1999
Ra228		8.19e-01	4.1e-02		PCI/GDRY	12/13/1999
Tl208		2.87e-01	1.6e-02		PCI/GDRY	12/13/1999

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
GAMMA ANALYSES
SDG #9900096

QC BATCH SUMMARY

QC batch #: 0001323M
Preparation procedure: N/A
Analysis procedure: GAMMA

NAREL Sample #	QC Type	Yield (%)	± 2σ Uncertainty (%)	Analyst
99.07313Y		N/A		N/A
99.07314Z		N/A		N/A
99.07315A		N/A		N/A
99.07316B		N/A		N/A
99.07317C		N/A		N/A
99.07318D		N/A		N/A
99.07319E		N/A		N/A
99.07320X		N/A		N/A
99.07320X	DUP	N/A		N/A
99.07321Y		N/A		N/A
99.07322Z		N/A		N/A
99.07323A		N/A		N/A
99.07324B		N/A		N/A
99.07325C		N/A		N/A
99.07326D		N/A		N/A
99.07327E		N/A		N/A
99.07328F		N/A		N/A
99.07329G		N/A		N/A
99.07330Z		N/A		N/A
99.07331A		N/A		N/A
99.07332B		N/A		N/A

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

National Air and Radiation Environmental Laboratory
QC Batch Report

QC Batch #: ¯0001323M   Analytical Procedure: GAMMA

LABORATORY DUPLICATES (PCI/GDRY)

Sample ID	Nuclide	Original ± 2σ	Duplicate ± 2σ	RPD	Z
99.07320X	BA140				
99.07320X	BI212	5.90e-01 ± 1.2e-01	6.01e-01 ± 1.9e-01	1.85	0.09 OK
99.07320X	BI214	5.64e-01 ± 2.5e-02	6.14e-01 ± 3.1e-02	8.49	1.08 OK
99.07320X	CO60				
99.07320X	CS137	1.67e-01 ± 1.2e-02	1.53e-01 ± 1.6e-02	8.75	-0.92 OK
99.07320X	I131				
99.07320X	K40	1.45e+01 ± 3.1e-01	1.41e+01 ± 4.3e-01	2.80	-0.38 OK
99.07320X	PB212	6.83e-01 ± 2.5e-02	6.52e-01 ± 2.7e-02	4.64	-0.61 OK
99.07320X	PB214	6.09e-01 ± 2.4e-02	6.62e-01 ± 2.7e-02	8.34	1.09 OK
99.07320X	RA224	5.21e-01 ± 2.4e-01	3.42e-01 ± 2.7e-01	41.48	-0.97 OK
99.07320X	RA228	5.78e-01 ± 3.3e-02	5.79e-01 ± 4.3e-02	0.17	0.02 OK
99.07320X	TL208	2.02e-01 ± 1.3e-02	2.12e-01 ± 1.7e-02	4.83	0.56 OK

Analyst: N/A

QA Officer: Carl McLure   1/6/2000

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RADIATION AND INDOOR AIR
National Air and Radiation Environmental Laboratory
540 South Morris Avenue, Montgomery, AL 36115-2601
(334) 270-3400

January 20, 2000

MEMORANDUM

SUBJECT: Radiochemical Results for
Seneca Army Depot Samples

FROM: John Griggs, Chief John Griggs
Monitoring and Analytical Services Branch

TO: Eric Simpson, Coordinator
Radiation Monitoring and Analytical Programs
Region 2

Attached is a data package for plutonium analysis of soil samples collected from the Seneca Army Depot site in Romulus, NY. The samples constitute NAREL batch number 9900096.

Radiochemical analyses usually require the subtraction of an instrument background measurement from a gross sample measurement. Both values are positive, but when the sample activity is low, random variations in the two measurements can cause the gross value to be less than the background, resulting in a measured activity less than zero. Although negative activities have no physical significance, they do have statistical significance, as for example in the evaluation of trends or the comparison of two groups of samples.

For all analyses except gamma spectroscopy, it is the policy of NAREL to report results as generated, whether positive, negative, or zero, together with the 2-sigma measurement uncertainty and a sample-specific estimate of the minimum detectable concentration (MDC). The activity, uncertainty, and MDC are given in the same units. The activity and 2-sigma uncertainty for a radionuclide measured by gamma spectroscopy are reported only if the nuclide is detected; so, the results of gamma analyses are never zero or negative. Nuclides that are not detected do not appear in the report, with the exception of Ba-140, Cs-137, I-131, K-40, Ra-226, and Ra-228. If one of these six nuclides is undetected, NAREL reports it as "Not Detected," or "ND," and provides a sample-specific estimate of the MDC.

Specific information concerning all aspects of the radiological analysis of the samples is contained in the batch case narrative of the data package. If you have any questions concerning the analytical results, please contact me at (334)270-3450.

Attachments

cc: Paul Giardina, Region 2, w/o attachments
Mary Clark, (6601J), w/o attachments
Ed Sensintaffar, NAREL

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES

REPORT OF SAMPLE DELIVERY GROUP #9900096

Project: SENECA ARMY DEPOT
Analysis Procedure: Plutonium
Date Reported: 01/19/2000

SAMPLES

NAREL Sample #	Client Sample ID	Type	Matrix	Date Collected	Date Received
99.07313Y	SS12-9	SAM	SOIL	12/07/1999	12/09/1999
99.07314Z	SS12-2	SAM	SOIL	12/07/1999	12/09/1999
99.07315A	SS12-13	SAM	SOIL	12/07/1999	12/09/1999
99.07316B	SS12-14	SAM	SOIL	12/07/1999	12/09/1999
99.07317C	EPA12-1	SAM	SOIL	12/07/1999	12/09/1999
99.07318D	EPA12-2	SAM	SOIL	12/07/1999	12/09/1999
99.07319E	EPA12-3	SAM	SOIL	12/07/1999	12/09/1999
99.07320X	EPA12-4	SAM	SOIL	12/07/1999	12/09/1999
99.07321Y	EPA12-5	SAM	SOIL	12/07/1999	12/09/1999
99.07322Z	EPA12-9	SAM	SOIL	12/07/1999	12/09/1999
99.07323A	EPA12-11	SAM	SOIL	12/07/1999	12/09/1999
99.07324B	EPA12-12	SAM	SOIL	12/07/1999	12/09/1999
99.07325C	EPA12-6	SAM	SOIL	12/13/1999	12/15/1999
99.07326D	EPA12-7	SAM	SOIL	12/13/1999	12/15/1999
99.07327E	EPA12-8	SAM	SOIL	12/13/1999	12/15/1999
99.07328F	EPA12-10	SAM	SOIL	12/13/1999	12/15/1999
99.07329G	EPA12-13	SAM	SOIL	12/13/1999	12/15/1999
99.07330Z	EPA12-14	SAM	SOIL	12/13/1999	12/15/1999
99.07331A	EPA12-15	SAM	SOIL	12/13/1999	12/15/1999
99.07332B	EPA12-16	SAM	SOIL	12/13/1999	12/15/1999

EXCEPTIONS

1. Packaging and Shipping - No problems were observed.
2. Documentation - No problems were observed.
3. Sample Preparation - No problems were encountered.
4. Analysis - NAREL sample 99.7329 is being recounted due to the Pu-238 result of the original count.
5. Holding Times - All holding times were met.

QUALITY CONTROL

1. QC samples - All QC analysis results met NAREL acceptance criteria.
2. Yields - All chemical yields were within acceptance limits.
3. Instruments - Response and background checks for all instruments used in these analyses met NAREL acceptance criteria.

CERTIFICATION

I certify that this data report complies with the terms and conditions of the Quality Assurance Project Plan, except as noted above. Release of the data contained in this report has been authorized by the Chief of the Monitoring and Analytical Services Branch and the NAREL Quality Assurance Coordinator, or their designees, as verified by the following signatures.

James B. Moore   1/20/00

James B. Moore   Date

Quality Assurance Coordinator

John Griggs   1/20/00

John Griggs, Ph.D.   Date

Chief, Monitoring and Analytical Services Branch

GENERAL INFORMATION

SAMPLE TYPES

BLD	Blind sample
DBD	Double blind sample
FBK	Field blank
SAM	Normal sample

ANALYSIS QC TYPES

ANA	Normal analysis
DUP	Laboratory duplicate
LCS	Laboratory control sample (blank spike)
MS	Matrix spike
MSD	Matrix spike duplicate
RBK	Reagent blank

QUALITY INDICATORS

RPD	Relative Percent Difference
%R	Percent Recovery
Z	Number of standard deviations by which a QC measurement differs from the expected value

EVALUATION OF QC ANALYSES

A reagent blank result is considered unacceptable if it is more than 3 standard deviations below zero or more than 3 standard deviations above a predetermined upper control limit. For some analyses NAREL has set the upper control limit at zero. For others the control limit is a small positive number.

NAREL evaluates the results of duplicate and spike analyses using "*Z* scores." A *Z* score is the number of standard deviations by which the QC result differs from its ideal value. The score is considered acceptable if its absolute value is not greater than 3.

The *Z* score for a spiked sample is computed by dividing the difference between the measured value and the target value by the combined standard uncertainty of the difference.

The *Z* score for a duplicate analysis is computed by dividing the difference between the two measured values by the combined standard uncertainty of the difference. When the precision of paired MS/MSD analyses is evaluated, the native sample activity is subtracted from each measured value and the net concentrations are then converted to total activities before the *Z* score is computed.

Each standard uncertainty used to compute a *Z* score includes an additional fixed term to represent sources of measurement error other than counting error. This additional term is not used in the evaluation of reagent blanks.

NAREL reports the "relative percent difference," or RPD, between duplicate results and the "percent recovery," or %R, for spiked analyses, but does not use these values for evaluation.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

ANALYSIS SUMMARY

Analysis Procedure: PU
Title: Plutonium

NAREL Sample #	QC Type	Preparation Procedure	Date Completed	Prep Batch #	QC Batch #
99.07313Y		N/A	01/11/2000	0003560T	0001332N
99.07313Y	DUP	N/A	01/11/2000	0003560T	0001332N
99.07314Z		N/A	01/11/2000	0003560T	0001332N
99.07314Z	MS	N/A	01/11/2000	0003560T	0001332N
99.07314Z	MSD	N/A	01/11/2000	0003560T	0001332N
99.07315A		N/A	01/11/2000	0003560T	0001332N
99.07316B		N/A	01/12/2000	0003562V	0001332N
99.07317C		N/A	01/12/2000	0003562V	0001332N
99.07318D		N/A	01/12/2000	0003562V	0001332N
99.07319E		N/A	01/12/2000	0003562V	0001332N
99.07320X		N/A	01/12/2000	0003562V	0001332N
99.07321Y		N/A	01/12/2000	0003562V	0001332N
99.07322Z		N/A	01/12/2000	0003562V	0001332N
99.07323A		N/A	01/19/2000	0003564X	0001333P
99.07324B		N/A	01/19/2000	0003564X	0001333P
99.07324B	DUP	N/A	01/19/2000	0003564X	0001333P
99.07325C		N/A	01/19/2000	0003564X	0001333P
99.07326D		N/A	01/19/2000	0003564X	0001333P
99.07327E		N/A	01/19/2000	0003564X	0001333P
99.07327E	MS	N/A	01/19/2000	0003564X	0001333P
99.07327E	MSD	N/A	01/19/2000	0003564X	0001333P
99.07328F		N/A	01/19/2000	0003564X	0001333P
99.07329G		N/A	01/19/2000	0003564X	0001333P
99.07330Z		N/A	01/19/2000	0003564X	0001333P
99.07331A		N/A	01/19/2000	0003564X	0001333P
99.07332B		N/A	01/19/2000	0003564X	0001333P
RBK-00403020U *	RBK	N/A	01/11/2000	0003560T	0001332N
RBK-00403029D *	RBK	N/A	01/19/2000	0003564X	0001333P

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07313Y	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003560T
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.628e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	68.91 %	Analyst:	SPK
Ash/dry weight:	92.20 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/10/2000 15:53	1000.0	AS01	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-3.85e-03	3.6e-02	7.8e-02	PCI/GDRY	01/10/2000
Pu239	2.69e-02	2.6e-02	3.0e-02	PCI/GDRY	01/10/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07313Y	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003560T
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	4.419e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	68.91 %	Analyst:	SPK
Ash/dry weight:	92.20 %	QC type:	DUP

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/10/2000 15:53	1000.0	AS03	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-5.99e-03	2.9e-02	6.8e-02	PCI/GDRY	01/10/2000
Pu239	9.16e-03	1.6e-02	2.9e-02	PCI/GDRY	01/10/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07314Z	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003560T
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.553e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	79.23 %	Analyst:	SPK
Ash/dry weight:	94.80 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/10/2000 15:53	1000.0	AS04	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	2.87e-02	4.0e-02	6.5e-02	PCI/GDRY	01/10/2000
Pu239	1.28e-02	2.9e-02	5.8e-02	PCI/GDRY	01/10/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07314Z	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003560T
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.512e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	79.23 %	Analyst:	SPK
Ash/dry weight:	94.80 %	QC type:	MS

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/10/2000 15:53	1000.0	AS05	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-5.46e-02	4.0e-02	1.2e-01	PCI/GDRY	01/10/2000
Pu239	5.02e+00	5.8e-01	7.2e-02	PCI/GDRY	01/10/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07314Z	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003560T
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.542e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	79.23 %	Analyst:	SPK
Ash/dry weight:	94.80 %	QC type:	MSD

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/10/2000 15:53	1000.0	AS06	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-2.06e-02	6.6e-02	1.4e-01	PCI/GDRY	01/10/2000
Pu239	4.76e+00	5.5e-01	6.0e-02	PCI/GDRY	01/10/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07315A	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003560T
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.577e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	70.32 %	Analyst:	SPK
Ash/dry weight:	92.80 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/10/2000 15:53	1000.0	AS07	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	8.56e-03	1.9e-02	3.9e-02	PCI/GDRY	01/10/2000
Pu239	1.28e-02	1.8e-02	1.9e-02	PCI/GDRY	01/10/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07316B	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003562V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.586e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	74.10 %	Analyst:	SPK
Ash/dry weight:	91.20 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/11/2000 16:54	1000.0	AS01	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	1.55e-02	4.7e-02	9.0e-02	PCI/GDRY	01/11/2000
Pu239	-2.21e-03	4.4e-03	3.4e-02	PCI/GDRY	01/11/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07317C	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003562V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.946e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	83.12 %	Analyst:	SPK
Ash/dry weight:	96.40 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/11/2000 16:54	1000.0	AS03	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-8.63e-03	4.2e-02	9.8e-02	PCI/GDRY	01/11/2000
Pu239	1.32e-02	2.3e-02	4.1e-02	PCI/GDRY	01/11/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07318D	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003562V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.033e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	62.13 %	Analyst:	SPK
Ash/dry weight:	86.80 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/11/2000 16:54	1000.0	AS04	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	1.43e-02	2.6e-02	4.9e-02	PCI/GDRY	01/11/2000
Pu239	5.24e-02	4.1e-02	4.4e-02	PCI/GDRY	01/11/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07319E	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003562V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.663e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	81.44 %	Analyst:	SPK
Ash/dry weight:	93.60 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/11/2000 16:54	1000.0	AS05	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-8.66e-03	5.4e-02	1.2e-01	PCI/GDRY	01/11/2000
Pu239	2.89e-03	2.8e-02	6.8e-02	PCI/GDRY	01/11/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07320X	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003562V
Sample type:	.SAM	Prep procedure:	N/A
Amount analyzed:	3.014e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	79.71 %	Analyst:	SPK
Ash/dry weight:	94.20 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/11/2000 16:54	1000.0	AS06	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-4.73e-02	4.8e-02	1.2e-01	PCI/GDRY	01/11/2000
Pu239	7.46e-03	2.3e-02	5.1e-02	PCI/GDRY	01/11/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07321Y	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003562V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.250e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	85.57 %	Analyst:	SPK
Ash/dry weight:	95.20 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/11/2000 16:54	1000.0	AS07	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	9.11e-03	2.0e-02	4.2e-02	PCI/GDRY	01/11/2000
Pu239	6.83e-03	1.4e-02	2.0e-02	PCI/GDRY	01/11/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07322Z	QC batch #:	0001332N
Matrix:	SOIL	Prep batch #:	0003562V
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.590e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	83.78 %	Analyst:	SPK
Ash/dry weight:	94.00 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/11/2000 16:54	1000.0	AS08	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	7.71e-03	5.0e-02	1.0e-01	PCI/GDRY	01/11/2000
Pu239	7.20e-02	5.0e-02	4.7e-02	PCI/GDRY	01/11/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07323A	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.526e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	65.79 %	Analyst:	AS
Ash/dry weight:	86.80 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:40	1038.0	AS02	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-3.32e-03	5.9e-02	1.2e-01	PCI/GDRY	01/18/2000
Pu239	3.72e-02	3.8e-02	5.5e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07324B	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.532e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	74.83 %	Analyst:	AS
Ash/dry weight:	90.40 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:41	1037.4	AS03	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	3.94e-03	4.4e-02	9.2e-02	PCI/GDRY	01/18/2000
Pu239	6.15e-03	2.8e-02	6.2e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07324B	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.517e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	74.83 %	Analyst:	AS
Ash/dry weight:	90.40 %	QC type:	DUP

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:41	1036.9	AS04	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	1.18e-02	2.8e-02	5.7e-02	PCI/GDRY	01/18/2000
Pu239	0.00e+00	0.0e+00	2.8e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07325C	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.556e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	93.26 %	Analyst:	AS
Ash/dry weight:	94.80 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:41	1036.3	AS05	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	6.18e-03	5.6e-02	1.1e-01	PCI/GDRY	01/18/2000
Pu239	-1.22e-02	2.2e-02	7.3e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07326D	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.513e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	87.69 %	Analyst:	AS
Ash/dry weight:	92.80 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:41	1035.8	AS06	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	2.36e-02	6.8e-02	1.3e-01	PCI/GDRY	01/18/2000
Pu239	1.93e-02	3.8e-02	7.1e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07327E	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.504e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	89.18 %	Analyst:	AS
Ash/dry weight:	97.60 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:41	1035.5	AS07	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-5.69e-04	1.8e-02	5.4e-02	PCI/GDRY	01/18/2000
Pu239	8.48e-03	2.4e-02	5.1e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07327E	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.525e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	89.18 %	Analyst:	AS
Ash/dry weight:	97.60 %	QC type:	MS

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:41	1034.6	AS08	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-8.27e-04	5.2e-02	1.0e-01	PCI/GDRY	01/18/2000
Pu239	6.55e+00	6.1e-01	4.9e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07327E	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.505e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	89.18 %	Analyst:	AS
Ash/dry weight:	97.60 %	QC type:	MSD

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:41	1033.9	AS09	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	1.22e-02	7.2e-02	1.4e-01	PCI/GDRY	01/18/2000
Pu239	7.16e+00	8.1e-01	3.2e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07328F	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.528e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	80.99 %	Analyst:	AS
Ash/dry weight:	94.80 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:41	1024.9	AS10	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	1.40e-02	6.0e-02	1.1e-01	PCI/GDRY	01/18/2000
Pu239	-3.04e-03	1.8e-02	5.7e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07329G	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.513e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	77.56 %	Analyst:	AS
Ash/dry weight:	93.00 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:41	1031.9	AS11	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	5.98e-02	4.4e-02	4.5e-02	PCI/GDRY	01/18/2000
Pu239	2.63e-02	2.9e-02	3.8e-02	PCI/GDRY	01/18/2000

Positive plutonium-238 [illegible] recognized by MDC —
239 is non-detect (actually a negative value upon reanalysis).

— ejs

[illegible]? 4/4/00

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07330Z	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.531e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	58.25 %	Analyst:	AS
Ash/dry weight:	85.00 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:41	1032.3	AS12	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	2.89e-02	5.3e-02	9.4e-02	PCI/GDRY	01/18/2000
Pu239	8.25e-02	5.1e-02	4.8e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07331A	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.528e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	73.46 %	Analyst:	AS
Ash/dry weight:	92.20 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:42	1031.3	AS17	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	-4.17e-02	5.4e-02	1.3e-01	PCI/GDRY	01/18/2000
Pu239	2.17e-02	3.7e-02	6.6e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

Sample #:	99.07332B	QC batch #:	0001333P
Matrix:	SOIL	Prep batch #:	0003564X
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	2.510e-01 GASH	Analysis procedure:	PU
Dry/wet weight:	85.63 %	Analyst:	AS
Ash/dry weight:	96.40 %	QC type:	ANA

Comment: 0"-2"

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:42	1030.7	AS18	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	7.99e-04	3.6e-02	8.1e-02	PCI/GDRY	01/18/2000
Pu239	1.27e-02	2.2e-02	4.1e-02	PCI/GDRY	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

QC Sample #: RBK-00403020U

QC batch #: 0001332N
Prep batch #: 0003560T
Prep procedure: N/A
Analysis procedure: PU
Analyst: SPK
QC type: RBK

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/10/2000 15:53	1000.0	AS08	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	2.48e-03	1.6e-02	3.2e-02	PCI	01/10/2000
Pu239	3.31e-03	7.4e-03	1.5e-02	PCI	01/10/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

SAMPLE ANALYSIS REPORT

QC Sample #: RBK-00403029D

QC batch #: 0001333P
Prep batch #: 0003564X
Prep procedure: N/A
Analysis procedure: PU
Analyst: AS
QC type: RBK

COUNTING INFORMATION

Date and time	Duration (min)	Detector ID	Operator
01/18/2000 15:42	1030.2	AS19	DPG

ANALYTICAL RESULTS

Analyte	Activity	± 2σ Uncertainty	MDC	Unit	Date
Pu238	4.06e-03	2.1e-02	4.1e-02	PCI	01/18/2000
Pu239	-9.42e-04	5.5e-03	1.7e-02	PCI	01/18/2000

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

QC BATCH SUMMARY

QC batch #: 0001332N
Preparation procedure: N/A
Analysis procedure: PU

NAREL Sample #	QC Type	Yield (%)	± 2σ Uncertainty (%)	Analyst
99.07313Y		84.94 %	6.50 %	SPK
99.07313Y	DUP	74.92 %	6.09 %	SPK
99.07314Z		75.38 %	6.07 %	SPK
99.07314Z	MS	78.92 %	6.18 %	SPK
99.07314Z	MSD	82.55 %	6.43 %	SPK
99.07315A		79.85 %	6.33 %	SPK
99.07316B		74.09 %	5.98 %	SPK
99.07317C		81.56 %	6.41 %	SPK
99.07318D		77.92 %	6.19 %	SPK
99.07319E		77.20 %	6.10 %	SPK
99.07320X		81.86 %	6.40 %	SPK
99.07321Y		84.71 %	6.56 %	SPK
99.07322Z		76.89 %	5.70 %	SPK
RBK-00403020U *	RBK	65.82 %	5.19 %	SPK

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

National Air and Radiation Environmental Laboratory
QC Batch Report

QC Batch #: 0001332N Analytical Procedure: PU

REAGENT BLANKS (PCI)

Sample ID	Nuclide	Activity ± 2σ
00403020U	PU238	2.48e-03 ± 1.6e-02
00403020U	PU239	3.31e-03 ± 7.4e-03

LABORATORY DUPLICATES (PCI/GASH)

Sample ID	Nuclide	Original ± 2σ	Duplicate ± 2σ	RPD	Z
99.07313Y	PU238	-4.17e-03 ± 3.9e-02	-6.50e-03 ± 3.2e-02	0.00	-0.09 OK
99.07313Y	PU239	2.92e-02 ± 2.8e-02	9.93e-03 ± 1.7e-02	98.50	-1.16 OK

MATRIX SPIKES (PCI/GASH)

Sample ID	Nuclide	Amt Added ± 2σ	Native ± 2σ	Measured ± 2σ	%R	Z
99.07314Z	PU238	NO SPIKE DATA				
99.07314Z	PU239	5.91e+00 ± 2.8%	1.35e-02 ± 3.0e-02	5.30e+00 ± 6.1e-01	89.46	-1.50 OK

MATRIX SPIKE DUPLICATES (PCI/GASH)

Sample ID	Nuclide	Amt Added ± 2σ	Measured ± 2σ	RPD	Z	%R	Z
99.07314Z	PU238	NO SPIKE DATA					
99.07314Z	PU239	5.84e+00 ± 2.8%	5.02e+00 ± 5.8e-01	4.18	0.38 OK	85.80	-2.10 OK

Analyst: Shane Knock 1/11/2000

Knockemus, Shane P.

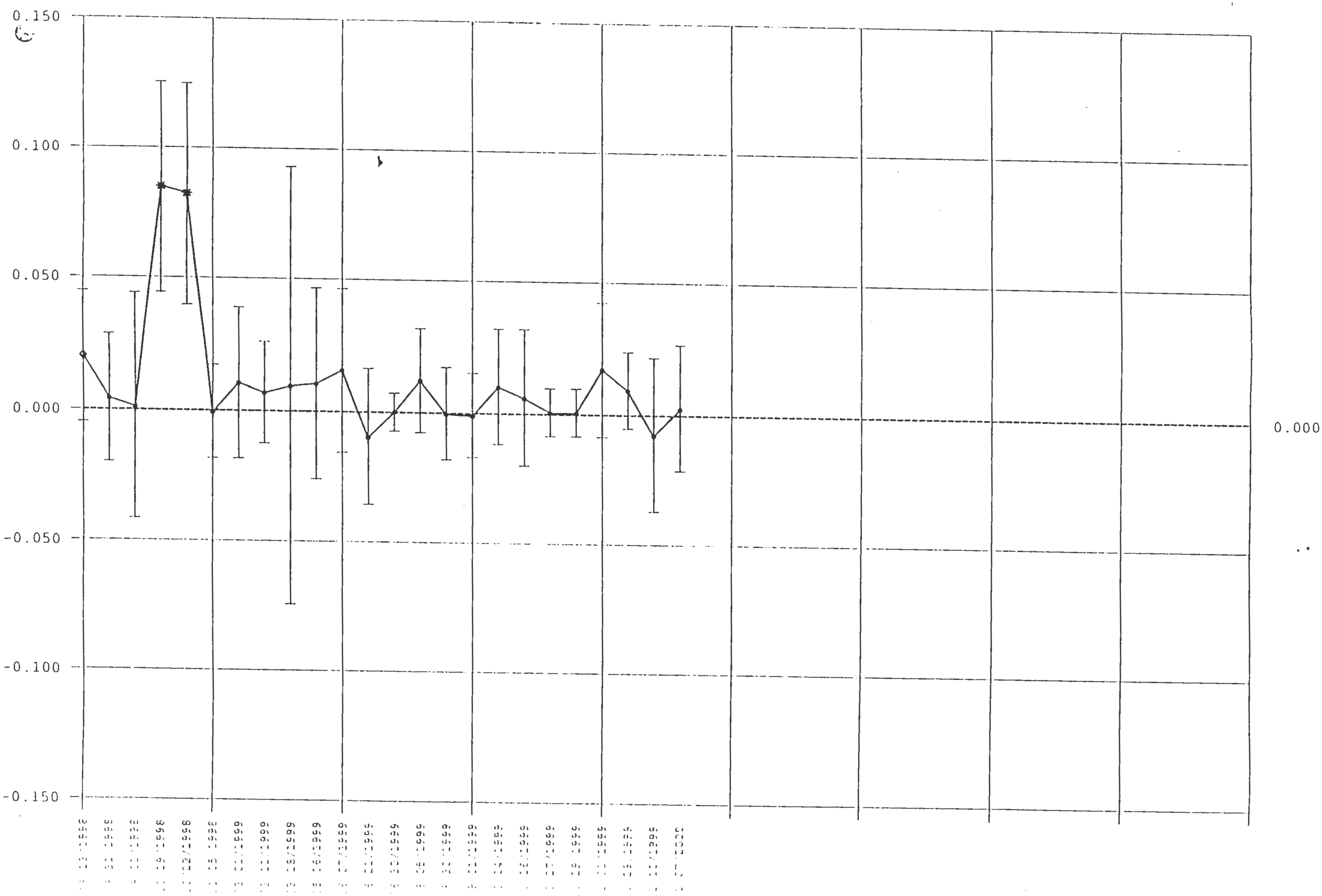
QA Officer: Link McEwen 1/11/2000

Reagent Blanks

Analyte: PU238

Procedure: PU

Analyst: Knockemus, Shane P.

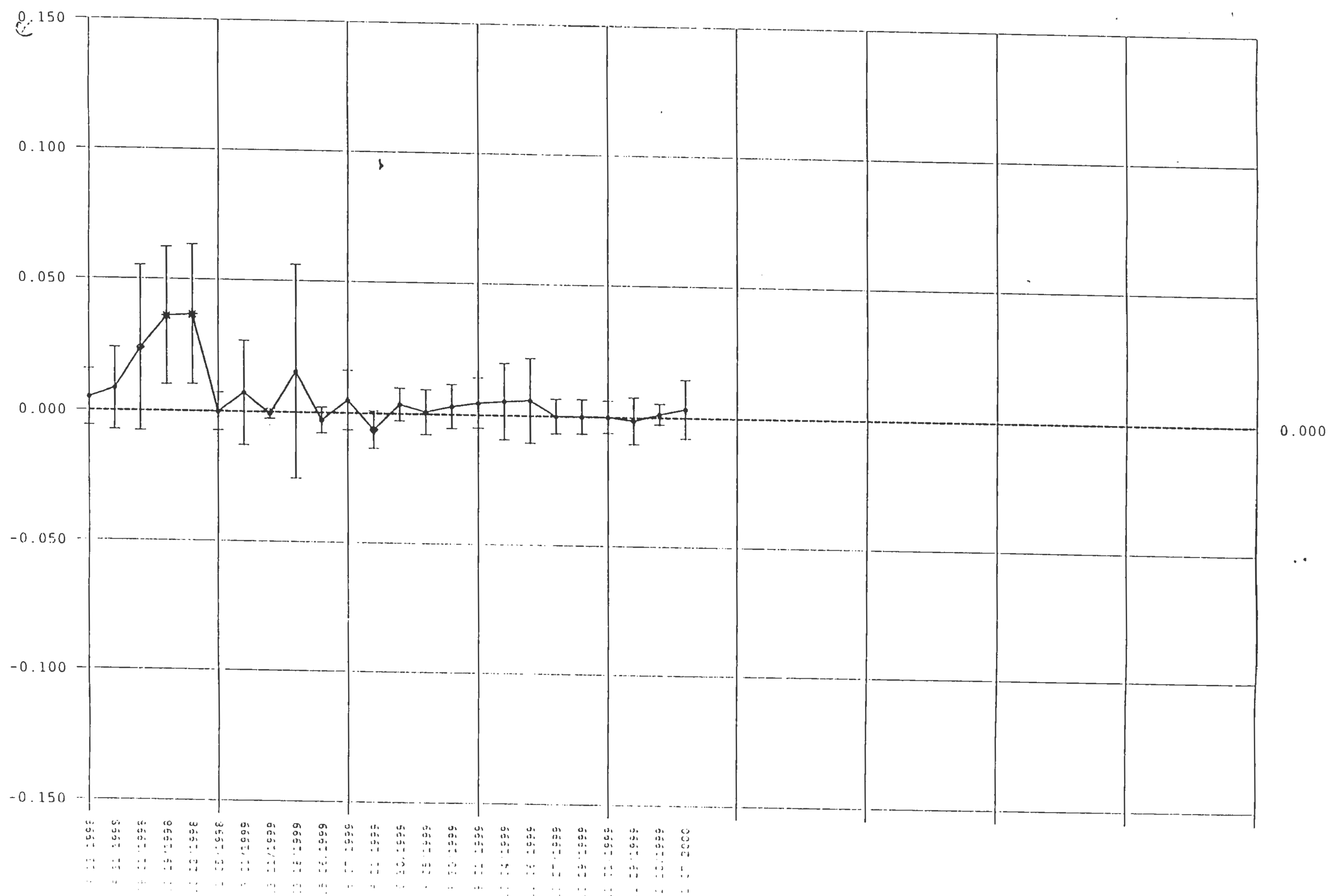


Reagent Blanks

Analyte: PU239

Procedure: PU

Analyst: Knockemus, Shane P.



U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY
PU ANALYSES
SDG #9900096

QC BATCH SUMMARY

QC batch #: 0001333P
Preparation procedure: N/A
Analysis procedure: PU

NAREL Sample #	QC Type	Yield (%)	± 2σ Uncertainty (%)	Analyst
99.07323A		96.54 %	6.86 %	AS
99.07324B		93.73 %	6.88 %	AS
99.07324B	DUP	73.32 %	5.88 %	AS
99.07325C		84.19 %	6.34 %	AS
99.07326D		79.78 %	6.21 %	AS
99.07327E		96.01 %	6.99 %	AS
99.07327E	MS	94.78 %	6.41 %	AS
99.07327E	MSD	88.44 %	7.34 %	AS
99.07328F		94.49 %	6.92 %	AS
99.07329G		95.30 %	6.87 %	AS
99.07330Z		91.85 %	6.78 %	AS
99.07331A		93.72 %	7.05 %	AS
99.07332B		89.82 %	6.62 %	AS
RBK-00403029D *	RBK	77.90 %	6.02 %	AS

* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

National Air and Radiation Environmental Laboratory
QC Batch Report

QC Batch #: 0001333P   Analytical Procedure: PU

REAGENT BLANKS (PCI)

Sample ID	Nuclide	Activity ± 2σ
00403029D	PU238	4.06e-03 ± 2.1e-02
00403029D	PU239	-9.42e-04 ± 5.5e-03

LABORATORY DUPLICATES (PCI/GASH)

Sample ID	Nuclide	Original ± 2σ	Duplicate ± 2σ	RPD	Z
99.07324B	PU238	4.36e-03 ± 4.9e-02	1.31e-02 ± 3.0e-02	99.87	0.30 OK
99.07324B	PU239	6.80e-03 ± 3.1e-02	0.00e+00 ± 0.0e+00	200.00	-0.44 OK

MATRIX SPIKES (PCI/GASH)

Sample ID	Nuclide	Amt Added ± 2σ	Native ± 2σ	Measured ± 2σ	%R	Z
99.07327E	PU238	NO SPIKE DATA				
99.07327E	PU239	7.96e+00 ± 4.5%	8.69e-03 ± 2.4e-02	6.71e+00 ± 6.2e-01	84.23	-2.56 OK

MATRIX SPIKE DUPLICATES (PCI/GASH)

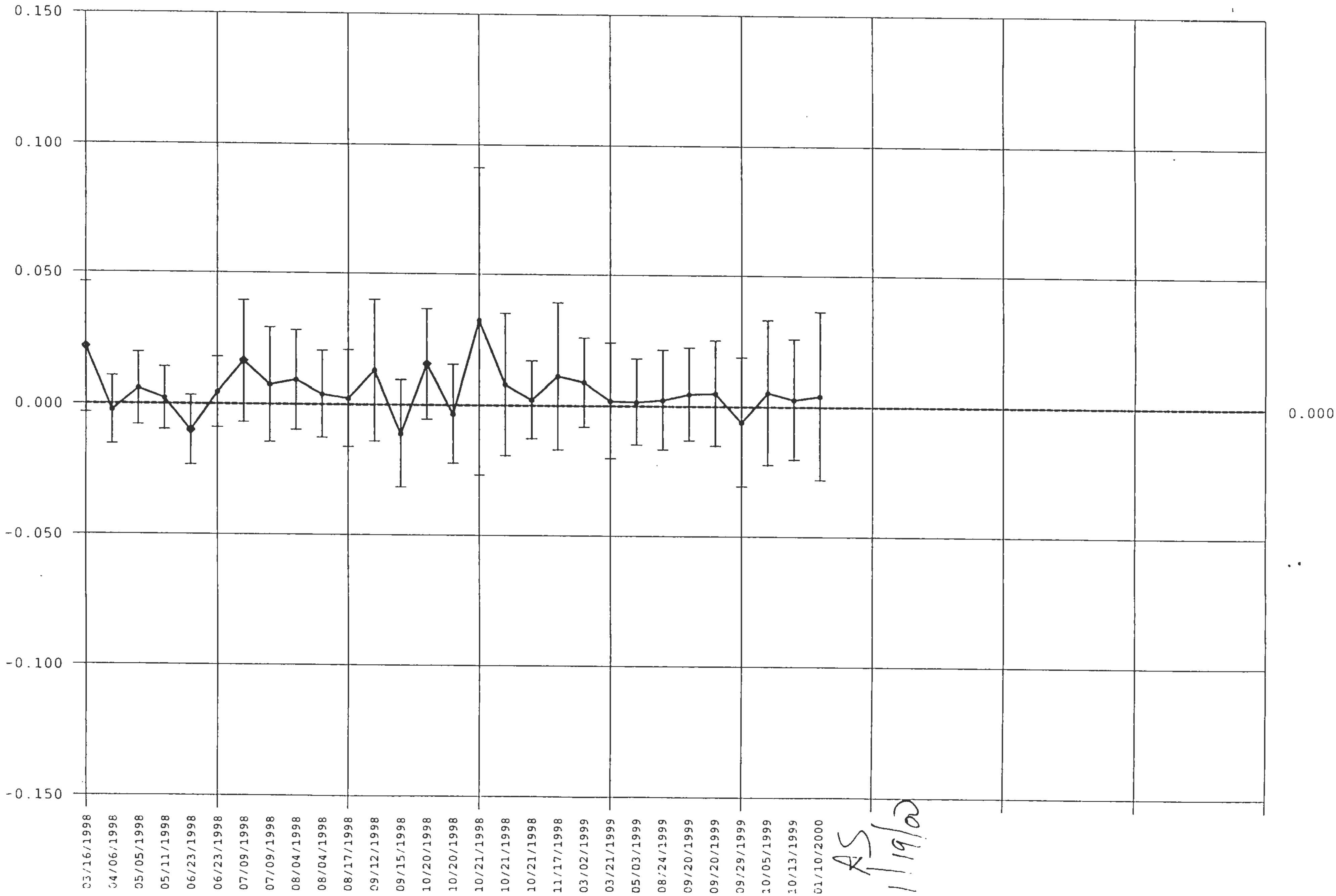
Sample ID	Nuclide	Amt Added ± 2σ	Measured ± 2σ	RPD	Z	%R	Z
99.07327E	PU238	NO SPIKE DATA					
99.07327E	PU239	8.02e+00 ± 4.5%	7.34e+00 ± 8.3e-01	8.14	0.80 OK	91.38	-1.19 OK

Analyst: Albert Smith   1/19/00

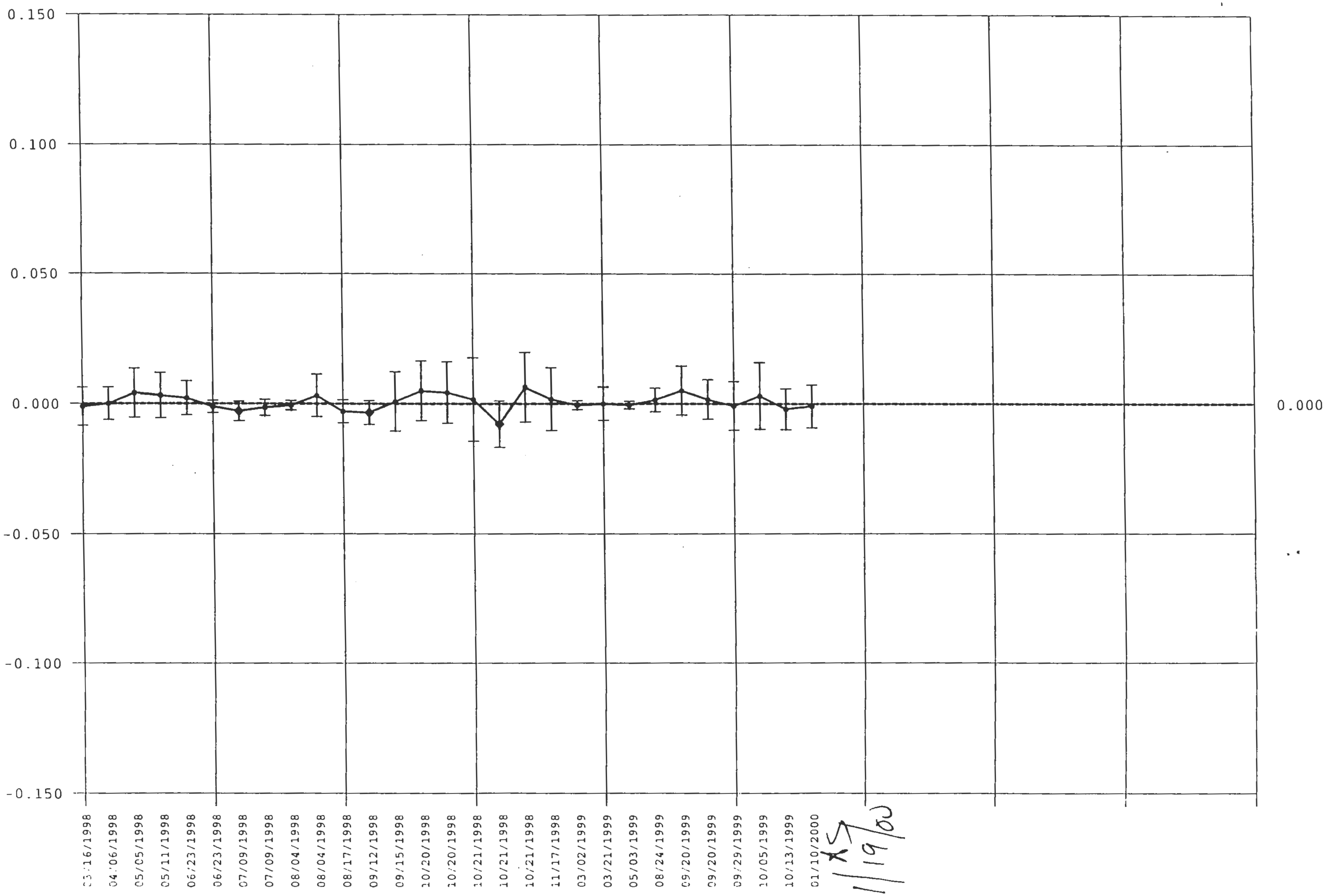
Smith, Albert

QA Officer: Kurt McLow   1/19/2000

Reagent Blanks
Analyte: PU238
Procedure: PU
Analyst: Smith, Albert



Reagent Blanks
Analyte: PU239
Procedure: PU
Analyst: Smith, Albert



AS 1/19/00

PARSONS ENGINEERING SCIENCE, INC.

30 Dan Road • Canton, Massachusetts 02021-2809 • (781) 401-3200 • Fax: (781) 401-2575

February 10, 2000

Mr. Julio Vazquez
USEPA Region II
Superfund Federal Facilities Section
290 Broadway, 18th Floor
New York, NY 10007-1866

Mr. Steven Paszko
New York State Department of Environmental Conservation
Division of Hazardous Waste Remediation
Bureau of Eastern Remedial Action
50 Wolfe Road, Room 208
Albany, NY 12233-7010

SUBJECT: Location Map of EPA Samples Collected for Plutonium-239/240 at SEAD-12, Seneca Army Depot Activity, Romulus, NY

Dear Mr. Vazquez/Mr. Paszko:

Please find enclosed a map of the soil sampling locations where EPA samples were collected in December 1999 and analyzed for Plutonium-239/240. Please note that no sample was collected at MW12-6; this location is shown for reference. Sample locations SS12-9, SS12-13, and SS12-14 are Parsons ES' original sample locations that were collected and re-analyzed in December 1999 by both Parsons ES and EPA. Sample location SS12-2 is a Parsons ES original sample location and was collected and re-analyzed by EPA only. Sample location EPA12-1 was collected and re-analyzed by both EPA and Parsons ES laboratory. The remaining locations (EPA12-2 through EPA12-16) were collected for analysis by EPA only. Data from the four samples analyzed by Parsons ES are attached to this letter. Please note that this data presentation is slightly different than that distributed during the January 2000 BCT meeting.

If you have any questions or concerns regarding this figure, please do not hesitate to call me at (781) 401-2535 or Michael Duchesneau at (781) 401-2492.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Jacqueline Travers

Jacqueline Travers, P.E.
Task Order Manager

cc: Mr. Tom Enroth, CENAN-PP-HE
Mr. Stephen Absolom, SEDA
Mr. Jim Mullikin (USACHPPM)
Mr. Keith Hoddinott, USACHPPM (Prov.)
Ms. Dorothy Richards, CEHNC-PM-ND

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PARSONS

Comparison of Original Sampling Data from the North End to Re-sampling data at Four North End Locations.

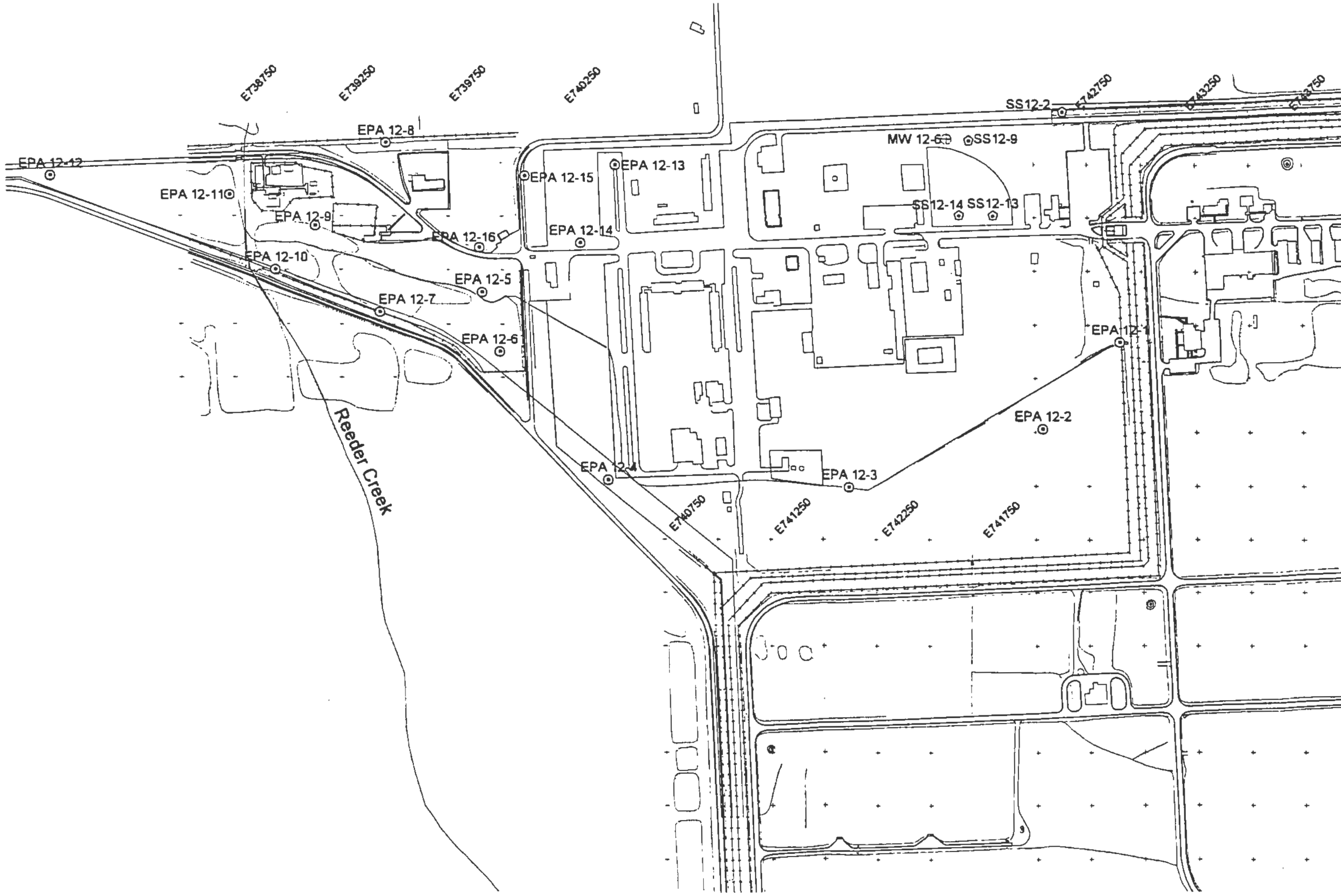
Original Pu-239/240 Data - Requested D.L = 0.1 pCi/g (November 1997)

Sample ID	*Radionuclide*	*Value(pCi/g)*	*Error*	*Lab Qualifier*	*Parsons Qualfier*
SS12-13	Plutonium-239/240	0.3	0.1	ND	UJ
SS12-2	Plutonium-239/240	0.2	0.2		UJ
SS12-13	Plutonium-239/240	0.2	0.1	ND	U
SS12-9	Plutonium-239/240	0.2	0.1	ND	U
SS12-14	Plutonium-239/240	0.3	0.1	ND	UJ

New Re-sampling Results - Requested D.L. = 0.01 pCi/g (December 1999)

Sample ID	*Radionuclide*	*Value(pCi/g)*	*Error*	*Lab Qualifier*	*Parsons Qualfier*
123506 (SS12-14)	Plutonium-239/240	0.007	0.00412	none	NA
123508 (EPA12-1)	Plutonium-239/240	0.005	0.00348	none	NA
123504 (SS12-13)	Plutonium-239/240	0.077	0.0156	none	NA
123502 (SS12-9)	Plutonium-239/240	0.009	0.00538	none	NA

Notes:
NA - Not available at this time.
A sample was re-collected from SS12-2 and analyzed by EPA's laboratory only.



Legend

- EPA Surface Soil Location
- Monitoring Well Location
- Surface Soil Re-Sampling Location
- Fence Line

N

Locations

Loc_id	Easting	Northing	Elevation
EPA 12-1	742890.393	1015174.477	630.506
EPA 12-2	742524.456	1014768.775	635.612
EPA 12-3	741616.907	1014498.762	634.851
EPA 12-4	740494.169	1014530.363	626.622
EPA 12-5	739903.022	1015404.240	607.315
EPA 12-6	739981.674	1015125.701	622.796
EPA 12-7	739422.906	1015311.721	609.018
EPA 12-8	739456.960	1016096.567	614.476
EPA 12-9	739123.910	1015709.378	612.899
EPA 12-10	738936.996	1015504.436	605.036
EPA 12-11	738724.927	1015952.753	595.366
EPA 12-12	737994.072	1015939.796	605.716
EPA 12-13	740529.103	1015994.897	627.731
EPA 12-14	740363.012	1015630.702	623.714
EPA 12-15	740102.975	1015943.733	622.582
EPA 12-16	739888.543	1015608.285	620.158
SS12-2	742629.600	1016253.000	645.587
SS12-9	742192.000	1016116.000	634.040
SS12-13	742301.500	1015743.000	634.330
SS12-14	742143.700	1015764.300	640.400

500 0 500 Feet

PARSONS

PARSONS ENGINEERING SCIENCE, INC.

Seneca Army Depot Activity

EPA
SURFACE SOIL
LOCATIONS

1:500 | FEB 2000 | Sheet 1 of 1

G:\AV_GIS30\SENECA\SEAD12\SAMPLELG\LOCATION

PARSONS ENGINEERING SCIENCE, INC.

M E M O R A N D U M

TO: Steve Absolom **DATE**: **July 2, 1999**

FROM: J. Travers **COPIES**: **T. Enroth, K. Healy**

SUBJECT: Pu-239/240 hits at SEAD-12.

Attached are two tables (soil and sediment) of all the Pu-239/240 detections we have at SEAD-12 (background plus site samples) based on the validated data. Pu-239/240 was not detected in surface water samples upon validation of the data. There are approximately 79 soil and 26 sediment samples which have reported values after validation. Our original estimate of 20 to 30 samples was based only on Phase I sampling results which included only sediment/surface water, background soil locations, and a few borings. Phase II data (surface soil sampling, test pits, and borings) have been included in the attached tables. Phase I groundwater data has not been evaluated since we have not received complete data packages from the laboratory yet.

Prior to our validation, approximately 70% of the Pu-239/240 results were reported as detections by the laboratory. This number decreased significantly after validation due to detections of Pu-239/240 in the method blank. All of the detections are between 0.1 and 0.2 pCi/g except for one sample from Area B (SS12-139) which was 1.0 pCi/g. The attached tables do not include instances of elevated detection limits which were qualified as non-detect.

In the cover letter to EPA enclosed, we propose to compare data from split samples which the agencies collected to see how the results compared. If you would like, we can prepare data tables for these samples to send to EPA and NYSDEC for comparison.

SEAD-12
PLUTONIUM 239/240 RESULTS
DETECTIONS IN SOIL (pCi/g)

07/02/1999

SDG	LOC_ID	PARSONS SAMP_ID	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	VALUE	VALIDATED QUALIFIER	LAB QUALIFIER	VALUE ERROR	LLD
976178	MW12-4	12501	4.0	5.4	0.10			0.10	0.20
	MW12-4	12502	6.0	8.0	0.10	J		0.10	0.20
976183	MW12-4	12505	0.0	0.2	0.20			0.10	0.10
	MW12-1	12506	0.2	2.0	0.20			0.20	0.20
	MW12-1	12507	0.0	0.2	0.20	J		0.30	0.30
	MW12-1	12508	4.0	6.0	0.10			0.10	0.20
976185	MW12-3	12509	0.0	0.2	0.20			0.20	0.20
	MW12-3	12511	6.0	8.0	0.20			0.20	0.20
976234	SB12-3	12524	0.0	0.2	0.20	J		0.20	0.20
	SB12-3	12525	1.0	4.0	0.10	J		0.10	0.20
	SB12-4	12530	0.0	0.2	0.20	J		0.20	0.30
976235	SB12-2	12533	8.0	10.0	0.20			0.10	0.10
976405	BLDG819-1	12552	0.0	0.2	0.20	J		0.20	0.30
985953	TP12-5	123089	0.5	0.5	0.10			0.10	0.10
	TP12-5	123091	8.0	8.0	0.10	J		0.10	0.10
	TP12-5	123092	0.5	0.5	0.10			0.10	0.10
985974	TP12-7	123127	1.0	1.0	0.10			0.10	0.10
	TP12-8	123130	1.0	1.0	0.10			0.10	0.10
	TP12-8	123132	3.0	3.0	0.10			0.10	0.10
986137	SS12-68	123213	0.0	0.2	0.10	J		0.10	0.10
	SS12-21	123215	0.0	0.2	0.10	J		0.10	0.10
	SS12-24	123218	0.0	0.2	0.10	J		0.10	0.10
	SS12-26	123220	0.0	0.2	0.10	J		0.10	0.20
	BLDG 815	123221	0.0	1.0	0.10	J		0.10	0.20
986167	SS12-34	123231	0.0	0.2	0.10	J		0.10	0.20
	SS12-36	123233	0.0	0.2	0.20	J		0.10	0.10
	SS12-39	123236	0.0	0.2	0.10	J		0.10	0.10
	SS12-42	123239	0.0	0.2	0.10	J		0.10	0.10
	SS12-44	123240	0.0	0.2	0.10	J		0.10	0.10
	SS12-46	123242	0.0	0.2	0.20	J		0.10	0.10
	SS12-48	123244	0.0	0.2	0.20	J		0.10	0.10
	SS12-49	123245	0.0	0.2	0.10	J		0.10	0.10
986177	SS12-51	123248	0.0	0.2	0.10			0.10	0.20
	SS12-52	123249	0.0	0.2	0.10			0.10	0.20
	SS12-53	123250	0.0	0.2	0.10			0.10	0.20
	SS12-54	123251	0.0	0.2	0.10			0.10	0.10
	SS12-58	123254	0.0	0.2	0.10			0.10	0.20
	SS12-59	123255	0.0	0.2	0.10			0.10	0.20
	81603	124044	0.5	1.0	0.10	J		0.10	0.30
	80402	124080	0.5	1.0	0.10			0.20	0.30
	80404	124082	0.0	2.0	0.10	J		0.20	0.30
	80405	124083	0.0	2.5	0.10	J		0.10	0.10
986189	SS12-87	123279	0.0	0.2	0.10	J		0.10	0.20

SEAD-12
PLUTONIUM 239/240 RESULTS
DETECTIONS IN SOIL (pCi/g)

SDG	LOC_ID	PARSONS SAMP_ID	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	VALUE	VALIDATED QUALIFIER	LAB QUALIFIER	VALUE ERROR	LLD
986189	SS12-90	123283	0.0	0.2	0.20	J		0.20	0.30
	SS12-94	123288	0.0	0.2	0.10			0.20	0.30
	SS12-99	123293	0.0	0.2	0.20	J		0.20	0.30
	SS12-103	123297	0.0	0.2	0.20			0.20	0.20
	SS12-112	123306	0.0	0.2	0.10			0.10	0.20
986209	SS12-170	123365	0.0	0.2	0.10			0.10	0.10
	SS12-175	123369	0.0	0.2	0.10			0.10	0.10
	SS12-176	123370	0.0	0.2	0.10			0.10	0.10
	SS12-179	123373	0.0	0.2	0.10			0.10	0.10
	SS12-187	123381	0.0	0.2	0.10			0.10	0.10
	SS12-188	123382	0.0	0.2	0.10			0.10	0.20
	SS12-197	123391	0.0	0.2	0.10			0.10	0.20
	SS12-199	123393	0.0	0.2	0.10			0.10	0.20
986212	SS12-201	123430	0.0	0.2	0.10			0.10	0.10
986213	SS12-127	123321	0.0	0.2	0.10			0.10	0.10
	SS12-134	123328	0.0	0.2	0.10			0.10	0.10
	SS12-135	123329	0.0	0.2	0.10			0.10	0.10
	SS12-136	123330	0.0	0.2	0.10	J		0.10	0.10
	SS12-139	123333	0.0	0.2	1.00			0.60	0.40
	SS12-140	123334	0.0	0.2	0.10			0.10	0.10
	SS12-141	123336	0.0	0.2	0.20			0.10	0.10
986224	SS12-129	123323	0.0	0.2	0.10			0.10	0.10
	SS12-137	123331	0.0	0.2	0.10			0.10	0.10
	SS12-145	123340	0.0	0.2	0.10			0.10	0.10
	SS12-148	123343	0.0	0.2	0.10			0.10	0.10
	SS12-155	123350	0.0	0.2	0.10			0.10	0.10
	SS12-158	123353	0.0	0.2	0.10			0.10	0.10
	SS12-172	123366	0.0	0.2	0.10			0.10	0.20
	SS12-183	123377	0.0	0.2	0.10			0.10	0.10
	SS12-89	123402	0.0	0.2	0.20			0.10	0.10
	SS12-218	123413	0.0	0.2	0.20			0.10	0.10
	SS12-228	123423	0.0	0.2	0.10			0.10	0.10
	SS12-233	123429	0.0	0.2	0.20			0.10	0.10
986225	SS12-167	123431	0.0	0.2	0.10			0.10	0.10
	SS12-235	123432	0.0	0.2	0.10			0.10	0.20
	SS12-236	123433	0.0	0.2	0.20			0.10	0.10

SEAD-12
PLUTONIUM 239/240 RESULTS
DETECTIONS IN SEDIMENT (pCi/g)

07/02/1999

SDG	LOC_ID	PARSONS SAMP_ID	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	VALUE	VALIDATED QUALIFIER	LAB QUALIFIER	VALUE ERROR	LLD
976095	SWSD12-2	12400	0.2	0.3	0.10			0.20	0.20
	SWSD12-2	12401	0.3	0.5	0.10			0.20	0.20
976105	SWSD12-4	12403	0.3	0.5	0.10			0.20	0.20
	SWSD12-4	12404	0.4	0.6	0.10			0.20	0.30
	SWSD12-3	12406	0.2	0.4	0.20	J		0.20	0.30
976118	SWSD12-2	12409	0.4	0.6	0.20	J		0.30	0.70
976183	SWSD12-1	12440	0.2	0.4	0.10			0.10	0.10
976185	SWSD12-4	12443	0.2	0.3	0.20			0.20	0.10
	SWSD12-4	12444	0.3	0.5	0.10			0.10	0.10
	SWSD12-2	12445	0.3	0.5	0.10			0.10	0.10
	SWSD12-4	12446	0.2	0.4	0.10	J		0.20	0.30
976192	SWSD12-2	12419	0.2	0.4	0.10			0.10	0.10
	SWSD12-2	12423	0.3	0.5	0.10			0.10	0.10
	SWSD12-2	12424	0.5	0.7	0.10	J		0.10	0.10
	SWSD12-1	12425	0.2	0.4	0.10			0.10	0.10
	SWSD12-5	12436	0.2	0.4	0.10	J		0.10	0.10
	SWSD12-9	12437	0.3	0.5	0.10	J		0.10	0.10
976234	SWSD12-7	12421	0.3	0.5	0.10	J		0.10	0.20
	SWSD12-6	12422	0.2	0.4	0.20	J		0.20	0.20
	SWSD12-3	12430	0.4	0.6	0.20	J		0.20	0.30
	SWSD12-3	12431	0.4	0.6	0.10	J		0.10	0.10
	SWSD12-1	12435	0.5	0.7	0.20	J		0.20	0.30
976235	SWSD12-6	12448	0.2	0.4	0.10			0.10	0.10
	SWSD12-4	12451	0.1	0.3	0.10	J		0.10	0.10
	SWSD12-1	12452	0.2	0.4	0.10			0.10	0.10
	SWSD12-6	12454	1.0	1.2	0.10	J		0.10	0.10

PARSONS ENGINEERING SCIENCE, INC.

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July 19, 1999

Ms. Carla Struble
USEPA Region II
Emergency & Remedial Response Division
290 Broadway, 18th Floor, E-3
New York, NY 10007-1866

Mr. James Quinn
New York State Department of Environmental Conservation
Bureau of Eastern Remedial Action
Division of Hazardous Waste Remediation
50 Wolf Road
Albany, NY 12233-7010

SUBJECT: **Additional Plutonium-239/240 Background Sample Locations at SEAD-12, Seneca Army Depot Activity**

Dear Ms. Struble/Mr. Quinn:

Enclosed are a revised Table 1, revised figure showing background soil sampling locations, and an insert to Appendix A for the document entitled "Background Sample Analyses for Plutonium-239/240 at SEAD-12". This document was sent out to you on July 2, 1999. Data for four background sample locations (MW12-6, SB12-7, SB12-8, and SB12-9) were inadvertently left off of Table 1 and the laboratory data for these samples are provided in this package. Please replace the existing Table 1 with "Table 1 (Revised)", replace the existing figure showing soil background locations with the one enclosed and insert the data for sample delivery group (SDG) 986113 into Appendix A.

We apologize for any inconvenience. Please do not hesitate to call me at (781) 401-2492, if you have any questions.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Jacqueline Travers/for

Michael Duchesneau, P.E.
Project Manager

cc: D. Geraghty, NYSDOH (2 copies)
S. Absolom, SEDA (1 copy)
K. Healy, USACOE (1 copy)
T. Enroth, USACOE (1 copy)

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PARSONS

PARSONS ENGINEERING SCIENCE, INC.

30 Dan Road • Canton, Massachusetts 02021-2809 • (781) 401-3200 • Fax: (781) 401-2575

July 2, 1999

Ms. Carla Struble
USEPA Region II
Emergency & Remedial Response Division
290 Broadway, 18th Floor, E-3
New York, NY 10007-1866

Mr. James Quinn
New York State Department of Environmental Conservation
Bureau of Eastern Remedial Action
Division of Hazardous Waste Remediation
50 Wolf Road
Albany, NY 12233-7010

SUBJECT: Plutonium-239/240 in Background Sample Locations at SEAD-12, Seneca Army Depot Activity

Dear Ms. Struble/Mr. Quinn:

At the request of Mr. Steve Absolom, we are providing you with the following information (enclosed) for your review:

- Data tables showing Pu-239/240 results from background and off-site sample locations at SEAD-12 (refer to Section 1 of the enclosed package);
- The location of background and off-site samples collected at SEAD-12 (refer to Section 2 of the enclosed package);
- Quality Control and Quality Assurance reports from Core Laboratories (refer to Appendix A of the enclosed package);
- Laboratory Validating criteria (refer Appendix B of the enclosed package).
- Core's Standard Operating Procedures (refer to Appendix C of the enclosed package);

The data tables presented in the Section 1 of the package provide the laboratory results for Pu-239/240 as well as the error and lower limit of detection (LLD) for each result. In addition, both the qualifier assigned by the laboratory (an "ND", if one was assigned) and the qualifier which our validator assigned upon validation (a "U" or "J", if one was assigned), have been included in these tables.

Quality control and quality assurance (QA/QC) reports provided in Appendix A are presented by sample delivery group (SDG) and include the laboratory case narrative and a Excel spreadsheet print out the electronic deliverable that the laboratory provided. The electronic deliverable shows the results for all the environmental samples collected within that SDG, as well as the QA/QC samples that were analyzed for that SDG, and provides the same information as the QA/QC summary package. The data tables provided in Section 1 show the SDG that contains the QA/QC data for each background or off-site sample listed.

Laboratory SOPs and validating criteria are presented in Appendices B and C. The criteria were also provided in Appendix F of the *Project Scoping Plan for Performing a CERCLA RI/FS at SEAD-12* (Parsons ES, 1998). These are the criteria that were used by our validator in validating the data.

According to our validated data and as we discussed during our conference call on June 1, 1999, there are two sediment and eight soil background/off-site sample locations where Pu-239/240 has been detected. These detections were between 0.1 and 0.2 pCi/g. Typically, the error reported for these samples are of the same value. None of these locations are in the ball field north of the site. During the June 1 conference call, EPA requested to conduct their own review the data, prompting this deliverable.

Upon your review of the data, we would like to discuss two plans for resolution of this matter. During the June 1, 1999 conference call, we discussed re-sampling the background locations to verify the presence/absence of Pu-239/240. First, we propose to review split samples that were collected during the two phases of sediment, surface water, and soil sampling conducted at SEAD-12. Our records indicate that EPA split seven soil samples and two sediment/surface water samples (we believe for radiological parameters). In addition, NYSDEC split 35 soil samples that included radiological analyses. Although none of these samples were from background locations, we feel that comparison of data from other locations may prove helpful in resolving the question of whether or not Pu-239/240 is really present at these levels. Review of the remainder of the site data at SEAD-12, indicates that, like the background/off-site samples, there is a similar trend of Pu-239/240 concentrations reported between 0.1 and 0.2 pCi/g and within five times (usually one to two times) the associated method blank. Again, the reported error is typically at least the sample value reported. Comparison of detection limits, resulting error, and method blanks may be helpful in determining if the reported values of Pu-239/240 are due to analytical artifacts.

Second, we propose to re-sample the background/off-site sediment and soil locations where Pu-239/240 was detected based on our validation of the data (no Pu-239/240 was detected in surface water locations after validation). These locations include the following: sediment samples SD12-60 (0.1J), SD23-63 (0.1); subsurface samples MW12-1 (0.1, 0.2), MW12-3 (0.2), and MW12-4 (0.1J, 0.2); and surface soil location MW12-1 (0.2), MW12-3 (0.2), and MW12-4 (0.2). The analysis would require detection limits 10 times below those achieved in the first sampling effort. By requesting lower detection limits, we can narrow the window of error of the results and better quantify the presence or absence of Pu-239/240 in these samples.

If you have any questions or need additional information, please do not hesitate to call me at (781) 401-2492. We look forward to your response regarding your review of these data.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Jacqueline Travers/for

Michael Duchesneau, P.E.
Project Manager

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Table 1 (Revised)
Plutonium (Pu-239/240) Results for Background Soil Sample Locations (pCi/g)
SEAD-12
Seneca Army Depot Activity, Romulus, NY

Sample Delivery Group (SDG)	Sample Location	Parsons ES Sample ID	Top Depth of Sample (ft)	Bottom Depth of Sample (ft)	Laboratory Result	Result Error +/-	Lower Limit of Detection (LLD)	Laboratory Qualifier	Parsons ES Validator Qualifier
976178	MW12-5	12500	2	3.5	ND	0.1	0.2	ND	U
976178	MW12-4	12501	4	5.4	0.1	0.1	0.2		
976178	MW12-4	12502	6	8	0.1	0.1	0.2		J
976178	MW12-5	12503	8	9.7	ND	0.1	0.3	ND	U
976183	MW12-5	12504	0	0.2	ND	0.1	0.3	ND	UJ
976183	MW12-4	12505	0	0.2	0.2	0.1	0.1		
976183	MW12-1	12506	0.2	2	0.2	0.2	0.2		
976183	MW12-1	12507	0	0.2	0.2	0.3	0.3		J
976183	MW12-1	12508	4	6	0.1	0.1	0.2		
976185	MW12-3	12509	0	0.2	0.2	0.2	0.2		
976185	MW12-3	12510	0.2	2	ND	0.1	0.3	ND	UJ
976185	MW12-3	12511	6	8	0.2	0.2	0.2		
976185	MW12-2	12513	2	4	ND	0.1	0.3	ND	UJ
976185	MW12-2	12512	0	0.2	ND	0.1	0.3	ND	U
976293	SS12-13	12212	0	0.2	ND	0.1	0.3	ND	UJ
976293	SS12-2	12535	0	0.2	0.2	0.2	0.3		UJ
976293	SS12-1	12536	0	0.2	0.1	0.3	0.5		UJ
976293	SS12-3	12537	0	0.2	ND	0.1	0.3	ND	UJ
976293	SS12-5	12538	0	0.2	0.2	0.2	0.2		U
976293	SS12-6	12539	0	0.2	ND	0.1	0.2	ND	U
976293	SS12-7	12540	0	0.2	ND	0.1	0.2	ND	U
976293	SS12-14	12541	0	0.2	ND	0.1	0.3	ND	UJ
976293	SS12-11	12542	0	0.2	ND	0.2	0.3	ND	UJ
976293	SS12-13	12543	0	0.2	ND	0.1	0.2	ND	U
976293	SS12-12	12544	0	0.2	ND	0.2	0.4	ND	UJ
976293	SS12-10	12545	0	0.2	ND	0.1	0.2	ND	U
976293	SS12-9	12546	0	0.2	ND	0.1	0.2	ND	U
976293	SS12-4	12547	0	0.2	ND	0.1	0.2	ND	U
976293	SS12-8	12548	0	0.2	ND	0.1	0.2	ND	U
976293	MW57-1	12549	2	2.5	0.1	0.2	0.2		UJ
976293	MW34/MW35	12550	1.5	2	ND	0.1	0.2	ND	U
976293	MW45-4	12551	2	2.5	ND	0.1	0.2	ND	U
986113	SB12-9	123189	4	6	0.1	0.1	0.2		U
986113	MW12-6	123190	0	0.2	ND	0.1	0.2	ND	U
986113	MW12-6	123191	4	6	ND	0.1	0.2	ND	U
986113	MW12-6	123192	6	8	0.1	0.1	0.2		U
986113	SB12-8	123193	4	6	0.1	0.1	0.2		U
986113	SB12-7	123194	4	5	ND	0.1	0.1	ND	U

Table 2
Plutonium (Pu-239/240) Results for Background Sediment Sample Locations (pCi/g)
SEAD-12
Seneca Army Depot Activity, Romulus, NY

Sample Delivery Group (SDG)	Sample Location	Parsons ES Sample ID	Top Depth of Sample (ft)	Bottom Depth of Sample (ft)	Laboratory Result	Result Error +/-	Lower Limit of Detection (LLD)	Laboratory Qualifier	Parsons ES Validator Qualifier
976235	SWSD12-67	12447	0.2	0.4	ND	0.1	0.2	ND	UJ
976235	SWSD12-63	12448	0.2	0.4	0.1	0.1	0.1		
976235	SWSD12-63	12449	0.3	0.5	ND	0.1	0.1	ND	UJ
976235	SWSD12-59	12453	0.8	1	ND	0.1	0.1	ND	U
976235	SWSD12-60	12454	1	1.2	0.1	0.1	0.1		J
976240	SWSD12-61	12455	0.7	0.9	ND	0.1	0.4	ND	UJ
976240	SWSD12-64	12456	0.6	0.8	0.1	0.2	0.2		UJ
976240	SWSD12-65	12457	0.2	0.5	ND	0.1	0.3	ND	UJ
976240	SWSD12-66	12458	2.5	2.8	0.3	0.2	0.2		UJ
976237	SWSD12-51	12459	0.6	0.7	0.2	0.3	0.4		UJ
976237	SWSD12-50	12460	0.2	0.4	0.1	0.1	0.2		U
976237	SWSD12-49	12461	0.8	1	0.4	0.3	0.2		UJ
976237	SWSD12-48	12462	0.4	0.6	ND	0.1	0.2	ND	UJ
976460	SWSD12-58	12465	0.7	0.9	ND	0.1	0.3	ND	UJ
976460	SWSD12-57	12466	0.5	0.7	ND	0.2	0.2	ND	U
976460	SWSD12-56	12467	0.5	0.7	ND	0.1	0.2	ND	UJ
976460	SWSD12-55	12468	0.7	0.9	0.1	0.2	0.3		UJ
976460	SWSD12-52	12469	0.4	0.6	0.4	0.4	0.4		UJ
976460	SWSD12-53	12470	0.6	0.8	0.2	0.2	0.2		UJ
976460	SWSD12-54	12471	0.4	0.5	ND	0.1	0.3	ND	UJ

Table 3
Plutonium (Pu-239/240) Results for Background Surface Water Sample Locations (pCi/L)
SEAD-12
Seneca Army Depot Activity, Romulus, NY

Sample Delivery Group (SDG)	Sample Location	Parsons ES Sample ID	Laboratory Result	Result Error +/-	Lower Limit of Detection (LLD)	Laboratory Qualifier	Parsons ES Validator Qualifier
976233	SWSD12-67	12047	0.2	0.2	0.2		U
976233	SWSD12-63	12048	ND	0.1	0.3	ND	U
976233	SWSD12-63	12049	0.2	0.2	0.3		U
976238	SWSD12-59	12053	0.1	0.1	0.1		U
976238	SWSD12-60	12054	0.1	0.2	0.2		U
976239	SWSD12-61	12055	0.2	0.1	0.2		U
976239	SWSD12-64	12056	ND	0.1	0.2	ND	U
976239	SWSD12-65	12057	ND	0.1	0.2	ND	U
976239	SWSD12-66	12058	0.3	0.2	0.2		U
976236	SWSD12-51	12059	0.3	0.2	0.2		U
976236	SWSD12-50	12060	ND	0.1	0.2	ND	U
976236	SWSD12-49	12061	0.4	0.2	0.2		U
976236	SWSD12-48	12062	ND	0.2	0.3	ND	U
976236	SWSD12-51	12210	0.1	0.1	0.2		U
976457	SWSD12-58	12065	0.2	0.2	0.2		U
976457	SWSD12-57	12066	ND	0.1	0.3	ND	U
976457	SWSD12-56	12067	0.3	0.2	0.2		U
976457	SWSD12-55	12068	0.1	0.1	0.2		U
976457	SWSD12-52	12069	0.1	0.1	0.2		U
976457	SWSD12-53	12070	0.2	0.2	0.2		U
976457	SWSD12-54	12071	0.1	0.2	0.2		U

CORE LAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

April 21, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976178

The following information is pertinent to the interpretation of the data.

On November 6, 1997, Core Laboratories - Casper received four soil samples in good condition.

The MD for the analytical batch for the isotopic thorium had low tracer recovery, which caused the batch to be reanalyzed. The sample volumes were reduced to limit matrix interferences. The reduced volumes elevated the LLDs. The reanalyzed thorium batch passed QC criteria. The MB for U-234 is slightly elevated at 0.3 pCi/g.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error is calculated by the software for the positive results. The Ra226 activity by gamma is not reported using the 186kev line since Ra226 has a low abundance at that line and the U235 has a greater abundance with an energy very close to 186 which would cause interference. Therefore, the Ra226 is calculated from the Bi214 line, a daughter of Ra226. The Ra228 is calculated from the Ac228 line, the daughter of Ra228, as Ra228 is a beta emitter.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Rondalynn Mull
Radiochemistry Supervisor

COOLER #96

◄◄◄ CORE LABORATORIES - CHAIN OF CUSTODY RECORD ►►►

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company..:	Parsons	Project..:	SEAD-12
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau
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ABC-012054

Page ~~1~~ 5 Of ~~1~~ 5

File = 11059708.bar

LAB JOB NUMBER

974178

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
DRG	11/04/97	1020	10281	12500	SED-1B	OVER-FOR-PARAM-KEY	
DRG	11/04/97	1520	10282	12501	SED-1B	OVER-FOR-PARAM-KEY	
DRG	11/04/97	1535	10283	12502	SED-1B	OVER-FOR-PARAM-KEY	
DRG	11/04/97	1100	10284	12503	SED-1B	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX　　AIRBILL NO.: 802367545756

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	11/5/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-6-97	Signature:		Signature:	
Printed Name/Company: IMFL-S / CORELABS	Time 0850	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
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[ ] Houston, TX (Env) (713) 690-4444
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[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12426	MD	976185	mod. HASL 300	Plutonium-239/240	0.1	RPD	0.1	0.2	Soil		2/10/98 15:49	2/10/98 15:49
12443	MS	976185	mod. HASL 300	Plutonium-239/240	102.1	% REC	0.8	0.2	Soil		2/10/98 15:49	2/10/98 15:49
12470	MD	976460	CA-GLR-17.0	Tritium, Activity	9.5	RPD	181	290	Soil		2/4/98 22:59	2/4/98 22:59
12500	SA1	976178	mod. HASL 300	Thorium-232, Activity	1.4	pCi/g	0.7	0.4	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12500	SA1	976178	mod. HASL 300	Thorium-230, Activity	1.9	pCi/g	0.9	0.5	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12500	SA1	976178	mod. HASL 300	Thorium-227	0.4	pCi/g	0.4	0.4	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12500	SA1	976178	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12500	SA1	976178	mod. HASL 300	Uranium-235, Activity	0.2	pCi/g	0.1	0.1	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12500	SA1	976178	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12500	SA1	976178	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/6/97 8:50	2/6/98 17:18	2/6/98 17:18
12500	SA1	976178	CA-GLR-R160	Moisture (@ 104 deg. C)	9.1	% by Wt			SEDIMENT	11/6/97 8:50	2/6/98 17:18	2/6/98 17:18
12500	SA1	976178	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/6/97 8:50	2/10/98 15:49	2/10/98 15:49
12500	SA1	976178	mod. HASL 300	Promethium 147	10	pCi/g	3.9	6.1	SEDIMENT	11/6/97 8:50	4/8/98 16:10	4/8/98 16:10
12500	SA1	976178	EPA 901.1	Lead-214, Activity	1.5	pCi/g	0.4	0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:01	2/10/98 8:01
12500	SA1	976178	EPA 901.1	Radium-228, Activity	1.8	pCi/g	0.4	0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:01	2/10/98 8:01
12500	SA1	976178	EPA 901.1	Bismuth-214, Activity	1.2	pCi/g	0.3	0.2	SEDIMENT	11/6/97 8:50	2/10/98 8:01	2/10/98 8:01
12500	SA1	976178	EPA 901.1	Radium-226, Activity	1.2	pCi/g	0.3	0.2	SEDIMENT	11/6/97 8:50	2/10/98 8:01	2/10/98 8:01
12500	SA1	976178	EPA 901.1	Cobalt-57, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:01	2/10/98 8:01
12500	SA1	976178	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	SEDIMENT	11/6/97 8:50	2/10/98 8:01	2/10/98 8:01
12500	SA1	976178	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:01	2/10/98 8:01
12500	SA1	976178	EPA 901.1	Lead-210, Activity	ND	pCi/g		3.7	SEDIMENT	11/6/97 8:50	2/10/98 8:01	2/10/98 8:01
12500	SA1	976178	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.5	SEDIMENT	11/6/97 8:50	2/10/98 8:01	2/10/98 8:01
12500	SA1	976178	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/6/97 8:50	2/10/98 8:01	2/10/98 8:01
12501	SA1	976178	mod. HASL 300	Thorium-232, Activity	2	pCi/g	0.9	0.4	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12501	SA1	976178	mod. HASL 300	Thorium-230, Activity	1.8	pCi/g	0.9	0.5	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12501	SA1	976178	mod. HASL 300	Thorium-227	ND	pCi/g	0.2	0.5	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12501	SA1	976178	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.2	0.1	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12501	SA1	976178	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12501	SA1	976178	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/g	0.3	0.2	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12501	SA1	976178	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/6/97 8:50	2/6/98 17:18	2/6/98 17:18
12501	SA1	976178	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.2	SEDIMENT	11/6/97 8:50	2/10/98 15:49	2/10/98 15:49
12501	SA1	976178	CA-GLR-R160	Moisture (@ 104 deg. C)	10.9	% by Wt			SEDIMENT	11/6/97 8:50	2/6/98 17:18	2/6/98 17:18
12501	SA1	976178	EPA 901.1	Lead-210, Activity	ND	pCi/g		17	SEDIMENT	11/6/97 8:50	2/10/98 8:59	2/10/98 8:59
12501	SA1	976178	mod. HASL 300	Promethium 147	3.2	pCi/g	3.7	6.1	SEDIMENT	11/6/97 8:50	4/8/98 16:10	4/8/98 16:10
12501	SA1	976178	EPA 901.1	Radium-228, Activity	1.5	pCi/g	0.4	0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:59	2/10/98 8:59
12501	SA1	976178	EPA 901.1	Bismuth-214, Activity	1	pCi/g	0.3	0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:59	2/10/98 8:59
12501	SA1	976178	EPA 901.1	Radium-226, Activity	1	pCi/g	0.3	0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:59	2/10/98 8:59
12501	SA1	976178	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:59	2/10/98 8:59
12501	SA1	976178	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:59	2/10/98 8:59
12501	SA1	976178	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:59	2/10/98 8:59
12501	SA1	976178	EPA 901.1	Lead-211, Activity	ND	pCi/g		0.8	SEDIMENT	11/6/97 8:50	2/10/98 8:59	2/10/98 8:59
12501	SA1	976178	EPA 901.1	Lead-214, Activity	1	pCi/g	0.2	0.1	SEDIMENT	11/6/97 8:50	2/10/98 8:59	2/10/98 8:59
12501	SA1	976178	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	SEDIMENT	11/6/97 8:50	2/10/98 8:59	2/10/98 8:59
12501	MD	976178	CA-GLR-17.0	Tritium, Activity	131	RPD	171	279	Soil		2/6/98 17:18	2/6/98 17:18

PARSONS ES	SAMPLE		ANALYSIS								EXTRACT	ANALYZED
SAMP ID	TYPE	SDG	METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	DATE	DATE
12502	SA1	976178	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/6/97 8:50	2/6/98 17:18	2/6/98 17:18
12502	SA1	976178	CA-GLR-R160	Moisture (@ 104 deg. C)	9.2	% by Wt			SEDIMENT	11/6/97 8:50	2/6/98 17:18	2/6/98 17:18
12502	SA1	976178	mod. HASL 300	Promethium 147	2.1	pCi/g	3.7	6.1	SEDIMENT	11/6/97 8:50	4/8/98 16:10	4/8/98 16:10
12502	SA1	976178	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.2	SEDIMENT	11/6/97 8:50	2/10/98 15:49	2/10/98 15:49
12502	SA1	976178	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.5	0.3	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12502	SA1	976178	EPA 901.1	Radium-228, Activity	1	pCi/g	0.4	0.2	SEDIMENT	11/6/97 8:50	2/10/98 9:58	2/10/98 9:58
12502	SA1	976178	mod. HASL 300	Thorium-230, Activity	0.9	pCi/g	0.5	0.4	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12502	SA1	976178	EPA 901.1	Bismuth-214, Activity	1	pCi/g	0.3	0.2	SEDIMENT	11/6/97 8:50	2/10/98 9:58	2/10/98 9:58
12502	SA1	976178	mod. HASL 300	Thorium-227	0.1	pCi/g	0.3	0.5	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12502	SA1	976178	mod HASL 300	Uranium-238, Activity	0.5	pCi/g	0.2	0.1	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12502	SA1	976178	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12502	SA1	976178	mod. HASL 300	Uranium-233/234, Activity	1	pCi/g	0.4	0.2	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12502	SA1	976178	EPA 901.1	Lead-210, Activity	ND	pCi/g		1.2	SEDIMENT	11/6/97 8:50	2/10/98 9:58	2/10/98 9:58
12502	SA1	976178	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	SEDIMENT	11/6/97 8:50	2/10/98 9:58	2/10/98 9:58
12502	SA1	976178	EPA 901.1	Lead-211, Activity	ND	pCi/g		2.2	SEDIMENT	11/6/97 8:50	2/10/98 9:58	2/10/98 9:58
12502	SA1	976178	EPA 901.1	Lead-214, Activity	1.3	pCi/g	0.3	0.2	SEDIMENT	11/6/97 8:50	2/10/98 9:58	2/10/98 9:58
12502	SA1	976178	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/6/97 8:50	2/10/98 9:58	2/10/98 9:58
12502	SA1	976178	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	SEDIMENT	11/6/97 8:50	2/10/98 9:58	2/10/98 9:58
12502	SA1	976178	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.3	SEDIMENT	11/6/97 8:50	2/10/98 9:58	2/10/98 9:58
12502	SA1	976178	EPA 901.1	Radium-226, Activity	1	pCi/g	0.3	0.2	SEDIMENT	11/6/97 8:50	2/10/98 9:58	2/10/98 9:58
12503	SA1	976178	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.7	0.7	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12503	SA1	976178	mod. HASL 300	Thorium-230, Activity	1.7	pCi/g	1.1	0.7	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12503	SA1	976178	mod. HASL 300	Thorium-227	0.3	pCi/g	0.5	0.8	SEDIMENT	11/6/97 8:50	2/19/98 13:48	2/19/98 13:48
12503	SA1	976178	mod. HASL 300	Uranium-238, Activity	0.9	pCi/g	0.3	0.1	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12503	SA1	976178	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.3	SEDIMENT	11/6/97 8:50	2/10/98 15:49	2/10/98 15:49
12503	SA1	976178	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12503	SA1	976178	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.1	SEDIMENT	11/6/97 8:50	2/10/98 10:56	2/10/98 10:56
12503	SA1	976178	CA-GLR-R160	Moisture (@ 104 deg. C)	8.9	% by Wt			SEDIMENT	11/6/97 8:50	2/6/98 17:18	2/6/98 17:18
12503	SA1	976178	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/6/97 8:50	2/6/98 17:18	2/6/98 17:18
12503	SA1	976178	EPA 901.1	Lead-210, Activity	ND	pCi/g		15.6	SEDIMENT	11/6/97 8:50	2/10/98 10:56	2/10/98 10:56
12503	SA1	976178	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.3	SEDIMENT	11/6/97 8:50	2/10/98 10:56	2/10/98 10:56
12503	SA1	976178	EPA 901.1	Lead-214, Activity	1	pCi/g	0.2	0.1	SEDIMENT	11/6/97 8:50	2/10/98 10:56	2/10/98 10:56
12503	SA1	976178	mod. HASL 300	Promethium 147	2.1	pCi/g	3.7	6.1	SEDIMENT	11/6/97 8:50	4/8/98 16:10	4/8/98 16:10
12503	SA1	976178	mod. HASL 300	Uranium-233/234, Activity	1	pCi/g	0.3	0.2	SEDIMENT	11/6/97 8:50	2/10/98 15:45	2/10/98 15:45
12503	SA1	976178	EPA 901.1	Radium-228, Activity	1.1	pCi/g	0.2	0.1	SEDIMENT	11/6/97 8:50	2/10/98 10:56	2/10/98 10:56
12503	SA1	976178	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	SEDIMENT	11/6/97 8:50	2/10/98 10:56	2/10/98 10:56
12503	SA1	976178	EPA 901.1	Bismuth-214, Activity	1.1	pCi/g	0.4	0.1	SEDIMENT	11/6/97 8:50	2/10/98 10:56	2/10/98 10:56
12503	SA1	976178	EPA 901.1	Radium-226, Activity	1.1	pCi/g	0.4	0.1	SEDIMENT	11/6/97 8:50	2/10/98 10:56	2/10/98 10:56
12503	SA1	976178	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/6/97 8:50	2/10/98 10:56	2/10/98 10:56
12503	SA1	976178	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/6/97 8:50	2/10/98 10:56	2/10/98 10:56
12503	MD	976178	EPA 901.1	Radium-228, Activity	30.8	RPD	0.4	0.1	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Radium-226, Activity	1.1	RPD		1.3	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Cobalt-60, Activity	0	RPD		0.1	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Bismuth-214, Activity	1.1	RPD		1.3	Soil		2/10/98 11:55	2/10/98 11:55

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12503	MD	976178	EPA 901.1	Cobalt-57, Activity	0	RPD		0.1	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Lead-210, Activity	0	RPD		9.8	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Lead-211, Activity	0	RPD		7.5	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Cesium-137, Activity	0	RPD		0.3	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Lead-214, Activity	0	RPD	0.2	0.1	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Radium-223, Activity	0	RPD		0.3	Soil		2/10/98 11:55	2/10/98 11:55
12506	MD	976183	mod. HASL 300	Thorium-227	0.1	RPD	0.2	0.3	Soil		2/19/98 13:48	2/19/98 13:48
12506	MD	976183	mod. HASL 300	Thorium-232, Activity	20	RPD	0.5	0.3	Soil		2/19/98 13:48	2/19/98 13:48
12506	MD	976183	mod. HASL 300	Thorium-230, Activity	16.2	RPD	0.8	0.5	Soil		2/19/98 13:48	2/19/98 13:48
12507	MS	976183	mod. HASL 300	Thorium-232, Activity	111.4	% REC	2.6	0.3	Soil		2/19/98 13:48	2/19/98 13:48
12512	MD	976185	mod. HASL 300	Uranium-233/234, Activity	37	RPD	0.3	0.2	Soil		2/10/98 15:45	2/10/98 15:45
12512	MD	976185	mod. HASL 300	Uranium-235, Activity	0	RPD	0.1	0.1	Soil		2/10/98 15:45	2/10/98 15:45
12512	MD	976185	mod. HASL 300	Uranium-238, Activity	22.2	RPD	0.3	0.1	Soil		2/10/98 15:45	2/10/98 15:45
12513	MS	976185	mod. HASL 300	Uranium-238, Activity	96	% REC	1	0.1	Soil		2/10/98 15:45	2/10/98 15:45
12513	MS	976185	mod. HASL 300	Uranium-233/234, Activity	96.3	% REC	1	0.1	Soil		2/10/98 15:45	2/10/98 15:45
12515	MS	976217	mod. HASL 300	Promethium 147	76.9	% REC	10.9	6.1	Soil		4/8/98 16:10	4/8/98 16:10
12519	MD	976217	mod. HASL 300	Promethium 147	21.1	RPD	3.7	6.1	Soil		4/8/98 16:10	4/8/98 16:10
12552	MS	976405	CA-GLR-17.0	Tritium, Activity	96.3	% REC	246	293	Soil		2/6/98 17:18	2/6/98 17:18
63102	MD	976409	CA-GLR-17.0	Tritium, Activity	113.9	RPD	180	304	Soil		2/3/98 17:54	2/3/98 17:54
63103	MS	976460	CA-GLR-17.0	Tritium, Activity	98.1	% REC	261	316	Soil		2/4/98 22:59	2/4/98 22:59
63108	MS	976469	CA-GLR-17.0	Tritium, Activity	85.9	% REC	257	317	Soil		2/3/98 17:54	2/3/98 17:54
GEM021098S	LCS	976178	EPA 901.1	Cesium-137, Activity	106.8	% REC	1270	339	Water		2/11/98 5:28	2/11/98 5:28
GEM021098S	LCS	976178	EPA 901.1	Cobalt-60, Activity	104.8	% REC	1540	327	Water		2/11/98 5:28	2/11/98 5:28
GEM021198	LCS	976178	EPA 901.1	Cesium-137, Activity	112.6	% REC	2010	335	Water		2/11/98 7:25	2/11/98 7:25
GEM021198	LCS	976178	EPA 901.1	Cobalt-60, Activity	106	% REC	1680	298	Water		2/11/98 7:25	2/11/98 7:25
GMX021098	LCS	976178	EPA 901.1	Cesium-137, Activity	104	% REC	822	238	Water		2/11/98 4:29	2/11/98 4:29
GMX021098	LCS	976178	EPA 901.1	Cobalt-60, Activity	102.8	% REC	1190	298	Water		2/11/98 4:29	2/11/98 4:29
GMX021198	LCS	976178	EPA 901.1	Cesium-137, Activity	102.9	% REC	1080	306	Water		2/11/98 6:26	2/11/98 6:26
GMX021198	LCS	976178	EPA 901.1	Cobalt-60, Activity	102.1	% REC	1230	265	Water		2/11/98 6:26	2/11/98 6:26
LCS1H30130	LCS	976178	CA-GLR-17.0	Tritium, Activity	94.1	% REC	2.5	3	Water		2/3/98 17:54	2/3/98 17:54
LCS1H30205	LCS	976178	CA-GLR-17.0	Tritium, Activity	102	% REC	2.4	3	Water		2/6/98 17:18	2/6/98 17:18
LCS2H30130	LCS	976178	CA-GLR-17.0	Tritium, Activity	86.2	% REC	2.4	2.9	Water		2/4/98 22:59	2/4/98 22:59
LCSAPU0205	LCS	976178	mod. HASL 300	Plutonium-239/240	95.8	% REC	0.6	0.1	Water		2/10/98 15:49	2/10/98 15:49
LCSAT0212	LCS	976178	mod. HASL 300	Thorium-232, Activity	108.6	% REC	1	0.1	Water		2/19/98 13:48	2/19/98 13:48
LCSAU0205	LCS	976178	mod. HASL 300	Uranium-238, Activity	98	% REC	0.9	0.1	Water		2/10/98 15:45	2/10/98 15:45
LCSAU0205	LCS	976178	mod. HASL 300	Uranium-233/234, Activity	92.6	% REC	1	0.2	Water		2/10/98 15:45	2/10/98 15:45
LCSCPM0303	LCS	976178	mod. HASL 300	Promethium 147	107.6	% REC	5.7	3	Water		4/8/98 16:10	4/8/98 16:10
MB1H30130	MB	976178	CA-GLR-17.0	Tritium, Activity	1.4	pCi/L	1.8	2.9	Water		2/3/98 17:54	2/3/98 17:54
MB2H30205	MB	976178	CA-GLR-17.0	Tritium, Activity	ND	pCi/L	1.6	2.7	Water		2/6/98 17:18	2/6/98 17:18
MB4H30130	MB	976178	CA-GLR-17.0	Tritium, Activity	0.8	pCi/L	1.7	2.8	Water		2/4/98 22:59	2/4/98 22:59
MBAPU0205	MB	976178	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.1	0.2	Water		2/10/98 15:49	2/10/98 15:49
MBAT0212	MB	976178	mod. HASL 300	Thorium-232, Activity	0.1	pCi/L	0.1	0.2	Water		2/19/98 13:48	2/19/98 13:48
MBAT0212	MB	976178	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water		2/19/98 13:48	2/19/98 13:48
MBAT0212	MB	976178	mod. HASL 300	Thorium-230, Activity	0.8	pCi/L	0.4	0.2	Water		2/19/98 13:48	2/19/98 13:48

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
MBAU0205	MB	976178	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.1	Water		2/10/98 15:45	2/10/98 15:45
MBAU0205	MB	976178	mod. HASL 300	Uranium-233/234, Activity	0.3	pCi/L	0.2	0.1	Water		2/10/98 15:45	2/10/98 15:45
MBAU0205	MB	976178	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.1	Water		2/10/98 15:45	2/10/98 15:45
MBFPM0303	MB	976178	mod. HASL 300	Promethium 147	ND	pCi/L	1.8	3	Water		4/8/98 16:10	4/8/98 16:10
ST1H30130	LCS	976178	CA-GLR-17 0	Tritium, Activity	90.6	% REC	2.5	3	Water		2/3/98 17:54	2/3/98 17:54
ST1H30205	LCS	976178	CA-GLR-17.0	Tritium, Activity	94.6	% REC	2.5	2.9	Water		2/6/98 17:18	2/6/98 17:18
ST2H30130	LCS	976178	CA-GLR-17.0	Tritium, Activity	100 5	% REC	2.5	3	Water		2/4/98 22:59	2/4/98 22:59

CORE LAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

April 21, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976183

The following information is pertinent to the interpretation of the data.

On November 7, 1997, Core Laboratories - Casper received six soil samples in good condition.

The analytical batch for the isotopic thorium had low tracer recovery, which caused the batch to be reanalyzed for samples 12505, 12508, 12506, 12504, and 12507. The sample volumes were reduced to limit matrix interferences. The reduced volumes elevated the LLDs. The reanalyzed thorium batch passed QC criteria. The MB for Th230 is slightly elevated at 0.8 pCi/g.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error is calculated by the software for the positive results. The Ra226 activity by gamma is not reported using the 186kev line since Ra226 has a low abundance at that line and the U235 has a greater abundance with an energy very close to 186 which would cause interference. Therefore, the Ra226 is calculated from the Bi214 line, a daughter of Ra226. The Ra228 is calculated from the Ac228 line, the daughter of Ra228, as Ra228 is a beta emitter.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Radiochemistry Supervisor

Cooler # C

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012062
Company..: Parsons	Project..: SEAD-12	Page 2 Of 5
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 11069701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976182 ~~976182~~ VCP
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
BJP	11/06/97	1000	10260	12040	H3	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1000	10257	12040	RN222	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1000	10258	12040	RN222	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1000	10259	12040	RN222	OVER-FOR-PARAM-KEY	
NAS	11/06/97	1100	10256	12440	SOLIDS-1A	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1120	10254	12041	LIQUID-1	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1120	10255	12041	LIQUID-2A	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1120	10253	12041	H3	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX AIRBILL NO.: 802367545712

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [✓] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: A Schwartz	11/6/97	Signature:		Signature:	
Printed Name/Company: Andrew Schwartz	Time 1710	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle	11/7/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder -CORE	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[✓] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

Cooler # 21

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company..:	Parsons	Project..:	SEAD-12
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau
	101 Huntington Ave.	Address..:	101 Huntington Ave.
	Boston MA,. 02199		Boston MA 02199
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043

ABC-012064

Page 4 Of 5

File = 11069701.bar

LAB JOB NUMBER

976183

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
BJP	11/06/97	1210	10246	12042	RN222	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1500	10243	12044	LIQUID-1	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1500	10242	12044	LIQUID-2A	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1500	10241	12044	H3	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1500	10238	12044	RN222	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1500	10239	12044	RN222	OVER-FOR-PARAM-KEY	
BJP	11/06/97	1500	10240	12044	RN222	OVER-FOR-PARAM-KEY	
KKS	11/05/97	0920	10233	12505	SOLIDS-1B	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX AIRBILL NO.: 802367545712

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [✓] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: A. Schwartz	11/6/97	Signature:		Signature:	
Printed Name/Company: Andrew Schwartz	Time 1710	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Ruder	11/7/97	Signature:		Signature:	
Printed Name/Company: Michelle Ruder	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[✓] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

Cooler # C

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION		PROJECT INFORMATION		
Company..:	Parsons	Project..:	SEAD-12	# ABC-012065
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	Page 5 Of 5
	101 Huntington Ave.	Address..:	101 Huntington Ave.	File = 11069701.bar
	Boston MA, 02199		Boston MA 02199	LAB JOB NUMBER
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	976183

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	11/05/97	1520	10234	12508	SOLIDS-1B	OVER-FOR-PARAM-KEY	
KKS	11/05/97	1440	10235	12506	SOLIDS-1B	OVER-FOR-PARAM-KEY	
KKS	11/05/97	1025	10237	12504	SOLIDS-1B	OVER-FOR-PARAM-KEY	
KKS	11/05/97	1450	10236	12507	SOLIDS-1B	OVER-FOR-PARAM-KEY	

ABS

SHIPMENT METHOD: FEDEX AIRBILL NO.: 802367545712

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [✓] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: A. Schwartz	11/6/97	Signature:		Signature:	
Printed Name/Company: Andrew Schwartz	Time 1710	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Puder	11/7/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder-CORE	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[✓] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12209	MS	976235	mod. HASL 300	Plutonium-239/240	118.8	% REC	0.9	0.1	Soil		2/23/98 16:16	2/23/98 16:16
12407	MS	976118	mod. HASL 300	Promethium 147	97	% REC	15.3	12.3	Soil		4/4/98 10:06	4/4/98 10:06
12426	MD	976185	mod. HASL 300	Plutonium-239/240	0.1	RPD	0.1	0.2	Soil		2/10/98 15:49	2/10/98 15:49
12440	SA1	976183	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.2	Solid	11/7/97 9:00	2/20/98 8:37	2/20/98 8:37
12440	SA1	976183	mod. HASL 300	Thorium-232, Activity	0.5	pCi/g	0.3	0.2	Solid	11/7/97 9:00	2/20/98 8:37	2/20/98 8:37
12440	SA1	976183	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.2	0.1	Solid	11/7/97 9:00	2/20/98 13:46	2/20/98 13:46
12440	SA1	976183	mod. HASL 300	Thorium-230, Activity	0.5	pCi/g	0.4	0.3	Solid	11/7/97 9:00	2/20/98 8:37	2/20/98 8:37
12440	SA1	976183	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Solid	11/7/97 9:00	2/20/98 13:46	2/20/98 13:46
12440	SA1	976183	mod. HASL 300	Uranium-233/234, Activity	0.4	pCi/g	0.2	0.1	Solid	11/7/97 9:00	2/20/98 13:46	2/20/98 13:46
12440	SA1	976183	EPA 901.1	Radium-228, Activity	1.2	pCi/g	0.3	0.1	Solid	11/7/97 9:00	2/10/98 17:46	2/10/98 17:46
12440	SA1	976183	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	Solid	11/7/97 9:00	2/10/98 17:46	2/10/98 17:46
12440	SA1	976183	CA-GLR-R160	Moisture (@ 104 deg. C)	21.9	% by Wt			Solid	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12440	SA1	976183	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Solid	11/7/97 9:00	2/10/98 17:46	2/10/98 17:46
12440	SA1	976183	EPA 901.1	Bismuth-214, Activity	1.2	pCi/g	0.2	0.1	Solid	11/7/97 9:00	2/10/98 17:46	2/10/98 17:46
12440	SA1	976183	EPA 901.1	Lead-214, Activity	1.2	pCi/g	0.3	0.1	Solid	11/7/97 9:00	2/10/98 17:46	2/10/98 17:46
12440	SA1	976183	EPA 901.1	Radium-226, Activity	1.2	pCi/g	0.2	0.1	Solid	11/7/97 9:00	2/10/98 17:46	2/10/98 17:46
12440	SA1	976183	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	Solid	11/7/97 9:00	2/10/98 17:46	2/10/98 17:46
12440	SA1	976183	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.1	Solid	11/7/97 9:00	2/23/98 16:16	2/23/98 16:16
12440	SA1	976183	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Solid	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12440	SA1	976183	EPA 901.1	Cesium-137, Activity	0.4	pCi/g	0.1	0.1	Solid	11/7/97 9:00	2/10/98 17:46	2/10/98 17:46
12440	SA1	976183	EPA 901.1	Lead-210, Activity	ND	pCi/g		5.1	Solid	11/7/97 9:00	2/10/98 17:46	2/10/98 17:46
12440	SA1	976183	EPA 901.1	Lead-211, Activity	11.4	pCi/g	5.2	1.2	Solid	11/7/97 9:00	2/10/98 17:46	2/10/98 17:46
12443	MS	976185	mod. HASL 300	Plutonium-239/240	102.1	% REC	0.8	0.2	Soil		2/10/98 15:49	2/10/98 15:49
12447	MD	976235	mod. HASL 300	Thorium-230, Activity	50	RPD	0.9	0.5	Soil		2/20/98 8:37	2/20/98 8:37
12447	MD	976235	mod. HASL 300	Thorium-232, Activity	0	RPD	0.8	0.3	Soil		2/20/98 8:37	2/20/98 8:37
12447	MD	976235	mod. HASL 300	Thorium-227	0	RPD	0.2	0.3	Soil		2/20/98 8:37	2/20/98 8:37
12448	MS	976235	mod. HASL 300	Thorium-232, Activity	80	% REC	1.5	0.3	Soil		2/20/98 8:37	2/20/98 8:37
12449	MD	976235	mod. HASL 300	Uranium-234, Activity	25	RPD	0.3	0.2	Soil		2/20/98 13:46	2/20/98 13:46
12449	MD	976235	mod. HASL 300	Uranium-235, Activity	0	RPD	0.1	0.1	Soil		2/20/98 13:46	2/20/98 13:46
12449	MD	976235	mod. HASL 300	Uranium-233/234, Activity	25	RPD	0.3	0.2	Soil		2/20/98 13:46	2/20/98 13:46
12449	MD	976235	mod. HASL 300	Uranium-238, Activity	15.4	RPD	0.3	0.1	Soil		2/20/98 13:46	2/20/98 13:46
12451	MS	976235	mod. HASL 300	Uranium-233/234, Activity	88.9	% REC	1	0.2	Soil		2/20/98 13:46	2/20/98 13:46
12451	MS	976235	mod. HASL 300	Uranium-238, Activity	94	% REC	1	0.1	Soil		2/20/98 13:46	2/20/98 13:46
12451	MS	976235	mod. HASL 300	Uranium-234, Activity	88.9	% REC	1	0.2	Soil		2/20/98 13:46	2/20/98 13:46
12470	MD	976460	CA-GLR-17.0	Tritium, Activity	9.5	RPD	181	290	Soil		2/4/98 22:59	2/4/98 22:59
12501	MD	976178	CA-GLR-17.0	Tritium, Activity	131	RPD	171	279	Soil		2/6/98 17:18	2/6/98 17:18
12503	MD	976178	EPA 901.1	Radium-226, Activity	1.1	RPD		1.3	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Radium-228, Activity	30.8	RPD	0.4	0.1	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Cobalt-57, Activity	0	RPD		0.1	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Bismuth-214, Activity	1.1	RPD		1.3	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Cesium-137, Activity	0	RPD		0.3	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Lead-210, Activity	0	RPD		9.8	Soil		2/10/98 11:55	2/10/98 11:55

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12503	MD	976178	EPA 901.1	Lead-211, Activity	0	RPD		7.5	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Cobalt-60, Activity	0	RPD		0.1	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Lead-214, Activity	0	RPD	0.2	0.1	Soil		2/10/98 11:55	2/10/98 11:55
12503	MD	976178	EPA 901.1	Radium-223, Activity	0	RPD		0.3	Soil		2/10/98 11:55	2/10/98 11:55
12504	SA1	976183	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.9	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12504	SA1	976183	mod. HASL 300	Promethium 147	8.9	pCi/g	5	8.2	SEDIMEN	11/7/97 9:00	4/4/98 10:06	4/4/98 10:06
12504	SA1	976183	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/g	0.2	0.2	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12504	SA1	976183	EPA 901.1	Lead-210, Activity	ND	pCi/g		3.9	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12504	SA1	976183	EPA 901.1	Lead-211, Activity	ND	pCi/g		10.7	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12504	SA1	976183	EPA 901.1	Lead-214, Activity	1.4	pCi/g	0.4	0.2	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12504	SA1	976183	CA-GLR-R160	Moisture (@ 104 deg. C)	18.7	% by Wt			SEDIMEN	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12504	SA1	976183	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12504	SA1	976183	EPA 901.1	Radium-228, Activity	1.6	pCi/g	0.4	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12504	SA1	976183	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.6	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12504	SA1	976183	EPA 901.1	Bismuth-214, Activity	1.5	pCi/g	0.2	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12504	SA1	976183	EPA 901.1	Radium-226, Activity	1.5	pCi/g	0.2	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12504	SA1	976183	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.2	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12504	SA1	976183	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12504	SA1	976183	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.3	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12504	SA1	976183	mod. HASL 300	Uranium-238, Activity	0.9	pCi/g	0.3	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12504	SA1	976183	mod. HASL 300	Thorium-230, Activity	1.5	pCi/g	0.7	0.5	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12504	SA1	976183	CA-GLR-17.0	Tritium, Activity	0.5	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12504	SA1	976183	mod. HASL 300	Thorium-232, Activity	1.2	pCi/g	0.6	0.3	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12504	SA1	976183	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.3	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12505	SA1	976183	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.6	SEDIMEN	11/7/97 9:00	2/10/98 12:53	2/10/98 12:53
12505	SA1	976183	mod. HASL 300	Plutonium-239/240	0.2	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12505	SA1	976183	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.6	0.5	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12505	SA1	976183	mod. HASL 300	Thorium-230, Activity	2.7	pCi/g	1.3	0.7	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12505	SA1	976183	mod. HASL 300	Thorium-227	0.3	pCi/g	0.3	0.5	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12505	SA1	976183	mod. HASL 300	Uranium-238, Activity	0.8	pCi/g	0.3	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12505	SA1	976183	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12505	SA1	976183	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/g	0.3	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12505	SA1	976183	mod. HASL 300	Promethium 147	7.9	pCi/g	5	8.2	SEDIMEN	11/7/97 9:00	4/4/98 10:06	4/4/98 10:06
12505	SA1	976183	CA-GLR-17.0	Tritium, Activity	0.5	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12505	SA1	976183	CA-GLR-R160	Moisture (@ 104 deg. C)	17.6	% by Wt			SEDIMEN	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12505	SA1	976183	EPA 901.1	Lead-214, Activity	1.1	pCi/g	0.3	0.2	SEDIMEN	11/7/97 9:00	2/10/98 12:53	2/10/98 12:53
12505	SA1	976183	EPA 901.1	Radium-228, Activity	1.5	pCi/g	0.4	0.1	SEDIMEN	11/7/97 9:00	2/10/98 12:53	2/10/98 12:53
12505	SA1	976183	EPA 901.1	Bismuth-214, Activity	1.9	pCi/g	0.4	0.1	SEDIMEN	11/7/97 9:00	2/10/98 12:53	2/10/98 12:53
12505	SA1	976183	EPA 901.1	Radium-226, Activity	1.9	pCi/g	0.4	0.1	SEDIMEN	11/7/97 9:00	2/10/98 12:53	2/10/98 12:53
12505	SA1	976183	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.2	SEDIMEN	11/7/97 9:00	2/10/98 12:53	2/10/98 12:53
12505	SA1	976183	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMEN	11/7/97 9:00	2/10/98 12:53	2/10/98 12:53
12505	SA1	976183	EPA 901.1	Cesium-137, Activity	0.7	pCi/g	0.2	0.1	SEDIMEN	11/7/97 9:00	2/10/98 12:53	2/10/98 12:53

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12505	SA1	976183	EPA 901.1	Lead-210, Activity	ND	pCi/g		1.3	SEDIMEN	11/7/97 9:00	2/10/98 12:53	2/10/98 12:53
12505	SA1	976183	EPA 901.1	Lead-211, Activity	ND	pCi/g		9.7	SEDIMEN	11/7/97 9:00	2/10/98 12:53	2/10/98 12:53
12506	SA1	976183	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.3	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12506	SA1	976183	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.3	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12506	SA1	976183	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12506	SA1	976183	mod. HASL 300	Uranium-233/234, Activity	1.1	pCi/g	0.4	0.2	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12506	SA1	976183	mod. HASL 300	Promethium 147	13.3	pCi/g	5.1	8.2	SEDIMEN	11/7/97 9:00	4/4/98 10:06	4/4/98 10:06
12506	SA1	976183	CA-GLR-R160	Moisture (@ 104 deg. C)	16.9	% by Wt			SEDIMEN	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12506	SA1	976183	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12506	SA1	976183	mod. HASL 300	Plutonium-239/240	0.2	pCi/g	0.2	0.2	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12506	SA1	976183	EPA 901.1	Radium-228, Activity	2	pCi/g	0.5	0.1	SEDIMEN	11/7/97 9:00	2/10/98 14:50	2/10/98 14:50
12506	SA1	976183	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.5	0.3	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12506	SA1	976183	EPA 901.1	Bismuth-214, Activity	1.2	pCi/g	0.3	0.1	SEDIMEN	11/7/97 9:00	2/10/98 14:50	2/10/98 14:50
12506	SA1	976183	mod. HASL 300	Thorium-230, Activity	1.7	pCi/g	0.8	0.4	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12506	SA1	976183	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	SEDIMEN	11/7/97 9:00	2/10/98 14:50	2/10/98 14:50
12506	SA1	976183	EPA 901.1	Radium-226, Activity	1.2	pCi/g	0.3	0.1	SEDIMEN	11/7/97 9:00	2/10/98 14:50	2/10/98 14:50
12506	SA1	976183	EPA 901.1	Lead-210, Activity	ND	pCi/g		21.6	SEDIMEN	11/7/97 9:00	2/10/98 14:50	2/10/98 14:50
12506	SA1	976183	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMEN	11/7/97 9:00	2/10/98 14:50	2/10/98 14:50
12506	SA1	976183	EPA 901.1	Lead-211, Activity	ND	pCi/g		4.5	SEDIMEN	11/7/97 9:00	2/10/98 14:50	2/10/98 14:50
12506	SA1	976183	EPA 901.1	Lead-214, Activity	1.2	pCi/g	0.2	0.1	SEDIMEN	11/7/97 9:00	2/10/98 14:50	2/10/98 14:50
12506	SA1	976183	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMEN	11/7/97 9:00	2/10/98 14:50	2/10/98 14:50
12506	SA1	976183	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	SEDIMEN	11/7/97 9:00	2/10/98 14:50	2/10/98 14:50
12506	MD	976183	mod. HASL 300	Thorium-230, Activity	16.2	RPD	0.8	0.5	Soil		2/19/98 13:48	2/19/98 13:48
12506	MD	976183	mod. HASL 300	Thorium-232, Activity	20	RPD	0.5	0.3	Soil		2/19/98 13:48	2/19/98 13:48
12506	MD	976183	mod. HASL 300	Thorium-227	0.1	RPD	0.2	0.3	Soil		2/19/98 13:48	2/19/98 13:48
12506	MD	976183	mod. HASL 300	Promethium 147	5.8	RPD	5.1	8.2	Soil		4/4/98 10:06	4/4/98 10:06
12507	SA1	976183	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	SEDIMEN	11/7/97 9:00	2/10/98 16:47	2/10/98 16:47
12507	SA1	976183	mod. HASL 300	Plutonium-239/240	0.2	pCi/g	0.3	0.3	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12507	SA1	976183	mod. HASL 300	Thorium-232, Activity	1.3	pCi/g	0.8	0.3	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12507	SA1	976183	mod. HASL 300	Thorium-230, Activity	1.8	pCi/g	0.9	0.6	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12507	SA1	976183	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.6	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12507	SA1	976183	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12507	SA1	976183	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12507	SA1	976183	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/g	0.3	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12507	SA1	976183	mod. HASL 300	Promethium 147	14.4	pCi/g	5.1	8.2	SEDIMEN	11/7/97 9:00	4/4/98 10:06	4/4/98 10:06
12507	SA1	976183	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12507	SA1	976183	CA-GLR-R160	Moisture (@ 104 deg. C)	25.2	% by Wt			SEDIMEN	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12507	SA1	976183	EPA 901.1	Lead-214, Activity	1.3	pCi/g	0.3	0.3	SEDIMEN	11/7/97 9:00	2/10/98 16:47	2/10/98 16:47
12507	SA1	976183	EPA 901.1	Radium-228, Activity	1.8	pCi/g	0.4	0.2	SEDIMEN	11/7/97 9:00	2/10/98 16:47	2/10/98 16:47
12507	SA1	976183	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.3	SEDIMEN	11/7/97 9:00	2/10/98 16:47	2/10/98 16:47
12507	SA1	976183	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.3	SEDIMEN	11/7/97 9:00	2/10/98 16:47	2/10/98 16:47
12507	SA1	976183	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMEN	11/7/97 9:00	2/10/98 16:47	2/10/98 16:47

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12507	SA1	976183	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	SEDIMEN	11/7/97 9:00	2/10/98 16:47	2/10/98 16:47
12507	SA1	976183	EPA 901.1	Cesium-137, Activity	0.6	pCi/g	0.2	0.1	SEDIMEN	11/7/97 9:00	2/10/98 16:47	2/10/98 16:47
12507	SA1	976183	EPA 901.1	Lead-210, Activity	ND	pCi/g		23.2	SEDIMEN	11/7/97 9:00	2/10/98 16:47	2/10/98 16:47
12507	SA1	976183	EPA 901.1	Lead-211, Activity	ND	pCi/g		13.8	SEDIMEN	11/7/97 9:00	2/10/98 16:47	2/10/98 16:47
12507	MS	976183	mod. HASL 300	Thorium-232, Activity	111.4	% REC	2.6	0.3	Soil		2/19/98 13:48	2/19/98 13:48
12508	SA1	976183	EPA 901.1	Lead-211, Activity	ND	pCi/g		2	SEDIMEN	11/7/97 9:00	2/10/98 13:52	2/10/98 13:52
12508	SA1	976183	EPA 901.1	Lead-214, Activity	1.2	pCi/g	0.3	0.1	SEDIMEN	11/7/97 9:00	2/10/98 13:52	2/10/98 13:52
12508	SA1	976183	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMEN	11/7/97 9:00	2/10/98 13:52	2/10/98 13:52
12508	SA1	976183	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.2	SEDIMEN	11/7/97 9:00	2/10/98 15:49	2/10/98 15:49
12508	SA1	976183	mod. HASL 300	Thorium-232, Activity	1.1	pCi/g	0.6	0.4	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12508	SA1	976183	mod. HASL 300	Thorium-230, Activity	1.8	pCi/g	0.9	0.6	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12508	SA1	976183	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.4	SEDIMEN	11/7/97 9:00	2/19/98 13:48	2/19/98 13:48
12508	SA1	976183	mod. HASL 300	Uranium-238, Activity	1	pCi/g	0.3	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12508	SA1	976183	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12508	SA1	976183	mod. HASL 300	Uranium-233/234, Activity	1.1	pCi/g	0.4	0.2	SEDIMEN	11/7/97 9:00	2/10/98 15:45	2/10/98 15:45
12508	SA1	976183	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMEN	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12508	SA1	976183	mod. HASL 300	Promethium 147	9.6	pCi/g	5	8.2	SEDIMEN	11/7/97 9:00	4/4/98 10:06	4/4/98 10:06
12508	SA1	976183	EPA 901.1	Lead-210, Activity	ND	pCi/g		1.2	SEDIMEN	11/7/97 9:00	2/10/98 13:52	2/10/98 13:52
12508	SA1	976183	CA-GLR-R160	Moisture (@ 104 deg. C)	9.9	% by Wt			SEDIMEN	11/7/97 9:00	2/6/98 17:18	2/6/98 17:18
12508	SA1	976183	EPA 901.1	Radium-228, Activity	2.1	pCi/g	0.4	0.1	SEDIMEN	11/7/97 9:00	2/10/98 13:52	2/10/98 13:52
12508	SA1	976183	EPA 901.1	Bismuth-214, Activity	1.4	pCi/g	0.3	0.2	SEDIMEN	11/7/97 9:00	2/10/98 13:52	2/10/98 13:52
12508	SA1	976183	EPA 901.1	Radium-226, Activity	1.4	pCi/g	0.3	0.2	SEDIMEN	11/7/97 9:00	2/10/98 13:52	2/10/98 13:52
12508	SA1	976183	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMEN	11/7/97 9:00	2/10/98 13:52	2/10/98 13:52
12508	SA1	976183	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMEN	11/7/97 9:00	2/10/98 13:52	2/10/98 13:52
12508	SA1	976183	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	SEDIMEN	11/7/97 9:00	2/10/98 13:52	2/10/98 13:52
12512	MD	976185	mod. HASL 300	Uranium-233/234, Activity	37	RPD	0.3	0.2	Soil		2/10/98 15:45	2/10/98 15:45
12512	MD	976185	mod. HASL 300	Uranium-235, Activity	0	RPD	0.1	0.1	Soil		2/10/98 15:45	2/10/98 15:45
12512	MD	976185	mod. HASL 300	Uranium-238, Activity	22.2	RPD	0.3	0.1	Soil		2/10/98 15:45	2/10/98 15:45
12513	MS	976185	mod. HASL 300	Uranium-238, Activity	96	% REC	1	0.1	Soil		2/10/98 15:45	2/10/98 15:45
12513	MS	976185	mod. HASL 300	Uranium-233/234, Activity	96.3	% REC	1	0.1	Soil		2/10/98 15:45	2/10/98 15:45
12534	MD	976235	mod. HASL 300	Plutonium-239/240	0.1	RPD	0.1	0.1	Soil		2/23/98 16:16	2/23/98 16:16
12552	MS	976405	CA-GLR-17.0	Tritium, Activity	96.3	% REC	246	293	Soil		2/6/98 17:18	2/6/98 17:18
63102	MD	976409	CA-GLR-17.0	Tritium, Activity	113.9	RPD	180	304	Soil		2/3/98 17:54	2/3/98 17:54
63103	MS	976460	CA-GLR-17.0	Tritium, Activity	98.1	% REC	261	316	Soil		2/4/98 22:59	2/4/98 22:59
63108	MS	976469	CA-GLR-17.0	Tritium, Activity	85.9	% REC	257	317	Soil		2/3/98 17:54	2/3/98 17:54
GEM021098S	LCS	976183	EPA 901.1	Cobalt-60, Activity	104.8	% REC	1540	327	Water		2/11/98 5:28	2/11/98 5:28
GEM021098S	LCS	976183	EPA 901.1	Cesium-137, Activity	106.8	% REC	1270	339	Water		2/11/98 5:28	2/11/98 5:28
GEM021198	LCS	976183	EPA 901.1	Cobalt-60, Activity	106	% REC	1680	298	Water		2/11/98 7:25	2/11/98 7:25
GEM021198	LCS	976183	EPA 901.1	Cesium-137, Activity	112.6	% REC	2010	335	Water		2/11/98 7:25	2/11/98 7:25
GMX021098	LCS	976183	EPA 901.1	Cobalt-60, Activity	102.8	% REC	1190	298	Water		2/11/98 4:29	2/11/98 4:29
GMX021098	LCS	976183	EPA 901.1	Cesium-137, Activity	104	% REC	822	238	Water		2/11/98 4:29	2/11/98 4:29
GMX021198	LCS	976183	EPA 901.1	Cesium-137, Activity	102.9	% REC	1080	306	Water		2/11/98 6:26	2/11/98 6:26

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
GMX021198	LCS	976183	EPA 901.1	Cobalt-60, Activity	102.1	% REC	1230	265	Water		2/11/98 6:26	2/11/98 6:26
LCS1H30130	LCS	976183	CA-GLR-17.0	Tritium, Activity	94.1	% REC	2.5	3	Water		2/3/98 17:54	2/3/98 17:54
LCS1H30205	LCS	976183	CA-GLR-17.0	Tritium, Activity	102	% REC	2.4	3	Water		2/6/98 17:18	2/6/98 17:18
LCS2H30130	LCS	976183	CA-GLR-17.0	Tritium, Activity	86.2	% REC	2.4	2.9	Water		2/4/98 22:59	2/4/98 22:59
LCSAPM0305	LCS	976183	mod. HASL 300	Promethium 147	97.6	% REC	4.9	4.1	Water		4/4/98 10:06	4/4/98 10:06
LCSAPU0205	LCS	976183	mod. HASL 300	Plutonium-239/240	95.8	% REC	0.6	0.1	Water		2/10/98 15:49	2/10/98 15:49
LCSAPU0217	LCS	976183	mod. HASL 300	Plutonium-239/240	93.8	% REC	0.7	0.1	Water		2/23/98 16:16	2/23/98 16:16
LCSAT0212	LCS	976183	mod. HASL 300	Thorium-232, Activity	108.6	% REC	1	0.1	Water		2/19/98 13:48	2/19/98 13:48
LCSAT0217	LCS	976183	mod. HASL 300	Thorium-232, Activity	117.1	% REC	1	0.1	Water		2/20/98 8:37	2/20/98 8:37
LCSAU0205	LCS	976183	mod. HASL 300	Uranium-233/234, Activity	92.6	% REC	1	0.2	Water		2/10/98 15:45	2/10/98 15:45
LCSAU0205	LCS	976183	mod. HASL 300	Uranium-238, Activity	98	% REC	0.9	0.1	Water		2/10/98 15:45	2/10/98 15:45
LCSAU0217	LCS	976183	mod. HASL 300	Uranium-234, Activity	85.2	% REC	1	0.1	Water		2/20/98 13:46	2/20/98 13:46
LCSAU0217	LCS	976183	mod. HASL 300	Uranium-233/234, Activity	85.2	% REC	1	0.1	Water		2/20/98 13:46	2/20/98 13:46
LCSAU0217	LCS	976183	mod. HASL 300	Uranium-238, Activity	108	% REC	1.1	0.1	Water		2/20/98 13:46	2/20/98 13:46
MB1H30130	MB	976183	CA-GLR-17.0	Tritium, Activity	1.4	pCi/L	1.8	2.9	Water		2/3/98 17:54	2/3/98 17:54
MB2H30205	MB	976183	CA-GLR-17.0	Tritium, Activity	ND	pCi/L	1.6	2.7	Water		2/6/98 17:18	2/6/98 17:18
MB4H30130	MB	976183	CA-GLR-17.0	Tritium, Activity	0.8	pCi/L	1.7	2.8	Water		2/4/98 22:59	2/4/98 22:59
MBAPU0205	MB	976183	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.1	0.2	Water		2/10/98 15:49	2/10/98 15:49
MBAPU0217	MB	976183	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.1	0.1	Water		2/23/98 16:16	2/23/98 16:16
MBAT0212	MB	976183	mod. HASL 300	Thorium-232, Activity	0.1	pCi/L	0.1	0.2	Water		2/19/98 13:48	2/19/98 13:48
MBAT0212	MB	976183	mod. HASL 300	Thorium-230, Activity	0.8	pCi/L	0.4	0.2	Water		2/19/98 13:48	2/19/98 13:48
MBAT0212	MB	976183	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water		2/19/98 13:48	2/19/98 13:48
MBAT0217	MB	976183	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.1	Water		2/20/98 8:37	2/20/98 8:37
MBAT0217	MB	976183	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.1	Water		2/20/98 8:37	2/20/98 8:37
MBAT0217	MB	976183	mod. HASL 300	Thorium-230, Activity	0.1	pCi/L	0.1	0.2	Water		2/20/98 8:37	2/20/98 8:37
MBAU0205	MB	976183	mod. HASL 300	Uranium-233/234, Activity	0.3	pCi/L	0.2	0.1	Water		2/10/98 15:45	2/10/98 15:45
MBAU0205	MB	976183	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.1	Water		2/10/98 15:45	2/10/98 15:45
MBAU0205	MB	976183	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.1	Water		2/10/98 15:45	2/10/98 15:45
MBAU0217	MB	976183	mod. HASL 300	Uranium-234, Activity	0.1	pCi/L	0.1	0.1	Water		2/20/98 13:46	2/20/98 13:46
MBAU0217	MB	976183	mod. HASL 300	Uranium-233/234, Activity	0.1	pCi/L	0.1	0.1	Water		2/20/98 13:46	2/20/98 13:46
MBAU0217	MB	976183	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.1	Water		2/20/98 13:46	2/20/98 13:46
MBAU0217	MB	976183	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water		2/20/98 13:46	2/20/98 13:46
MBBPM0305	MB	976183	mod. HASL 300	Promethium 147	2.3	pCi/L	2.5	4.1	Water		4/4/98 10:06	4/4/98 10:06
ST1H30130	LCS	976183	CA-GLR-17.0	Tritium, Activity	90.6	% REC	2.5	3	Water		2/3/98 17:54	2/3/98 17:54
ST1H30205	LCS	976183	CA-GLR-17.0	Tritium, Activity	94.6	% REC	2.5	2.9	Water		2/6/98 17:18	2/6/98 17:18
ST2H30130	LCS	976183	CA-GLR-17.0	Tritium, Activity	100.5	% REC	2.5	3	Water		2/4/98 22:59	2/4/98 22:59

CORE LAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

April 20, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976233

The following information is pertinent to the interpretation of the data.

On November 13, 1997, Core Laboratories - Casper received four water samples in good condition.

The analytical batch MS for the radium-223/226 had low recovery, 41%, which caused the batch to be reanalyzed. The reanalyzed radium batch passed QC criteria. The Th-230 blank is slightly elevated at 0.4 pCi/L.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error is calculated by the software for the positive results.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Rondalynn Mull
Radiochemistry Supervisor

Core Laboratories, Inc.
420 West First Street, Casper, Wyoming 82601, (307) 235-5741, (800) 666-0306, Fax (307) 266-1676

Cooler 102

« « « CORE LABORATORIES - CHAIN OF CUSTODY RECORD » » »

CUSTOMER INFORMATION		PROJECT INFORMATION		
Company..:	Parsons	Project..:	SEAD-12	# ABC-012110
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	Page 1 Of 1
	101 Huntington Ave.	Address..:	101 Huntington Ave.	File = 11129701.bar
	Boston MA, 02199		Boston MA 02199	LAB JOB NUMBER 976233
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	11/09/97	1030	10089	12047	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	11/09/97	1030	10088	12047	LIQUID-2A	OVER-FOR-PARAM-KEY	
KKS	11/09/97	1130	10082	12048	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	11/09/97	1130	10081	12048	LIQUID-2A	OVER-FOR-PARAM-KEY	
BJP	11/10/97	1140	10057	12049	LIQUID-1	OVER-FOR-PARAM-KEY	
BJP	11/10/97	1140	10056	12049	LIQUID-2B	OVER-FOR-PARAM-KEY	
KKS	11/10/97	1330	10075	12050	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	11/10/97	1330	10074	12050	LIQUID-2A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801 452 981 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [ ] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Graffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Graffin / Parsons ES	Time 19^00	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	RECEIVED BY:	Date	RECEIVED BY:	Date
Signature: Maria Lopz-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MLS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	BATCH	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12041	MD	976182	EPA 901.1	Lead-211, Activity	0	RPD		321	Water	7291		3/3/98 4:51	3/3/98 4:51
12041	MD	976182	EPA 901.1	Lead-214, Activity	7.8	RPD	5.4	2.8	Water	7291		3/3/98 4:51	3/3/98 4:51
12041	MD	976182	EPA 901.1	Bismuth-214, Activity	31.1	RPD	4.5	2.1	Water	7291		3/3/98 4:51	3/3/98 4:51
12041	MD	976182	EPA 901.1	Cobalt-57, Activity	0	RPD		0.3	Water	7291		3/3/98 4:51	3/3/98 4:51
12041	MD	976182	EPA 901.1	Cesium-137, Activity	0	RPD		2.3	Water	7291		3/3/98 4:51	3/3/98 4:51
12041	MD	976182	EPA 901.1	Cobalt-60, Activity	0	RPD		1.5	Water	7291		3/3/98 4:51	3/3/98 4:51
12047	SA1	976233	EPA 900.0	Gross Beta, Activity	23.7	pCi/L	1.1	1.1	Water	6791	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12047	SA1	976233	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	7073	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12047	SA1	976233	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	7073	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12047	SA1	976233	mod. HASL 300	Plutonium-239/240	0.2	pCi/L	0.2	0.2	Water	6987	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12047	SA1	976233	mod. HASL 300	Thorium-232, Activity	0.1	pCi/L	0.1	0.3	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12047	SA1	976233	mod. HASL 300	Thorium-230, Activity	0.4	pCi/L	0.3	0.3	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12047	SA1	976233	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12047	SA1	976233	mod. HASL 300	Uranium-238, Activity	0.2	pCi/L	0.2	0.1	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12047	SA1	976233	EPA 900.0	Gross Alpha, Activity	7.6	pCi/L	1.5	1.7	Water	6791	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12047	SA1	976233	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12047	SA1	976233	EPA 901.1	Lead-214, Activity	12.7	pCi/L	5.3	2.7	Water	7291	11/13/97 9:00	3/5/98 13:20	3/5/98 13:20
12047	SA1	976233	mod. HASL 300	Uranium-233/234, Activity	0.3	pCi/L	0.2	0.2	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12047	SA1	976233	EPA 901.1	Bismuth-214, Activity	13.7	pCi/L	6.3	3	Water	7291	11/13/97 9:00	3/5/98 13:20	3/5/98 13:20
12047	SA1	976233	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.6	Water	7291	11/13/97 9:00	3/5/98 13:20	3/5/98 13:20
12047	SA1	976233	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		2.9	Water	7291	11/13/97 9:00	3/5/98 13:20	3/5/98 13:20
12047	SA1	976233	EPA 901.1	Cesium-137, Activity	ND	pCi/L		4.5	Water	7291	11/13/97 9:00	3/5/98 13:20	3/5/98 13:20
12047	SA1	976233	EPA 901.1	Lead-211, Activity	ND	pCi/L		13.8	Water	7291	11/13/97 9:00	3/5/98 13:20	3/5/98 13:20
12047	MS	976233	mod. HASL 300	Thorium-232, Activity	118	% REC	4.5	0.6	Water	7014		2/12/98 11:17	2/12/98 11:17
12048	SA1	976233	EPA 900.0	Gross Alpha, Activity	11.5	pCi/L	1.7	1.8	Water	6791	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12048	SA1	976233	EPA 900.0	Gross Beta, Activity	23	pCi/L	1.4	1.5	Water	6791	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12048	SA1	976233	EPA 901.1	Lead-211, Activity	ND	pCi/L		22.9	Water	7291	11/13/97 9:00	3/5/98 20:24	3/5/98 20:24
12048	SA1	976233	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	7073	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12048	SA1	976233	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.1	0.3	Water	6987	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12048	SA1	976233	mod. HASL 300	Thorium-232, Activity	0.1	pCi/L	0.1	0.2	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12048	SA1	976233	mod. HASL 300	Thorium-230, Activity	0.6	pCi/L	0.3	0.3	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12048	SA1	976233	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12048	SA1	976233	mod. HASL 300	Uranium-238, Activity	ND	pCi/L	0.1	0.1	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12048	SA1	976233	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12048	SA1	976233	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	7073	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12048	SA1	976233	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/L	0.3	0.2	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12048	SA1	976233	EPA 901.1	Lead-214, Activity	ND	pCi/L		18.4	Water	7291	11/13/97 9:00	3/5/98 20:24	3/5/98 20:24
12048	SA1	976233	EPA 901.1	Bismuth-214, Activity	16.7	pCi/L	5.7	2.7	Water	7291	11/13/97 9:00	3/5/98 20:24	3/5/98 20:24
12048	SA1	976233	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.5	Water	7291	11/13/97 9:00	3/5/98 20:24	3/5/98 20:24
12048	SA1	976233	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		3.2	Water	7291	11/13/97 9:00	3/5/98 20:24	3/5/98 20:24
12048	SA1	976233	EPA 901.1	Cesium-137, Activity	ND	pCi/L		2.4	Water	7291	11/13/97 9:00	3/5/98 20:24	3/5/98 20:24
12048	MD	976233	EPA 901.1	Cobalt-57, Activity	0	RPD		0.9	Water	7291		3/6/98 3:28	3/6/98 3:28
12048	MD	976233	EPA 901.1	Cobalt-60, Activity	0	RPD		5.5	Water	7291		3/6/98 3:28	3/6/98 3:28
12048	MD	976233	EPA 901.1	Bismuth-214, Activity	16.7	RPD		18	Water	7291		3/6/98 3:28	3/6/98 3:28
12048	MD	976233	EPA 901.1	Cesium-137, Activity	0	RPD		1.4	Water	7291		3/6/98 3:28	3/6/98 3:28

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	BATCH	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12048	MD	976233	EPA 901.1	Lead-214, Activity	13.2	RPD	4	2.2	Water	7291		3/6/98 3:28	3/6/98 3:28
12048	MD	976233	EPA 901.1	Lead-211, Activity	0	RPD		20.4	Water	7291		3/6/98 3:28	3/6/98 3:28
12049	SA1	976233	EPA 900.0	Gross Alpha, Activity	7.4	pCi/L	1.5	1.8	Water	6791	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12049	SA1	976233	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	7073	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12049	SA1	976233	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	7073	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12049	SA1	976233	mod. HASL 300	Plutonium-239/240	0.2	pCi/L	0.2	0.3	Water	6987	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12049	SA1	976233	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12049	SA1	976233	EPA 900.0	Gross Beta, Activity	27.4	pCi/L	1.4	1.5	Water	6791	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12049	SA1	976233	mod. HASL 300	Thorium-230, Activity	0.6	pCi/L	0.3	0.2	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12049	SA1	976233	mod. HASL 300	Uranium-238, Activity	0.3	pCi/L	0.2	0.2	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12049	SA1	976233	mod. HASL 300	Thorium-227	0.1	pCi/L	0.1	0.2	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12049	SA1	976233	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.2	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12049	SA1	976233	mod. HASL 300	Promethium 147	ND	pCi/L			Water	7623	11/13/97 9:00	3/31/98 7:03	3/31/98 7:03
12049	SA1	976233	mod. HASL 300	Uranium-233/234, Activity	0.4	pCi/L	0.3	0.3	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12049	SA1	976233	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.7	Water	7291	11/13/97 9:00	3/6/98 10:32	3/6/98 10:32
12049	SA1	976233	EPA 901.1	Bismuth-214, Activity	18	pCi/L	7.6	3.2	Water	7291	11/13/97 9:00	3/6/98 10:32	3/6/98 10:32
12049	SA1	976233	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		0.4	Water	7291	11/13/97 9:00	3/6/98 10:32	3/6/98 10:32
12049	SA1	976233	EPA 901.1	Lead-214, Activity	ND	pCi/L		12.2	Water	7291	11/13/97 9:00	3/6/98 10:32	3/6/98 10:32
12049	SA1	976233	EPA 901.1	Cesium-137, Activity	ND	pCi/L		2.9	Water	7291	11/13/97 9:00	3/6/98 10:32	3/6/98 10:32
12049	SA1	976233	EPA 901.1	Lead-211, Activity	ND	pCi/L		219	Water	7291	11/13/97 9:00	3/6/98 10:32	3/6/98 10:32
12049	MD	976233	mod. HASL 300	Promethium 147	0	RPD			Water	7623		3/31/98 8:58	3/31/98 8:58
12049	MS	976233	mod. HASL 300	Promethium 147	100.9	% REC			Water	7623		3/31/98 7:41	3/31/98 7:41
12050	SA1	976233	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		5.1	Water	7291	11/13/97 9:00	3/6/98 17:35	3/6/98 17:35
12050	SA1	976233	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.4	Water	7291	11/13/97 9:00	3/6/98 17:35	3/6/98 17:35
12050	SA1	976233	EPA 901.1	Cesium-137, Activity	ND	pCi/L		1.4	Water	7291	11/13/97 9:00	3/6/98 17:35	3/6/98 17:35
12050	SA1	976233	EPA 901.1	Lead-214, Activity	ND	pCi/L		18.7	Water	7291	11/13/97 9:00	3/6/98 17:35	3/6/98 17:35
12050	SA1	976233	EPA 901.1	Lead-211, Activity	ND	pCi/L		8.3	Water	7291	11/13/97 9:00	3/6/98 17:35	3/6/98 17:35
12050	SA1	976233	EPA 900.0	Gross Beta, Activity	8.5	pCi/L	1	1.4	Water	6791	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12050	SA1	976233	EPA 903.0	Radium-226, Activity	0.1	pCi/L	0.2	0.5	Water	7073	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12050	SA1	976233	EPA 900.0	Gross Alpha, Activity	0.8	pCi/L	0.8	1.3	Water	6791	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12050	SA1	976233	EPA 903.0	Radium-223, Activity	0.1	pCi/L			Water	7073	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12050	SA1	976233	EPA 901.1	Bismuth-214, Activity	12.2	pCi/L	6.1	2.9	Water	7291	11/13/97 9:00	3/6/98 17:35	3/6/98 17:35
12050	SA1	976233	mod. HASL 300	Plutonium-239/240	0.1	pCi/L	0.2	0.2	Water	6987	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12050	SA1	976233	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12050	SA1	976233	mod. HASL 300	Thorium-230, Activity	0.4	pCi/L	0.2	0.2	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12050	SA1	976233	mod. HASL 300	Thorium-227	0.1	pCi/L	0.1	0.2	Water	7014	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12050	SA1	976233	mod. HASL 300	Uranium-238, Activity	0.2	pCi/L	0.2	0.2	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12050	SA1	976233	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.2	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12050	SA1	976233	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/L	0.3	0.3	Water	6929	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12050	MD	976233	mod. HASL 300	Thorium-230, Activity	0.4	RPD	0.5	0.4	Water	7014		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-232, Activity	0	RPD	0.1	0.4	Water	7014		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-227	0.3	RPD	0.4	0.6	Water	7014		2/12/98 11:17	2/12/98 11:17
12050	MS	976233	EPA 900.0	Gross Alpha, Activity	89.7	% REC	3.5	1.3	Water	6791		1/29/98 16:10	1/29/98 16:10
12051	MD	976238	EPA 900.0	Gross Beta, Activity	48.6	RPD	1.9	2.4	Water	6791		1/29/98 16:10	1/29/98 16:10
12051	MD	976238	EPA 900.0	Gross Alpha, Activity	0.3	RPD	1	1.6	Water	6791		1/29/98 16:10	1/29/98 16:10

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	BATCH	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12053	MD	976238	mod. HASL 300	Plutonium-239/240	0.4	RPD	0.4	0.5	Water	6987		2/12/98 8:48	2/12/98 8:48
12062	MD	976236	mod. HASL 300	Uranium-233/234, Activity	0	RPD	0.4	0.5	Water	6929		2/6/98 15:39	2/6/98 15:39
12062	MD	976236	mod. HASL 300	Uranium-235, Activity	0.3	RPD	0.1	0.3	Water	6929		2/6/98 15:39	2/6/98 15:39
12062	MD	976236	mod. HASL 300	Uranium-238, Activity	0.1	RPD	0.4	0.3	Water	6929		2/6/98 15:39	2/6/98 15:39
12062	MS	976236	mod. HASL 300	Plutonium-239/240	92.7	% REC	2.2	0.5	Water	6987		2/12/98 8:48	2/12/98 8:48
12201	MS	976216	EPA 903.0	Radium-226, Activity	97.8	% REC	2.3	1.1	Water	7073		2/19/98 7:04	2/19/98 7:04
12201	MS	976216	EPA 903.0	Radium-223, Activity	97.8	% REC			Water	7073		2/19/98 7:04	2/19/98 7:04
12204	MD	976216	EPA 903.0	Radium-226, Activity	0	RPD	0.4	1.1	Water	7073		2/19/98 7:04	2/19/98 7:04
12204	MD	976216	EPA 903.0	Radium-223, Activity	0	RPD			Water	7073		2/19/98 7:04	2/19/98 7:04
12210	MS	976236	mod. HASL 300	Uranium-238, Activity	115.4	% REC	3.2	0.4	Water	6929		2/6/98 15:39	2/6/98 15:39
12210	MS	976236	mod. HASL 300	Uranium-233/234, Activity	109.7	% REC	3.3	0.4	Water	6929		2/6/98 15:39	2/6/98 15:39
12211-Associate	MS	976291	EPA 900.0	Gross Beta, Activity	98.4	% REC	0.9	0.6	Water	6791		1/29/98 16:10	1/29/98 16:10
EFF2A0126	LCS	976233	EPA 900.0	Gross Alpha, Activity	85.1	% REC	0.5	0.1	Water	6791		1/29/98 16:10	1/29/98 16:10
GEM030298	LCS	976233	EPA 901.1	Cesium-137, Activity	102	% REC	1480	449	Water	7291		3/7/98 7:43	3/7/98 7:43
GEM030298	LCS	976233	EPA 901.1	Cobalt-60, Activity	101.2	% REC	1260	287	Water	7291		3/7/98 7:43	3/7/98 7:43
GEM030498	LCS	976233	EPA 901.1	Cesium-137, Activity	112.5	% REC	1540	425	Water	7291		3/8/98 4:54	3/8/98 4:54
GEM030498	LCS	976233	EPA 901.1	Cobalt-60, Activity	100	% REC	1650	307	Water	7291		3/8/98 4:54	3/8/98 4:54
GEM030598	LCS	976233	EPA 901.1	Cobalt-60, Activity	109.6	% REC	1810	288	Water	7291		3/8/98 19:01	3/8/98 19:01
GEM030598	LCS	976233	EPA 901.1	Cesium-137, Activity	102	% REC	1620	497	Water	7291		3/8/98 19:01	3/8/98 19:01
GEM030998	LCS	976233	EPA 901.1	Cesium-137, Activity	102	% REC	1380	465	Water	7291		3/9/98 16:12	3/9/98 16:12
GEM030998	LCS	976233	EPA 901.1	Cobalt-60, Activity	107.1	% REC	1870	246	Water	7291		3/9/98 16:12	3/9/98 16:12
GMX030298	LCS	976233	EPA 901.1	Cobalt-60, Activity	103.1	% REC	1400	274	Water	7291		3/7/98 0:39	3/7/98 0:39
GMX030298	LCS	976233	EPA 901.1	Cesium-137, Activity	103	% REC	1260	329	Water	7291		3/7/98 0:39	3/7/98 0:39
GMX030398	LCS	976233	EPA 901.1	Cesium-137, Activity	99	% REC	1260	310	Water	7291		3/7/98 14:46	3/7/98 14:46
GMX030398	LCS	976233	EPA 901.1	Cobalt-60, Activity	98.5	% REC	1280	236	Water	7291		3/7/98 14:46	3/7/98 14:46
GMX030498	LCS	976233	EPA 901.1	Cesium-137, Activity	101.5	% REC	1130	326	Water	7291		3/7/98 21:50	3/7/98 21:50
GMX030498	LCS	976233	EPA 901.1	Cobalt-60, Activity	100.9	% REC	1180	273	Water	7291		3/7/98 21:50	3/7/98 21:50
GMX030598	LCS	976233	EPA 901.1	Cobalt-60, Activity	101.9	% REC	1420	229	Water	7291		3/8/98 11:57	3/8/98 11:57
GMX030598	LCS	976233	EPA 901.1	Cesium-137, Activity	100.5	% REC	1010	312	Water	7291		3/8/98 11:57	3/8/98 11:57
GMX030698	LCS	976233	EPA 901.1	Cesium-137, Activity	103	% REC	1040	319	Water	7291		3/9/98 2:05	3/9/98 2:05
GMX030698	LCS	976233	EPA 901.1	Cobalt-60, Activity	100.3	% REC	1180	218	Water	7291		3/9/98 2:05	3/9/98 2:05
GMX030998	LCS	976233	EPA 901.1	Cobalt-60, Activity	101.5	% REC	1180	192	Water	7291		3/9/98 9:08	3/9/98 9:08
GMX030998	LCS	976233	EPA 901.1	Cesium-137, Activity	105.5	% REC	1240	320	Water	7291		3/9/98 9:08	3/9/98 9:08
LC1PM0330	LCS	976233	mod. HASL 300	Promethium 147	101.9	% REC			Water	7623		3/31/98 11:30	3/31/98 11:30
LCS1A0126	LCS	976233	EPA 900.0	Gross Alpha, Activity	99.2	% REC	0.5	0.1	Water	6791		1/29/98 16:10	1/29/98 16:10
LCS1B0126	LCS	976233	EPA 900.0	Gross Beta, Activity	97.8	% REC	0.4	0.3	Water	6791		1/29/98 16:10	1/29/98 16:10
LCS1PU0126	LCS	976233	mod. HASL 300	Plutonium-239/240	93.8	% REC	0.8	0.1	Water	6987		2/12/98 8:48	2/12/98 8:48
LCS1U0123	LCS	976233	mod. HASL 300	Uranium-233/234, Activity	94.4	% REC	1	0.2	Water	6929		2/6/98 15:39	2/6/98 15:39
LCS1U0123	LCS	976233	mod. HASL 300	Uranium-238, Activity	98	% REC	1	0.1	Water	6929		2/6/98 15:39	2/6/98 15:39
LCS2A0126	LCS	976233	EPA 900.0	Gross Alpha, Activity	82	% REC	0.5	0.1	Water	6791		1/29/98 16:10	1/29/98 16:10
LCS2B0126	LCS	976233	EPA 900.0	Gross Beta, Activity	101.7	% REC	0.4	0.3	Water	6791		1/29/98 16:10	1/29/98 16:10
LCS2TH0126	LCS	976233	mod. HASL 300	Thorium-232, Activity	95.6	% REC	1.3	0.2	Water	7014		2/12/98 11:17	2/12/98 11:17
MB1PB0330	MB	976233	mod. HASL 300	Promethium 147	ND	pCi/L			Water	7623		3/31/98 9:36	3/31/98 9:36
MB1PU0126	MB	976233	mod. HASL 300	Plutonium-239/240	0.2	pCi/L	0.1	0.1	Water	6987		2/12/98 8:48	2/12/98 8:48
MB1U0123	MB	976233	mod. HASL 300	Uranium-233/234, Activity	0.2	pCi/L	0.1	0.1	Water	6929		2/6/98 15:39	2/6/98 15:39

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	BATCH	RCVD DATE	EXTRACT DATE	ANALYZED DATE
MB1U0123	MB	976233	mod. HASL 300	Uranium-238, Activity	ND	pCi/L	0.1	0.1	Water	6929		2/6/98 15:39	2/6/98 15:39
MB1U0123	MB	976233	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water	6929		2/6/98 15:39	2/6/98 15:39
MB2AB0126	MB	976233	EPA 900.0	Gross Beta, Activity	0.4	pCi/L	0.2	0.3	Water	6791		1/29/98 16:10	1/29/98 16:10
MB2AB0126	MB	976233	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	0.1	0.1	Water	6791		1/29/98 16:10	1/29/98 16:10
MB2MB0330	MB	976233	mod. HASL 300	Promethium 147	0.3	pCi/L			Water	7623		3/31/98 10:14	3/31/98 10:14
MB2R60218	MB	976233	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.1	0.3	Water	7073		2/19/98 7:04	2/19/98 7:04
MB2R60218	MB	976233	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	7073		2/19/98 7:04	2/19/98 7:04
MB2TH0126	MB	976233	mod. HASL 300	Thorium-227	ND	pCi/L	0 1	0.2	Water	7014		2/12/98 11:17	2/12/98 11:17
MB2TH0126	MB	976233	mod. HASL 300	Thorium-230, Activity	0.4	pCi/L	0.3	0.2	Water	7014		2/12/98 11:17	2/12/98 11:17
MB2TH0126	MB	976233	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water	7014		2/12/98 11:17	2/12/98 11:17
ST1PM0330	LCS	976233	mod. HASL 300	Promethium 147	98.1	% REC			Water	7623		3/31/98 10:52	3/31/98 10:52
ST1R60218	LCS	976233	EPA 903.0	Radium-226, Activity	75.2	% REC	0.5	0.3	Water	7073		2/19/98 7:04	2/19/98 7:04
ST1R60218	LCS	976233	EPA 903.0	Radium-223, Activity	75.2	% REC			Water	7073		2/19/98 7:04	2/19/98 7:04

CORE LAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

April 24, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976235

The following information is pertinent to the interpretation of the data.

On November 13, 1997, Core Laboratories - Casper received eleven soil samples in good condition.

The tracer recovery for samples 12452 and 12453 were low for isotopic thorium. The samples were successfully reanalyzed at a reduced volume.

For the Th-227 results that are reported as C.N., there is no evidence that there is any Th-227 in those samples as there is no Ra-223, the daughter of Th-227, present in the samples.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error is calculated by the software for the positive results. The Ra226 activity by gamma is not reported using the 186kev line since Ra226 has a low abundance at that line and the U235 has a greater abundance with an energy very close to 186 which would cause interference. Therefore, the Ra226 is calculated from the Bi214 line, a daughter of Ra226. The Ra228 is calculated from the Ac228 line, the daughter of Ra228, as Ra228 is a beta emitter.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Rondalynn Mull
Radiochemistry Supervisor

Cooler #104

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION		PROJECT INFORMATION		
Company..:	Parsons	Project..:	SEAD-12	# ABC-012122
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	Page 1 Of 1
	101 Huntington Ave.	Address..:	101 Huntington Ave.	File = 11129706.bar
	Boston MA, 02199		Boston MA 02199	LAB JOB NUMBER
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	976235

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
ABS	11/11/97	1300	10203	12534	SED-1A	OVER-FOR-PARAM-KEY	
ABS	11/11/97	1245	10202	12209	SED-1A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 901952991524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MFLS/CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

Cooler # 104

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012112
Company..: Parsons	Project..: SEAD-12	Page 1 Of 2
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 11129703.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976235
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	11/09/97	1100	10087	12447 ✓	SED-1B	OVER-FOR-PARAM-KEY	
KKS	11/09/97	1150	10080	12448 ✓	SED-1B	OVER-FOR-PARAM-KEY	
BJP	11/10/97	1220	10051	12449 ✓	SED-1B	OVER-FOR-PARAM-KEY	
KKS	11/09/97	1500	10065	12451 ✓	SED-1A	OVER-FOR-PARAM-KEY	
NAS	11/10/97	1010	10058	12452 ✓	SED-1A	OVER-FOR-PARAM-KEY	
BJP	11/10/97	1400	10044	12453 ✓	SED-1B	OVER-FOR-PARAM-KEY	
BJP	11/10/97	1530	10037	12454 ✓	SED-1B	OVER-FOR-PARAM-KEY	
ABS	11/10/97	1055	10212	12532 ✓	SED-1A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801 952 781 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MLS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094	[ ] Corpus Christi, TX (512) 289-2673	[ ] Houston, TX (Pet) (713) 943-9776	[ ] Long Beach, CA (310) 595-8401
[ ] Aurora, CO (303) 751-1780	[ ] Edison, NJ (908) 225-6700	[ ] Indianapolis, IN (317) 875-5894	[ ] Tampa, FL (813) 884-8268
[X] Casper, WY (307) 235-5741	[ ] Houston, TX (Env) (713) 690-4444	[ ] Lake Charles, LA (318) 583-4926	[ ] Valparaiso, IN (219) 464-2389

C2P

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION
Company..: Parsons	Project..: SEAD-12
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau
101 Huntington Ave.	Address..: 101 Huntington Ave.
Boston MA, 02199	Boston MA 02199
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043

 # ABC-012113

Page 2 **Of** 2

File = 11129703.bar

LAB JOB NUMBER

976235

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
ABS	11/10/97	1215	10211	12533	SED-1A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex

AIRBILL NO.: 801 952 981524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ____________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Maffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Maffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MFLS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES	SAMPLE		ANALYSIS								EXTRACT	ANALYZED
SAMP ID	TYPE	SDG	METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	DATE	DATE
12209	SA1	976235	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12209	SA1	976235	mod. HASL 300	Thorium-232, Activity	1.1	pCi/g	0.5	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12209	SA1	976235	mod. HASL 300	Thorium-230, Activity	1.1	pCi/g	0.6	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12209	SA1	976235	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12209	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	18.4	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12209	SA1	976235	EPA 901.1	Radium-228, Activity	1.7	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12209	SA1	976235	EPA 901.1	Bismuth-214, Activity	1.9	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12209	SA1	976235	EPA 901.1	Radium-226, Activity	1.9	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12209	SA1	976235	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12209	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	1	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12209	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12209	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12209	SA1	976235	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12209	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12209	SA1	976235	EPA 901.1	Lead-214, Activity	1.7	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12209	SA1	976235	EPA 901.1	Radium-223, Activity	1.5	pCi/g	0.7	0.4	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12209	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.9	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12209	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		3.3	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12209	SA1	976235	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12209	MS	976235	CA-GLR-17.0	Tritium, Activity	84.9	% REC	244	289	Soil		2/10/98 13:45	2/10/98 13:45
12209	MS	976235	mod. HASL 300	Plutonium-239/240	118.8	% REC	0.9	0.1	Soil		2/23/98 16:16	2/23/98 16:16
12425	MD	976192	mod. HASL 300	Thorium-227	0	RPD			Soil		3/23/98 15:00	3/23/98 15:00
12425	MD	976192	mod. HASL 300	Thorium-232, Activity	26.1	RPD	0.7	0.5	Soil		3/23/98 15:00	3/23/98 15:00
12425	MD	976192	mod. HASL 300	Thorium-230, Activity	0.9	RPD	0.7	1	Soil		3/23/98 15:00	3/23/98 15:00
12436	MS	976192	mod. HASL 300	Thorium-227		% REC			Soil		3/23/98 15:00	3/23/98 15:00
12436	MS	976192	mod. HASL 300	Thorium-230, Activity	77.5	% REC	1.4	0.5	Soil		3/23/98 15:00	3/23/98 15:00
12447	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.4	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12447	SA1	976235	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12447	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12447	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	60.5	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12447	SA1	976235	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12447	SA1	976235	EPA 901.1	Radium-228, Activity	1.6	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12447	SA1	976235	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12447	SA1	976235	mod. HASL 300	Thorium-232, Activity	1.4	pCi/g	0.7	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12447	SA1	976235	mod. HASL 300	Thorium-230, Activity	0.9	pCi/g	0.5	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12447	SA1	976235	mod. HASL 300	Thorium-227	0.1	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12447	SA1	976235	EPA 901.1	Radium-226, Activity	2	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12447	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12447	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12447	SA1	976235	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12447	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		28.4	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12447	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		10.2	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12447	SA1	976235	EPA 901.1	Lead-214, Activity	2	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12447	SA1	976235	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12447	SA1	976235	EPA 901.1	Bismuth-214, Activity	2	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/18/98 15:29	3/18/98 15:29
12447	SA1	976235	mod. HASL 300	Promethium 147	13.5	pCi/g	5.3	8.5	SEDIMENT	11/13/97 9:00	4/7/98 6:35	4/7/98 6:35
12447	MD	976235	mod. HASL 300	Thorium-232, Activity	0	RPD	0.8	0.3	Soil		2/20/98 8:37	2/20/98 8:37
12447	MD	976235	mod. HASL 300	Thorium-227	0	RPD	0.2	0.3	Soil		2/20/98 8:37	2/20/98 8:37
12447	MD	976235	mod. HASL 300	Thorium-230, Activity	50	RPD	0.9	0.5	Soil		2/20/98 8:37	2/20/98 8:37
12448	SA1	976235	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12448	SA1	976235	mod. HASL 300	Thorium-232, Activity	1	pCi/g	0.6	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12448	SA1	976235	mod. HASL 300	Thorium-230, Activity	1.2	pCi/g	0.7	0.4	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12448	SA1	976235	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12448	SA1	976235	mod. HASL 300	Thorium-227	0.1	pCi/g	0.2	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12448	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	48.4	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12448	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.5	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12448	SA1	976235	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12448	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12448	SA1	976235	EPA 901.1	Radium-228, Activity	1.9	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12448	SA1	976235	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.4	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12448	SA1	976235	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.4	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12448	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12448	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12448	SA1	976235	EPA 901.1	Cesium-137, Activity	0.6	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12448	SA1	976235	mod. HASL 300	Promethium 147	15.8	pCi/g	5.3	8.5	SEDIMENT	11/13/97 9:00	4/7/98 6:35	4/7/98 6:35
12448	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		4.6	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12448	SA1	976235	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12448	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		2.5	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12448	SA1	976235	EPA 901.1	Lead-214, Activity	2.1	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12448	MS	976235	mod. HASL 300	Promethium 147	105.2	% REC	10.4	8.5	Soil		4/7/98 6:35	4/7/98 6:35
12448	MS	976235	mod. HASL 300	Thorium-232, Activity	80	% REC	1.5	0.3	Soil		2/20/98 8:37	2/20/98 8:37
12449	SA1	976235	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12449	SA1	976235	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12449	SA1	976235	mod. HASL 300	Thorium-230, Activity	0.7	pCi/g	0.4	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12449	SA1	976235	mod. HASL 300	Thorium-232, Activity	1	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12449	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12449	SA1	976235	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12449	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12449	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	54.5	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12449	SA1	976235	EPA 901.1	Radium-228, Activity	2.3	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12449	SA1	976235	EPA 901.1	Bismuth-214, Activity	1.8	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12449	SA1	976235	EPA 901.1	Radium-226, Activity	1.8	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12449	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12449	SA1	976235	mod. HASL 300	Thorium-227	0.1	pCi/g	0.2	0.4	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12449	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12449	SA1	976235	mod. HASL 300	Promethium 147	12	pCi/g	5.3	8.5	SEDIMENT	11/13/97 9:00	4/7/98 6:35	4/7/98 6:35

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12449	SA1	976235	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.4	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12449	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		27.1	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12449	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		5.5	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12449	SA1	976235	EPA 901.1	Lead-214, Activity	1.7	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12449	SA1	976235	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/19/98 7:47	3/19/98 7:47
12449	MD	976235	mod. HASL 300	Uranium-235, Activity	0	RPD	0.1	0.1	Soil		2/20/98 13:46	2/20/98 13:46
12449	MD	976235	mod. HASL 300	Uranium-234, Activity	25	RPD	0.3	0.2	Soil		2/20/98 13:46	2/20/98 13:46
12449	MD	976235	mod. HASL 300	Uranium-238, Activity	15.4	RPD	0.3	0.1	Soil		2/20/98 13:46	2/20/98 13:46
12449	MD	976235	mod. HASL 300	Uranium-233/234, Activity	25	RPD	0.3	0.2	Soil		2/20/98 13:46	2/20/98 13:46
12451	SA1	976235	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.6	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12451	SA1	976235	mod. HASL 300	Thorium-230, Activity	0.6	pCi/g	0.5	0.4	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12451	SA1	976235	mod. HASL 300	Thorium-227	ND	pCi/g	0.2	0.4	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12451	SA1	976235	EPA 901.1	Radium-226, Activity	1.8	pCi/g	0.6	0.2	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12451	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12451	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12451	SA1	976235	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12451	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12451	SA1	976235	EPA 901.1	Cesium-137, Activity	ND	pCi/g		1.2	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12451	SA1	976235	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12451	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12451	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	32.2	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12451	SA1	976235	EPA 901.1	Radium-228, Activity	2.6	pCi/g	0.6	0.1	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12451	SA1	976235	EPA 901.1	Bismuth-214, Activity	1.8	pCi/g	0.6	0.2	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12451	SA1	976235	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12451	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		4	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12451	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		6.5	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12451	SA1	976235	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12451	SA1	976235	EPA 901.1	Lead-214, Activity	2.1	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12451	MS	976235	mod. HASL 300	Uranium-234, Activity	88.9	% REC	1	0.2	Soil		2/20/98 13:46	2/20/98 13:46
12451	MS	976235	mod. HASL 300	Uranium-238, Activity	94	% REC	1	0.1	Soil		2/20/98 13:46	2/20/98 13:46
12451	MS	976235	mod. HASL 300	Uranium-233/234, Activity	88.9	% REC	1	0.2	Soil		2/20/98 13:46	2/20/98 13:46
12452	SA1	976235	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12452	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.9	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12452	SA1	976235	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12452	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/g	0.3	0.2	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12452	SA1	976235	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12452	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	37.2	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12452	SA1	976235	EPA 901.1	Lead-214, Activity	1.4	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12452	SA1	976235	EPA 901.1	Radium-228, Activity	2.1	pCi/g	0.5	0.1	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12452	SA1	976235	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.7	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12452	SA1	976235	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.7	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12452	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12452	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12452	SA1	976235	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.7	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12452	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		22.7	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12452	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		5.9	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12452	SA1	976235	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/19/98 8:51	3/19/98 8:51
12452	SA1	976235	mod. HASL 300	Thorium-232, Activity	0.4	pCi/g	0.4	0.6	SEDIMENT	11/13/97 9:00	3/23/98 15:00	3/23/98 15:00
12452	SA1	976235	mod. HASL 300	Thorium-227	C.N	pCi/g			SEDIMENT	11/13/97 9:00	3/23/98 15:00	3/23/98 15:00
12452	SA1	976235	mod. HASL 300	Thorium-230, Activity	1.6	pCi/g	1	0.8	SEDIMENT	11/13/97 9:00	3/23/98 15:00	3/23/98 15:00
12453	SA1	976235	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12453	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12453	SA1	976235	mod. HASL 300	Uranium-235, Activity	0.2	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12453	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/g	0.3	0.2	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12453	SA1	976235	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12453	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	26.5	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12453	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		12.3	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12453	SA1	976235	mod. HASL 300	Promethium 147	7	pCi/g	5.2	8.5	SEDIMENT	11/13/97 9:00	4/7/98 6:35	4/7/98 6:35
12453	SA1	976235	EPA 901.1	Radium-228, Activity	ND	pCi/g		2.4	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12453	SA1	976235	EPA 901.1	Bismuth-214, Activity	2	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12453	SA1	976235	EPA 901.1	Radium-226, Activity	2	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12453	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12453	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12453	SA1	976235	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12453	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		6.1	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12453	SA1	976235	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12453	SA1	976235	EPA 901.1	Lead-214, Activity	ND	pCi/g		0.4	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12453	SA1	976235	mod. HASL 300	Thorium-232, Activity	1.7	pCi/g	1	0.7	SEDIMENT	11/13/97 9:00	3/23/98 15:00	3/23/98 15:00
12453	SA1	976235	mod. HASL 300	Thorium-227	C.N	pCi/g			SEDIMENT	11/13/97 9:00	3/23/98 15:00	3/23/98 15:00
12453	SA1	976235	mod. HASL 300	Thorium-230, Activity	0.9	pCi/g	0.8	1	SEDIMENT	11/13/97 9:00	3/23/98 15:00	3/23/98 15:00
12454	SA1	976235	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12454	SA1	976235	mod. HASL 300	Thorium-232, Activity	1.3	pCi/g	0.7	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12454	SA1	976235	mod. HASL 300	Thorium-230, Activity	1.4	pCi/g	0.8	0.4	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12454	SA1	976235	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12454	SA1	976235	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.4	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12454	SA1	976235	mod. HASL 300	Promethium 147	11.6	pCi/g	5.3	8.5	SEDIMENT	11/13/97 9:00	4/7/98 6:35	4/7/98 6:35
12454	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12454	SA1	976235	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12454	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/g	0.2	0.2	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12454	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	67.3	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12454	SA1	976235	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12454	SA1	976235	EPA 901.1	Radium-228, Activity	2	pCi/g	0.7	0.2	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12454	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		18.1	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12454	SA1	976235	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		2.2	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12454	SA1	976235	EPA 901.1	Radium-226, Activity	ND	pCi/g		2.2	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12454	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		12.5	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12454	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12454	SA1	976235	EPA 901.1	Lead-214, Activity	1.9	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12454	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12454	SA1	976235	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.6	SEDIMENT	11/13/97 9:00	3/19/98 10:22	3/19/98 10:22
12454	MD	976235	mod. HASL 300	Promethium 147	1.2	RPD	5.2	8.5	Soil		4/7/98 6:35	4/7/98 6:35
12460	MD	976237	EPA 901.1	Lead-210, Activity	0	RPD		8.5	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Lead-211, Activity	0	RPD		7.6	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Lead-214, Activity	13.3	RPD	0.3	0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Radium-226, Activity	0	RPD	0.3	0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Radium-223, Activity	0	RPD		0.4	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Cobalt-57, Activity	0	RPD		0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Cobalt-60, Activity	0	RPD		0.2	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Cesium-137, Activity	0.2	RPD	0.1	0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Bismuth-214, Activity	0	RPD	0.3	0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Radium-228, Activity	20	RPD	0.5	0.1	Soil		3/19/98 15:39	3/19/98 15:39
12532	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.8	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12532	SA1	976235	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12532	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12532	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	13.4	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12532	SA1	976235	EPA 901.1	Radium-228, Activity	1.6	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12532	SA1	976235	EPA 901.1	Bismuth-214, Activity	2.4	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12532	SA1	976235	EPA 901.1	Radium-226, Activity	2.4	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12532	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12532	SA1	976235	mod. HASL 300	Thorium-227	0.1	pCi/g	0.2	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12532	SA1	976235	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12532	SA1	976235	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12532	SA1	976235	EPA 901.1	Lead-214, Activity	3	pCi/g	0.5	0.1	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12532	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12532	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		2	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12532	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		2.9	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12532	SA1	976235	mod. HASL 300	Thorium-230, Activity	1.7	pCi/g	0.9	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12532	SA1	976235	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12532	SA1	976235	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12532	SA1	976235	mod. HASL 300	Thorium-232, Activity	0.5	pCi/g	0.4	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12533	SA1	976235	mod. HASL 300	Plutonium-239/240	0.2	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12533	SA1	976235	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12533	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12533	SA1	976235	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12533	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12533	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	10.8	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12533	SA1	976235	EPA 901.1	Radium-228, Activity	1.6	pCi/g	0.5	0.1	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12533	SA1	976235	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.5	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12533	SA1	976235	mod. HASL 300	Thorium-232, Activity	1.1	pCi/g	0.7	0.4	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12533	SA1	976235	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.5	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12533	SA1	976235	mod. HASL 300	Thorium-230, Activity	0.6	pCi/g	0.6	0.6	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12533	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12533	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12533	SA1	976235	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12533	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		40.8	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12533	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		5.4	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12533	SA1	976235	EPA 901.1	Lead-214, Activity	1.1	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12533	SA1	976235	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/19/98 11:32	3/19/98 11:32
12533	SA1	976235	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12534	SA1	976235	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/23/98 16:16	2/23/98 16:16
12534	SA1	976235	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.4	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12534	SA1	976235	mod. HASL 300	Thorium-230, Activity	0.8	pCi/g	0.4	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12534	SA1	976235	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.3	SEDIMENT	11/13/97 9:00	2/20/98 8:37	2/20/98 8:37
12534	SA1	976235	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12534	SA1	976235	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12534	SA1	976235	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/20/98 13:46	2/20/98 13:46
12534	SA1	976235	CA-GLR-R160	Moisture (@ 104 deg. C)	17.6	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12534	SA1	976235	CA-GLR-17.0	Tritium, Activity	0.3	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/10/98 13:45	2/10/98 13:45
12534	SA1	976235	EPA 901.1	Radium-228, Activity	1.2	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/18/98 14:14	3/18/98 14:14
12534	SA1	976235	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/13/97 9:00	3/18/98 14:14	3/18/98 14:14
12534	SA1	976235	EPA 901.1	Bismuth-214, Activity	1.7	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/18/98 14:14	3/18/98 14:14
12534	SA1	976235	EPA 901.1	Radium-226, Activity	1.7	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/18/98 14:14	3/18/98 14:14
12534	SA1	976235	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/18/98 14:14	3/18/98 14:14
12534	SA1	976235	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/18/98 14:14	3/18/98 14:14
12534	SA1	976235	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.7	SEDIMENT	11/13/97 9:00	3/18/98 14:14	3/18/98 14:14
12534	SA1	976235	EPA 901.1	Lead-210, Activity	ND	pCi/g		3.9	SEDIMENT	11/13/97 9:00	3/18/98 14:14	3/18/98 14:14
12534	SA1	976235	EPA 901.1	Lead-211, Activity	ND	pCi/g		10.8	SEDIMENT	11/13/97 9:00	3/18/98 14:14	3/18/98 14:14
12534	SA1	976235	EPA 901.1	Lead-214, Activity	1.4	pCi/g	0.3	0.2	SEDIMENT	11/13/97 9:00	3/18/98 14:14	3/18/98 14:14
12534	MD	976235	CA-GLR-17.0	Tritium, Activity	420	RPD	308	490	Soil		2/10/98 13:45	2/10/98 13:45
12534	MD	976235	mod. HASL 300	Plutonium-239/240	0.1	RPD	0.1	0.1	Soil		2/23/98 16:16	2/23/98 16:16
GEM031898S	LCS	976235	EPA 901.1	Cesium-137, Activity	102.9	% REC	1160	324	Water		3/18/98 7:26	3/18/98 7:26
GEM031898S	LCS	976235	EPA 901.1	Cobalt-60, Activity	100.3	% REC	1820	279	Water		3/18/98 7:26	3/18/98 7:26
GEM031998S	LCS	976235	EPA 901.1	Cobalt-60, Activity	106	% REC	1730	274	Water		3/19/98 7:26	3/19/98 7:26
GEM031998S	LCS	976235	EPA 901.1	Cesium-137, Activity	102.9	% REC	2310	404	Water		3/19/98 7:26	3/19/98 7:26
GMX031898S	LCS	976235	EPA 901.1	Cesium-137, Activity	107.3	% REC	907	250	Water		3/18/98 7:13	3/18/98 7:13
GMX031898S	LCS	976235	EPA 901.1	Cobalt-60, Activity	101.2	% REC	1180	237	Water		3/18/98 7:13	3/18/98 7:13
GMX031998S	LCS	976235	EPA 901.1	Cesium-137, Activity	102.9	% REC	862	231	Water		3/19/98 7:14	3/19/98 7:14
GMX031998S	LCS	976235	EPA 901.1	Cobalt-60, Activity	102.7	% REC	1220	254	Water		3/19/98 7:14	3/19/98 7:14
LC1H30210	LCS	976235	CA-GLR-17.0	Tritium, Activity	96.5	% REC	2.4	2.8	Water		2/10/98 13:45	2/10/98 13:45
LCAPM0303	LCS	976235	mod. HASL 300	Promethium 147	104.3	% REC	5.1	4.3	Water		4/7/98 6:35	4/7/98 6:35
LCSAPU0217	LCS	976235	mod. HASL 300	Plutonium-239/240	93.8	% REC	0.7	0.1	Water		2/23/98 16:16	2/23/98 16:16
LCSAT0217	LCS	976235	mod. HASL 300	Thorium-232, Activity	117.1	% REC	1	0.1	Water		2/20/98 8:37	2/20/98 8:37

PARSONS ES SAMPLE SAMP ID	TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
LCSAU0217	LCS	976235	mod. HASL 300	Uranium-233/234, Activity	85.2	% REC	1	0.1	Water		2/20/98 13:46	2/20/98 13:46
LCSAU0217	LCS	976235	mod. HASL 300	Uranium-234, Activity	85.2	% REC	1	0.1	Water		2/20/98 13:46	2/20/98 13:46
LCSAU0217	LCS	976235	mod. HASL 300	Uranium-238, Activity	108	% REC	1.1	0.1	Water		2/20/98 13:46	2/20/98 13:46
LCSCT0319	LCS	976235	mod. HASL 300	Thorium-227		% REC			Water		3/23/98 15:00	3/23/98 15:00
LCSCT0319	LCS	976235	mod. HASL 300	Thorium-230, Activity	90	% REC	0.4	0.2	Water		3/23/98 15:00	3/23/98 15:00
MB2H30210	MB	976235	CA-GLR-17.0	Tritium, Activity	0.3	pCi/L	1.6	2.7	Water		2/10/98 13:45	2/10/98 13:45
MBAPU0217	MB	976235	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.1	0.1	Water		2/23/98 16:16	2/23/98 16:16
MBAT0217	MB	976235	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.1	Water		2/20/98 8:37	2/20/98 8:37
MBAT0217	MB	976235	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.1	Water		2/20/98 8:37	2/20/98 8:37
MBAT0217	MB	976235	mod. HASL 300	Thorium-230, Activity	0.1	pCi/L	0.1	0.2	Water		2/20/98 8:37	2/20/98 8:37
MBAU0217	MB	976235	mod. HASL 300	Uranium-234, Activity	0.1	pCi/L	0.1	0.1	Water		2/20/98 13:46	2/20/98 13:46
MBAU0217	MB	976235	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water		2/20/98 13:46	2/20/98 13:46
MBAU0217	MB	976235	mod. HASL 300	Uranium-233/234, Activity	0.1	pCi/L	0.1	0.1	Water		2/20/98 13:46	2/20/98 13:46
MBAU0217	MB	976235	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.1	Water		2/20/98 13:46	2/20/98 13:46
MBBPM0303	MB	976235	mod. HASL 300	Promethium 147	ND	pCi/L	2.5	4.3	Water		4/7/98 6:35	4/7/98 6:35
MBCT0319	MB	976235	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.1	Water		3/23/98 15:00	3/23/98 15:00
MBCT0319	MB	976235	mod. HASL 300	Thorium-227	C.N	pCi/L			Water		3/23/98 15:00	3/23/98 15:00
MBCT0319	MB	976235	mod. HASL 300	Thorium-230, Activity	0.1	pCi/L	0.1	0.1	Water		3/23/98 15:00	3/23/98 15:00
ST1H30210	LCS	976235	CA-GLR-17.0	Tritium, Activity	102.5	% REC	2.4	2.8	Water		2/10/98 13:45	2/10/98 13:45

CORELAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

March 17, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976236

The following information is pertinent to the interpretation of the data.

On November 13, 1997, Core Laboratories - Casper received five water samples in good condition.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error is calculated by the software for the positive results. The Ra226 activity by gamma is not reported using the 186kev line since Ra226 has a low abundance at that line and the U235 has a greater abundance with an energy very close to 186 which would cause interference. Therefore, the Ra226 is calculated form the Bi214 line, a daughter of Ra226. The Ra228 is calculated from the Ac228 line, the daughter of Ra228, as Ra228 is a beta emitter. Pb211 has high MDAs due to short half-life, 36.1 minutes, and low abundance gamma lines, 3.83% and 3.81%.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Radiochemistry Supervisor

Cooler #106

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012117
Company..: Parsons	Project..: SEAD-12	Page 1 Of 5
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 11129705.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976236
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
BJP	11/11/97	1405	10107	12210 ✓	LIQUID-1	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1405	10106	12210 ✓	LIQUID-2A	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1405	10105	12210 ✓	H3	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1405	10104	12210 ✓	RN222	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1405	10103	12210 ✓	RN222	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1405	10102	12210 ✓	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1400	10114	12059 ✓	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1400	10113	12059 ✓	LIQUID-2A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex   AIRBILL NO.: 801 952 901 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: A. Maffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Maffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MELS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094	[ ] Corpus Christi, TX (512) 289-2673	[ ] Houston, TX (Pet) (713) 943-9776	[ ] Long Beach, CA (310) 595-8401
[ ] Aurora, CO (303) 751-1780	[ ] Edison, NJ (908) 225-6700	[ ] Indianapolis, IN (317) 875-5894	[ ] Tampa, FL (813) 884-8268
[X] Casper, WY (307) 235-5741	[ ] Houston, TX (Env) (713) 690-4444	[ ] Lake Charles, LA (318) 583-4926	[ ] Valparaiso, IN (219) 464-2389

« « « CORE LABORATORIES - CHAIN OF CUSTODY RECORD » » »

CUSTOMER INFORMATION		PROJECT INFORMATION		# ABC-012118
Company..:	Parsons	Project..:	SEAD-12	Page 2 Of 5
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	File = 11129705.bar
	101 Huntington Ave.	Address..:	101 Huntington Ave.	LAB JOB NUMBER
	Boston MA, 02199		Boston MA 02199	976236
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	11/11/97	1400	10112	12059-	H3	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1400	10111	12059-	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1400	10110	12059-	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1400	10109	12059-	RN222	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1500	10008	12060-	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1500	10007	12060-	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1500	10006	12060-	H3	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1500	10005	12060-	RN222	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801 952 981 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ **. RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MLS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

« « « CORE LABORATORIES - CHAIN OF CUSTODY RECORD » » »

CUSTOMER INFORMATION		PROJECT INFORMATION		
Company..:	Parsons	Project..:	SEAD-12	# ABC-012119
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	Page 3 Of 5
	101 Huntington Ave.	Address..:	101 Huntington Ave.	File = 11129705.bar
	Boston MA, 02199		Boston MA 02199	LAB JOB NUMBER 976236
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	11/11/97	1500	10004	12060	RN222	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1500	10003	12060	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1530	10143	12061	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1530	10142	12061	LIQUID-2A	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1530	10141	12061	H3	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1530	10140	12061	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1530	10139	12061	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1530	10138	12061	RN222	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801 952 981 527

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	RECEIVED BY:	Date	RECEIVED BY:	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MLS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company..:	Parsons	Project..:	SEAD-12
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau
	101 Huntington Ave.	Address..:	101 Huntington Ave.
	Boston MA, 02199		Boston MA 02199
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043

ABC-012120

Page 4 Of 5

File = 11129705.bar

LAB JOB NUMBER

97623C

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	11/11/97	1630	10149	12062	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1630	10148	12062	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1630	10147	12062	H3	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1630	10146	12062	RN222	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1630	10145	12062	RN222	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1630	10144	12062	RN222	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1430	10108	12459	SED-1A	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1510	10101	12460	SED-1A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801 952 981 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: O. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: O. Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MEL-S / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12047	MS	976233	mod. HASL 300	Thorium-232	118	% REC	4.5	0.6	Water		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-230	0.4	RPD	0.5	0.4	Water		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-232	0	RPD	0.1	0.4	Water		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-227	0.3	RPD	0.4	0.6	Water		2/12/98 11:17	2/12/98 11:17
12050	MS	976233	EPA 900.0	Gross Alpha, Activity	89.7	% REC	3.5	1.3	Water		1/29/98 16:10	1/29/98 16:10
12051	MD	976238	EPA 900.0	Gross Alpha, Activity	0.3	RPD	1	1.6	Water		1/29/98 16:10	1/29/98 16:10
12051	MD	976238	EPA 900.0	Gross Beta, Activity	48.6	RPD	1.9	2.4	Water		1/29/98 16:10	1/29/98 16:10
12053	MD	976238	mod. HASL 300	Plutonium-239/240	0.4	RPD	0.4	0.5	Water		2/12/98 8:48	2/12/98 8:48
12053	MD	976232	CA-GLR-R510	Radon 222, Activity	5.9	RPD	37.5	61.4	Water		11/14/97 5:05	11/14/97 5:05
12059	SA1	976236	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	1.8	3	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12059	SA1	976236	mod. HASL 300	Uranium-233/234, Activity	1.1	pCi/L	0.4	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12059	SA1	976236	mod. HASL 300	Uranium-235	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12059	SA1	976236	EPA 900.0	Gross Beta, Activity	10.6	pCi/L	2.1	3.2	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12059	SA1	976236	EPA 903.0	Radium-226, Activity	0.2	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12059	SA1	976236	EPA 901.1	Bismuth-214, Activity	ND	pCi/L		16.7	Water	11/13/97 9:00	3/13/98 8:22	3/13/98 8:22
12059	SA1	976236	EPA 903.0	Radium-223, Activity	0.2	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12059	SA1	976236	mod. HASL 300	Thorium-230	0.3	pCi/L	0.2	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12059	SA1	976236	CA-GLR-R510	Radon 222, Activity	55.4	pCi/L	32.9	53.6	Water	11/13/97 9:00	11/14/97 11:08	11/14/97 11:08
12059	SA1	976236	CA-GLR-17.0	Tritium	176	pCi/L	187	310	Water	11/13/97 9:00	12/2/97 18:19	12/2/97 18:19
12059	SA1	976236	mod. HASL 300	Uranium-238	0.6	pCi/L	0.3	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12059	SA1	976236	mod. HASL 300	Plutonium-239/240	0.3	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12059	SA1	976236	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12059	SA1	976236	mod. HASL 300	Thorium-232	0.1	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12059	SA1	976236	EPA 901.1	Lead-214, Activity	10.6	pCi/L	4.8	2.7	Water	11/13/97 9:00	3/13/98 8:22	3/13/98 8:22
12059	SA1	976236	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.3	Water	11/13/97 9:00	3/13/98 8:22	3/13/98 8:22
12059	SA1	976236	EPA 901.1	Lead-211, Activity	ND	pCi/L		273	Water	11/13/97 9:00	3/13/98 8:22	3/13/98 8:22
12059	SA1	976236	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		1.3	Water	11/13/97 9:00	3/13/98 8:22	3/13/98 8:22
12059	SA1	976236	EPA 901.1	Cesium-137, Activity	ND	pCi/L		0.5	Water	11/13/97 9:00	3/13/98 8:22	3/13/98 8:22
12060	SA1	976236	mod. HASL 300	Thorium-232	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12060	SA1	976236	mod. HASL 300	Thorium-230	ND	pCi/L	0.1	0.5	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12060	SA1	976236	EPA 900.0	Gross Alpha, Activity	2.2	pCi/L	1.7	2.7	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12060	SA1	976236	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12060	SA1	976236	EPA 900.0	Gross Beta, Activity	16	pCi/L	1.9	2.6	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12060	SA1	976236	mod. HASL 300	Uranium-238	0.5	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12060	SA1	976236	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12060	SA1	976236	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12060	SA1	976236	CA-GLR-R510	Radon 222, Activity	33	pCi/L	32.5	53.6	Water	11/13/97 9:00	11/14/97 12:09	11/14/97 12:09
12060	SA1	976236	CA-GLR-17.0	Tritium	149	pCi/L	179	296	Water	11/13/97 9:00	12/2/97 18:19	12/2/97 18:19
12060	SA1	976236	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12060	SA1	976236	EPA 901.1	Bismuth-214, Activity	33.7	pCi/L	11.1	4.3	Water	11/13/97 9:00	3/16/98 7:41	3/16/98 7:41
12060	SA1	976236	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		1	Water	11/13/97 9:00	3/16/98 7:41	3/16/98 7:41
12060	SA1	976236	mod. HASL 300	Uranium-235	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12060	SA1	976236	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		2.1	Water	11/13/97 9:00	3/16/98 7:41	3/16/98 7:41

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12060	SA1	976236	EPA 901.1	Lead-214, Activity	ND	pCi/L		22.1	Water	11/13/97 9:00	3/16/98 7:41	3/16/98 7:41
12060	SA1	976236	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/L	0.4	0.3	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12060	SA1	976236	EPA 901.1	Cesium-137, Activity	ND	pCi/L		7.3	Water	11/13/97 9:00	3/16/98 7:41	3/16/98 7:41
12060	SA1	976236	EPA 901.1	Lead-211, Activity	ND	pCi/L		29.3	Water	11/13/97 9:00	3/16/98 7:41	3/16/98 7:41
12061	SA1	976236	EPA 900.0	Gross Alpha, Activity	0.6	pCi/L	1.8	2.9	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12061	SA1	976236	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12061	SA1	976236	EPA 900.0	Gross Beta, Activity	6.1	pCi/L	1.6	2.4	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12061	SA1	976236	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12061	SA1	976236	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12061	SA1	976236	CA-GLR-R510	Radon 222, Activity	42.1	pCi/L	33.5	55	Water	11/13/97 9:00	11/14/97 16:11	11/14/97 16:11
12061	SA1	976236	CA-GLR-17.0	Tritium	85.6	pCi/L	174	291	Water	11/13/97 9:00	12/2/97 18:19	12/2/97 18:19
12061	SA1	976236	mod. HASL 300	Plutonium-239/240	0.4	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12061	SA1	976236	mod. HASL 300	Thorium-232	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12061	SA1	976236	mod. HASL 300	Thorium-230	0.2	pCi/L	0.3	0.4	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12061	SA1	976236	mod. HASL 300	Uranium-235	0.1	pCi/L	0.1	0.1	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12061	SA1	976236	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/L	0.4	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12061	SA1	976236	EPA 901.1	Bismuth-214, Activity	28.2	pCi/L	9.8	4.2	Water	11/13/97 9:00	3/16/98 7:50	3/16/98 7:50
12061	SA1	976236	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.8	Water	11/13/97 9:00	3/16/98 7:50	3/16/98 7:50
12061	SA1	976236	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		7.2	Water	11/13/97 9:00	3/16/98 7:50	3/16/98 7:50
12061	SA1	976236	EPA 901.1	Cesium-137, Activity	ND	pCi/L		5.1	Water	11/13/97 9:00	3/16/98 7:50	3/16/98 7:50
12061	SA1	976236	mod. HASL 300	Uranium-238	0.5	pCi/L	0.3	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12061	SA1	976236	EPA 901.1	Lead-211, Activity	ND	pCi/L		856	Water	11/13/97 9:00	3/16/98 7:50	3/16/98 7:50
12061	SA1	976236	EPA 901.1	Lead-214, Activity	ND	pCi/L		25.1	Water	11/13/97 9:00	3/16/98 7:50	3/16/98 7:50
12061	MD	976236	EPA 901.1	Cobalt-57, Activity	0	RPD		1.8	Water		3/16/98 16:33	3/16/98 16:33
12061	MD	976236	EPA 901.1	Cobalt-60, Activity	0	RPD		15.6	Water		3/16/98 16:33	3/16/98 16:33
12061	MD	976236	EPA 901.1	Bismuth-214, Activity	31.1	RPD	7.6	3.7	Water		3/16/98 16:33	3/16/98 16:33
12061	MD	976236	EPA 901.1	Cesium-137, Activity	0	RPD		1.1	Water		3/16/98 16:33	3/16/98 16:33
12061	MD	976236	EPA 901.1	Lead-214, Activity	15.3	RPD	6.4	4.1	Water		3/16/98 16:33	3/16/98 16:33
12061	MD	976236	EPA 901.1	Lead-211, Activity	0	RPD		13.4	Water		3/16/98 16:33	3/16/98 16:33
12062	SA1	976236	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	1.8	3.3	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12062	SA1	976236	EPA 900.0	Gross Beta, Activity	9.2	pCi/L	1.8	2.6	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12062	SA1	976236	EPA 903.0	Radium-226, Activity	0.1	pCi/L	0.2	0.3	Water	11/13/97 9:00	2/25/98 6:30	2/25/98 6:30
12062	SA1	976236	EPA 903.0	Radium-223, Activity	0.1	pCi/L			Water	11/13/97 9:00	2/25/98 6:30	2/25/98 6:30
12062	SA1	976236	CA-GLR-R510	Radon 222, Activity	106	pCi/L	33.7	53.4	Water	11/13/97 9:00	11/14/97 13:09	11/14/97 13:09
12062	SA1	976236	CA-GLR-17.0	Tritium	36	pCi/L	169	284	Water	11/13/97 9:00	12/2/97 18:19	12/2/97 18:19
12062	SA1	976236	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.2	0.3	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12062	SA1	976236	mod. HASL 300	Thorium-232	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12062	SA1	976236	mod. HASL 300	Thorium-230	0.5	pCi/L	0.4	0.4	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12062	SA1	976236	EPA 901.1	Lead-211, Activity	ND	pCi/L		10	Water	11/13/97 9:00	3/16/98 13:09	3/16/98 13:09
12062	SA1	976236	mod. HASL 300	Thorium-227	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12062	SA1	976236	EPA 901.1	Lead-214, Activity	7.7	pCi/L	3.4	2.5	Water	11/13/97 9:00	3/16/98 13:09	3/16/98 13:09
12062	SA1	976236	mod. HASL 300	Uranium-238	0.4	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12062	SA1	976236	mod. HASL 300	Uranium-235	0.3	pCi/L	0.2	0.1	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12062	SA1	976236	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/L	0.3	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12062	SA1	976236	EPA 901.1	Bismuth-214, Activity	ND	pCi/L		12.5	Water	11/13/97 9:00	3/16/98 13:09	3/16/98 13:09
12062	SA1	976236	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.5	Water	11/13/97 9:00	3/16/98 13:09	3/16/98 13:09
12062	SA1	976236	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		3.3	Water	11/13/97 9:00	3/16/98 13:09	3/16/98 13:09
12062	SA1	976236	EPA 901.1	Cesium-137, Activity	ND	pCi/L		7	Water	11/13/97 9:00	3/16/98 13:09	3/16/98 13:09
12062	MD	976236	mod. HASL 300	Uranium-233/234, Activity	0	RPD	0.4	0.5	Water		2/6/98 15:39	2/6/98 15:39
12062	MD	976236	mod. HASL 300	Uranium-238	0.1	RPD	0.4	0.3	Water		2/6/98 15:39	2/6/98 15:39
12062	MD	976236	mod. HASL 300	Uranium-235	0.3	RPD	0.1	0.3	Water		2/6/98 15:39	2/6/98 15:39
12062	MD	976236	EPA 903.0	Radium-226, Activity	0.3	RPD	0.3	0.7	Water		2/25/98 6:30	2/25/98 6:30
12062	MD	976236	EPA 903.0	Radium-223, Activity		RPD			Water		2/25/98 6:30	2/25/98 6:30
12062	MD	976236	CA-GLR-17.0	Tritium	13.5	RPD	168	281	Water		12/2/97 18:19	12/2/97 18:19
12062	MS	976236	mod. HASL 300	Plutonium-239/240	92.7	% REC	2.2	0.5	Water		2/12/98 8:48	2/12/98 8:48
12062	MS	976236	EPA 903.0	Radium-223, Activity	80.6	% REC			Water		2/25/98 6:30	2/25/98 6:30
12062	MS	976236	EPA 903.0	Radium-226, Activity	80.6	% REC	1.8	0.7	Water		2/25/98 6:30	2/25/98 6:30
12201	MS	976216	EPA 903.0	Radium-223, Activity	97.8	% REC			Water		2/19/98 7:04	2/19/98 7:04
12201	MS	976216	EPA 903.0	Radium-226, Activity	97.8	% REC	2.3	1.1	Water		2/19/98 7:04	2/19/98 7:04
12204	MD	976216	EPA 903.0	Radium-226, Activity	0	RPD	0.4	1.1	Water		2/19/98 7:04	2/19/98 7:04
12204	MD	976216	EPA 903.0	Radium-223, Activity	0	RPD			Water		2/19/98 7:04	2/19/98 7:04
12207	MS	976239	CA-GLR-17.0	Tritium	96.6	% REC	243	288	Water		12/2/97 18:19	12/2/97 18:19
12210	SA1	976236	EPA 901.1	Lead-214, Activity	10	pCi/L	3.1	1.7	Water	11/13/97 9:00	3/12/98 15:26	3/12/98 15:26
12210	SA1	976236	EPA 903.0	Radium-226, Activity	0.2	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12210	SA1	976236	EPA 903.0	Radium-223, Activity	0.2	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12210	SA1	976236	CA-GLR-R510	Radon 222, Activity	38.8	pCi/L	33.5	55.2	Water	11/13/97 9:00	11/14/97 15:10	11/14/97 15:10
12210	SA1	976236	CA-GLR-17.0	Tritium	81.1	pCi/L	174	290	Water	11/13/97 9:00	12/2/97 18:19	12/2/97 18:19
12210	SA1	976236	mod. HASL 300	Plutonium-239/240	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12210	SA1	976236	EPA 900.0	Gross Beta, Activity	6.1	pCi/L	1.8	2.8	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12210	SA1	976236	mod. HASL 300	Thorium-232	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12210	SA1	976236	EPA 900.0	Gross Alpha, Activity	1.1	pCi/L	1.8	3	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12210	SA1	976236	mod. HASL 300	Thorium-230	0.6	pCi/L	0.4	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12210	SA1	976236	EPA 901.1	Lead-211, Activity	ND	pCi/L		447	Water	11/13/97 9:00	3/12/98 15:26	3/12/98 15:26
12210	SA1	976236	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12210	SA1	976236	mod. HASL 300	Uranium-238	0.4	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12210	SA1	976236	mod. HASL 300	Uranium-235	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12210	SA1	976236	mod. HASL 300	Uranium-233/234, Activity	1.1	pCi/L	0.4	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12210	SA1	976236	EPA 901.1	Bismuth-214, Activity	16.7	pCi/L	4.2	2.7	Water	11/13/97 9:00	3/12/98 15:26	3/12/98 15:26
12210	SA1	976236	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.3	Water	11/13/97 9:00	3/12/98 15:26	3/12/98 15:26
12210	SA1	976236	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		5.6	Water	11/13/97 9:00	3/12/98 15:26	3/12/98 15:26
12210	SA1	976236	EPA 901.1	Cesium-137, Activity	ND	pCi/L		5.3	Water	11/13/97 9:00	3/12/98 15:26	3/12/98 15:26
12210	MS	976236	mod. HASL 300	Uranium-233/234, Activity	109.7	% REC	3.3	0.4	Water		2/6/98 15:39	2/6/98 15:39
12210	MS	976236	mod. HASL 300	Uranium-238	115.4	% REC	3.2	0.4	Water		2/6/98 15:39	2/6/98 15:39
12211-Associate	MS	976291	EPA 900.0	Gross Beta, Activity	98.4	% REC	0.9	0.6	Water		1/29/98 16:10	1/29/98 16:10
EFF2A0126	LCS	976236	EPA 900.0	Gross Alpha, Activity	85.1	% REC	0.5	0.1	Water		1/29/98 16:10	1/29/98 16:10
GEM031698W	LCS	976236	EPA 901.1	Cesium-137, Activity	103.5	% REC	1250	432	Water		3/16/98 7:32	3/16/98 7:32

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
GEM031698W	LCS	976236	EPA 901.1	Cobalt-60, Activity	100.3	% REC	1530	288	Water		3/16/98 7:32	3/16/98 7:32
GMX031198W	LCS	976236	EPA 901.1	Cesium-137, Activity	102	% REC	1160	333	Water		3/11/98 16:31	3/11/98 16:31
GMX031198W	LCS	976236	EPA 901.1	Cobalt-60, Activity	100.3	% REC	1180	250	Water		3/11/98 16:31	3/11/98 16:31
GMX031398W	LCS	976236	EPA 901.1	Cobalt-60, Activity	100.9	% REC	1220	225	Water		3/13/98 8:09	3/13/98 8:09
GMX031398W	LCS	976236	EPA 901.1	Cesium-137, Activity	102.5	% REC	1100	312	Water		3/13/98 8:09	3/13/98 8:09
GMX031698W	LCS	976236	EPA 901.1	Cobalt-60, Activity	101.2	% REC	1130	231	Water		3/16/98 7:19	3/16/98 7:19
GMX031698W	LCS	976236	EPA 901.1	Cesium-137, Activity	102	% REC	991	283	Water		3/16/98 7:19	3/16/98 7:19
LC1R60223	LCS	976236	EPA 903.0	Radium-223, Activity	88.8	% REC			Water		2/25/98 6:30	2/25/98 6:30
LC1R60223	LCS	976236	EPA 903.0	Radium-226, Activity	88.8	% REC	0.5	0.2	Water		2/25/98 6:30	2/25/98 6:30
LC2H31125	LCS	976236	CA-GLR-17.0	Tritium	99	% REC	2.5	3	Water		12/2/97 18:19	12/2/97 18:19
LCS1A0126	LCS	976236	EPA 900.0	Gross Alpha, Activity	99.2	% REC	0.5	0.1	Water		1/29/98 16:10	1/29/98 16:10
LCS1B0126	LCS	976236	EPA 900.0	Gross Beta, Activity	97.8	% REC	0.4	0.3	Water		1/29/98 16:10	1/29/98 16:10
LCS1PU0126	LCS	976236	mod. HASL 300	Plutonium-239/240	93.8	% REC	0.8	0.1	Water		2/12/98 8:48	2/12/98 8:48
LCS1U0123	LCS	976236	mod. HASL 300	Uranium-233/234, Activity	94.4	% REC	1	0.2	Water		2/6/98 15:39	2/6/98 15:39
LCS1U0123	LCS	976236	mod. HASL 300	Uranium-238	98	% REC	1	0.1	Water		2/6/98 15:39	2/6/98 15:39
LCS2A0126	LCS	976236	EPA 900.0	Gross Alpha, Activity	82	% REC	0.5	0.1	Water		1/29/98 16:10	1/29/98 16:10
LCS2B0126	LCS	976236	EPA 900.0	Gross Beta, Activity	101.7	% REC	0.4	0.3	Water		1/29/98 16:10	1/29/98 16:10
LCS2TH0126	LCS	976236	mod. HASL 300	Thorium-232	95.6	% REC	1.3	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB1PU0126	MB	976236	mod. HASL 300	Plutonium-239/240	0.2	pCi/L	0.1	0.1	Water		2/12/98 8:48	2/12/98 8:48
MB1RN1113	MB	976236	CA-GLR-R510	Radon 222, Activity	ND	pCi/L	0.2	0.3	Water		11/14/97 17:11	11/14/97 17:11
MB1U0123	MB	976236	mod. HASL 300	Uranium-238	ND	pCi/L	0.1	0.1	Water		2/6/98 15:39	2/6/98 15:39
MB1U0123	MB	976236	mod. HASL 300	Uranium-235	ND	pCi/L	0.1	0.1	Water		2/6/98 15:39	2/6/98 15:39
MB1U0123	MB	976236	mod. HASL 300	Uranium-233/234, Activity	0.2	pCi/L	0.1	0.1	Water		2/6/98 15:39	2/6/98 15:39
MB2AB0126	MB	976236	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	0.1	0.1	Water		1/29/98 16:10	1/29/98 16:10
MB2AB0126	MB	976236	EPA 900.0	Gross Beta, Activity	0.4	pCi/L	0.2	0.3	Water		1/29/98 16:10	1/29/98 16:10
MB2R60218	MB	976236	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.1	0.3	Water		2/19/98 7:04	2/19/98 7:04
MB2R60218	MB	976236	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water		2/19/98 7:04	2/19/98 7:04
MB2R60223	MB	976236	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water		2/25/98 6:30	2/25/98 6:30
MB2R60223	MB	976236	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.1	0.2	Water		2/25/98 6:30	2/25/98 6:30
MB2TH0126	MB	976236	mod. HASL 300	Thorium-232	ND	pCi/L	0.1	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB2TH0126	MB	976236	mod. HASL 300	Thorium-230	0.4	pCi/L	0.3	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB2TH0126	MB	976236	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB4H31125	MB	976236	CA-GLR-17.0	Tritium	ND	pCi/L	1.6	2.7	Water		12/2/97 18:19	12/2/97 18:19
ST1R60218	LCS	976236	EPA 903.0	Radium-223, Activity	75.2	% REC			Water		2/19/98 7:04	2/19/98 7:04
ST1R60218	LCS	976236	EPA 903.0	Radium-226, Activity	75.2	% REC	0.5	0.3	Water		2/19/98 7:04	2/19/98 7:04
ST1RN1113	LCS	976236	CA-GLR-R510	Radon 222, Activity	97.9	% REC	0.4	0.3	Water		11/14/97 18:12	11/14/97 18:12
ST2H31125	LCS	976236	CA-GLR-17.0	Tritium	103.4	% REC	2.5	3	Water		12/2/97 18:19	12/2/97 18:19

CORE LAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

April 24, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976237

The following information is pertinent to the interpretation of the data.

On November 13, 1997, Core Laboratories - Casper received four soil samples in good condition.

The analytical batch for the isotopic thorium had low tracer recovery, which caused the batch to be reanalyzed. The reanalyzed thorium batch passed QC criteria. The lower volumes elevated the LLDs for thoriums.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error is calculated by the software for the positive results. The Ra226 activity by gamma is not reported using the 186kev line since Ra226 has a low abundance at that line and the U235 has a greater abundance with an energy very close to 186 which would cause interference. Therefore, the Ra226 is calculated from the Bi214 line, a daughter of Ra226. The Ra228 is calculated from the Ac228 line, the daughter of Ra228, as Ra228 is a beta emitter.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Radiochemistry Supervisor

Core Laboratories, Inc.
420 West First Street, Casper, Wyoming 82601, (307) 235-5741, (800) 666-0306, Fax (307) 266-1676

« « « CORE LABORATORIES - CHAIN OF CUSTODY RECORD » » »

CUSTOMER INFORMATION		PROJECT INFORMATION		
Company..:	Parsons	Project..:	SEAD-12	# ABC-012120
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	Page 4 Of 5
	101 Huntington Ave.	Address..:	101 Huntington Ave.	File = 11129705.bar
	Boston MA, 02199		Boston MA 02199	LAB JOB NUMBER 976237
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	11/11/97	1630	10149	12062 ✓	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1630	10148	12062 ✓	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1630	10147	12062 ✓	H3	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1630	10146	12062 ✓	RN222	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1630	10145	12062 ✓	RN222	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1630	10144	12062 ✓	RN222	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1430	10108	12459 ✓	SED-1A	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1510	10101	12460 ✓	SED-1A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801952 981 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ______ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MFS/CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

«« CORE LABORATORIES - CHAIN OF CUSTODY RECORD »»

CUSTOMER INFORMATION		PROJECT INFORMATION		# ABC-012121
Company..:	Parsons	Project..:	SEAD-12	Page 5 Of 5
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	File = 11129705.bar
	101 Huntington Ave.	Address..:	101 Huntington Ave.	LAB JOB NUMBER
	Boston MA, 02199		Boston MA 02199	976237
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	11/11/97	1550	10100	12461	SED-1A	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1645	10137	12462	SED-1A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801952 981 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: David Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MLS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12407	MD	976118	CA-GLR-17.0	Tritium, Activity	0	RPD	0.1	0.2	Soil		11/25/97 0:32	11/25/97 0:32
12409	MS	976118	CA-GLR-17.0	Tritium, Activity	85.9	% REC	205	271	Soil		11/25/97 0:32	11/25/97 0:32
12409	MSD	976118	CA-GLR-17.0	Tritium, Activity	84	% REC	205	273	Soil		11/25/97 0:32	11/25/97 0:32
12455	MD	976240	mod. HASL 300	Thorium-232, Activity	37	RPD	0.8	0.4	Soil		3/27/98 19:05	3/27/98 19:05
12455	MD	976240	mod. HASL 300	Thorium-227	0.2	RPD	0.3	0.4	Soil		3/27/98 19:05	3/27/98 19:05
12455	MD	976240	mod. HASL 300	Thorium-230, Activity	37	RPD	0.7	0.5	Soil		3/27/98 19:05	3/27/98 19:05
12456	MS	976240	mod. HASL 300	Thorium-232, Activity	107.9	% REC	3.5	0.3	Soil		3/27/98 19:05	3/27/98 19:05
12459	SA1	976237	mod. HASL 300	Thorium-227	0.2	pCi/g	0.3	0.4	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12459	SA1	976237	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.5	0.4	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12459	SA1	976237	mod. HASL 300	Plutonium-239/240	0.2	pCi/g	0.3	0.4	SEDIMENT	11/13/97 9:00	2/27/98 8:29	2/27/98 8:29
12459	SA1	976237	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.8	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12459	SA1	976237	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12459	SA1	976237	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	11/25/97 0:32	11/25/97 0:32
12459	SA1	976237	mod. HASL 300	Thorium-230, Activity	2.6	pCi/g	1	0.4	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12459	SA1	976237	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12459	SA1	976237	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12459	SA1	976237	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12459	SA1	976237	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12459	SA1	976237	CA-GLR-R160	Moisture (@ 104 deg. C)	40.4	% by Wt			SEDIMENT	11/13/97 9:00	11/22/97 12:00	11/22/97 12:00
12459	SA1	976237	EPA 901.1	Radium-228, Activity	2.4	pCi/g	0.5	0.1	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12459	SA1	976237	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.8	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12459	SA1	976237	EPA 901.1	Lead-210, Activity	ND	pCi/g		5.3	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12459	SA1	976237	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12459	SA1	976237	EPA 901.1	Lead-211, Activity	ND	pCi/g		1	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12459	SA1	976237	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12459	SA1	976237	EPA 901.1	Lead-214, Activity	1.5	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12460	SA1	976237	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/27/98 8:29	2/27/98 8:29
12460	SA1	976237	mod. HASL 300	Thorium-232, Activity	0.5	pCi/g	0.4	0.4	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12460	SA1	976237	mod. HASL 300	Thorium-230, Activity	1.6	pCi/g	0.8	0.5	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12460	SA1	976237	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	11/25/97 0:32	11/25/97 0:32
12460	SA1	976237	mod. HASL 300	Thorium-227	0.1	pCi/g	0.3	0.5	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12460	SA1	976237	EPA 901.1	Bismuth-214, Activity	1.5	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12460	SA1	976237	mod. HASL 300	Uranium-238, Activity	0.5	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12460	SA1	976237	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12460	SA1	976237	EPA 901.1	Radium-228, Activity	2.2	pCi/g	0.5	0.1	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12460	SA1	976237	CA-GLR-R160	Moisture (@ 104 deg. C)	24.7	% by Wt			SEDIMENT	11/13/97 9:00	11/22/97 12:00	11/22/97 12:00
12460	SA1	976237	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12460	SA1	976237	EPA 901.1	Radium-226, Activity	1.5	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12460	SA1	976237	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12460	SA1	976237	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12460	SA1	976237	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12460	SA1	976237	EPA 901.1	Lead-214, Activity	1.4	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12460	SA1	976237	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12460	SA1	976237	EPA 901.1	Lead-210, Activity	ND	pCi/g		13.8	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12460	SA1	976237	EPA 901.1	Lead-211, Activity	ND	pCi/g		4.9	SEDIMENT	11/13/97 9:00	3/19/98 13:08	3/19/98 13:08
12460	MD	976237	EPA 901.1	Radium-223, Activity	0	RPD		0.4	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Radium-228, Activity	20	RPD	0.5	0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Bismuth-214, Activity	0	RPD	0.3	0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Radium-226, Activity	0	RPD	0.3	0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Cobalt-57, Activity	0	RPD		0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Cobalt-60, Activity	0	RPD		0.2	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Cesium-137, Activity	0.2	RPD	0.1	0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Lead-210, Activity	0	RPD		8.5	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Lead-214, Activity	13.3	RPD	0.3	0.1	Soil		3/19/98 15:39	3/19/98 15:39
12460	MD	976237	EPA 901.1	Lead-211, Activity	0	RPD		7.6	Soil		3/19/98 15:39	3/19/98 15:39
12461	SA1	976237	EPA 901.1	Radium-226, Activity	1.6	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12461	SA1	976237	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12461	SA1	976237	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12461	SA1	976237	EPA 901.1	Bismuth-214, Activity	1.6	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12461	SA1	976237	EPA 901.1	Lead-214, Activity	1.8	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12461	SA1	976237	EPA 901.1	Lead-211, Activity	ND	pCi/g		3.2	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12461	SA1	976237	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.8	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12461	SA1	976237	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12461	SA1	976237	EPA 901.1	Lead-210, Activity	ND	pCi/g		6.9	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12461	SA1	976237	CA-GLR-R160	Moisture (@ 104 deg. C)	45.6	% by Wt			SEDIMENT	11/13/97 9:00	11/22/97 12:00	11/22/97 12:00
12461	SA1	976237	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	11/25/97 0:32	11/25/97 0:32
12461	SA1	976237	EPA 901.1	Radium-228, Activity	1.9	pCi/g	0.5	0.1	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12461	SA1	976237	mod. HASL 300	Plutonium-239/240	0.4	pCi/g	0.3	0.2	SEDIMENT	11/13/97 9:00	2/27/98 8:29	2/27/98 8:29
12461	SA1	976237	mod. HASL 300	Thorium-232, Activity	1.4	pCi/g	0.7	0.4	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12461	SA1	976237	mod. HASL 300	Thorium-230, Activity	1.5	pCi/g	0.8	0.5	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12461	SA1	976237	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.4	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12461	SA1	976237	mod. HASL 300	Uranium-238, Activity	1.2	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12461	SA1	976237	mod. HASL 300	Uranium-235, Activity	0.4	pCi/g	0.2	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12461	SA1	976237	mod. HASL 300	Uranium-233/234, Activity	1.1	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12462	SA1	976237	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	2/27/98 8:29	2/27/98 8:29
12462	SA1	976237	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12462	SA1	976237	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12462	SA1	976237	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	11/25/97 0:32	11/25/97 0:32
12462	SA1	976237	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12462	SA1	976237	mod. HASL 300	Thorium-232, Activity	0.7	pCi/g	0.7	0.7	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12462	SA1	976237	mod. HASL 300	Thorium-230, Activity	1.2	pCi/g	0.9	0.8	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12462	SA1	976237	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.6	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12462	SA1	976237	EPA 901.1	Radium-228, Activity	ND	pCi/g		1.5	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12462	SA1	976237	EPA 901.1	Bismuth-214, Activity	1.7	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12462	SA1	976237	EPA 901.1	Radium-226, Activity	1.7	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12462	SA1	976237	EPA 901.1	Lead-210, Activity	ND	pCi/g		48.6	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12462	SA1	976237	EPA 901.1	Lead-214, Activity	1.3	pCi/g	0.3	0.2	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12462	SA1	976237	EPA 901.1	Lead-211, Activity	ND	pCi/g		10.1	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12462	SA1	976237	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12462	SA1	976237	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12462	SA1	976237	CA-GLR-R160	Moisture (@ 104 deg. C)	44.2	% by Wt			SEDIMENT	11/13/97 9:00	11/22/97 12:00	11/22/97 12:00
12462	SA1	976237	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12462	SA1	976237	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/13/97 9:00	3/19/98 14:31	3/19/98 14:31
12465	MD	976460	mod. HASL 300	Plutonium-239/240	0	RPD	0.1	0.3	Soil		2/27/98 8:29	2/27/98 8:29
12466	MS	976460	mod. HASL 300	Plutonium-239/240	77.1	% REC	1	0.3	Soil		2/27/98 8:29	2/27/98 8:29
12469	MD	976460	mod. HASL 300	Uranium-233/234, Activity	11.8	RPD	0.3	0.2	Soil		2/25/98 14:15	2/25/98 14:15
12469	MD	976460	mod. HASL 300	Uranium-235, Activity	0.1	RPD	0.2	0.1	Soil		2/25/98 14:15	2/25/98 14:15
12469	MD	976460	mod. HASL 300	Uranium-238, Activity	0	RPD	0.3	0.1	Soil		2/25/98 14:15	2/25/98 14:15
12470	MS	976460	mod. HASL 300	Uranium-238, Activity	92	% REC	1.2	0.1	Soil		2/25/98 14:15	2/25/98 14:15
12470	MS	976460	mod. HASL 300	Uranium-233/234, Activity	81.5	% REC	1.3	0.1	Soil		2/25/98 14:15	2/25/98 14:15
GEM031898S	LCS	976237	EPA 901.1	Cobalt-60, Activity	100.3	% REC	1820	279	Water		3/18/98 7:26	3/18/98 7:26
GEM031898S	LCS	976237	EPA 901.1	Cesium-137, Activity	102.9	% REC	1160	324	Water		3/18/98 7:26	3/18/98 7:26
GEM031998S	LCS	976237	EPA 901.1	Cobalt-60, Activity	106	% REC	1730	274	Water		3/19/98 7:26	3/19/98 7:26
GEM031998S	LCS	976237	EPA 901.1	Cesium-137, Activity	102.9	% REC	2310	404	Water		3/19/98 7:26	3/19/98 7:26
GMX031898S	LCS	976237	EPA 901.1	Cobalt-60, Activity	101.2	% REC	1180	237	Water		3/18/98 7:13	3/18/98 7:13
GMX031898S	LCS	976237	EPA 901.1	Cesium-137, Activity	107.3	% REC	907	250	Water		3/18/98 7:13	3/18/98 7:13
GMX031998S	LCS	976237	EPA 901.1	Cobalt-60, Activity	102.7	% REC	1220	254	Water		3/19/98 7:14	3/19/98 7:14
GMX031998S	LCS	976237	EPA 901.1	Cesium-137, Activity	102.9	% REC	862	231	Water		3/19/98 7:14	3/19/98 7:14
LC1H31122	LCS	976237	CA-GLR-17.0	Tritium, Activity	76.8	% REC	1.9	2.6	Water		11/25/97 0:32	11/25/97 0:32
LCSAP0224	LCS	976237	mod. HASL 300	Plutonium-239/240	91.7	% REC	1	0.2	Water		2/27/98 8:29	2/27/98 8:29
LCSAT0224	LCS	976237	mod. HASL 300	Thorium-232, Activity	100	% REC	1.1	0.2	Water		2/26/98 10:54	2/26/98 10:54
LCSBT0310	LCS	976237	mod. HASL 300	Thorium-232, Activity	91.4	% REC	0.7	0.1	Water		3/27/98 19:05	3/27/98 19:05
LCSBU0223	LCS	976237	mod. HASL 300	Uranium-238, Activity	90	% REC	1	0.1	Water		2/25/98 14:15	2/25/98 14:15
LCSBU0223	LCS	976237	mod. HASL 300	Uranium-233/234, Activity	79.6	% REC	1	0.2	Water		2/25/98 14:15	2/25/98 14:15
MB1H31122	MB	976237	CA-GLR-17.0	Tritium, Activity	ND	pCi/L	1.5	2.4	Water		11/25/97 0:32	11/25/97 0:32
MB2H31122	MB	976237	CA-GLR-17.0	Tritium, Activity	ND	pCi/L	1.5	2.5	Water		11/25/97 0:32	11/25/97 0:32
MBAP0224	MB	976237	mod. HASL 300	Plutonium-239/240	0.3	pCi/L	0.2	0.2	Water		2/27/98 8:29	2/27/98 8:29
MBAT0224	MB	976237	mod. HASL 300	Thorium-227	0.1	pCi/L	0.1	0.2	Water		2/26/98 10:54	2/26/98 10:54
MBAT0224	MB	976237	mod. HASL 300	Thorium-230, Activity	0.3	pCi/L	0.3	0.3	Water		2/26/98 10:54	2/26/98 10:54
MBAT0224	MB	976237	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water		2/26/98 10:54	2/26/98 10:54
MBBT0310	MB	976237	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water		3/27/98 19:05	3/27/98 19:05
MBBT0310	MB	976237	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water		3/27/98 19:05	3/27/98 19:05
MBBT0310	MB	976237	mod. HASL 300	Thorium-230, Activity	0.5	pCi/L	0.3	0.3	Water		3/27/98 19:05	3/27/98 19:05
MBCU0223	MB	976237	mod. HASL 300	Uranium-233/234, Activity	0.1	pCi/L	0.1	0.1	Water		2/25/98 14:15	2/25/98 14:15
MBCU0223	MB	976237	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.1	Water		2/25/98 14:15	2/25/98 14:15
MBCU0223	MB	976237	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.1	Water		2/25/98 14:15	2/25/98 14:15
ST1H31122	LCS	976237	CA-GLR-17.0	Tritium, Activity	84.7	% REC	2	2.6	Water		11/25/97 0:32	11/25/97 0:32

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12047	MS	976233	mod. HASL 300	Thorium-232, Activity	118	% REC	4.5	0.6	Water		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-230, Activity	0.4	RPD	0.5	0.4	Water		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-227	0.3	RPD	0.4	0.6	Water		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-232, Activity	0	RPD	0.1	0.4	Water		2/12/98 11:17	2/12/98 11:17
12050	MS	976233	EPA 900.0	Gross Alpha, Activity	89.7	% REC	3.5	1.3	Water		1/29/98 16:10	1/29/98 16:10
12051	SA1	976238	EPA 900.0	Gross Beta, Activity	14	pCi/L	1.7	2.3	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12051	SA1	976238	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12051	SA1	976238	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12051	SA1	976238	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.1	0.3	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12051	SA1	976238	mod. HASL 300	Thorium-232, Activity	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12051	SA1	976238	mod. HASL 300	Thorium-230, Activity	0.3	pCi/L	0.3	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12051	SA1	976238	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12051	SA1	976238	mod. HASL 300	Uranium-238, Activity	0.3	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12051	SA1	976238	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	1.1	1.9	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12051	SA1	976238	mod. HASL 300	Uranium-235, Activity	0.2	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12051	SA1	976238	EPA 901.1	Lead-214, Activity	11.6	pCi/L	4.7	2.8	Water	11/13/97 9:00	3/19/98 16:06	3/19/98 16:06
12051	SA1	976238	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/L	0.4	0.3	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12051	SA1	976238	EPA 901.1	Bismuth-214, Activity	19.9	pCi/L	6.1	2.6	Water	11/13/97 9:00	3/19/98 16:06	3/19/98 16:06
12051	SA1	976238	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		1.8	Water	11/13/97 9:00	3/19/98 16:06	3/19/98 16:06
12051	SA1	976238	EPA 901.1	Cobalt-60, Activity	3.6	pCi/L	0.9	1.1	Water	11/13/97 9:00	3/19/98 16:06	3/19/98 16:06
12051	SA1	976238	EPA 901.1	Cesium-137, Activity	ND	pCi/L		2	Water	11/13/97 9:00	3/19/98 16:06	3/19/98 16:06
12051	SA1	976238	EPA 901.1	Lead-211, Activity	ND	pCi/L		181	Water	11/13/97 9:00	3/19/98 16:06	3/19/98 16:06
12051	MD	976238	EPA 900.0	Gross Alpha, Activity	0.3	RPD	1	1.6	Water		1/29/98 16:10	1/29/98 16:10
12051	MD	976238	EPA 900.0	Gross Beta, Activity	48.6	RPD	1.9	2.4	Water		1/29/98 16:10	1/29/98 16:10
12052	SA1	976238	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12052	SA1	976238	mod. HASL 300	Thorium-230, Activity	1.1	pCi/L	0.5	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12052	SA1	976238	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12052	SA1	976238	mod. HASL 300	Uranium-238, Activity	0.2	pCi/L	0.2	0.1	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12052	SA1	976238	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12052	SA1	976238	EPA 903.0	Radium-226, Activity	0.4	pCi/L	0.3	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12052	SA1	976238	mod. HASL 300	Uranium-233/234, Activity	0.4	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12052	SA1	976238	EPA 901.1	Lead-214, Activity	12.6	pCi/L	5.1	3.4	Water	11/13/97 9:00	3/19/98 16:57	3/19/98 16:57
12052	SA1	976238	EPA 901.1	Bismuth-214, Activity	19.3	pCi/L	6.4	3.5	Water	11/13/97 9:00	3/19/98 16:57	3/19/98 16:57
12052	SA1	976238	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.5	Water	11/13/97 9:00	3/19/98 16:57	3/19/98 16:57
12052	SA1	976238	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		2.5	Water	11/13/97 9:00	3/19/98 16:57	3/19/98 16:57
12052	SA1	976238	EPA 901.1	Cesium-137, Activity	ND	pCi/L		2	Water	11/13/97 9:00	3/19/98 16:57	3/19/98 16:57
12052	SA1	976238	EPA 903.0	Radium-223, Activity	0.4	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12052	SA1	976238	mod. HASL 300	Plutonium-239/240	0.1	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12052	SA1	976238	EPA 901.1	Lead-211, Activity	ND	pCi/L		467	Water	11/13/97 9:00	3/19/98 16:57	3/19/98 16:57
12052	SA1	976238	EPA 900.0	Gross Alpha, Activity	0.6	pCi/L	1.1	1.7	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12052	SA1	976238	EPA 900.0	Gross Beta, Activity	9.6	pCi/L	1.7	2.5	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12053	SA1	976238	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	0.8	1.4	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12053	SA1	976238	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12053	SA1	976238	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12053	SA1	976238	mod. HASL 300	Plutonium-239/240	0.1	pCi/L	0.1	0.1	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12053	SA1	976238	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12053	SA1	976238	EPA 900.0	Gross Beta, Activity	3.1	pCi/L	0.9	1.4	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12053	SA1	976238	mod. HASL 300	Thorium-230, Activity	0.1	pCi/L	0.2	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12053	SA1	976238	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12053	SA1	976238	mod. HASL 300	Thorium-227	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12053	SA1	976238	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12053	SA1	976238	EPA 901.1	Bismuth-214, Activity	20.2	pCi/L	8.9	3.6	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12053	SA1	976238	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/L	0.3	0.3	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12053	SA1	976238	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		4.9	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12053	SA1	976238	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.7	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12053	SA1	976238	EPA 901.1	Cesium-137, Activity	ND	pCi/L		5.9	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12053	SA1	976238	mod. HASL 300	Promethium 147	57.2	pCi/L	40.1	65.7	Water	11/13/97 9:00	4/2/98 23:39	4/2/98 23:39
12053	SA1	976238	EPA 901.1	Lead-211, Activity	ND	pCi/L		16.1	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12053	SA1	976238	EPA 901.1	Lead-214, Activity	15.2	pCi/L	6.8	3.2	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12053	MD	976238	mod. HASL 300	Plutonium-239/240	0.4	RPD	0.4	0.5	Water		2/12/98 8:48	2/12/98 8:48
12054	SA1	976238	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		4	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12054	SA1	976238	EPA 901.1	Bismuth-214, Activity	14.5	pCi/L	5	2.7	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12054	SA1	976238	EPA 901.1	Cesium-137, Activity	ND	pCi/L		6.2	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12054	SA1	976238	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.3	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12054	SA1	976238	EPA 901.1	Lead-211, Activity	ND	pCi/L		196	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12054	SA1	976238	EPA 901.1	Lead-214, Activity	15.5	pCi/L	4.9	2.9	Water	11/13/97 9:00	3/20/98 8:05	3/20/98 8:05
12054	SA1	976238	mod. HASL 300	Promethium 147	61.3	pCi/L	33.7	54.8	Water	11/13/97 9:00	4/2/98 23:39	4/2/98 23:39
12054	SA1	976238	EPA 900.0	Gross Beta, Activity	3.9	pCi/L	0.9	1.4	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12054	SA1	976238	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12054	SA1	976238	EPA 900.0	Gross Alpha, Activity	0.4	pCi/L	1.1	1.9	Water	11/13/97 9:00	1/29/98 16:10	1/29/98 16:10
12054	SA1	976238	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12054	SA1	976238	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/L	0.3	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12054	SA1	976238	mod. HASL 300	Plutonium-239/240	0.1	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12054	SA1	976238	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12054	SA1	976238	mod. HASL 300	Thorium-230, Activity	0.4	pCi/L	0.3	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12054	SA1	976238	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12054	SA1	976238	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12054	SA1	976238	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.1	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12058	MD	976239	EPA 901.1	Cobalt-60, Activity	0	RPD		6.8	Water		3/24/98 11:30	3/24/98 11:30
12058	MD	976239	EPA 901.1	Cobalt-57, Activity	0	RPD		0.8	Water		3/24/98 11:30	3/24/98 11:30
12058	MD	976239	EPA 901.1	Bismuth-214, Activity	10.1	RPD	8	3.1	Water		3/24/98 11:30	3/24/98 11:30
12058	MD	976239	EPA 901.1	Cesium-137, Activity	0	RPD		3.2	Water		3/24/98 11:30	3/24/98 11:30
12058	MD	976239	EPA 901.1	Lead-211, Activity	0	RPD		35.9	Water		3/24/98 11:30	3/24/98 11:30
12058	MD	976239	EPA 901.1	Lead-214, Activity	15.5	RPD	6.9	3.2	Water		3/24/98 11:30	3/24/98 11:30

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12062	MD	976236	mod. HASL 300	Uranium-233/234, Activity	0	RPD	0.4	0.5	Water		2/6/98 15:39	2/6/98 15:39
12062	MD	976236	mod. HASL 300	Uranium-238, Activity	0.1	RPD	0.4	0.3	Water		2/6/98 15:39	2/6/98 15:39
12062	MD	976236	mod. HASL 300	Uranium-235, Activity	0.3	RPD	0.1	0.3	Water		2/6/98 15:39	2/6/98 15:39
12062	MS	976236	mod. HASL 300	Plutonium-239/240	92.7	% REC	1.7	0.5	Water		2/12/98 8:48	2/12/98 8:48
12201	MS	976216	EPA 903.0	Radium-226, Activity	97.8	% REC	2.3	1.1	Water		2/19/98 7:04	2/19/98 7:04
12201	MS	976216	EPA 903.0	Radium-223, Activity	97.8	% REC			Water		2/19/98 7:04	2/19/98 7:04
12204	MD	976216	EPA 903.0	Radium-223, Activity	0	RPD			Water		2/19/98 7:04	2/19/98 7:04
12204	MD	976216	EPA 903.0	Radium-226, Activity	0	RPD	0.4	1.1	Water		2/19/98 7:04	2/19/98 7:04
12207	MD	976239	mod. HASL 300	Promethium 147	17.1	RPD	40.4	65.7	Water		4/2/98 23:39	4/2/98 23:39
12210	MS	976236	mod. HASL 300	Uranium-233/234, Activity	109.7	% REC	3.3	0.4	Water		2/6/98 15:39	2/6/98 15:39
12210	MS	976236	mod. HASL 300	Uranium-238, Activity	115.4	% REC	3.2	0.4	Water		2/6/98 15:39	2/6/98 15:39
12211-Associate	MS	976291	EPA 900.0	Gross Beta, Activity	98.4	% REC	0.9	0.6	Water		1/29/98 16:10	1/29/98 16:10
12416	MS	976182	mod. HASL 300	Promethium 147	97.4	% REC	67.2	54.8	Water		4/2/98 23:39	4/2/98 23:39
EFF2A0126	LCS	976238	EPA 900.0	Gross Alpha, Activity	85.1	% REC	0.5	0.1	Water		1/29/98 16:10	1/29/98 16:10
GEM031998M	LCS	976238	EPA 901.1	Cobalt-60, Activity	104	% REC	1490	305	Water		3/19/98 16:44	3/19/98 16:44
GEM031998M	LCS	976238	EPA 901.1	Cesium-137, Activity	103.5	% REC	1210	408	Water		3/19/98 16:44	3/19/98 16:44
GEM032398M	LCS	976238	EPA 901.1	Cesium-137, Activity	105	% REC	2820	484	Water		3/23/98 7:24	3/23/98 7:24
GEM032398M	LCS	976238	EPA 901.1	Cobalt-60, Activity	95.7	% REC	1390	383	Water		3/23/98 7:24	3/23/98 7:24
GMX031998M	LCS	976238	EPA 901.1	Cesium-137, Activity	105.5	% REC	1190	330	Water		3/19/98 15:39	3/19/98 15:39
GMX031998M	LCS	976238	EPA 901.1	Cobalt-60, Activity	103.7	% REC	1190	239	Water		3/19/98 15:39	3/19/98 15:39
GMX032398M	LCS	976238	EPA 901.1	Cobalt-60, Activity	105.9	% REC	1530	218	Water		3/23/98 7:10	3/23/98 7:10
GMX032398M	LCS	976238	EPA 901.1	Cesium-137, Activity	101.5	% REC	939	283	Water		3/23/98 7:10	3/23/98 7:10
GMX032498M	LCS	976238	EPA 901.1	Cobalt-60, Activity	101.2	% REC	1320	249	Water		3/24/98 7:04	3/24/98 7:04
GMX032498M	LCS	976238	EPA 901.1	Cesium-137, Activity	101	% REC	951	245	Water		3/24/98 7:04	3/24/98 7:04
LCS1A0126	LCS	976238	EPA 900.0	Gross Alpha, Activity	99.2	% REC	0.5	0.1	Water		1/29/98 16:10	1/29/98 16:10
LCS1B0126	LCS	976238	EPA 900.0	Gross Beta, Activity	97.8	% REC	0.4	0.3	Water		1/29/98 16:10	1/29/98 16:10
LCS1PU0126	LCS	976238	mod. HASL 300	Plutonium-239/240	93.8	% REC	0.6	0.1	Water		2/12/98 8:48	2/12/98 8:48
LCS1U0123	LCS	976238	mod. HASL 300	Uranium-233/234, Activity	94.4	% REC	1	0.2	Water		2/6/98 15:39	2/6/98 15:39
LCS1U0123	LCS	976238	mod. HASL 300	Uranium-238, Activity	98	% REC	1	0.1	Water		2/6/98 15:39	2/6/98 15:39
LCS2A0126	LCS	976238	EPA 900.0	Gross Alpha, Activity	82	% REC	0.5	0.1	Water		1/29/98 16:10	1/29/98 16:10
LCS2B0126	LCS	976238	EPA 900.0	Gross Beta, Activity	101.7	% REC	0.4	0.3	Water		1/29/98 16:10	1/29/98 16:10
LCS2PM0402	LCS	976238	mod. HASL 300	Promethium 147	98.1	% REC	4.8	3.9	Water		4/2/98 23:39	4/2/98 23:39
LCS2TH0126	LCS	976238	mod. HASL 300	Thorium-232, Activity	95.6	% REC	1.3	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB1PU0126	MB	976238	mod. HASL 300	Plutonium-239/240	0.2	pCi/L	0.1	0.1	Water		2/12/98 8:48	2/12/98 8:48
MB1U0123	MB	976238	mod. HASL 300	Uranium-233/234, Activity	0.2	pCi/L	0.1	0.1	Water		2/6/98 15:39	2/6/98 15:39
MB1U0123	MB	976238	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water		2/6/98 15:39	2/6/98 15:39
MB1U0123	MB	976238	mod. HASL 300	Uranium-238, Activity	ND	pCi/L	0.1	0.1	Water		2/6/98 15:39	2/6/98 15:39
MB2AB0126	MB	976238	EPA 900.0	Gross Beta, Activity	0.4	pCi/L	0.2	0.3	Water		1/29/98 16:10	1/29/98 16:10
MB2AB0126	MB	976238	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	0.1	0.1	Water		1/29/98 16:10	1/29/98 16:10
MB2PM0402	MB	976238	mod. HASL 300	Promethium 147	ND	pCi/L	2.3	3.9	Water		4/2/98 23:39	4/2/98 23:39
MB2R60218	MB	976238	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.1	0.3	Water		2/19/98 7:04	2/19/98 7:04
MB2R60218	MB	976238	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water		2/19/98 7:04	2/19/98 7:04

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
MB2TH0126	MB	976238	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB2TH0126	MB	976238	mod. HASL 300	Thorium-230, Activity	0.4	pCi/L	0.3	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB2TH0126	MB	976238	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water		2/12/98 11:17	2/12/98 11:17
ST1R60218	LCS	976238	EPA 903.0	Radium-223, Activity	75.2	% REC			Water		2/19/98 7:04	2/19/98 7:04
ST1R60218	LCS	976238	EPA 903.0	Radium-226, Activity	75.2	% REC	0.5	0.3	Water		2/19/98 7:04	2/19/98 7:04

CORELAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

April 24, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976239

The following information is pertinent to the interpretation of the data.

On November 13, 1997, Core Laboratories - Casper received five water samples in good condition.

The MS for the analytical batch for the Ra-226 had low recovery at 41%. The batch was successfully reanalyzed. The MB for Th-230 was slightly elevated at 0.4 pCi/L.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error are calculated by the software for the positive results.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Rondalynn Mull
Radiochemistry Supervisor

Core Laboratories, Inc.
420 West First Street, Casper, Wyoming 82601, (307) 235-5741, (800) 666-0306, Fax (307) 266-1676

Cooler #1C   8B

<<< CORE LABORATORIES - CHAIN OF CUSTODY RECORD >>>

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012105
Company..: Parsons	Project..: SEAD-12	Page 1 Of 5
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 11119702.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976239
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
ABS	11/11/97	1215	10209	12207	RN222	OVER-FOR-PARAM-KEY	
ABS	11/11/97	1215	10208	12207	RN222	OVER-FOR-PARAM-KEY	
ABS	11/11/97	1215	10207	12207	RN222	OVER-FOR-PARAM-KEY	
ABS	11/11/97	1215	10206	12207	H3	OVER-FOR-PARAM-KEY	
ABS	11/11/97	1215	10205	12207	LIQUID-1	OVER-FOR-PARAM-KEY	
ABS	11/11/97	1215	10204	12207	LIQUID-2B	OVER-FOR-PARAM-KEY	
BJP	11/11/97	0950	10036	12055	LIQUID-1	OVER-FOR-PARAM-KEY	
BJP	11/11/97	0950	10035	12055	LIQUID-2B	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex   AIRBILL NO.: 801 952 991 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ______ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MLS/CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

<<< CORE LABORATORIES - CHAIN OF CUSTODY RECORD >>>

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012106
Company..: Parsons	Project..: SEAD-12	Page 2 Of 5
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 11119702.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976239
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
BJP	11/11/97	0950	10034	12055	H3	OVER-FOR-PARAM-KEY	
BJP	11/11/97	0950	10033	12055	RN222	OVER-FOR-PARAM-KEY	
BJP	11/11/97	0950	10032	12055	RN222	OVER-FOR-PARAM-KEY	
BJP	11/11/97	0950	10031	12055	RN222	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1005	10029	12056	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1005	10028	12056	LIQUID-2B	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1005	10027	12056	H3	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1005	10026	12056	RN222	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801 952 981 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ______ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MLS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

◄◄◄ CORE LABORATORIES - CHAIN OF CUSTODY RECORD ►►►

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company..:	Parsons	Project..:	SEAD-12
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau
	101 Huntington Ave.	Address..:	101 Huntington Ave.
	Boston MA, 02199		Boston MA 02199
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043

ABC-012107

Page 3 Of 5

File = 11119702.bar

LAB JOB NUMBER

976239

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	11/11/97	1005	10025	12056	RN222	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1005	10024	12056	RN222	OVER-FOR-PARAM-KEY	
ABS	11/11/97	1000	10022	12057	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1000	10021	12057	LIQUID-2B	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1000	10020	12057	H3	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1000	10019	12057	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1000	10018	12057	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1000	10017	12057	RN222	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex. AIRBILL NO.: 801 952 981 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ______ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MLS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

««« CORE LABORATORIES - CHAIN OF CUSTODY RECORD »»»

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012108
Company..: Parsons	Project..: SEAD-12	Page 4 Of 5
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 11119702.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976239
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	11/11/97	1055	10015	12058	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1055	10014	12058	LIQUID-2B	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1055	10013	12058	H3	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1055	10012	12058	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1055	10011	12058	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1055	10010	12058	RN222	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1015	10030	12455	SED-1B	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1015	10023	12456	SED-1B	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801452 981 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [ ] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Craffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Craffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MFLS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[✓] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12047	MS	976233	mod. HASL 300	Thorium-232, Activity	118	% REC	4.5	0.6	Water		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-230, Activity	0.4	RPD	0.5	0.4	Water		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-227	0.3	RPD	0.4	0.6	Water		2/12/98 11:17	2/12/98 11:17
12050	MD	976233	mod. HASL 300	Thorium-232, Activity	0	RPD	0.1	0.4	Water		2/12/98 11:17	2/12/98 11:17
12053	MD	976238	mod. HASL 300	Plutonium-239/240	0.4	RPD	0.4	0.5	Water		2/12/98 8:48	2/12/98 8:48
12053	MD	976232	CA-GLR-R510	Radon 222, Activity	5.9	RPD	37.5	61.4	Water		11/14/97 5:05	11/14/97 5:05
12055	SA1	976239	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12055	SA1	976239	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12055	SA1	976239	mod. HASL 300	Thorium-227	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12055	SA1	976239	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	1.4	2.5	Water	11/13/97 9:00	2/3/98 14:49	2/3/98 14:49
12055	SA1	976239	EPA 900.0	Gross Beta, Activity	ND	pCi/L	1.3	2.5	Water	11/13/97 9:00	2/3/98 14:49	2/3/98 14:49
12055	SA1	976239	mod. HASL 300	Uranium-233/234, Activity	0.3	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12055	SA1	976239	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12055	SA1	976239	mod. HASL 300	Plutonium-239/240	0.2	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12055	SA1	976239	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12055	SA1	976239	CA-GLR-R510	Radon 222, Activity	66.9	pCi/L	33.1	53.6	Water	11/13/97 9:00	11/14/97 7:06	11/14/97 7:06
12055	SA1	976239	mod. HASL 300	Thorium-230, Activity	0.2	pCi/L	0.2	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12055	SA1	976239	CA-GLR-17.0	Tritium, Activity	113	pCi/L	176	292	Water	11/13/97 9:00	12/2/97 18:19	12/2/97 18:19
12055	SA1	976239	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12055	SA1	976239	EPA 901.1	Lead-214, Activity	ND	pCi/L		32.6	Water	11/13/97 9:00	3/23/98 11:14	3/23/98 11:14
12055	SA1	976239	EPA 901.1	Lead-211, Activity	464	pCi/L	220	25.9	Water	11/13/97 9:00	3/23/98 11:14	3/23/98 11:14
12055	SA1	976239	mod. HASL 300	Promethium 147	63.9	pCi/L	40.2	65.7	Water	11/13/97 9:00	4/2/98 23:39	4/2/98 23:39
12055	SA1	976239	EPA 901.1	Cesium-137, Activity	ND	pCi/L		0.7	Water	11/13/97 9:00	3/23/98 11:14	3/23/98 11:14
12055	SA1	976239	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		0.5	Water	11/13/97 9:00	3/23/98 11:14	3/23/98 11:14
12055	SA1	976239	EPA 901.1	Bismuth-214, Activity	21.9	pCi/L	6	3.3	Water	11/13/97 9:00	3/23/98 11:14	3/23/98 11:14
12055	SA1	976239	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		1	Water	11/13/97 9:00	3/23/98 11:14	3/23/98 11:14
12056	SA1	976239	CA-GLR-17.0	Tritium, Activity	ND	pCi/L	167	286	Water	11/13/97 9:00	12/2/97 18:19	12/2/97 18:19
12056	SA1	976239	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12056	SA1	976239	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12056	SA1	976239	mod. HASL 300	Thorium-230, Activity	0.4	pCi/L	0.3	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12056	SA1	976239	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	1.4	2.5	Water	11/13/97 9:00	2/3/98 14:49	2/3/98 14:49
12056	SA1	976239	EPA 900.0	Gross Beta, Activity	ND	pCi/L	1.5	2.9	Water	11/13/97 9:00	2/3/98 14:49	2/3/98 14:49
12056	SA1	976239	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12056	SA1	976239	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12056	SA1	976239	CA-GLR-R510	Radon 222, Activity	54.8	pCi/L	33.1	53.9	Water	11/13/97 9:00	11/14/97 8:07	11/14/97 8:07
12056	SA1	976239	mod. HASL 300	Uranium-238, Activity	0.2	pCi/L	0.2	0.1	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12056	SA1	976239	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12056	SA1	976239	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/L	0.3	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12056	SA1	976239	mod. HASL 300	Promethium 147	70.6	pCi/L	33.8	54.8	Water	11/13/97 9:00	4/2/98 23:39	4/2/98 23:39
12056	SA1	976239	EPA 901.1	Bismuth-214, Activity	16.1	pCi/L	4.3	2.4	Water	11/13/97 9:00	3/23/98 14:17	3/23/98 14:17
12056	SA1	976239	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		1.4	Water	11/13/97 9:00	3/23/98 14:17	3/23/98 14:17
12056	SA1	976239	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		0.5	Water	11/13/97 9:00	3/23/98 14:17	3/23/98 14:17
12056	SA1	976239	EPA 901.1	Cesium-137, Activity	ND	pCi/L		1.5	Water	11/13/97 9:00	3/23/98 14:17	3/23/98 14:17

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12056	SA1	976239	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12056	SA1	976239	EPA 901.1	Lead-214, Activity	ND	pCi/L		17.7	Water	11/13/97 9:00	3/23/98 14:17	3/23/98 14:17
12056	SA1	976239	EPA 901.1	Lead-211, Activity	ND	pCi/L		279	Water	11/13/97 9:00	3/23/98 14:17	3/23/98 14:17
12056	MS	976239	EPA 900.0	Gross Alpha, Activity	91.1	% REC	5.5	2.3	Water		2/3/98 14:49	2/3/98 14:49
12057	SA1	976239	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12057	SA1	976239	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	1.5	2.7	Water	11/13/97 9:00	2/3/98 14:49	2/3/98 14:49
12057	SA1	976239	CA-GLR-R510	Radon 222, Activity	57.5	pCi/L	33.4	54.4	Water	11/13/97 9:00	11/14/97 9:07	11/14/97 9:07
12057	SA1	976239	EPA 900.0	Gross Beta, Activity	ND	pCi/L	1.3	2.5	Water	11/13/97 9:00	2/3/98 14:49	2/3/98 14:49
12057	SA1	976239	CA-GLR-17.0	Tritium, Activity	153	pCi/L	177	290	Water	11/13/97 9:00	12/2/97 18:19	12/2/97 18:19
12057	SA1	976239	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12057	SA1	976239	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12057	SA1	976239	mod. HASL 300	Thorium-230, Activity	0.3	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12057	SA1	976239	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12057	SA1	976239	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		2.8	Water	11/13/97 9:00	3/23/98 15:46	3/23/98 15:46
12057	SA1	976239	EPA 901.1	Cesium-137, Activity	ND	pCi/L		3	Water	11/13/97 9:00	3/23/98 15:46	3/23/98 15:46
12057	SA1	976239	EPA 901.1	Lead-211, Activity	ND	pCi/L		9.3	Water	11/13/97 9:00	3/23/98 15:46	3/23/98 15:46
12057	SA1	976239	mod. HASL 300	Uranium-238, Activity	0.4	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12057	SA1	976239	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.1	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12057	SA1	976239	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12057	SA1	976239	mod. HASL 300	Uranium-233/234, Activity	0.4	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12057	SA1	976239	EPA 901.1	Lead-214, Activity	11.3	pCi/L	3.4	2.1	Water	11/13/97 9:00	3/23/98 15:46	3/23/98 15:46
12057	SA1	976239	mod. HASL 300	Promethium 147	55.1	pCi/L	33.6	54.8	Water	11/13/97 9:00	4/2/98 23:39	4/2/98 23:39
12057	SA1	976239	EPA 901.1	Bismuth-214, Activity	10.4	pCi/L	3.4	1.7	Water	11/13/97 9:00	3/23/98 15:46	3/23/98 15:46
12057	SA1	976239	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.7	Water	11/13/97 9:00	3/23/98 15:46	3/23/98 15:46
12058	SA1	976239	EPA 900.0	Gross Beta, Activity	ND	pCi/L	1.2	2.2	Water	11/13/97 9:00	2/3/98 14:49	2/3/98 14:49
12058	SA1	976239	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	1.5	2.5	Water	11/13/97 9:00	2/3/98 14:49	2/3/98 14:49
12058	SA1	976239	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12058	SA1	976239	CA-GLR-R510	Radon 222, Activity	82.3	pCi/L	33.9	54.4	Water	11/13/97 9:00	11/14/97 10:08	11/14/97 10:08
12058	SA1	976239	CA-GLR-17.0	Tritium, Activity	58.6	pCi/L	173	290	Water	11/13/97 9:00	12/2/97 18:19	12/2/97 18:19
12058	SA1	976239	mod. HASL 300	Plutonium-239/240	0.3	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12058	SA1	976239	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12058	SA1	976239	mod. HASL 300	Thorium-230, Activity	0.2	pCi/L	0.2	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12058	SA1	976239	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12058	SA1	976239	mod. HASL 300	Uranium-238, Activity	0.2	pCi/L	0.1	0.1	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12058	SA1	976239	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12058	SA1	976239	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.1	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12058	SA1	976239	EPA 901.1	Lead-214, Activity	14.9	pCi/L	4.6	3.2	Water	11/13/97 9:00	3/24/98 7:17	3/24/98 7:17
12058	SA1	976239	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/L	0.3	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12058	SA1	976239	mod. HASL 300	Promethium 147	49.1	pCi/L	40	65.7	Water	11/13/97 9:00	4/2/98 23:39	4/2/98 23:39
12058	SA1	976239	EPA 901.1	Bismuth-214, Activity	17.9	pCi/L	7.2	3.3	Water	11/13/97 9:00	3/24/98 7:17	3/24/98 7:17
12058	SA1	976239	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.8	Water	11/13/97 9:00	3/24/98 7:17	3/24/98 7:17
12058	SA1	976239	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		8	Water	11/13/97 9:00	3/24/98 7:17	3/24/98 7:17
12058	SA1	976239	EPA 901.1	Cesium-137, Activity	ND	pCi/L		1.9	Water	11/13/97 9:00	3/24/98 7:17	3/24/98 7:17

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12058	SA1	976239	EPA 901.1	Lead-211, Activity	ND	pCi/L		269	Water	11/13/97 9:00	3/24/98 7:17	3/24/98 7:17
12058	MD	976239	EPA 901.1	Cobalt-60, Activity	0	RPD		6.8	Water		3/24/98 11:30	3/24/98 11:30
12058	MD	976239	EPA 901.1	Cobalt-57, Activity	0	RPD		0.8	Water		3/24/98 11:30	3/24/98 11:30
12058	MD	976239	EPA 901.1	Bismuth-214, Activity	10.1	RPD	8	3.1	Water		3/24/98 11:30	3/24/98 11:30
12058	MD	976239	EPA 901.1	Cesium-137, Activity	0	RPD		3.2	Water		3/24/98 11:30	3/24/98 11:30
12058	MD	976239	EPA 901.1	Lead-211, Activity	0	RPD		35.9	Water		3/24/98 11:30	3/24/98 11:30
12058	MD	976239	EPA 901.1	Lead-214, Activity	15.5	RPD	6.9	3.2	Water		3/24/98 11:30	3/24/98 11:30
12062	MD	976236	mod. HASL 300	Uranium-238, Activity	0.1	RPD	0.4	0.3	Water		2/6/98 15:39	2/6/98 15:39
12062	MD	976236	mod. HASL 300	Uranium-235, Activity	0.3	RPD	0.1	0.3	Water		2/6/98 15:39	2/6/98 15:39
12062	MD	976236	mod. HASL 300	Uranium-233/234, Activity	0	RPD	0.4	0.5	Water		2/6/98 15:39	2/6/98 15:39
12062	MD	976236	CA-GLR-17.0	Tritium, Activity	13.5	RPD	168	281	Water		12/2/97 18:19	12/2/97 18:19
12062	MS	976236	mod. HASL 300	Plutonium-239/240	92.7	% REC	1.7	0.5	Water		2/12/98 8:48	2/12/98 8:48
12201	MS	976216	EPA 903.0	Radium-226, Activity	97.8	% REC	2.3	1.1	Water		2/19/98 7:04	2/19/98 7:04
12201	MS	976216	EPA 903.0	Radium-223, Activity	97.8	% REC			Water		2/19/98 7:04	2/19/98 7:04
12204	MD	976216	EPA 903.0	Radium-223, Activity	0	RPD			Water		2/19/98 7:04	2/19/98 7:04
12204	MD	976216	EPA 903.0	Radium-226, Activity	0	RPD	0.4	1.1	Water		2/19/98 7:04	2/19/98 7:04
12207	SA1	976239	EPA 901.1	Lead-214, Activity	18.4	pCi/L	6.6	3.7	Water	11/13/97 9:00	3/23/98 9:31	3/23/98 9:31
12207	SA1	976239	EPA 901.1	Lead-211, Activity	ND	pCi/L		738	Water	11/13/97 9:00	3/23/98 9:31	3/23/98 9:31
12207	SA1	976239	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2	0.5	Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12207	SA1	976239	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	11/13/97 9:00	2/19/98 7:04	2/19/98 7:04
12207	SA1	976239	CA-GLR-R510	Radon 222, Activity	79.2	pCi/L	34.5	55.5	Water	11/13/97 9:00	11/14/97 14:10	11/14/97 14:10
12207	SA1	976239	CA-GLR-17.0	Tritium, Activity	49.5	pCi/L	165	274	Water	11/13/97 9:00	12/2/97 18:19	12/2/97 18:19
12207	SA1	976239	mod. HASL 300	Plutonium-239/240	0.4	pCi/L	0.2	0.3	Water	11/13/97 9:00	2/12/98 8:48	2/12/98 8:48
12207	SA1	976239	EPA 900.0	Gross Beta, Activity	ND	pCi/L	0.5	1	Water	11/13/97 9:00	2/3/98 14:49	2/3/98 14:49
12207	SA1	976239	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12207	SA1	976239	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	0.2	0.4	Water	11/13/97 9:00	2/3/98 14:49	2/3/98 14:49
12207	SA1	976239	mod. HASL 300	Thorium-230, Activity	0.3	pCi/L	0.2	0.3	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12207	SA1	976239	EPA 901.1	Cesium-137, Activity	ND	pCi/L		3.5	Water	11/13/97 9:00	3/23/98 9:31	3/23/98 9:31
12207	SA1	976239	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/12/98 11:17	2/12/98 11:17
12207	SA1	976239	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12207	SA1	976239	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12207	SA1	976239	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/L	0.3	0.2	Water	11/13/97 9:00	2/6/98 15:39	2/6/98 15:39
12207	SA1	976239	mod. HASL 300	Promethium 147	59.5	pCi/L	40.2	65.7	Water	11/13/97 9:00	4/2/98 23:39	4/2/98 23:39
12207	SA1	976239	EPA 901.1	Bismuth-214, Activity	ND	pCi/L		15.5	Water	11/13/97 9:00	3/23/98 9:31	3/23/98 9:31
12207	SA1	976239	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.6	Water	11/13/97 9:00	3/23/98 9:31	3/23/98 9:31
12207	SA1	976239	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		6	Water	11/13/97 9:00	3/23/98 9:31	3/23/98 9:31
12207	MD	976239	mod. HASL 300	Promethium 147	17.1	RPD	40.4	65.7	Water		4/2/98 23:39	4/2/98 23:39
12207	MS	976239	CA-GLR-17.0	Tritium, Activity	96.6	% REC	243	288	Water		12/2/97 18:19	12/2/97 18:19
12210	MS	976236	mod. HASL 300	Uranium-238, Activity	115.4	% REC	3.2	0.4	Water		2/6/98 15:39	2/6/98 15:39
12210	MS	976236	mod. HASL 300	Uranium-233/234, Activity	109.7	% REC	3.3	0.4	Water		2/6/98 15:39	2/6/98 15:39
12416	MS	976182	mod. HASL 300	Promethium 147	97.4	% REC	67.2	54.8	Water		4/2/98 23:39	4/2/98 23:39
63007	MD	976468	EPA 900.0	Gross Alpha, Activity	0	RPD	2.2	3.7	Water		2/3/98 14:49	2/3/98 14:49
63007	MD	976468	EPA 900.0	Gross Beta, Activity	0	RPD	2	3.7	Water		2/3/98 14:49	2/3/98 14:49

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
63206	MS	976480	EPA 900.0	Gross Beta, Activity	89.6	% REC	1	1	Water		2/3/98 14:49	2/3/98 14:49
EFF1A0129	LCS	976239	EPA 900.0	Gross Alpha, Activity	104.3	% REC	0.5	0.2	Water		2/3/98 14:49	2/3/98 14:49
GEM031998M	LCS	976239	EPA 901.1	Cobalt-60, Activity	104	% REC	1490	305	Water		3/19/98 16:44	3/19/98 16:44
GEM031998M	LCS	976239	EPA 901.1	Cesium-137, Activity	103.5	% REC	1210	408	Water		3/19/98 16:44	3/19/98 16:44
GEM032398M	LCS	976239	EPA 901.1	Cesium-137, Activity	105	% REC	2820	484	Water		3/23/98 7:24	3/23/98 7:24
GEM032398M	LCS	976239	EPA 901.1	Cobalt-60, Activity	95.7	% REC	1390	383	Water		3/23/98 7:24	3/23/98 7:24
GMX031998M	LCS	976239	EPA 901.1	Cesium-137, Activity	105.5	% REC	1190	330	Water		3/19/98 15:39	3/19/98 15:39
GMX031998M	LCS	976239	EPA 901.1	Cobalt-60, Activity	103.7	% REC	1190	239	Water		3/19/98 15:39	3/19/98 15:39
GMX032398M	LCS	976239	EPA 901.1	Cobalt-60, Activity	105.9	% REC	1530	218	Water		3/23/98 7:10	3/23/98 7:10
GMX032398M	LCS	976239	EPA 901.1	Cesium-137, Activity	101.5	% REC	939	283	Water		3/23/98 7:10	3/23/98 7:10
GMX032498M	LCS	976239	EPA 901.1	Cobalt-60, Activity	101.2	% REC	1320	249	Water		3/24/98 7:04	3/24/98 7:04
GMX032498M	LCS	976239	EPA 901.1	Cesium-137, Activity	101	% REC	951	245	Water		3/24/98 7:04	3/24/98 7:04
LC2H31125	LCS	976239	CA-GLR-17.0	Tritium, Activity	99	% REC	2.5	3	Water		12/2/97 18:19	12/2/97 18:19
LCS1A0129	LCS	976239	EPA 900.0	Gross Alpha, Activity	107.1	% REC	0.5	0.2	Water		2/3/98 14:49	2/3/98 14:49
LCS1B0129	LCS	976239	EPA 900.0	Gross Beta, Activity	96.1	% REC	0.4	0.4	Water		2/3/98 14:49	2/3/98 14:49
LCS1PU0126	LCS	976239	mod. HASL 300	Plutonium-239/240	93.8	% REC	0.6	0.1	Water		2/12/98 8:48	2/12/98 8:48
LCS1U0123	LCS	976239	mod. HASL 300	Uranium-233/234, Activity	94.4	% REC	1	0.2	Water		2/6/98 15:39	2/6/98 15:39
LCS1U0123	LCS	976239	mod. HASL 300	Uranium-238, Activity	98	% REC	1	0.1	Water		2/6/98 15:39	2/6/98 15:39
LCS2A0129	LCS	976239	EPA 900.0	Gross Alpha, Activity	99	% REC	0.6	0.1	Water		2/3/98 14:49	2/3/98 14:49
LCS2B0129	LCS	976239	EPA 900.0	Gross Beta, Activity	92.8	% REC	0.4	0.4	Water		2/3/98 14:49	2/3/98 14:49
LCS2PM0402	LCS	976239	mod. HASL 300	Promethium 147	98.1	% REC	4.8	3.9	Water		4/2/98 23:39	4/2/98 23:39
LCS2TH0126	LCS	976239	mod. HASL 300	Thorium-232, Activity	95.6	% REC	1.3	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB1AB0129	MB	976239	EPA 900.0	Gross Beta, Activity	ND	pCi/L	0.2	0.4	Water		2/3/98 14:49	2/3/98 14:49
MB1AB0129	MB	976239	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	0.1	0.2	Water		2/3/98 14:49	2/3/98 14:49
MB1PU0126	MB	976239	mod. HASL 300	Plutonium-239/240	0.2	pCi/L	0.1	0.1	Water		2/12/98 8:48	2/12/98 8:48
MB1RN1113	MB	976239	CA-GLR-R510	Radon 222, Activity	ND	pCi/L	0.2	0.3	Water		11/14/97 17:11	11/14/97 17:11
MB1U0123	MB	976239	mod. HASL 300	Uranium-238, Activity	ND	pCi/L	0.1	0.1	Water		2/6/98 15:39	2/6/98 15:39
MB1U0123	MB	976239	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water		2/6/98 15:39	2/6/98 15:39
MB1U0123	MB	976239	mod. HASL 300	Uranium-233/234, Activity	0.2	pCi/L	0.1	0.1	Water		2/6/98 15:39	2/6/98 15:39
MB2PM0402	MB	976239	mod. HASL 300	Promethium 147	ND	pCi/L	2.3	3.9	Water		4/2/98 23:39	4/2/98 23:39
MB2R60218	MB	976239	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.1	0.3	Water		2/19/98 7:04	2/19/98 7:04
MB2R60218	MB	976239	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water		2/19/98 7:04	2/19/98 7:04
MB2TH0126	MB	976239	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB2TH0126	MB	976239	mod. HASL 300	Thorium-230, Activity	0.4	pCi/L	0.3	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB2TH0126	MB	976239	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water		2/12/98 11:17	2/12/98 11:17
MB4H31125	MB	976239	CA-GLR-17.0	Tritium, Activity	ND	pCi/L	1.6	2.7	Water		12/2/97 18:19	12/2/97 18:19
ST1R60218	LCS	976239	EPA 903.0	Radium-223, Activity	75.2	% REC			Water		2/19/98 7:04	2/19/98 7:04
ST1R60218	LCS	976239	EPA 903.0	Radium-226, Activity	75.2	% REC	0.5	0.3	Water		2/19/98 7:04	2/19/98 7:04
ST1RN1113	LCS	976239	CA-GLR-R510	Radon 222, Activity	97.9	% REC	0.4	0.3	Water		11/14/97 18:12	11/14/97 18:12
ST2H31125	LCS	976239	CA-GLR-17.0	Tritium, Activity	103.4	% REC	2.5	3	Water		12/2/97 18:19	12/2/97 18:19

CORE LAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

April 24, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976240

The following information is pertinent to the interpretation of the data.

On November 13, 1997, Core Laboratories - Casper received four soil samples in good condition.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error is calculated by the software for the positive results. The Ra226 activity by gamma is not reported using the 186kev line since Ra226 has a low abundance at that line and the U235 has a greater abundance with an energy very close to 186 which would cause interference. Therefore, the Ra226 is calculated from the Bi214 line, a daughter of Ra226. The Ra228 is calculated from the Ac228 line, the daughter of Ra228, as Ra228 is a beta emitter.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Radiochemistry Supervisor

«« CORE LABORATORIES - CHAIN OF CUSTODY RECORD »»

CUSTOMER INFORMATION		PROJECT INFORMATION		# ABC-012108
Company..:	Parsons	Project..:	SEAD-12	Page 4 Of 5
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	File = 11119702.bar
	101 Huntington Ave.	Address..:	101 Huntington Ave.	LAB JOB NUMBER
	Boston MA, 02199		Boston MA 02199	97624 0
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	11/11/97	1055	10015	12058	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1055	10014	12058	LIQUID-2B	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1055	10013	12058	H3	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1055	10012	12058	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1055	10011	12058	RN222	OVER-FOR-PARAM-KEY	
KKS	11/11/97	1055	10010	12058	RN222	OVER-FOR-PARAM-KEY	
BJP	11/11/97	1015	10030	12455	SED-1B	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1015	10023	12456	SED-1B	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801 452 961 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [ ] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/12/97	Signature:		Signature:	
Printed Name/Company: D. Chaffin / Parsons ES	Time 1900	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MLS / CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

«« CORE LABORATORIES - CHAIN OF CUSTODY RECORD »»

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012109
Company..: Parsons	Project..: SEAD-12	Page 5 Of 5
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 11119702.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199.	976240
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	11/11/97	1020	10016	12457	SED-1B	OVER-FOR-PARAM-KEY	
EAF	11/11/97	1111	10009	12458	SED-1B	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801 952 981 524

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: O. Maffin		Signature:		Signature:	
Printed Name/Company: O. Maffin /Parsons ES	Time	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	**Date**	**RECEIVED BY:**	**Date**	**RECEIVED BY:**	**Date**
Signature: Maria Lopez-Smith	11-13-97	Signature:		Signature:	
Printed Name/Company: MFLS/CORE LABS	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12407	MD	976118	CA-GLR-17.0	Tritium, Activity	0	RPD	0.1	0.2	Soil		11/25/97 0:32	11/25/97 0:32
12409	MS	976118	CA-GLR-17.0	Tritium, Activity	85.9	% REC	205	271	Soil		11/25/97 0:32	11/25/97 0:32
12409	MSD	976118	CA-GLR-17.0	Tritium, Activity	84	% REC	205	273	Soil		11/25/97 0:32	11/25/97 0:32
12448	MS	976235	mod. HASL 300	Promethium 147	105.2	% REC	10.4	8.5	Soil		4/7/98 6:35	4/7/98 6:35
12454	MD	976235	mod. HASL 300	Promethium 147	1.2	RPD	5.2	8.5	Soil		4/7/98 6:35	4/7/98 6:35
12455	SA1	976240	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.4	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12455	SA1	976240	mod. HASL 300	Thorium-232, Activity	1.1	pCi/g	0.6	0.5	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12455	SA1	976240	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.4	SEDIMENT	11/13/97 9:00	2/27/98 8:29	2/27/98 8:29
12455	SA1	976240	EPA 901.1	Bismuth-214, Activity	1.1	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/26/98 7:35	3/26/98 7:35
12455	SA1	976240	EPA 901.1	Radium-226, Activity	1.1	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/26/98 7:35	3/26/98 7:35
12455	SA1	976240	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	11/25/97 0:32	11/25/97 0:32
12455	SA1	976240	mod. HASL 300	Thorium-230, Activity	1.6	pCi/g	0.8	0.5	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12455	SA1	976240	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/26/98 7:35	3/26/98 7:35
12455	SA1	976240	mod. HASL 300	Uranium-238, Activity	0.8	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12455	SA1	976240	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12455	SA1	976240	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12455	SA1	976240	mod. HASL 300	Promethium 147	3.7	pCi/g	5.1	8.5	SEDIMENT	11/13/97 9:00	4/7/98 6:35	4/7/98 6:35
12455	SA1	976240	CA-GLR-R160	Moisture (@ 104 deg. C)	16.4	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12455	SA1	976240	EPA 901.1	Radium-228, Activity	2.1	pCi/g	0.5	0.1	SEDIMENT	11/13/97 9:00	3/26/98 7:35	3/26/98 7:35
12455	SA1	976240	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/26/98 7:35	3/26/98 7:35
12455	SA1	976240	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/26/98 7:35	3/26/98 7:35
12455	SA1	976240	EPA 901.1	Lead-210, Activity	ND	pCi/g		13	SEDIMENT	11/13/97 9:00	3/26/98 7:35	3/26/98 7:35
12455	SA1	976240	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/26/98 7:35	3/26/98 7:35
12455	SA1	976240	EPA 901.1	Lead-211, Activity	ND	pCi/g		4.5	SEDIMENT	11/13/97 9:00	3/26/98 7:35	3/26/98 7:35
12455	SA1	976240	EPA 901.1	Lead-214, Activity	1.3	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/26/98 7:35	3/26/98 7:35
12455	MD	976240	mod. HASL 300	Thorium-232, Activity	37	RPD	0.8	0.4	Soil		3/27/98 19:05	3/27/98 19:05
12455	MD	976240	mod. HASL 300	Thorium-230, Activity	37	RPD	0.7	0.5	Soil		3/27/98 19:05	3/27/98 19:05
12455	MD	976240	mod. HASL 300	Thorium-227	0.2	RPD	0.3	0.4	Soil		3/27/98 19:05	3/27/98 19:05
12456	SA1	976240	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.2	0.2	SEDIMENT	11/13/97 9:00	2/27/98 8:29	2/27/98 8:29
12456	SA1	976240	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.5	0.4	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12456	SA1	976240	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	11/25/97 0:32	11/25/97 0:32
12456	SA1	976240	mod. HASL 300	Thorium-230, Activity	1.5	pCi/g	0.7	0.4	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12456	SA1	976240	EPA 901.1	Radium-228, Activity	1.4	pCi/g	0.5	0.2	SEDIMENT	11/13/97 9:00	3/26/98 8:40	3/26/98 8:40
12456	SA1	976240	mod. HASL 300	Thorium-227	0.6	pCi/g	0.5	0.5	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12456	SA1	976240	CA-GLR-R160	Moisture (@ 104 deg. C)	68	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12456	SA1	976240	mod. HASL 300	Promethium 147	16.3	pCi/g	5.3	8.5	SEDIMENT	11/13/97 9:00	4/7/98 6:35	4/7/98 6:35
12456	SA1	976240	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12456	SA1	976240	mod. HASL 300	Uranium-235, Activity	0.6	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12456	SA1	976240	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/g	0.5	0.3	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12456	SA1	976240	EPA 901.1	Radium-226, Activity	1.4	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/26/98 8:40	3/26/98 8:40
12456	SA1	976240	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/26/98 8:40	3/26/98 8:40
12456	SA1	976240	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/26/98 8:40	3/26/98 8:40
12456	SA1	976240	EPA 901.1	Bismuth-214, Activity	1.4	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	3/26/98 8:40	3/26/98 8:40

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12456	SA1	976240	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/26/98 8:40	3/26/98 8:40
12456	SA1	976240	EPA 901.1	Lead-211, Activity	ND	pCi/g		5.7	SEDIMENT	11/13/97 9:00	3/26/98 8:40	3/26/98 8:40
12456	SA1	976240	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/26/98 8:40	3/26/98 8:40
12456	SA1	976240	EPA 901.1	Lead-214, Activity	1.8	pCi/g	0.3	0.2	SEDIMENT	11/13/97 9:00	3/26/98 8:40	3/26/98 8:40
12456	SA1	976240	EPA 901.1	Lead-210, Activity	ND	pCi/g		19.3	SEDIMENT	11/13/97 9:00	3/26/98 8:40	3/26/98 8:40
12456	MS	976240	mod. HASL 300	Thorium-232, Activity	107.9	% REC	3.5	0.3	Soil		3/27/98 19:05	3/27/98 19:05
12457	SA1	976240	CA-GLR-R160	Moisture (@ 104 deg. C)	64.6	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12457	SA1	976240	EPA 901.1	Radium-228, Activity	2.4	pCi/g	0.6	0.2	SEDIMENT	11/13/97 9:00	3/26/98 9:43	3/26/98 9:43
12457	SA1	976240	EPA 901.1	Bismuth-214, Activity	1.3	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/26/98 9:43	3/26/98 9:43
12457	SA1	976240	EPA 901.1	Radium-226, Activity	1.3	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	3/26/98 9:43	3/26/98 9:43
12457	SA1	976240	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/26/98 9:43	3/26/98 9:43
12457	SA1	976240	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/13/97 9:00	3/26/98 9:43	3/26/98 9:43
12457	SA1	976240	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/26/98 9:43	3/26/98 9:43
12457	SA1	976240	EPA 901.1	Lead-210, Activity	ND	pCi/g		37	SEDIMENT	11/13/97 9:00	3/26/98 9:43	3/26/98 9:43
12457	SA1	976240	mod. HASL 300	Promethium 147	14.3	pCi/g	5.3	8.5	SEDIMENT	11/13/97 9:00	4/7/98 6:35	4/7/98 6:35
12457	SA1	976240	EPA 901.1	Lead-214, Activity	1.6	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/26/98 9:43	3/26/98 9:43
12457	SA1	976240	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/13/97 9:00	3/26/98 9:43	3/26/98 9:43
12457	SA1	976240	EPA 901.1	Lead-211, Activity	ND	pCi/g		2.1	SEDIMENT	11/13/97 9:00	3/26/98 9:43	3/26/98 9:43
12457	SA1	976240	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.3	SEDIMENT	11/13/97 9:00	2/27/98 8:29	2/27/98 8:29
12457	SA1	976240	mod. HASL 300	Uranium-233/234, Activity	1.1	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12457	SA1	976240	mod. HASL 300	Uranium-235, Activity	0.4	pCi/g	0.2	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12457	SA1	976240	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.2	SEDIMENT	11/13/97 9:00	11/25/97 0:32	11/25/97 0:32
12457	SA1	976240	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12457	SA1	976240	mod. HASL 300	Thorium-232, Activity	1.9	pCi/g	1	0.6	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12457	SA1	976240	mod. HASL 300	Thorium-230, Activity	1.5	pCi/g	1	0.7	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12457	SA1	976240	mod. HASL 300	Thorium-227	0.6	pCi/g	0.6	0.6	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12458	SA1	976240	mod. HASL 300	Thorium-232, Activity	1.4	pCi/g	0.8	0.4	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12458	SA1	976240	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	11/25/97 0:32	11/25/97 0:32
12458	SA1	976240	mod. HASL 300	Thorium-230, Activity	2.3	pCi/g	1.1	0.6	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12458	SA1	976240	mod. HASL 300	Plutonium-239/240	0.3	pCi/g	0.2	0.2	SEDIMENT	11/13/97 9:00	2/27/98 8:29	2/27/98 8:29
12458	SA1	976240	mod. HASL 300	Thorium-227	0.1	pCi/g	0.2	0.5	SEDIMENT	11/13/97 9:00	3/27/98 19:05	3/27/98 19:05
12458	SA1	976240	mod. HASL 300	Uranium-235, Activity	0.2	pCi/g	0.1	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12458	SA1	976240	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/g	0.4	0.2	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12458	SA1	976240	mod. HASL 300	Promethium 147	10.2	pCi/g	5.2	8.5	SEDIMENT	11/13/97 9:00	4/7/98 6:35	4/7/98 6:35
12458	SA1	976240	CA-GLR-R160	Moisture (@ 104 deg. C)	26.6	% by Wt			SEDIMENT	11/13/97 9:00	11/19/97 12:00	11/19/97 12:00
12458	SA1	976240	EPA 901.1	Radium-228, Activity	1.4	pCi/g	0.4	0.1	SEDIMENT	11/13/97 9:00	3/26/98 13:05	3/26/98 13:05
12458	SA1	976240	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.7	SEDIMENT	11/13/97 9:00	3/26/98 13:05	3/26/98 13:05
12458	SA1	976240	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.7	SEDIMENT	11/13/97 9:00	3/26/98 13:05	3/26/98 13:05
12458	SA1	976240	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.2	SEDIMENT	11/13/97 9:00	3/26/98 13:05	3/26/98 13:05
12458	SA1	976240	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.3	0.1	SEDIMENT	11/13/97 9:00	2/25/98 14:15	2/25/98 14:15
12458	SA1	976240	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/26/98 13:05	3/26/98 13:05
12458	SA1	976240	EPA 901.1	Lead-214, Activity	1.3	pCi/g	0.3	0.2	SEDIMENT	11/13/97 9:00	3/26/98 13:05	3/26/98 13:05
12458	SA1	976240	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.5	SEDIMENT	11/13/97 9:00	3/26/98 13:05	3/26/98 13:05

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12458	SA1	976240	EPA 901.1	Lead-210, Activity	ND	pCi/g		14.9	SEDIMENT	11/13/97 9:00	3/26/98 13:05	3/26/98 13:05
12458	SA1	976240	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.3	SEDIMENT	11/13/97 9:00	3/26/98 13:05	3/26/98 13:05
12458	SA1	976240	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/13/97 9:00	3/26/98 13:05	3/26/98 13:05
12458	MD	976240	EPA 901.1	Cesium-137, Activity	0	RPD		0.3	Soil		3/26/98 14:07	3/26/98 14:07
12458	MD	976240	EPA 901.1	Lead-210, Activity	0	RPD		6.7	Soil		3/26/98 14:07	3/26/98 14:07
12458	MD	976240	EPA 901.1	Lead-211, Activity	0	RPD		15.2	Soil		3/26/98 14:07	3/26/98 14:07
12458	MD	976240	EPA 901.1	Radium-228, Activity	40	RPD	0.5	0.1	Soil		3/26/98 14:07	3/26/98 14:07
12458	MD	976240	EPA 901.1	Bismuth-214, Activity	1.5	RPD	0.3	0.1	Soil		3/26/98 14:07	3/26/98 14:07
12458	MD	976240	EPA 901.1	Radium-226, Activity	1.5	RPD	0.3	0.1	Soil		3/26/98 14:07	3/26/98 14:07
12458	MD	976240	EPA 901.1	Lead-214, Activity	8	RPD	0.3	0.2	Soil		3/26/98 14:07	3/26/98 14:07
12458	MD	976240	EPA 901.1	Cobalt-57, Activity	0	RPD		0.1	Soil		3/26/98 14:07	3/26/98 14:07
12458	MD	976240	EPA 901.1	Radium-223, Activity	0	RPD		0.4	Soil		3/26/98 14:07	3/26/98 14:07
12458	MD	976240	EPA 901.1	Cobalt-60, Activity	0	RPD		0.4	Soil		3/26/98 14:07	3/26/98 14:07
12465	MD	976460	mod. HASL 300	Plutonium-239/240	0	RPD	0.1	0.3	Soil		2/27/98 8:29	2/27/98 8:29
12466	MS	976460	mod. HASL 300	Plutonium-239/240	77.1	% REC	1	0.3	Soil		2/27/98 8:29	2/27/98 8:29
12469	MD	976460	mod. HASL 300	Uranium-238, Activity	0	RPD	0.3	0.1	Soil		2/25/98 14:15	2/25/98 14:15
12469	MD	976460	mod. HASL 300	Uranium-233/234, Activity	11.8	RPD	0.3	0.2	Soil		2/25/98 14:15	2/25/98 14:15
12469	MD	976460	mod. HASL 300	Uranium-235, Activity	0.1	RPD	0.2	0.1	Soil		2/25/98 14:15	2/25/98 14:15
12470	MS	976460	mod. HASL 300	Uranium-233/234, Activity	81.5	% REC	1.3	0.1	Soil		2/25/98 14:15	2/25/98 14:15
12470	MS	976460	mod. HASL 300	Uranium-238, Activity	92	% REC	1.2	0.1	Soil		2/25/98 14:15	2/25/98 14:15
GEM032698S	LCS	976240	EPA 901.1	Cesium-137, Activity	102.9	% REC	1340	317	Water		3/26/98 7:19	3/26/98 7:19
GEM032698S	LCS	976240	EPA 901.1	Cobalt-60, Activity	100.9	% REC	1530	326	Water		3/26/98 7:19	3/26/98 7:19
LC1H31122	LCS	976240	CA-GLR-17.0	Tritium, Activity	76.8	% REC	1.9	2.6	Water		11/25/97 0:32	11/25/97 0:32
LCAPM0303	LCS	976240	mod. HASL 300	Promethium 147	104.3	% REC	5.1	4.3	Water		4/7/98 6:35	4/7/98 6:35
LCSAP0224	LCS	976240	mod. HASL 300	Plutonium-239/240	91.7	% REC	1	0.2	Water		2/27/98 8:29	2/27/98 8:29
LCSAT0224	LCS	976240	mod. HASL 300	Thorium-232, Activity	100	% REC	1.1	0.2	Water		2/26/98 10:54	2/26/98 10:54
LCSBT0310	LCS	976240	mod. HASL 300	Thorium-232, Activity	91.4	% REC	0.7	0.1	Water		3/27/98 19:05	3/27/98 19:05
LCSBU0223	LCS	976240	mod. HASL 300	Uranium-238, Activity	90	% REC	1	0.1	Water		2/25/98 14:15	2/25/98 14:15
LCSBU0223	LCS	976240	mod. HASL 300	Uranium-233/234, Activity	79.6	% REC	1	0.2	Water		2/25/98 14:15	2/25/98 14:15
MB1H31122	MB	976240	CA-GLR-17.0	Tritium, Activity	ND	pCi/L	1.5	2.4	Water		11/25/97 0:32	11/25/97 0:32
MB2H31122	MB	976240	CA-GLR-17.0	Tritium, Activity	ND	pCi/L	1.5	2.5	Water		11/25/97 0:32	11/25/97 0:32
MBAP0224	MB	976240	mod. HASL 300	Plutonium-239/240	0.3	pCi/L	0.2	0.2	Water		2/27/98 8:29	2/27/98 8:29
MBAT0224	MB	976240	mod. HASL 300	Thorium-227	0.1	pCi/L	0.1	0.2	Water		2/26/98 10:54	2/26/98 10:54
MBAT0224	MB	976240	mod. HASL 300	Thorium-230, Activity	0.3	pCi/L	0.3	0.3	Water		2/26/98 10:54	2/26/98 10:54
MBAT0224	MB	976240	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water		2/26/98 10:54	2/26/98 10:54
MBBPM0303	MB	976240	mod. HASL 300	Promethium 147	ND	pCi/L	2.5	4.3	Water		4/7/98 6:35	4/7/98 6:35
MBBT0310	MB	976240	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water		3/27/98 19:05	3/27/98 19:05
MBBT0310	MB	976240	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water		3/27/98 19:05	3/27/98 19:05
MBBT0310	MB	976240	mod. HASL 300	Thorium-230, Activity	0.5	pCi/L	0.3	0.3	Water		3/27/98 19:05	3/27/98 19:05
MBCU0223	MB	976240	mod. HASL 300	Uranium-233/234, Activity	0.1	pCi/L	0.1	0.1	Water		2/25/98 14:15	2/25/98 14:15
MBCU0223	MB	976240	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.1	Water		2/25/98 14:15	2/25/98 14:15
MBCU0223	MB	976240	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.1	Water		2/25/98 14:15	2/25/98 14:15
ST1H31122	LCS	976240	CA-GLR-17.0	Tritium, Activity	84.7	% REC	2	2.6	Water		11/25/97 0:32	11/25/97 0:32

CORELAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

April 24, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976293

The following information is pertinent to the interpretation of the data.

On November 19, 1997, Core Laboratories - Casper received eighteen soil samples in good condition.

The isotopic thorium batch was reanalyzed due to low tracer recovery. The reanalysis batch was acceptable.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error is calculated by the software for the positive results. The Ra226 activity by gamma is not reported using the 186kev line since Ra226 has a low abundance at that line and the U235 has a greater abundance with an energy very close to 186 which would cause interference. Therefore, the Ra226 is calculated from the Bi214 line, a daughter of Ra226. The Ra228 is calculated from the Ac228 line, the daughter of Ra228, as Ra228 is a beta emitter.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Radiochemistry Supervisor

Cooler # 77

<<< CORE LABORATORIES - CHAIN OF CUSTODY RECORD >>>

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012124
Company..: Parsons	Project..: SEAD-12 LIMS No. 1935	Page 1 Of 3
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 11189701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976293
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
BJP	11/17/97	1315	10150	12535	SOLIDS-1B	OVER-FOR-PARAM-KEY	
DLC	11/17/97	1330	10151	12536	SOLIDS-1B	OVER-FOR-PARAM-KEY	
BJP	11/17/97	1350	10152	12537	SOLIDS-1B	OVER-FOR-PARAM-KEY	
DLC	11/17/97	1400	10153	12538	SOLIDS-1B	OVER-FOR-PARAM-KEY	
DLC	11/17/97	1420	10154	12539	SOLIDS-1B	OVER-FOR-PARAM-KEY	
NAS	11/17/97	1440	10155	12540	SOLIDS-1B	OVER-FOR-PARAM-KEY	
DLC	11/18/97	0950	10162	12541	SOLIDS-1B	OVER-FOR-PARAM-KEY	
BJP	11/18/97	1000	10163	12542	SOLIDS-1B	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 8014493040 20

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ______ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY	Date
Signature: D. Luthin	11/18/97	Signature:		Signature:	
Printed Name/Company: D Luthin / Parsons ES	Time 1830	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Puder	11/19/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder - CORE	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

Cooler #77

◄◄◄ CORE LABORATORIES - CHAIN OF CUSTODY RECORD ►►►

CUSTOMER INFORMATION	PROJECT INFORMATION	
Company..: Parsons	Project..: SEAD-12 LIMS No. 1835	# ABC-012125
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	Page 2 Of 3
101 Huntington Ave.	Address..: 101 Huntington Ave.	File = 11189701.bar
Boston MA, 02199	Boston MA 02199	LAB JOB NUMBER 976293
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	Sediments only

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
BJP	11/18/97	0845	10156	12211 (associate w/ 12512)	S-WAT-1	OVER-FOR-PARAM-KEY	
BJP	11/18/97	0845	10157	12211 "	S-WAT-2B	OVER-FOR-PARAM-KEY	
BJP	11/18/97	0845	10158	12211 "	H3	OVER-FOR-PARAM-KEY	
BJP	11/18/97	0845	10159	12211 "	RN222	OVER-FOR-PARAM-KEY	
BJP	11/18/97	0845	10160	12211 "	RN222	OVER-FOR-PARAM-KEY	
BJP	11/18/97	0845	10161	12211 "	RN222	OVER-FOR-PARAM-KEY	
DLC	11/18/97	1010	10164	12543	SOLIDS-1B	OVER-FOR-PARAM-KEY	
DLC	11/18/97	1015	10165	12212	SOLIDS-1B	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801199304020

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Griffin	11/18/97	Signature:		Signature:	
Printed Name/Company: D. Griffin / Parsons ES	Time 1830	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Puder	11/19/97	Signature:		Signature:	
Printed Name/Company: M. Puder - CORE	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

Cooler #77

« « « CORE LABORATORIES - CHAIN OF CUSTODY RECORD » » »

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012126
Company..: Parsons	Project..: SEAD-12 LMNS No. 4835	Page 3 Of 3
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 11189701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976293
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	sediments only

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
CSM	11/18/97	1020	10166	12544	SOLIDS-1B	OVER-FOR-PARAM-KEY	
CSM	11/18/97	1335	10167	12545	SOLIDS-1B	OVER-FOR-PARAM-KEY	
DLC	11/18/97	1330	10168	12546	SOLIDS-1B	OVER-FOR-PARAM-KEY	
CSM	11/18/97	13~~3~~0 5	10169	12547	SOLIDS-1B	OVER-FOR-PARAM-KEY	
DLC	11/18/97	1415	10170	12548	SOLIDS-1B	OVER-FOR-PARAM-KEY	
NAS	11/18/97	1250	10171	12549	SOLIDS ~~SED~~-1B	OVER-FOR-PARAM-KEY	
NAS	11/18/97	1315	10172	12550	SOLIDS ~~SED~~-1B	OVER-FOR-PARAM-KEY	
NAS	11/18/97	1410	10173	12551	SOLIDS ~~SED~~-1B	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: Fed Ex AIRBILL NO.: 801449304020

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ____________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: D. Chaffin	11/18/97	Signature:		Signature:	
Printed Name/Company: D. Chaffin / Parsons ES	Time 1830	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Puder	11/19/97	Signature:		Signature:	
Printed Name/Company: M. Puder - CORE	Time 0900	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12212	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	29.8	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12212	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.3	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12212	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.7	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12212	SA1	976293	mod. HASL 300	Thorium-230, Activity	1	pCi/g	0.9	0.8	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12212	SA1	976293	mod. HASL 300	Thorium-227	0.3	pCi/g	0.4	0.6	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12212	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12212	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12212	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12212	SA1	976293	mod. HASL 300	Promethium 147	10.5	pCi/g	5.2	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12212	SA1	976293	CA-GLR-17.0	Tritium, Activity	60.4	pCi/g	0.8	0.3	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12212	SA1	976293	EPA 901.1	Bismuth-214, Activity	1.3	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12212	SA1	976293	EPA 901.1	Radium-226, Activity	1.3	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12212	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12212	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12212	SA1	976293	EPA 901.1	Cesium-137, Activity	0.5	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12212	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		21.7	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12212	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.2	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12212	SA1	976293	EPA 901.1	Lead-214, Activity	1.9	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12212	SA1	976293	EPA 901.1	Radium-228, Activity	1.4	pCi/g	0.4	0.1	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12212	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12212	MD	976293	mod. HASL 300	Thorium-227	0	RPD	0.4	0.5	Soil		3/31/98 13:39	3/31/98 13:39
12212	MD	976293	mod. HASL 300	Thorium-230, Activity	57.1	RPD	0.9	0.5	Soil		3/31/98 13:39	3/31/98 13:39
12212	MD	976293	mod. HASL 300	Thorium-232, Activity	20	RPD	0.7	0.4	Soil		3/31/98 13:39	3/31/98 13:39
12535	SA1	976293	mod. HASL 300	Plutonium-239/240	0.2	pCi/g	0.2	0.3	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12535	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.5	pCi/g	0.4	0.4	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12535	SA1	976293	mod. HASL 300	Thorium-230, Activity	1.6	pCi/g	0.8	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12535	SA1	976293	mod. HASL 300	Thorium-227	0.2	pCi/g	0.2	0.4	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12535	SA1	976293	mod. HASL 300	Uranium-238, Activity	1.4	pCi/g	0.6	0.3	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12535	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.3	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12535	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	1.9	pCi/g	0.8	0.3	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12535	SA1	976293	mod. HASL 300	Promethium 147	12.8	pCi/g	5.2	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12535	SA1	976293	CA-GLR-17.0	Tritium, Activity	0.8	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12535	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	22.4	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12535	SA1	976293	EPA 901.1	Lead-214, Activity	2.5	pCi/g	0.5	0.1	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12535	SA1	976293	EPA 901.1	Radium-228, Activity	2.1	pCi/g	0.7	0.2	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12535	SA1	976293	EPA 901.1	Bismuth-214, Activity	1.7	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12535	SA1	976293	EPA 901.1	Radium-226, Activity	1.7	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12535	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12535	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12535	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12535	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		5	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12535	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		8.3	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12535	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12535	MD	976293	mod. HASL 300	Plutonium-239/240	0.2	RPD	0.1	0.3	Soil		3/5/98 9:42	3/5/98 9:42
12536	SA1	976293	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.3	0.5	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12536	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.8	0.8	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12536	SA1	976293	mod. HASL 300	Thorium-230, Activity	0.5	pCi/g	1	1.2	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12536	SA1	976293	mod. HASL 300	Thorium-227	0.1	pCi/g	0.3	0.7	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12536	SA1	976293	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12536	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.2	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12536	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	25.6	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12536	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12536	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/g	0.2	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12536	SA1	976293	EPA 901.1	Radium-226, Activity	1.6	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12536	SA1	976293	mod. HASL 300	Promethium 147	13.4	pCi/g	5.2	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12536	SA1	976293	EPA 901.1	Bismuth-214, Activity	1.6	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12536	SA1	976293	EPA 901.1	Radium-228, Activity	1.5	pCi/g	0.5	0.1	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12536	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12536	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12536	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12536	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		33.6	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12536	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		1.4	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12536	SA1	976293	EPA 901.1	Lead-211, Activity	9.7	pCi/g	3.3	1.2	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12536	SA1	976293	EPA 901.1	Lead-214, Activity	1.5	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/30/98 7:52	3/30/98 7:52
12536	MS	976293	CA-GLR-17.0	Tritium, Activity	78.2	% REC	195	260	Soil		2/19/98 3:39	2/19/98 3:39
12536	MS	976293	mod. HASL 300	Promethium 147	104.2	% REC	10.3	8.3	Soil		4/8/98 10:12	4/8/98 10:12
12536	MS	976293	mod. HASL 300	Plutonium-239/240	108.3	% REC	1.3	0.3	Soil		3/5/98 9:42	3/5/98 9:42
12537	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.3	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12537	SA1	976293	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12537	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.6	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12537	SA1	976293	mod. HASL 300	Promethium 147	10.1	pCi/g	5.1	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12537	SA1	976293	mod. HASL 300	Thorium-230, Activity	0.5	pCi/g	0.7	0.8	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12537	SA1	976293	mod. HASL 300	Thorium-227	0.6	pCi/g	0.5	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12537	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12537	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12537	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12537	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		12.1	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12537	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	29.7	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12537	SA1	976293	EPA 901.1	Radium-228, Activity	2.2	pCi/g	0.6	0.3	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12537	SA1	976293	EPA 901.1	Bismuth-214, Activity	2.6	pCi/g	0.4	0.1	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12537	SA1	976293	EPA 901.1	Radium-226, Activity	2.6	pCi/g	0.4	0.1	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12537	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12537	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12537	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		1.1	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12537	SA1	976293	EPA 901.1	Lead-214, Activity	2.4	pCi/g	0.6	0.2	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12537	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		3.9	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12537	SA1	976293	EPA 901.1	Radium-223, Activity	0.7	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	SA1	976293	mod. HASL 300	Thorium-230, Activity	0.5	pCi/g	0.6	0.6	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12538	SA1	976293	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12538	SA1	976293	mod. HASL 300	Thorium-227	0.1	pCi/g	0.2	0.3	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12538	SA1	976293	mod. HASL 300	Plutonium-239/240	0.2	pCi/g	0.2	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12538	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.2	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12538	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.7	pCi/g	0.5	0.4	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12538	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/g	0.2	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12538	SA1	976293	mod. HASL 300	Promethium 147	12	pCi/g	5.2	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12538	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	22.3	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12538	SA1	976293	EPA 901.1	Radium-228, Activity	1.2	pCi/g	0.4	0.1	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	SA1	976293	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.5	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	SA1	976293	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.5	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12538	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.6	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		25.9	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		4.8	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	SA1	976293	EPA 901.1	Lead-214, Activity	ND	pCi/g		1.2	SEDIMENT	11/19/97 9:00	3/30/98 9:12	3/30/98 9:12
12538	MD	976293	CA-GLR-17.0	Tritium, Activity	26.1	RPD	156	255	Soil		2/19/98 3:39	2/19/98 3:39
12539	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12539	SA1	976293	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12539	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.5	0.3	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12539	SA1	976293	mod. HASL 300	Thorium-227	0.1	pCi/g	0.1	0.3	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12539	SA1	976293	mod. HASL 300	Thorium-230, Activity	1	pCi/g	0.6	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12539	SA1	976293	mod. HASL 300	Promethium 147	9.5	pCi/g	5.1	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12539	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	30.1	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12539	SA1	976293	EPA 901.1	Radium-228, Activity	1.4	pCi/g	0.4	0.1	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12539	SA1	976293	EPA 901.1	Bismuth-214, Activity	1.8	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12539	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12539	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12539	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.5	pCi/g	0.2	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12539	SA1	976293	EPA 901.1	Radium-226, Activity	1.8	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12539	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		3.7	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12539	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.8	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12539	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12539	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12539	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		2.5	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12539	SA1	976293	EPA 901.1	Lead-214, Activity	ND	pCi/g		1.4	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12539	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12539	MD	976293	mod. HASL 300	Uranium-238, Activity	0.2	RPD	0.3	0.1	Soil		3/3/98 10:09	3/3/98 10:09
12539	MD	976293	mod. HASL 300	Uranium-235, Activity	0	RPD	0.1	0.1	Soil		3/3/98 10:09	3/3/98 10:09
12539	MD	976293	mod. HASL 300	Uranium-233/234, Activity	13.3	RPD	0.3	0.1	Soil		3/3/98 10:09	3/3/98 10:09
12540	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12540	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.6	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12540	SA1	976293	mod. HASL 300	Thorium-230, Activity	1.4	pCi/g	0.9	0.7	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12540	SA1	976293	mod. HASL 300	Thorium-227	0.5	pCi/g	0.5	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12540	SA1	976293	mod. HASL 300	Uranium-238, Activity	1	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12540	SA1	976293	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12540	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.3	pCi/g	0.3	0.3	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12540	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12540	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.4	0.4	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12540	SA1	976293	mod. HASL 300	Promethium 147	16.8	pCi/g	5.3	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12540	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	28.2	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12540	SA1	976293	EPA 901.1	Radium-228, Activity	1	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12540	SA1	976293	EPA 901.1	Bismuth-214, Activity	1.4	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15

PARSONS ES SAMPLE SAMP ID	TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12540	SA1	976293	EPA 901.1	Radium-226, Activity	1.4	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12540	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12540	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12540	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		23.1	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12540	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12540	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		5.8	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12540	SA1	976293	EPA 901.1	Lead-214, Activity	1.6	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/30/98 10:15	3/30/98 10:15
12540	MD	976293	mod. HASL 300	Promethium 147	5.9	RPD	5.2	8.3	Soil		4/8/98 10:12	4/8/98 10:12
12540	MS	976293	mod. HASL 300	Uranium-233/234, Activity	88.9	% REC	1.2	0.2	Soil		3/3/98 10:09	3/3/98 10:09
12540	MS	976293	mod. HASL 300	Uranium-238, Activity	82	% REC	1.1	0.1	Soil		3/3/98 10:09	3/3/98 10:09
12541	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.3	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12541	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.5	pCi/g	0.6	0.7	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12541	SA1	976293	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12541	SA1	976293	mod. HASL 300	Thorium-230, Activity	0.8	pCi/g	0.9	1	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12541	SA1	976293	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.5	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12541	SA1	976293	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.6	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12541	SA1	976293	mod. HASL 300	Uranium-238, Activity	1.2	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12541	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.4	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12541	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.4	0.4	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12541	SA1	976293	mod. HASL 300	Promethium 147	9.5	pCi/g	5.1	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12541	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	28.2	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12541	SA1	976293	EPA 901.1	Radium-228, Activity	2.3	pCi/g	0.5	0.1	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12541	SA1	976293	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.5	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12541	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12541	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.3	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12541	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12541	SA1	976293	EPA 901.1	Lead-210, Activity	3.7	pCi/g	1.3	0.9	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12541	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12541	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		3.5	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12541	SA1	976293	EPA 901.1	Lead-214, Activity	1.5	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12542	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.2	0.3	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12542	SA1	976293	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12542	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.6	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12542	SA1	976293	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.2	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12542	SA1	976293	mod. HASL 300	Thorium-230, Activity	1.1	pCi/g	0.7	0.6	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12542	SA1	976293	mod. HASL 300	Thorium-227	0.5	pCi/g	0.5	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12542	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.8	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12542	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.4	pCi/g	0.2	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12542	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12542	SA1	976293	mod. HASL 300	Promethium 147	15.2	pCi/g	5.2	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12542	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	30.3	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12542	SA1	976293	EPA 901.1	Radium-228, Activity	1.7	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12542	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12542	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.5	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12542	SA1	976293	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.2	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12542	SA1	976293	EPA 901.1	Cesium-137, Activity	0.6	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12542	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12542	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		42.2	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12542	SA1	976293	EPA 901.1	Lead-211, Activity	3.9	pCi/g	1.6	0.5	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12542	SA1	976293	EPA 901.1	Lead-214, Activity	1.2	pCi/g	0.2	0.1	SEDIMENT	11/19/97 9:00	3/30/98 11:17	3/30/98 11:17
12543	SA1	976293	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12543	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12543	SA1	976293	EPA 901.1	Radium-228, Activity	1.7	pCi/g	0.6	0.3	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12543	SA1	976293	mod. HASL 300	Thorium-232, Activity	1.7	pCi/g	0.8	0.4	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12543	SA1	976293	mod. HASL 300	Thorium-230, Activity	1.4	pCi/g	0.9	0.7	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12543	SA1	976293	mod. HASL 300	Thorium-227	0.1	pCi/g	0.2	0.3	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12543	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12543	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12543	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12543	SA1	976293	mod. HASL 300	Promethium 147	7.7	pCi/g	5.1	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12543	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg C)	27.2	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12543	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12543	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12543	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.6	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12543	SA1	976293	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.6	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12543	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		4.3	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12543	SA1	976293	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.6	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12543	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		10	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12543	SA1	976293	EPA 901.1	Lead-214, Activity	2	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12543	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/19/97 9:00	3/30/98 13:09	3/30/98 13:09
12544	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.2	0.4	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12544	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.7	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12544	SA1	976293	mod. HASL 300	Thorium-230, Activity	1.3	pCi/g	0.9	0.7	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12544	SA1	976293	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12544	SA1	976293	mod. HASL 300	Thorium-227	0.5	pCi/g	0.5	0.6	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12544	SA1	976293	mod. HASL 300	Promethium 147	17.8	pCi/g	5.3	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12544	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12544	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.2	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12544	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	1.1	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12544	SA1	976293	EPA 901.1	Radium-228, Activity	1.9	pCi/g	0.7	0.2	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12544	SA1	976293	EPA 901.1	Bismuth-214, Activity	1.4	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12544	SA1	976293	EPA 901.1	Radium-226, Activity	1.4	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12544	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12544	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12544	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.9	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12544	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		4.8	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12544	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		0.9	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12544	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	35.8	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12544	SA1	976293	EPA 901.1	Lead-214, Activity	2.2	pCi/g	0.5	0.3	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12544	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12544	MS	976293	mod. HASL 300	Thorium-232, Activity	90.7	% REC	3.4	0.3	Soil		3/31/98 13:39	3/31/98 13:39
12545	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12545	SA1	976293	mod. HASL 300	Thorium-232, Activity	1.5	pCi/g	0.8	0.4	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12545	SA1	976293	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12545	SA1	976293	mod. HASL 300	Thorium-230, Activity	1.7	pCi/g	0.8	0.2	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12545	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	1.1	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12545	SA1	976293	mod. HASL 300	Thorium-227	0.3	pCi/g	0.4	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12545	SA1	976293	mod. HASL 300	Uranium-238, Activity	1	pCi/g	0.4	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12545	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.2	pCi/g	0.1	0 2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12545	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	38.2	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12545	SA1	976293	EPA 901.1	Radium-228, Activity	1.6	pCi/g	0.6	0.3	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12545	SA1	976293	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.4	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12545	SA1	976293	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.4	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12545	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0 1	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12545	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12545	SA1	976293	EPA 901.1	Cesium-137, Activity	0.7	pCi/g	0.2	0.1	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12545	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		23.6	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12545	SA1	976293	mod. HASL 300	Promethium 147	7.8	pCi/g	5.1	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12545	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.3	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12545	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12545	SA1	976293	EPA 901.1	Lead-214, Activity	2	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/30/98 14:11	3/30/98 14:11
12546	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12546	SA1	976293	mod. HASL 300	Thorium-232, Activity	1	pCi/g	0.7	0.6	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12546	SA1	976293	CA-GLR-17.0	Tritium, Activity	9.6	pCi/g	0.2	0.2	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12546	SA1	976293	mod. HASL 300	Thorium-230, Activity	1.5	pCi/g	1	0.8	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12546	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.2	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12546	SA1	976293	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.7	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12546	SA1	976293	mod. HASL 300	Uranium-238, Activity	1	pCi/g	0.4	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12546	SA1	976293	mod. HASL 300	Promethium 147	11.5	pCi/g	5.2	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12546	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	32.7	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12546	SA1	976293	EPA 901.1	Radium-228, Activity	ND	pCi/g		2.3	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12546	SA1	976293	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		2.5	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12546	SA1	976293	EPA 901.1	Radium-226, Activity	ND	pCi/g		2.5	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12546	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12546	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12546	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		1.1	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12546	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12546	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		6.3	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12546	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12546	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		21.5	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12546	SA1	976293	EPA 901.1	Lead-214, Activity	2.2	pCi/g	0.4	0.1	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12547	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12547	SA1	976293	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12547	SA1	976293	mod. HASL 300	Thorium-232, Activity	1.2	pCi/g	0.7	0.4	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12547	SA1	976293	mod. HASL 300	Uranium-238, Activity	1	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12547	SA1	976293	mod. HASL 300	Thorium-230, Activity	0.6	pCi/g	0.6	0.6	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12547	SA1	976293	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.5	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12547	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12547	SA1	976293	mod. HASL 300	Promethium 147	15.5	pCi/g	5.2	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12547	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	28.3	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12547	SA1	976293	EPA 901.1	Radium-228, Activity	2	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12547	SA1	976293	EPA 901.1	Bismuth-214, Activity	1.3	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12547	SA1	976293	EPA 901.1	Radium-226, Activity	1.3	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12547	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.2	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12547	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12547	SA1	976293	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12547	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		1	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12547	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12547	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		23	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12547	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.3	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12547	SA1	976293	EPA 901.1	Lead-214, Activity	1.3	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/30/98 15:43	3/30/98 15:43
12548	SA1	976293	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	1.1	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12548	SA1	976293	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12548	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12548	SA1	976293	mod. HASL 300	Thorium-232, Activity	1.8	pCi/g	1.4	1.2	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12548	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.9	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12548	SA1	976293	mod. HASL 300	Thorium-230, Activity	1.2	pCi/g	1.3	1.4	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12548	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12548	SA1	976293	mod. HASL 300	Promethium 147	12.4	pCi/g	5.2	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12548	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	36	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12548	SA1	976293	EPA 901.1	Radium-228, Activity	2.5	pCi/g	0.6	0.2	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12548	SA1	976293	EPA 901.1	Bismuth-214, Activity	1.6	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12548	SA1	976293	EPA 901.1	Radium-226, Activity	1.6	pCi/g	0.5	0.2	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12548	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.2	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12548	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12548	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12548	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12548	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12548	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		17.9	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12548	SA1	976293	EPA 901.1	Lead-211, Activity	9.9	pCi/g	3.8	1.8	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12548	SA1	976293	EPA 901.1	Lead-214, Activity	1.7	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12549	SA1	976293	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.2	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12549	SA1	976293	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12549	SA1	976293	mod. HASL 300	Thorium-232, Activity	1.3	pCi/g	1	0.8	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12549	SA1	976293	mod. HASL 300	Thorium-227	1.7	pCi/g	1.1	0.8	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12549	SA1	976293	mod. HASL 300	Thorium-230, Activity	1.3	pCi/g	1	0.9	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12549	SA1	976293	EPA 901.1	Radium-228, Activity	2	pCi/g	0.5	0.1	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12549	SA1	976293	EPA 901.1	Bismuth-214, Activity	1.6	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12549	SA1	976293	EPA 901.1	Radium-226, Activity	1.6	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12549	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.2	pCi/g	0.2	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12549	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.8	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12549	SA1	976293	mod. HASL 300	Promethium 147	11.4	pCi/g	5.2	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12549	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12549	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12549	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	15.2	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12549	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12549	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12549	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.5	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12549	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		5.1	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12549	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.3	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12549	SA1	976293	EPA 901.1	Lead-214, Activity	1.4	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/30/98 16:48	3/30/98 16:48
12550	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42

PARSONS ES SAMPLE SAMP ID	TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12550	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.6	pCi/g	0.7	0.9	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12550	SA1	976293	mod. HASL 300	Thorium-230, Activity	0.9	pCi/g	1.1	1.2	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12550	SA1	976293	mod. HASL 300	Thorium-227	0.4	pCi/g	0.7	1	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12550	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.5	pCi/g	0.2	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12550	SA1	976293	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12550	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.4	pCi/g	0.2	0.2	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12550	SA1	976293	mod. HASL 300	Promethium 147	10.3	pCi/g	5.1	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12550	SA1	976293	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0 1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12550	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	15.8	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12550	SA1	976293	EPA 901.1	Lead-214, Activity	1.6	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12550	SA1	976293	EPA 901.1	Radium-228, Activity	2.6	pCi/g	0.7	0.3	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12550	SA1	976293	EPA 901.1	Bismuth-214, Activity	1.5	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12550	SA1	976293	EPA 901.1	Radium-226, Activity	1.5	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12550	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12550	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12550	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.4	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12550	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		3.7	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12550	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		8.7	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12550	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	SA1	976293	mod. HASL 300	Promethium 147	8	pCi/g	5.1	8.3	SEDIMENT	11/19/97 9:00	4/8/98 10:12	4/8/98 10:12
12551	SA1	976293	mod. HASL 300	Uranium-238, Activity	0.5	pCi/g	0.2	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12551	SA1	976293	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12551	SA1	976293	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/g	0.3	0.1	SEDIMENT	11/19/97 9:00	3/3/98 10:09	3/3/98 10:09
12551	SA1	976293	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	SEDIMENT	11/19/97 9:00	3/5/98 9:42	3/5/98 9:42
12551	SA1	976293	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	SEDIMENT	11/19/97 9:00	2/19/98 3:39	2/19/98 3:39
12551	SA1	976293	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.7	0.6	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12551	SA1	976293	CA-GLR-R160	Moisture (@ 104 deg. C)	13.6	% by Wt			SEDIMENT	11/19/97 9:00	11/20/97 12:00	11/20/97 12:00
12551	SA1	976293	mod. HASL 300	Thorium-230, Activity	0.6	pCi/g	0.6	0.7	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12551	SA1	976293	mod. HASL 300	Thorium-227	0.5	pCi/g	0.6	0.7	SEDIMENT	11/19/97 9:00	3/31/98 13:39	3/31/98 13:39
12551	SA1	976293	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.3	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	SA1	976293	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.3	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	SA1	976293	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	SA1	976293	EPA 901.1	Radium-228, Activity	2.1	pCi/g	0.4	0.1	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	SA1	976293	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	SA1	976293	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	SA1	976293	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.3	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	SA1	976293	EPA 901.1	Lead-210, Activity	ND	pCi/g		12.8	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	SA1	976293	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.4	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	SA1	976293	EPA 901.1	Lead-214, Activity	1.8	pCi/g	0.4	0.2	SEDIMENT	11/19/97 9:00	3/31/98 7:39	3/31/98 7:39
12551	MD	976293	EPA 901.1	Lead-211, Activity	0	RPD		6	Soil		3/31/98 8:56	3/31/98 8:56
12551	MD	976293	EPA 901.1	Lead-214, Activity	25	RPD	0.5	0.2	Soil		3/31/98 8:56	3/31/98 8:56
12551	MD	976293	EPA 901.1	Lead-210, Activity	0	RPD		20	Soil		3/31/98 8:56	3/31/98 8:56
12551	MD	976293	EPA 901.1	Radium-223, Activity	0	RPD		0.4	Soil		3/31/98 8:56	3/31/98 8:56
12551	MD	976293	EPA 901.1	Cesium-137, Activity	0	RPD		0.3	Soil		3/31/98 8:56	3/31/98 8:56
12551	MD	976293	EPA 901.1	Bismuth-214, Activity	2	RPD	0.3	0.1	Soil		3/31/98 8:56	3/31/98 8:56
12551	MD	976293	EPA 901.1	Radium-228, Activity	2.1	RPD		1.3	Soil		3/31/98 8:56	3/31/98 8:56
12551	MD	976293	EPA 901.1	Radium-226, Activity	2	RPD	0.3	0.1	Soil		3/31/98 8:56	3/31/98 8:56
12551	MD	976293	EPA 901.1	Cobalt-60, Activity	0	RPD		0.3	Soil		3/31/98 8:56	3/31/98 8:56

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12551	MD	976293	EPA 901.1	Cobalt-57, Activity	0	RPD		0.1	Soil		3/31/98 8:56	3/31/98 8:56
GEM033098S	LCS	976293	EPA 901.1	Cesium-137, Activity	105.8	% REC	1360	369	Water		3/30/98 7:34	3/30/98 7:34
GEM033098S	LCS	976293	EPA 901.1	Cobalt-60, Activity	94.3	% REC	1460	259	Water		3/30/98 7:34	3/30/98 7:34
GEM033198S	LCS	976293	EPA 901.1	Cesium-137, Activity	109.2	% REC	1430	338	Water		3/31/98 7:12	3/31/98 7:12
GEM033198S	LCS	976293	EPA 901.1	Cobalt-60, Activity	97	% REC	1410	276	Water		3/31/98 7:12	3/31/98 7:12
GMX033098S	LCS	976293	EPA 901.1	Cobalt-60, Activity	102.4	% REC	1130	242	Water		3/30/98 7:13	3/30/98 7:13
GMX033098S	LCS	976293	EPA 901.1	Cesium-137, Activity	92.2	% REC	688	262	Water		3/30/98 7:13	3/30/98 7:13
GMX033198S	LCS	976293	EPA 901.1	Cobalt-60, Activity	101.5	% REC	1120	203	Water		3/31/98 7:34	3/31/98 7:34
GMX033198S	LCS	976293	EPA 901.1	Cesium-137, Activity	109.2	% REC	1070	293	Water		3/31/98 7:34	3/31/98 7:34
LC1H30218	LCS	976293	CA-GLR-17.0	Tritium, Activity	78.8	% REC	1.9	2.5	Water		2/19/98 3:39	2/19/98 3:39
LCBPM0303	LCS	976293	mod. HASL 300	Promethium 147	100.5	% REC	5	4.2	Water		4/8/98 10:12	4/8/98 10:12
LCSAP0302	LCS	976293	mod. HASL 300	Plutonium-239/240	112.5	% REC	1	0.1	Water		3/5/98 9:42	3/5/98 9:42
LCSAU0225	LCS	976293	mod. HASL 300	Uranium-238, Activity	108	% REC	1.1	0.1	Water		3/3/98 10:09	3/3/98 10:09
LCSAU0225	LCS	976293	mod. HASL 300	Uranium-233/234, Activity	79.6	% REC	0.9	0.2	Water		3/3/98 10:09	3/3/98 10:09
LCSCT0311	LCS	976293	mod. HASL 300	Thorium-232, Activity	102.9	% REC	0.9	0.1	Water		3/31/98 13:39	3/31/98 13:39
MB2H30218	MB	976293	CA-GLR-17.0	Tritium, Activity	0.1	pCi/L	1.4	2.4	Water		2/19/98 3:39	2/19/98 3:39
MBAP0302	MB	976293	mod. HASL 300	Plutonium-239/240	0.1	pCi/L	0.1	0.1	Water		3/5/98 9:42	3/5/98 9:42
MBAU0225	MB	976293	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.1	Water		3/3/98 10:09	3/3/98 10:09
MBAU0225	MB	976293	mod. HASL 300	Uranium-233/234, Activity	0.1	pCi/L	0.1	0.1	Water		3/3/98 10:09	3/3/98 10:09
MBAU0225	MB	976293	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water		3/3/98 10:09	3/3/98 10:09
MBDPM0303	MB	976293	mod. HASL 300	Promethium 147	1.6	pCi/L	2.5	4.2	Water		4/8/98 10:12	4/8/98 10:12
MBDT0311	MB	976293	mod. HASL 300	Thorium-227	0.3	pCi/L	0.2	0.1	Water		3/31/98 13:39	3/31/98 13:39
MBDT0311	MB	976293	mod. HASL 300	Thorium-230, Activity	0.2	pCi/L	0.2	0.1	Water		3/31/98 13:39	3/31/98 13:39
MBDT0311	MB	976293	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.1	Water		3/31/98 13:39	3/31/98 13:39
ST1H30218	LCS	976293	CA-GLR-17.0	Tritium, Activity	81.3	% REC	1.9	2.5	Water		2/19/98 3:39	2/19/98 3:39

CORE LAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

April 24, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976457

The following information is pertinent to the interpretation of the data.

On December 12, 1997, Core Laboratories - Casper received eleven water samples in good condition.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error are calculated by the software for the positive results.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Rondalynn Mull
Radiochemistry Supervisor

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012131
Company..: Parsons	Project..: SEAD-12	Page 1 Of 4
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12109701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976451
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	12/09/97	1100	00796	12065	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1100	00797	12065	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1100	00798	12065	H3	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1100	00799	12065	RN222	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1100	00800	12065	RN222	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1100	00801	12065	RN222	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1130	00802	12465	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1111	00803	12066	LIQUID-1	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER ~~100~~ 101   AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: Nicholas A. Smith	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	**Date**	**RECEIVED BY:**	**Date**	**RECEIVED BY:**	**Date**
Signature: Michelle Pudel	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Pudel - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

<<< CORE LABORATORIES - CHAIN OF CUSTODY RECORD >>>

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012132
Company..: Parsons	Project..: SEAD-12	Page 2 Of 4
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12109701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976457
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/09/97	1111	00804	12066	LIQUID-2A	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1111	00805	12066	H3	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1111	00806	12066	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1111	00807	12066	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1111	00808	12066	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1140	00809	12466	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1340	00810	12067	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1340	00811	12067	LIQUID-2A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER # 101 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Pyder - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

«««« CORE LABORATORIES - CHAIN OF CUSTODY RECORD »»»

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012133
Company..: Parsons	Project..: SEAD-12	Page 3 Of 4
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12109701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976457
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/09/97	1340	00812	12067	H3	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1340	00813	12067	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1340	00814	12067	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1340	00815	12067	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1400	00816	12467	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1450	00817	12068	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1450	00818	12068	LIQUID-2A	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1450	00819	12068	H3	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER # 101   AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: Nicholas A Smith	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	**Date**	**RECEIVED BY:**	**Date**	**RECEIVED BY:**	**Date**
Signature: Michelle Puder	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012134
Company..: Parsons	Project..: SEAD-12	Page 4 Of 4
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12109701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976457
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/09/97	1450	00820	12068	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1450	00821	12068	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1450	00822	12068	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1510	00823	12468	SOLIDS-1A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER #101 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ______ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	RECEIVED BY:	Date	RECEIVED BY:	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

Coolr #07

*** CORE LABORATORIES - CHAIN OF CUSTODY RECORD ***

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012135
Company..: Parsons	Project..: SEAD-12	Page 1 Of 3
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12109702.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976457
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	12/10/97	1050	00824	12069	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1050	00825	12069	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1050	00826	12069	H3	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1050	00827	12069	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1050	00828	12069	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1050	00829	12069	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1120	00830	12469	SOLIDS-1A	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1300	00831	12070	LIQUID-1	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ______ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A-SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	RECEIVED BY:	Date	RECEIVED BY:	Date
Signature: Michelle Pruder	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder-CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

Code ‘027

« « « CORE LABORATORIES - CHAIN OF CUSTODY RECORD » » »

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012136
Company..: Parsons	Project..: SEAD-12	Page 2 Of 3
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12109702.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976457
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	12/10/97	1300	00832	12070	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1300	00833	12070	H3	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1300	00834	12070	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1300	00835	12070	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1300	00836	12070	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1315	00754	12470	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/10/97	1340	00843	12471	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/10/97	1320	00837	12071	LIQUID-1	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX   AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: Nicholas A. Smith	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Ruder	12/11/97	Signature:		Signature:	
Printed Name/Company: Michelle Ruder - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

C... -#027

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012137
Company..: Parsons	Project..: SEAD-12	Page 3 Of 3
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12109702.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976457
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/10/97	1320	00838	12071	LIQUID-2A	OVER-FOR-PARAM-KEY	
KKS	12/10/97	1320	00839	12071	H3	OVER-FOR-PARAM-KEY	
KKS	12/10/97	1320	00840	12071	RN222	OVER-FOR-PARAM-KEY	
KKS	12/10/97	1320	00841	12071	RN222	OVER-FOR-PARAM-KEY	
KKS	12/10/97	1320	00842	12071	RN222	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX AIRBILL NO.: 802 36754 5697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [x] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Purdes	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

« « « CORE LABORATORIES - CHAIN OF CUSTODY RECORD » » »

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012138
Company..: Parsons	Project..: SEAD-12	Page 1 Of 4
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12119701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976457
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	12/11/97	0945	0844	63003	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	12/11/97	0945	0845	63003	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	12/11/97	0945	0846	63003	H3	OVER-FOR-PARAM-KEY	
EAF	12/11/97	0945	0847	63003	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	0945	0848	63003	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	0945	0849	63003	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1010	0850	63103	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/11/97	0950	0851	63004	LIQUID-1	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER #3 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A SMITH /PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle C Puder	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[X] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012139
Company..: Parsons	Project..: SEAD-12	Page 2 Of 4
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12119701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976457
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/11/97	0950	0852	63004	LIQUID-2A	OVER-FOR-PARAM-KEY	
KKS	12/11/97	0950	0853	63004	H3	OVER-FOR-PARAM-KEY	
KKS	12/11/97	0950	0854	63004	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	0950	0855	63004	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	0950	0856	63004	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1020	0857	63104	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1040	0858	63005	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1040	0859	63005	LIQUID-2A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - Cooler #3 AIRBILL NO.: 802 367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: Nicholas A. Smith	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Pinder	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Pinder-CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012140
Company..: Parsons	Project..: SEAD-12	Page 3 Of 4
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12119701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976457
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/11/97	1040	0860	63005	H3	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1040	0861	63005	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1040	0862	63005	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1040	0863	63005	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1100	0864	63105	SOLIDS-1A	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1111	0865	63006	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1111	0866	63006	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1111	0867	63006	H3	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER #3 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	RECEIVED BY:	Date	RECEIVED BY:	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

<<< CORE LABORATORIES - CHAIN OF CUSTODY RECORD >>>

CUSTOMER INFORMATION		PROJECT INFORMATION		
Company..:	Parsons	Project..:	SEAD-12	# ABC-012141
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	Page 4 Of 4
	101 Huntington Ave.	Address..:	101 Huntington Ave.	File = 12119701.bar
	Boston MA, 02199		Boston MA 02199	LAB JOB NUMBER
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	976457

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	12/11/97	1111	0868	63006	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1111	0869	63006	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1111	0870	63006	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1140	0871	63106	SOLIDS-1A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER #3 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12065	SA1	976457	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		3.7	Water	12/12/97 9:10	4/1/98 15:31	4/1/98 15:31
12065	SA1	976457	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.8	Water	12/12/97 9:10	4/1/98 15:31	4/1/98 15:31
12065	SA1	976457	EPA 901.1	Cesium-137, Activity	ND	pCi/L		2.5	Water	12/12/97 9:10	4/1/98 15:31	4/1/98 15:31
12065	SA1	976457	EPA 901.1	Lead-214, Activity	20	pCi/L	6.6	3.5	Water	12/12/97 9:10	4/1/98 15:31	4/1/98 15:31
12065	SA1	976457	EPA 901.1	Lead-211, Activity	ND	pCi/L		27.7	Water	12/12/97 9:10	4/1/98 15:31	4/1/98 15:31
12065	SA1	976457	mod. HASL 300	Uranium-233/234, Activity	0.3	pCi/L	0.3	0.4	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12065	SA1	976457	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2141	0.5285	Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12065	SA1	976457	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12065	SA1	976457	CA-GLR-R510	Radon 222, Activity	73.3	pCi/L	35.7	57.8	Water	12/12/97 9:10	12/12/97 19:39	12/12/97 19:39
12065	SA1	976457	CA-GLR-17.0	Tritium, Activity	207	pCi/L	168	268	Water	12/12/97 9:10	12/15/97 18:16	12/15/97 18:16
12065	SA1	976457	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.1	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12065	SA1	976457	mod. HASL 300	Thorium-230, Activity	0.4	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12065	SA1	976457	mod. HASL 300	Thorium-227	0.1	pCi/L	0.1	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12065	SA1	976457	mod. HASL 300	Uranium-238, Activity	0.4	pCi/L	0.3	0.3	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12065	SA1	976457	EPA 900.0	Gross Beta, Activity	10.1	pCi/L	1.8	2.6	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12065	SA1	976457	EPA 901.1	Bismuth-214, Activity	ND	pCi/L		31.6	Water	12/12/97 9:10	4/1/98 15:31	4/1/98 15:31
12065	SA1	976457	mod. HASL 300	Plutonium-239/240	0.2	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/18/98 8:45	2/18/98 8:45
12065	SA1	976457	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	1.8	3.2	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12065	SA1	976457	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.2	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12065	MS	976457	CA-GLR-17.0	Tritium, Activity	99.2	% REC	250	282	Water		12/15/97 18:16	12/15/97 18:16
12065	MS	976457	mod. HASL 300	Plutonium-239/240	84.7	% REC	2.1	0.6	Water		2/18/98 8:45	2/18/98 8:45
12066	SA1	976457	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12066	SA1	976457	CA-GLR-R510	Radon 222, Activity	62.5	pCi/L	36	58.6	Water	12/12/97 9:10	12/12/97 21:40	12/12/97 21:40
12066	SA1	976457	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.184	0.5285	Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12066	SA1	976457	CA-GLR-17.0	Tritium, Activity	234	pCi/L	170	269	Water	12/12/97 9:10	12/15/97 18:16	12/15/97 18:16
12066	SA1	976457	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/L	0.4	0.3	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12066	SA1	976457	mod. HASL 300	Thorium-232, Activity	0.1	pCi/L	0.1	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12066	SA1	976457	mod. HASL 300	Thorium-230, Activity	0.3	pCi/L	0.2	0.3	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12066	SA1	976457	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.3	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12066	SA1	976457	mod. HASL 300	Plutonium-239/240	ND	pCi/L	0.1	0.3	Water	12/12/97 9:10	2/18/98 8:45	2/18/98 8:45
12066	SA1	976457	EPA 900.0	Gross Alpha, Activity	0.3	pCi/L	2	3.3	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12066	SA1	976457	EPA 900.0	Gross Beta, Activity	24.6	pCi/L	2.5	3.4	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12066	SA1	976457	mod. HASL 300	Uranium-238, Activity	0.3	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12066	SA1	976457	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.3	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12066	SA1	976457	EPA 901.1	Lead-214, Activity	16.9	pCi/L	4.1	2.6	Water	12/12/97 9:10	4/2/98 11:12	4/2/98 11:12
12066	SA1	976457	EPA 901.1	Bismuth-214, Activity	25.1	pCi/L	6.5	1.9	Water	12/12/97 9:10	4/2/98 11:12	4/2/98 11:12
12066	SA1	976457	EPA 901.1	Lead-211, Activity	ND	pCi/L		119	Water	12/12/97 9:10	4/2/98 11:12	4/2/98 11:12
12066	SA1	976457	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.8	Water	12/12/97 9:10	4/2/98 11:12	4/2/98 11:12
12066	SA1	976457	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		5.4	Water	12/12/97 9:10	4/2/98 11:12	4/2/98 11:12
12066	SA1	976457	EPA 901.1	Cesium-137, Activity	ND	pCi/L		1.1	Water	12/12/97 9:10	4/2/98 11:12	4/2/98 11:12
12066	MD	976457	mod. HASL 300	Plutonium-239/240	0.1	RPD	0.3	0.6	Water		2/18/98 8:45	2/18/98 8:45
12066	MS	976457	EPA 900.0	Gross Alpha, Activity	76.9	% REC	8.6	3.1	Water		2/2/98 17:40	2/2/98 17:40
12066	MS	976457	EPA 903.0	Radium-226, Activity	74.3	% REC	2.018	1.057	Water		1/21/98 6:44	1/21/98 6:44
12067	SA1	976457	mod. HASL 300	Uranium-238, Activity	0.4	pCi/L	0.2	0.1	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42

PARSONS SAMP ID	ES SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12067	SA1	976457	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.1	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12067	SA1	976457	EPA 901.1	Bismuth-214, Activity	18.1	pCi/L	6.5	3.1	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12067	SA1	976457	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.7	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12067	SA1	976457	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		0.6	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12067	SA1	976457	EPA 901.1	Cesium-137, Activity	ND	pCi/L		1.5	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12067	SA1	976457	EPA 901.1	Lead-211, Activity	ND	pCi/L		32.3	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12067	SA1	976457	mod. HASL 300	Uranium-233/234, Activity	0.4	pCi/L	0.2	0.1	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12067	SA1	976457	EPA 901.1	Lead-214, Activity	13.9	pCi/L	5.6	2.9	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12067	SA1	976457	EPA 900.0	Gross Alpha, Activity	0.7	pCi/L	1.7	2.8	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12067	SA1	976457	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.2136	0.5285	Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12067	SA1	976457	EPA 900.0	Gross Beta, Activity	ND	pCi/L	1.6	2.8	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12067	SA1	976457	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12067	SA1	976457	CA-GLR-R510	Radon 222, Activity	21	pCi/L	35.1	58.4	Water	12/12/97 9:10	12/12/97 23:41	12/12/97 23:41
12067	SA1	976457	CA-GLR-17.0	Tritium, Activity	270	pCi/L	170	266	Water	12/12/97 9:10	12/15/97 18:16	12/15/97 18:16
12067	SA1	976457	mod. HASL 300	Thorium-232, Activity	0.1	pCi/L	0.1	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12067	SA1	976457	mod. HASL 300	Thorium-230, Activity	0.8	pCi/L	0.4	0.3	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12067	SA1	976457	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.3	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12067	SA1	976457	mod. HASL 300	Plutonium-239/240	0.3	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/18/98 8:45	2/18/98 8:45
12067	MS	976457	mod. HASL 300	Thorium-232, Activity	87	% REC	2	0.3	Water		2/20/98 11:02	2/20/98 11:02
12068	SA1	976457	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12068	SA1	976457	CA-GLR-R510	Radon 222, Activity	21.6	pCi/L	35.4	58.8	Water	12/12/97 9:10	12/13/97 1:42	12/13/97 1:42
12068	SA1	976457	CA-GLR-17.0	Tritium, Activity	261	pCi/L	169	263	Water	12/12/97 9:10	12/15/97 18:16	12/15/97 18:16
12068	SA1	976457	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.183	0.5285	Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12068	SA1	976457	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.1	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12068	SA1	976457	EPA 900.0	Gross Alpha, Activity	0.7	pCi/L	1.7	2.8	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12068	SA1	976457	mod. HASL 300	Thorium-230, Activity	0.2	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12068	SA1	976457	mod. HASL 300	Thorium-227	0.2	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12068	SA1	976457	mod. HASL 300	Plutonium-239/240	0.1	pCi/L	0.1	0.2	Water	12/12/97 9:10	2/18/98 8:45	2/18/98 8:45
12068	SA1	976457	mod. HASL 300	Uranium-233/234, Activity	0.4	pCi/L	0.3	0.3	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12068	SA1	976457	mod. HASL 300	Uranium-238, Activity	0.3	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12068	SA1	976457	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.1	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12068	SA1	976457	EPA 901.1	Bismuth-214, Activity	16.2	pCi/L	5.7	3	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12068	SA1	976457	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.4	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12068	SA1	976457	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		5.2	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12068	SA1	976457	EPA 901.1	Cesium-137, Activity	ND	pCi/L		1.5	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12068	SA1	976457	EPA 901.1	Lead-211, Activity	ND	pCi/L		545	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12068	SA1	976457	EPA 900.0	Gross Beta, Activity	ND	pCi/L	1.6	2.7	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12068	SA1	976457	EPA 901.1	Lead-214, Activity	ND	pCi/L		19.6	Water	12/12/97 9:10	4/2/98 16:01	4/2/98 16:01
12068	MD	976457	mod. HASL 300	Thorium-227	0.2	RPD	0.1	0.4	Water		2/20/98 11:02	2/20/98 11:02
12068	MD	976457	mod. HASL 300	Thorium-232, Activity	0	RPD	0.1	0.5	Water		2/20/98 11:02	2/20/98 11:02
12068	MD	976457	mod. HASL 300	Thorium-230, Activity	0.7	RPD	0.5	0.5	Water		2/20/98 11:02	2/20/98 11:02
12068	MS	976457	EPA 900.0	Gross Beta, Activity	111.5	% REC	3.8	2.6	Water		2/2/98 17:40	2/2/98 17:40
12069	SA1	976457	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12069	SA1	976457	CA-GLR-R510	Radon 222, Activity	11.8	pCi/L	30.7	51.3	Water	12/12/97 9:10	12/13/97 3:43	12/13/97 3:43

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12069	SA1	976457	mod. HASL 300	Thorium-227	0.1	pCi/L	0.1	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12069	SA1	976457	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.1489	0.5285	Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12069	SA1	976457	CA-GLR-17.0	Tritium, Activity	324	pCi/L	173	267	Water	12/12/97 9:10	12/15/97 18:16	12/15/97 18:16
12069	SA1	976457	mod. HASL 300	Plutonium-239/240	0.1	pCi/L	0.1	0.2	Water	12/12/97 9:10	2/18/98 8:45	2/18/98 8:45
12069	SA1	976457	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.1	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12069	SA1	976457	mod. HASL 300	Thorium-230, Activity	ND	pCi/L	0.1	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12069	SA1	976457	EPA 900.0	Gross Beta, Activity	9	pCi/L	1.5	2.3	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12069	SA1	976457	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/L	0.3	0.2	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12069	SA1	976457	mod. HASL 300	Uranium-238, Activity	0.2	pCi/L	0.2	0.1	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12069	SA1	976457	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12069	SA1	976457	EPA 901.1	Bismuth-214, Activity	17.4	pCi/L	7.4	3.4	Water	12/12/97 9:10	4/3/98 8:13	4/3/98 8:13
12069	SA1	976457	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.5	Water	12/12/97 9:10	4/3/98 8:13	4/3/98 8:13
12069	SA1	976457	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		1.8	Water	12/12/97 9:10	4/3/98 8:13	4/3/98 8:13
12069	SA1	976457	EPA 901.1	Cesium-137, Activity	ND	pCi/L		1.5	Water	12/12/97 9:10	4/3/98 8:13	4/3/98 8:13
12069	SA1	976457	EPA 900.0	Gross Alpha, Activity	0.9	pCi/L	1.8	2.9	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12069	SA1	976457	EPA 901.1	Lead-211, Activity	ND	pCi/L		28.6	Water	12/12/97 9:10	4/3/98 8:13	4/3/98 8:13
12069	SA1	976457	EPA 901.1	Lead-214, Activity	ND	pCi/L		15.1	Water	12/12/97 9:10	4/3/98 8:13	4/3/98 8:13
12069	MD	976457	CA-GLR-R510	Radon 222, Activity	14.7	RPD	31.5	52.1	Water		12/13/97 5:44	12/13/97 5:44
12069	MS	976457	mod. HASL 300	Uranium-238, Activity	98.6	% REC	3.3	0.4	Water		2/20/98 13:42	2/20/98 13:42
12069	MS	976457	mod. HASL 300	Uranium-233/234, Activity	90.9	% REC	3.4	0.6	Water		2/20/98 13:42	2/20/98 13:42
12070	SA1	976457	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12070	SA1	976457	CA-GLR-R510	Radon 222, Activity	36.4	pCi/L	31.6	52	Water	12/12/97 9:10	12/13/97 7:45	12/13/97 7:45
12070	SA1	976457	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.1846	0.5285	Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12070	SA1	976457	CA-GLR-17.0	Tritium, Activity	140	pCi/L	165	269	Water	12/12/97 9:10	12/15/97 18:16	12/15/97 18:16
12070	SA1	976457	mod. HASL 300	Plutonium-239/240	0.2	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/18/98 8:45	2/18/98 8:45
12070	SA1	976457	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.1	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12070	SA1	976457	mod. HASL 300	Thorium-230, Activity	0.3	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12070	SA1	976457	mod. HASL 300	Thorium-227	0.2	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12070	SA1	976457	EPA 900.0	Gross Alpha, Activity	ND	pCi/L	1.9	3.2	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12070	SA1	976457	EPA 900.0	Gross Beta, Activity	ND	pCi/L	1.5	2.5	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12070	SA1	976457	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/L	0.4	0.3	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12070	SA1	976457	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.1	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12070	SA1	976457	EPA 901.1	Cesium-137, Activity	ND	pCi/L		4	Water	12/12/97 9:10	4/3/98 9:13	4/3/98 9:13
12070	SA1	976457	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12070	SA1	976457	EPA 901.1	Bismuth-214, Activity	15.9	pCi/L	6.8	3	Water	12/12/97 9:10	4/3/98 9:13	4/3/98 9:13
12070	SA1	976457	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.7	Water	12/12/97 9:10	4/3/98 9:13	4/3/98 9:13
12070	SA1	976457	EPA 901.1	Lead-211, Activity	ND	pCi/L		339	Water	12/12/97 9:10	4/3/98 9:13	4/3/98 9:13
12070	SA1	976457	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		2.8	Water	12/12/97 9:10	4/3/98 9:13	4/3/98 9:13
12070	SA1	976457	EPA 901.1	Lead-214, Activity	16.1	pCi/L	5.5	2.9	Water	12/12/97 9:10	4/3/98 9:13	4/3/98 9:13
12070	MD	976457	mod. HASL 300	Uranium-233/234, Activity	28.6	RPD	0.4	0.4	Water		2/20/98 13:42	2/20/98 13:42
12070	MD	976457	mod. HASL 300	Uranium-235, Activity	0.1	RPD	0.2	0.3	Water		2/20/98 13:42	2/20/98 13:42
12070	MD	976457	mod. HASL 300	Uranium-238, Activity	0.2	RPD	0.3	0.3	Water		2/20/98 13:42	2/20/98 13:42
12071	SA1	976457	mod. HASL 300	Plutonium-239/240	0.1	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/18/98 8:45	2/18/98 8:45
12071	SA1	976457	EPA 900.0	Gross Alpha, Activity	0.2	pCi/L	1.7	2.9	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12071	SA1	976457	EPA 900.0	Gross Beta, Activity	2.3	pCi/L	1.9	3	Water	12/12/97 9:10	2/2/98 17:40	2/2/98 17:40
12071	SA1	976457	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/L	0.3	0.2	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12071	SA1	976457	mod. HASL 300	Uranium-238, Activity	0.2	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12071	SA1	976457	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.2	Water	12/12/97 9:10	2/20/98 13:42	2/20/98 13:42
12071	SA1	976457	EPA 901.1	Bismuth-214, Activity	20.8	pCi/L	6.9	2.5	Water	12/12/97 9:10	4/6/98 7:42	4/6/98 7:42
12071	SA1	976457	EPA 901.1	Cobalt-57, Activity	ND	pCi/L		0.5	Water	12/12/97 9:10	4/6/98 7:42	4/6/98 7:42
12071	SA1	976457	mod. HASL 300	Thorium-227	0.1	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12071	SA1	976457	EPA 901.1	Cobalt-60, Activity	ND	pCi/L		1.9	Water	12/12/97 9:10	4/6/98 7:42	4/6/98 7:42
12071	SA1	976457	EPA 901.1	Lead-214, Activity	20.5	pCi/L	6.4	2.4	Water	12/12/97 9:10	4/6/98 7:42	4/6/98 7:42
12071	SA1	976457	EPA 901.1	Cesium-137, Activity	ND	pCi/L		2.7	Water	12/12/97 9:10	4/6/98 7:42	4/6/98 7:42
12071	SA1	976457	EPA 901.1	Lead-211, Activity	ND	pCi/L		21.8	Water	12/12/97 9:10	4/6/98 7:42	4/6/98 7:42
12071	SA1	976457	CA-GLR-17.0	Tritium, Activity	243	pCi/L	171	271	Water	12/12/97 9:10	12/15/97 18:16	12/15/97 18:16
12071	SA1	976457	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.09	0.5285	Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12071	SA1	976457	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.1	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12071	SA1	976457	EPA 903.0	Radium-223, Activity	ND	pCi/L			Water	12/12/97 9:10	1/21/98 6:44	1/21/98 6:44
12071	SA1	976457	mod. HASL 300	Thorium-230, Activity	0.4	pCi/L	0.2	0.2	Water	12/12/97 9:10	2/20/98 11:02	2/20/98 11:02
12071	SA1	976457	CA-GLR-R510	Radon 222, Activity	35.9	pCi/L	32	52.7	Water	12/12/97 9:10	12/13/97 9:46	12/13/97 9:46
12071	MD	976457	EPA 903.0	Radium-226, Activity	0.4145	RPD	0.2324	1.057	Water		1/21/98 6:44	1/21/98 6:44
12214	MD	976408	CA-GLR-17.0	Tritium, Activity	45	RPD	172	280	Water		12/15/97 18:16	12/15/97 18:16
EFF1A0128	LCS	976457	EPA 900.0	Gross Alpha, Activity	102.4	% REC	0.5	0.1	Water		2/2/98 17:40	2/2/98 17:40
GEM033198M	LCS	976457	EPA 901.1	Cesium-137, Activity	100.5	% REC	1020	318	Water		3/31/98 16:49	3/31/98 16:49
GEM033198M	LCS	976457	EPA 901.1	Cobalt-60, Activity	102.5	% REC	1330	323	Water		3/31/98 16:49	3/31/98 16:49
GEM040298M	LCS	976457	EPA 901.1	Cesium-137, Activity	107	% REC	1390	287	Water		4/2/98 10:51	4/2/98 10:51
GEM040298M	LCS	976457	EPA 901.1	Cobalt-60, Activity	100.9	% REC	1450	282	Water		4/2/98 10:51	4/2/98 10:51
GEM040798M	LCS	976457	EPA 901.1	Cesium-137, Activity	107	% REC	1490	355	Water		4/7/98 13:04	4/7/98 13:04
GEM040798M	LCS	976457	EPA 901.1	Cobalt-60, Activity	96	% REC	1500	282	Water		4/7/98 13:04	4/7/98 13:04
GMX040298M	LCS	976457	EPA 901.1	Cobalt-60, Activity	104.3	% REC	1490	253	Water		4/2/98 10:40	4/2/98 10:40
GMX040298M	LCS	976457	EPA 901.1	Cesium-137, Activity	103	% REC	1080	270	Water		4/2/98 10:40	4/2/98 10:40
GMX040798M	LCS	976457	EPA 901.1	Cobalt-60, Activity	101.9	% REC	1210	148	Water		4/7/98 14:05	4/7/98 14:05
GMX040798M	LCS	976457	EPA 901.1	Cesium-137, Activity	100.5	% REC	912	241	Water		4/7/98 14:05	4/7/98 14:05
LC1H31215	LCS	976457	CA-GLR-17.0	Tritium, Activity	101.5	% REC	2.4	2.8	Water		12/15/97 18:16	12/15/97 18:16
LC2R60112	LCS	976457	EPA 903.0	Radium-226, Activity	86.5	% REC	0.7624	0.3699	Water		1/21/98 6:44	1/21/98 6:44
LCS1A0128	LCS	976457	EPA 900.0	Gross Alpha, Activity	99.2	% REC	0.5	0.1	Water		2/2/98 17:40	2/2/98 17:40
LCS1B0128	LCS	976457	EPA 900.0	Gross Beta, Activity	102.8	% REC	0.4	0.3	Water		2/2/98 17:40	2/2/98 17:40
LCS1PU0211	LCS	976457	mod. HASL 300	Plutonium-239/240	102.1	% REC	0.8	0.1	Water		2/18/98 8:45	2/18/98 8:45
LCS1TH0211	LCS	976457	mod. HASL 300	Thorium-232, Activity	80	% REC	0.7	0.1	Water		2/20/98 11:02	2/20/98 11:02
LCS1U0211	LCS	976457	mod. HASL 300	Uranium-233/234, Activity	94.4	% REC	1	0.1	Water		2/20/98 13:42	2/20/98 13:42
LCS1U0211	LCS	976457	mod. HASL 300	Uranium-238, Activity	90	% REC	0.9	0.1	Water		2/20/98 13:42	2/20/98 13:42
LCS2A0128	LCS	976457	EPA 900.0	Gross Alpha, Activity	95.1	% REC	0.6	0.1	Water		2/2/98 17:40	2/2/98 17:40
LCS2B0128	LCS	976457	EPA 900.0	Gross Beta, Activity	95	% REC	0.4	0.3	Water		2/2/98 17:40	2/2/98 17:40
MB1PU0211	MB	976457	mod. HASL 300	Plutonium-239/240	0.1	pCi/L	0.1	0.1	Water		2/18/98 8:45	2/18/98 8:45
MB1RN1212	MB	976457	CA-GLR-R510	Radon 222, Activity	ND	pCi/L	0.2	0.3	Water		12/12/97 15:37	12/12/97 15:37
MB1TH0211	MB	976457	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.1	Water		2/20/98 11:02	2/20/98 11:02
MB1TH0211	MB	976457	mod. HASL 300	Thorium-227	0.2	pCi/L	0.1	0.1	Water		2/20/98 11:02	2/20/98 11:02

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
MB1TH0211	MB	976457	mod. HASL 300	Thorium-230, Activity	0.1	pCi/L	0.1	0.2	Water		2/20/98 11:02	2/20/98 11:02
MB1U0211	MB	976457	mod. HASL 300	Uranium-233/234, Activity	0.1	pCi/L	0.1	0.1	Water		2/20/98 13:42	2/20/98 13:42
MB1U0211	MB	976457	mod. HASL 300	Uranium-238, Activity	ND	pCi/L	0.1	0.1	Water		2/20/98 13:42	2/20/98 13:42
MB1U0211	MB	976457	mod. HASL 300	Uranium-235, Activity	ND	pCi/L	0.1	0.1	Water		2/20/98 13:42	2/20/98 13:42
MB2AB0128	MB	976457	EPA 900.0	Gross Beta, Activity	0.8	pCi/L	0.2	0.2	Water		2/2/98 17:40	2/2/98 17:40
MB2AB0128	MB	976457	EPA 900.0	Gross Alpha, Activity	0.1	pCi/L	0.1	0.1	Water		2/2/98 17:40	2/2/98 17:40
MB2H31215	MB	976457	CA-GLR-17.0	Tritium, Activity	0.2	pCi/L	1.6	2.7	Water		12/15/97 18:16	12/15/97 18:16
MB4R60112	MB	976457	EPA 903.0	Radium-226, Activity	ND	pCi/L	0.1287	0.3699	Water		1/21/98 6:44	1/21/98 6:44
ST1H31215	LCS	976457	CA-GLR-17.0	Tritium, Activity	101	% REC	2.4	2.8	Water		12/15/97 18:16	12/15/97 18:16
ST1RN1212	LCS	976457	CA-GLR-R510	Radon 222, Activity	100.8	% REC	0.5	0.3	Water		12/12/97 17:38	12/12/97 17:38

CORE LAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

April 24, 1998

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 976460

The following information is pertinent to the interpretation of the data.

On December 12, 1997, Core Laboratories - Casper received five soil samples in good condition.

Most samples for isotopic thorium had low tracer recoveries. The samples were reanalyzed at reduced volumes to minimize any matrix affects. The reduced volumes resulted in elevated LLDs. Sample 63103 had a 9.5% yield on the reanalysis but acceptable recovery from the first run. The first run data is reported for this sample.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error is calculated by the software for the positive results. The Ra226 activity by gamma is not reported using the 186kev line since Ra226 has a low abundance at that line and the U235 has a greater abundance with an energy very close to 186 which would cause interference. Therefore, the Ra226 is calculated from the Bi214 line, a daughter of Ra226. The Ra228 is calculated from the Ac228 line, the daughter of Ra228, as Ra228 is a beta emitter.

If you have any questions concerning this data, please call Ronni Mull at (307) 235-5741.

Debra Phillabaum
Debra Phillabaum
QA/QC Coordinator

Rondalynn Mull
Rondalynn Mull
Radiochemistry Supervisor

««« CORE LABORATORIES - CHAIN OF CUSTODY RECORD »»»

CUSTOMER INFORMATION		PROJECT INFORMATION		
Company..:	Parsons	Project...:	SEAD-12	# ABC-012131
Report To:	Mike Duchesneau	Bill To...:	Mike Duchesneau	Page 1 Of 4
	101 Huntington Ave.	Address..:	101 Huntington Ave.	File = 12109701.bar
	Boston MA, 02199		Boston MA 02199	LAB JOB NUMBER
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	976460

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	12/09/97	1100	00796	12065	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1100	00797	12065	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1100	00798	12065	H3	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1100	00799	12065	RN222	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1100	00800	12065	RN222	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1100	00801	12065	RN222	OVER-FOR-PARAM-KEY	
EAF	12/09/97	1130	00802	12465	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1111	00803	12066	LIQUID-1	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER ~~100~~ 101 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Pudei - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION		PROJECT INFORMATION		# ABC-012132
Company..:	Parsons	Project..:	SEAD-12	Page 2 Of 4
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	File = 12109701.bar
	101 Huntington Ave.	Address..:	101 Huntington Ave.	LAB JOB NUMBER
	Boston MA, 02199		Boston MA 02199	976460
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/09/97	1111	00804	12066	LIQUID-2A	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1111	00805	12066	H3	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1111	00806	12066	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1111	00807	12066	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1111	00808	12066	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1140	00809	12466	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1340	00810	12067	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1340	00811	12067	LIQUID-2A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER # 101 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Pucler - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094	[ ] Corpus Christi, TX (512) 289-2673	[ ] Houston, TX (Pet) (713) 943-9776	[ ] Long Beach, CA (310) 595-8401
[ ] Aurora, CO (303) 751-1780	[ ] Edison, NJ (908) 225-6700	[ ] Indianapolis, IN (317) 875-5894	[ ] Tampa, FL (813) 884-8268
[X] Casper, WY (307) 235-5741	[ ] Houston, TX (Env) (713) 690-4444	[ ] Lake Charles, LA (318) 583-4926	[ ] Valparaiso, IN (219) 464-2389

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012133
Company..: Parsons	Project..: SEAD-12	Page 3 Of 4
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12109701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976460
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/09/97	1340	00812	12067	H3	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1340	00813	12067	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1340	00814	12067	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1340	00815	12067	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1400	00816	12467	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1450	00817	12068	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1450	00818	12068	LIQUID-2A	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1450	00819	12068	H3	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER # 101 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: Nicholas A Smith	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Puder	12/11/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION		PROJECT INFORMATION		# ABC-012134
Company..:	Parsons	Project..:	SEAD-12	Page 4 Of 4
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	File = 12109701.bar
	101 Huntington Ave.	Address..:	101 Huntington Ave.	LAB JOB NUMBER
	Boston MA, 02199		Boston MA 02199	976460
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/09/97	1450	00820	12068	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1450	00821	12068	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1450	00822	12068	RN222	OVER-FOR-PARAM-KEY	
KKS	12/09/97	1510	00823	12468	SOLIDS-1A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER #101 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	RECEIVED BY:	Date	RECEIVED BY:	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

Cooler # 27

« « « CORE LABORATORIES - CHAIN OF CUSTODY RECORD » » »

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012135
Company..: Parsons	Project..: SEAD-12	Page 1 Of 3
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12109702.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976460
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	12/10/97	1050	00824	12069	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1050	00825	12069	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1050	00826	12069	H3	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1050	00827	12069	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1050	00828	12069	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1050	00829	12069	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1120	00830	12469	SOLIDS-1A	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1300	00831	12070	LIQUID-1	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: Nicholas A Smith	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Purdie	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Purdie - CORE	Time 0910 ~~0800~~	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

Code 027

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company..:	Parsons	Project..:	SEAD-12
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau
	101 Huntington Ave.	Address..:	101 Huntington Ave.
	Boston MA, 02199		Boston MA 02199
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043

ABC-012136

Page 2 Of 3

File = 12109702.bar

LAB JOB NUMBER

976460

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	12/10/97	1300	00832	12070	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1300	00833	12070	H3	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1300	00834	12070	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1300	00835	12070	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1300	00836	12070	RN222	OVER-FOR-PARAM-KEY	
EAF	12/10/97	1315	00754	12470	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/10/97	1340	00843	12471	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/10/97	1320	00837	12071	LIQUID-1	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

« « « CORE LABORATORIES - CHAIN OF CUSTODY RECORD » » »

CUSTOMER INFORMATION		PROJECT INFORMATION		# ABC-012138
Company..:	Parsons	Project..:	SEAD-12	Page 1 Of 4
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	File = 12119701.bar
	101 Huntington Ave.	Address..:	101 Huntington Ave.	LAB JOB NUMBER
	Boston MA, 02199		Boston MA 02199	976460
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	12/11/97	0945	0844	63003	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	12/11/97	0945	0845	63003	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	12/11/97	0945	0846	63003	H3	OVER-FOR-PARAM-KEY	
EAF	12/11/97	0945	0847	63003	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	0945	0848	63003	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	0945	0849	63003	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1010	0850	63103	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/11/97	0950	0851	63004	LIQUID-1	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER #3 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Pinder - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

««« CORE LABORATORIES - CHAIN OF CUSTODY RECORD »»»

CUSTOMER INFORMATION	PROJECT INFORMATION	# ABC-012139
Company..: Parsons	Project..: SEAD-12	Page 2 Of 4
Report To: Mike Duchesneau	Bill To..: Mike Duchesneau	File = 12119701.bar
101 Huntington Ave.	Address..: 101 Huntington Ave.	LAB JOB NUMBER
Boston MA, 02199	Boston MA 02199	976460
Phone/Fax: 617-859-2492 617-859-2043	Phone/Fax: 617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/11/97	0950	0852	63004	LIQUID-2A	OVER-FOR-PARAM-KEY	
KKS	12/11/97	0950	0853	63004	H3	OVER-FOR-PARAM-KEY	
KKS	12/11/97	0950	0854	63004	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	0950	0855	63004	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	0950	0856	63004	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1020	0857	63104	SOLIDS-1A	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1040	0858	63005	LIQUID-1	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1040	0859	63005	LIQUID-2A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - Cooler #3 AIRBILL NO.: 802 367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: Nicholas A. Smith	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Pucler	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Pucler - CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

«« CORE LABORATORIES - CHAIN OF CUSTODY RECORD »»

CUSTOMER INFORMATION		PROJECT INFORMATION		# ABC-012140
Company..:	Parsons	Project..:	SEAD-12	Page 3 Of 4
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau	File = 12119701.bar
	101 Huntington Ave.	Address..:	101 Huntington Ave.	LAB JOB NUMBER
	Boston MA, 02199		Boston MA 02199	976460
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
KKS	12/11/97	1040	0860	63005	H3	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1040	0861	63005	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1040	0862	63005	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1040	0863	63005	RN222	OVER-FOR-PARAM-KEY	
KKS	12/11/97	1100	0864	63105	SOLIDS-1A	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1111	0865	63006	LIQUID-1	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1111	0866	63006	LIQUID-2A	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1111	0867	63006	H3	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER #3 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [x] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Puder-CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[x] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

CORE LABORATORIES - CHAIN OF CUSTODY RECORD

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company..:	Parsons	Project..:	SEAD-12
Report To:	Mike Duchesneau	Bill To..:	Mike Duchesneau
	101 Huntington Ave.	Address..:	101 Huntington Ave.
	Boston MA, 02199		Boston MA 02199
Phone/Fax:	617-859-2492 617-859-2043	Phone/Fax:	617-859-2492 617-859-2043

 # ABC-012141

Page 4 **Of** 4

File = 12119701.bar

LAB JOB NUMBER

976460

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
EAF	12/11/97	1111	0868	63006	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1111	0869	63006	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1111	0870	63006	RN222	OVER-FOR-PARAM-KEY	
EAF	12/11/97	1140	0871	63106	SOLIDS-1A	OVER-FOR-PARAM-KEY	

SHIPMENT METHOD: FEDEX - COOLER #3 AIRBILL NO.: 802367545697

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [X] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: [signature]	12/11/97	Signature:		Signature:	
Printed Name/Company: NICHOLAS A. SMITH / PARSONS	Time 1800	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: [signature]	12/12/97	Signature:		Signature:	
Printed Name/Company: Michelle Pucler-CORE	Time 0910	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[X] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12455	MD	976240	mod. HASL 300	Thorium-232, Activity	37	RPD	0.8	0.4	Soil		3/27/98 19:05	3/27/98 19:05
12455	MD	976240	mod. HASL 300	Thorium-230, Activity	37	RPD	0.7	0.5	Soil		3/27/98 19:05	3/27/98 19:05
12455	MD	976240	mod. HASL 300	Thorium-227	0.2	RPD	0.3	0.4	Soil		3/27/98 19:05	3/27/98 19:05
12456	MS	976240	mod. HASL 300	Thorium-232, Activity	107.9	% REC	3.5	0.3	Soil		3/27/98 19:05	3/27/98 19:05
12465	SA1	976460	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.3	Solid	12/12/97 9:10	2/27/98 8:29	2/27/98 8:29
12465	SA1	976460	mod. HASL 300	Thorium-232, Activity	1.1	pCi/g	0.7	0.4	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12465	SA1	976460	mod. HASL 300	Thorium-230, Activity	1.3	pCi/g	0.7	0.5	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12465	SA1	976460	mod. HASL 300	Thorium-227	0.5	pCi/g	0.5	0.5	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12465	SA1	976460	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/g	0.4	0.3	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12465	SA1	976460	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.4	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12465	SA1	976460	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12465	SA1	976460	CA-GLR-R160	Moisture (@ 104 deg. C)	17.9	% by Wt			Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12465	SA1	976460	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12465	SA1	976460	EPA 901.1	Radium-228, Activity	2	pCi/g	0.5	0.1	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12465	SA1	976460	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12465	SA1	976460	EPA 901.1	Bismuth-214, Activity	1	pCi/g	0.4	0.2	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12465	SA1	976460	EPA 901.1	Radium-226, Activity	1	pCi/g	0.4	0.2	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12465	SA1	976460	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12465	SA1	976460	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.4	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12465	SA1	976460	EPA 901.1	Cesium-137, Activity	0.4	pCi/g	0.2	0.1	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12465	SA1	976460	EPA 901.1	Lead-210, Activity	ND	pCi/g		3.5	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12465	SA1	976460	EPA 901.1	Lead-211, Activity	ND	pCi/g		2.8	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12465	SA1	976460	EPA 901.1	Lead-214, Activity	1.4	pCi/g	0.4	0.2	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12465	MD	976460	mod. HASL 300	Plutonium-239/240	0	RPD	0.1	0.3	Soil		2/27/98 8:29	2/27/98 8:29
12466	SA1	976460	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.2	0.2	Solid	12/12/97 9:10	2/27/98 8:29	2/27/98 8:29
12466	SA1	976460	mod. HASL 300	Thorium-232, Activity	0.5	pCi/g	0.4	0.4	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12466	SA1	976460	mod. HASL 300	Thorium-230, Activity	1.5	pCi/g	0.7	0.4	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12466	SA1	976460	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.5	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12466	SA1	976460	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/g	0.2	0.1	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12466	SA1	976460	mod. HASL 300	Uranium-238, Activity	0.5	pCi/g	0.2	0.1	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12466	SA1	976460	mod. HASL 300	Uranium-235, Activity	0.2	pCi/g	0.1	0.1	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12466	SA1	976460	CA-GLR-R160	Moisture (@ 104 deg. C)	48.3	% by Wt			Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12466	SA1	976460	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12466	SA1	976460	EPA 901.1	Radium-228, Activity	2.5	pCi/g	0.7	0.2	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12466	SA1	976460	EPA 901.1	Lead-214, Activity	2.2	pCi/g	0.5	0.2	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12466	SA1	976460	EPA 901.1	Bismuth-214, Activity	1.4	pCi/g	0.4	0.1	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12466	SA1	976460	EPA 901.1	Radium-226, Activity	1.4	pCi/g	0.4	0.1	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12466	SA1	976460	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12466	SA1	976460	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.5	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12466	SA1	976460	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.4	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12466	SA1	976460	EPA 901.1	Lead-210, Activity	ND	pCi/g		41.5	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12466	SA1	976460	EPA 901.1	Lead-211, Activity	7	pCi/g	2.4	0.7	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12466	SA1	976460	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	Solid	12/12/97 9:10	4/8/98 7:38	4/8/98 7:38
12466	MS	976460	mod. HASL 300	Plutonium-239/240	77.1	% REC	1	0.3	Soil		2/27/98 8:29	2/27/98 8:29
12467	SA1	976460	CA-GLR-R160	Moisture (@ 104 deg. C)	46.4	% by Wt			Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12467	SA1	976460	EPA 901.1	Radium-228, Activity	3.2	pCi/g	0.6	0.1	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12467	SA1	976460	EPA 901.1	Bismuth-214, Activity	1.6	pCi/g	0.4	0.2	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12467	SA1	976460	EPA 901.1	Radium-226, Activity	1.6	pCi/g	0.4	0.2	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12467	SA1	976460	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	Solid	12/12/97 9:10	2/27/98 8:29	2/27/98 8:29
12467	SA1	976460	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.6	0.4	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12467	SA1	976460	mod. HASL 300	Thorium-230, Activity	2.1	pCi/g	1	0.5	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12467	SA1	976460	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12467	SA1	976460	mod. HASL 300	Thorium-227	ND	pCi/g	0.1	0.5	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12467	SA1	976460	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.2	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12467	SA1	976460	mod. HASL 300	Uranium-233/234, Activity	1.1	pCi/g	0.5	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12467	SA1	976460	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12467	SA1	976460	mod. HASL 300	Uranium-235, Activity	0.3	pCi/g	0.2	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12467	SA1	976460	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.9	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12467	SA1	976460	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.6	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12467	SA1	976460	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12467	SA1	976460	EPA 901.1	Lead-210, Activity	ND	pCi/g		4	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12467	SA1	976460	EPA 901.1	Lead-214, Activity	2.3	pCi/g	0.5	0.2	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12467	SA1	976460	EPA 901.1	Lead-211, Activity	14.5	pCi/g	3.7	1.9	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	SA1	976460	mod. HASL 300	Thorium-227	1	pCi/g	0.7	0.6	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12468	SA1	976460	mod. HASL 300	Uranium-233/234, Activity	1.1	pCi/g	0.4	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12468	SA1	976460	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12468	SA1	976460	mod. HASL 300	Thorium-232, Activity	1.5	pCi/g	0.8	0.4	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12468	SA1	976460	CA-GLR-R160	Moisture (@ 104 deg. C)	30.3	% by Wt			Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12468	SA1	976460	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12468	SA1	976460	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.2	0.3	Solid	12/12/97 9:10	2/27/98 8:29	2/27/98 8:29
12468	SA1	976460	mod. HASL 300	Uranium-235, Activity	0.3	pCi/g	0.2	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12468	SA1	976460	mod. HASL 300	Thorium-230, Activity	2.9	pCi/g	1.2	0.6	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12468	SA1	976460	EPA 901.1	Radium-226, Activity	ND	pCi/g		2	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	SA1	976460	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.4	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	SA1	976460	EPA 901.1	Lead-211, Activity	ND	pCi/g		6.3	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	SA1	976460	EPA 901.1	Lead-210, Activity	ND	pCi/g		14.9	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	SA1	976460	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		2	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	SA1	976460	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	SA1	976460	EPA 901.1	Radium-228, Activity	2.2	pCi/g	0.5	0.2	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	SA1	976460	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	SA1	976460	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	SA1	976460	EPA 901.1	Lead-214, Activity	1.7	pCi/g	0.3	0.1	Solid	12/12/97 9:10	4/8/98 8:40	4/8/98 8:40
12468	MD	976460	EPA 901.1	Lead-210, Activity	0	RPD		24.6	Soil		4/8/98 10:24	4/8/98 10:24
12468	MD	976460	EPA 901.1	Lead-211, Activity	0	RPD		3.9	Soil		4/8/98 10:24	4/8/98 10:24

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12468	MD	976460	EPA 901.1	Radium-228, Activity	25.6	RPD	0.5	0.2	Soil		4/8/98 10:24	4/8/98 10:24
12468	MD	976460	EPA 901.1	Bismuth-214, Activity	1.9	RPD	0.4	0.1	Soil		4/8/98 10:24	4/8/98 10:24
12468	MD	976460	EPA 901.1	Radium-226, Activity	1.9	RPD	0.4	0.1	Soil		4/8/98 10:24	4/8/98 10:24
12468	MD	976460	EPA 901.1	Cobalt-57, Activity	0	RPD		0.1	Soil		4/8/98 10:24	4/8/98 10:24
12468	MD	976460	EPA 901.1	Cobalt-60, Activity	0	RPD		0.2	Soil		4/8/98 10:24	4/8/98 10:24
12468	MD	976460	EPA 901.1	Lead-214, Activity	0	RPD	0.4	0.2	Soil		4/8/98 10:24	4/8/98 10:24
12468	MD	976460	EPA 901.1	Cesium-137, Activity	0.4	RPD	0.1	0.1	Soil		4/8/98 10:24	4/8/98 10:24
12468	MD	976460	EPA 901.1	Radium-223, Activity	0	RPD		0.5	Soil		4/8/98 10:24	4/8/98 10:24
12469	SA1	976460	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12469	SA1	976460	mod. HASL 300	Plutonium-239/240	0.4	pCi/g	0.4	0.4	Solid	12/12/97 9:10	2/27/98 8:29	2/27/98 8:29
12469	SA1	976460	mod. HASL 300	Thorium-230, Activity	1.7	pCi/g	0.8	0.4	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12469	SA1	976460	mod. HASL 300	Thorium-227	0.1	pCi/g	0.3	0.4	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12469	SA1	976460	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/g	0.3	0.1	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12469	SA1	976460	mod. HASL 300	Uranium-238, Activity	0.6	pCi/g	0.3	0.1	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12469	SA1	976460	mod. HASL 300	Uranium-235, Activity	0.2	pCi/g	0.2	0.1	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12469	SA1	976460	CA-GLR-R160	Moisture (@ 104 deg. C)	20.3	% by Wt			Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12469	SA1	976460	EPA 901.1	Radium-228, Activity	1.1	pCi/g	0.4	0.2	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12469	SA1	976460	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.7	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12469	SA1	976460	mod. HASL 300	Thorium-232, Activity	0.6	pCi/g	0.4	0.3	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12469	SA1	976460	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.7	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12469	SA1	976460	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12469	SA1	976460	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12469	SA1	976460	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.3	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12469	SA1	976460	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.1	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12469	SA1	976460	EPA 901.1	Lead-210, Activity	ND	pCi/g		4.6	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12469	SA1	976460	EPA 901.1	Lead-211, Activity	ND	pCi/g		11.7	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12469	SA1	976460	EPA 901.1	Lead-214, Activity	1.3	pCi/g	0.3	0.1	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12469	MD	976460	mod. HASL 300	Uranium-233/234, Activity	11.8	RPD	0.3	0.2	Soil		2/25/98 14:15	2/25/98 14:15
12469	MD	976460	mod. HASL 300	Uranium-235, Activity	0.1	RPD	0.2	0.1	Soil		2/25/98 14:15	2/25/98 14:15
12469	MD	976460	mod. HASL 300	Uranium-238, Activity	0	RPD	0.3	0.1	Soil		2/25/98 14:15	2/25/98 14:15
12470	SA1	976460	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12470	SA1	976460	mod. HASL 300	Thorium-232, Activity	1.2	pCi/g	0.6	0.3	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12470	SA1	976460	mod. HASL 300	Thorium-230, Activity	1.4	pCi/g	0.7	0.4	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12470	SA1	976460	mod. HASL 300	Thorium-227	0.1	pCi/g	0.2	0.4	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12470	SA1	976460	mod. HASL 300	Uranium-233/234, Activity	1.7	pCi/g	0.6	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12470	SA1	976460	mod. HASL 300	Uranium-238, Activity	1.1	pCi/g	0.5	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12470	SA1	976460	mod. HASL 300	Uranium-235, Activity	0.3	pCi/g	0.2	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12470	SA1	976460	CA-GLR-R160	Moisture (@ 104 deg. C)	23.3	% by Wt			Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12470	SA1	976460	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12470	SA1	976460	EPA 901.1	Radium-228, Activity	2.3	pCi/g	0.5	0.1	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12470	SA1	976460	mod. HASL 300	Plutonium-239/240	0.2	pCi/g	0.2	0.2	Solid	12/12/97 9:10	2/27/98 8:29	2/27/98 8:29
12470	SA1	976460	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.9	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
12470	SA1	976460	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.9	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12470	SA1	976460	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12470	SA1	976460	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12470	SA1	976460	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.4	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12470	SA1	976460	EPA 901.1	Lead-210, Activity	ND	pCi/g		18.5	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12470	SA1	976460	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.4	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12470	SA1	976460	EPA 901.1	Lead-214, Activity	1.5	pCi/g	0.3	0.1	Solid	12/12/97 9:10	4/8/98 9:42	4/8/98 9:42
12470	MD	976460	CA-GLR-17.0	Tritium, Activity	9.5	RPD	181	290	Soil		2/4/98 22:59	2/4/98 22:59
12470	MS	976460	mod. HASL 300	Uranium-238, Activity	92	% REC	1.2	0.1	Soil		2/25/98 14:15	2/25/98 14:15
12470	MS	976460	mod. HASL 300	Uranium-233/234, Activity	81.5	% REC	1.3	0.1	Soil		2/25/98 14:15	2/25/98 14:15
12471	SA1	976460	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.3	Solid	12/12/97 9:10	2/27/98 8:29	2/27/98 8:29
12471	SA1	976460	mod. HASL 300	Thorium-232, Activity	1 6	pCi/g	0.9	0.4	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12471	SA1	976460	mod. HASL 300	Thorium-230, Activity	3.4	pCi/g	1.4	0.6	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12471	SA1	976460	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12471	SA1	976460	mod. HASL 300	Thorium-227	0.1	pCi/g	0.2	0.5	Solid	12/12/97 9:10	3/27/98 19:05	3/27/98 19:05
12471	SA1	976460	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.2	Solid	12/12/97 9:10	4/8/98 11:29	4/8/98 11:29
12471	SA1	976460	mod. HASL 300	Uranium-233/234, Activity	1.2	pCi/g	0.4	0.2	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12471	SA1	976460	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12471	SA1	976460	mod. HASL 300	Uranium-235, Activity	0.2	pCi/g	0.1	0.1	Solid	12/12/97 9:10	2/25/98 14:15	2/25/98 14:15
12471	SA1	976460	CA-GLR-R160	Moisture (@ 104 deg. C)	14.9	% by Wt			Solid	12/12/97 9:10	2/4/98 22:59	2/4/98 22:59
12471	SA1	976460	EPA 901.1	Radium-228, Activity	1.3	pCi/g	0.5	0.2	Solid	12/12/97 9:10	4/8/98 11:29	4/8/98 11:29
12471	SA1	976460	EPA 901.1	Bismuth-214, Activity	ND	pCi/g		1.8	Solid	12/12/97 9:10	4/8/98 11:29	4/8/98 11:29
12471	SA1	976460	EPA 901.1	Radium-226, Activity	ND	pCi/g		1.8	Solid	12/12/97 9:10	4/8/98 11:29	4/8/98 11:29
12471	SA1	976460	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Solid	12/12/97 9:10	4/8/98 11:29	4/8/98 11:29
12471	SA1	976460	EPA 901.1	Lead-210, Activity	ND	pCi/g		1.5	Solid	12/12/97 9:10	4/8/98 11:29	4/8/98 11:29
12471	SA1	976460	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.2	Solid	12/12/97 9:10	4/8/98 11:29	4/8/98 11:29
12471	SA1	976460	EPA 901.1	Lead-211, Activity	ND	pCi/g		3.1	Solid	12/12/97 9:10	4/8/98 11:29	4/8/98 11:29
12471	SA1	976460	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Solid	12/12/97 9:10	4/8/98 11:29	4/8/98 11:29
12471	SA1	976460	EPA 901.1	Lead-214, Activity	1.8	pCi/g	0.3	0.2	Solid	12/12/97 9:10	4/8/98 11:29	4/8/98 11:29
12501	MD	976178	CA-GLR-17.0	Tritium, Activity	131	RPD	171	279	Soil		2/6/98 17:18	2/6/98 17:18
12552	MS	976405	CA-GLR-17.0	Tritium, Activity	96.3	% REC	246	293	Soil		2/6/98 17:18	2/6/98 17:18
GEM040898S	LCS	976460	EPA 901.1	Cesium-137, Activity	103.4	% REC	1190	328	Water		4/8/98 7:23	4/8/98 7:23
GEM040898S	LCS	976460	EPA 901.1	Cobalt-60, Activity	98.2	% REC	1420	262	Water		4/8/98 7:23	4/8/98 7:23
GMX040898S	LCS	976460	EPA 901.1	Cesium-137, Activity	106.8	% REC	1090	299	Water		4/8/98 7:08	4/8/98 7:08
GMX040898S	LCS	976460	EPA 901.1	Cobalt-60, Activity	103.3	% REC	1110	171	Water		4/8/98 7:08	4/8/98 7:08
LCS1H30130	LCS	976460	CA-GLR-17.0	Tritium, Activity	94.1	% REC	2.5	3	Water		2/3/98 17:54	2/3/98 17:54
LCS1H30205	LCS	976460	CA-GLR-17.0	Tritium, Activity	102	% REC	2.4	3	Water		2/6/98 17:18	2/6/98 17:18
LCS2H30130	LCS	976460	CA-GLR-17.0	Tritium, Activity	86.2	% REC	2.4	2.9	Water		2/4/98 22:59	2/4/98 22:59
LCSAP0224	LCS	976460	mod. HASL 300	Plutonium-239/240	91.7	% REC	1	0.2	Water		2/27/98 8:29	2/27/98 8:29
LCSAT0224	LCS	976460	mod. HASL 300	Thorium-232, Activity	100	% REC	1.1	0.2	Water		2/26/98 10:54	2/26/98 10:54
LCSBT0310	LCS	976460	mod. HASL 300	Thorium-232, Activity	91.4	% REC	0.7	0.1	Water		3/27/98 19:05	3/27/98 19:05
LCSBU0223	LCS	976460	mod. HASL 300	Uranium-238, Activity	90	% REC	1	0.1	Water		2/25/98 14:15	2/25/98 14:15

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
LCSBU0223	LCS	976460	mod. HASL 300	Uranium-233/234, Activity	79.6	% REC	1	0.2	Water		2/25/98 14:15	2/25/98 14:15
MB1H30130	MB	976460	CA-GLR-17.0	Tritium, Activity	1.4	pCi/L	1.8	2.9	Water		2/3/98 17:54	2/3/98 17:54
MB2H30205	MB	976460	CA-GLR-17.0	Tritium, Activity	ND	pCi/L	1.6	2.7	Water		2/6/98 17:18	2/6/98 17:18
MB4H30130	MB	976460	CA-GLR-17.0	Tritium, Activity	0.8	pCi/L	1.7	2.8	Water		2/4/98 22:59	2/4/98 22:59
MBAP0224	MB	976460	mod. HASL 300	Plutonium-239/240	0.3	pCi/L	0.2	0.2	Water		2/27/98 8:29	2/27/98 8:29
MBAT0224	MB	976460	mod. HASL 300	Thorium-227	0.1	pCi/L	0.1	0.2	Water		2/26/98 10:54	2/26/98 10:54
MBAT0224	MB	976460	mod. HASL 300	Thorium-230, Activity	0.3	pCi/L	0.3	0.3	Water		2/26/98 10:54	2/26/98 10:54
MBAT0224	MB	976460	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water		2/26/98 10:54	2/26/98 10:54
MBBT0310	MB	976460	mod. HASL 300	Thorium-232, Activity	ND	pCi/L	0.1	0.2	Water		3/27/98 19:05	3/27/98 19:05
MBBT0310	MB	976460	mod. HASL 300	Thorium-230, Activity	0.5	pCi/L	0.3	0.3	Water		3/27/98 19:05	3/27/98 19:05
MBBT0310	MB	976460	mod. HASL 300	Thorium-227	ND	pCi/L	0.1	0.2	Water		3/27/98 19:05	3/27/98 19:05
MBCU0223	MB	976460	mod. HASL 300	Uranium-238, Activity	0.1	pCi/L	0.1	0.1	Water		2/25/98 14:15	2/25/98 14:15
MBCU0223	MB	976460	mod. HASL 300	Uranium-235, Activity	0.1	pCi/L	0.1	0.1	Water		2/25/98 14:15	2/25/98 14:15
MBCU0223	MB	976460	mod. HASL 300	Uranium-233/234, Activity	0.1	pCi/L	0.1	0.1	Water		2/25/98 14:15	2/25/98 14:15
ST1H30130	LCS	976460	CA-GLR-17.0	Tritium, Activity	90.6	% REC	2.5	3	Water		2/3/98 17:54	2/3/98 17:54
ST1H30205	LCS	976460	CA-GLR-17.0	Tritium, Activity	94.6	% REC	2.5	2.9	Water		2/6/98 17:18	2/6/98 17:18
ST2H30130	LCS	976460	CA-GLR-17.0	Tritium, Activity	100.5	% REC	2.5	3	Water		2/4/98 22:59	2/4/98 22:59

This came w/ package of revised data, 19 July 99 cover letter

CORE LAB

ENVIRONMENTAL TESTING SERVICES

Sample Delivery Group Narrative

January 11, 1999

Customer: Parsons Engineering Science, Inc.
Project: SEAD-12
Core Laboratories – Casper Job Number: 986113

The following information is pertinent to the interpretation of the data.

On November 11, 1998, Core Laboratories - Casper received 16 soil samples in good condition.

The positive results that are reported for the gamma emitters have calculated MDAs based on the most abundant line of the gamma emitter in question. The activity and the error are calculated by the software for the positive results. The Ra226 activity by gamma is not reported using the 186kev line since Ra226 has a low abundance at that line and the U235 has a greater abundance with an energy very close to 186 which would cause interference. Therefore, the Ra226 is calculated from the Bi214 line, a daughter of Ra226. The Ra228 is calculated from the Ac228 line, the daughter of Ra228, as Ra228 is a beta emitter. Since the parent of Th-227, U-235, is not present in the sample and the progeny of Th-227, Ra-223, is not present in the sample, the presence of Th-227 in the sample is not probable. The tritium QC section is reported before the %moisture is taken into consideration. The tritium in the body of the report is reported as pCi/g and in the QC section as pCi/L. The sample chosen for the MS/MSD for tritium had activity greater the 5 times the activity of the spike added that makes the spike added indiscernible, therefore the batch was not reanalyzed. The MS for the Th230 was elevated at 150%. The count rates for both the MS and MSD are very similar indicating that there was a pipetting error during the addition of the tracer which resulted in the erroneous measurement of the tracer recovery of the MS sample. All other QC for the thorium batch was acceptable and the batch was not reanalyzed.

If you have any questions concerning this data, please call me at (307) 235-5741.

Debra Phillabaum

Debra Phillabaum
QA/QC Coordinator

Core Laboratories, Inc.
420 West First Street. Casper, Wyoming 82601. (307) 235-5741, (800) 666-0306. Fax (307) 266-1676

««« CORE LABORATORIES - CHAIN OF CUSTODY RECORD »»»

CUSTOMER INFORMATION		PROJECT INFORMATION		# ABC-010160
Company..:	Parsons Engineering Science	Project..:	SEAD-12 RI	Page 1 Of 3
Report To:	Micheal Duchesneau	Bill To..:	As Listed Above	File = 10319801.bar
	30 Dan Road	Address..:		LAB JOB NUMBER
	Canton, MA 02021			986113
Phone/Fax:	791-401-2262 fax: 2043	Phone/Fax:	Your Bill To Phone & Fax Numbers	

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
ITR	10/27/98	1440	56892	123179	SOIL-1A		
ITR	10/28/98	1325	56905	123180	SOIL-1A		
ITR	10/28/98	1510	56904	123181	SOIL-1A		
ITR	10/28/98	1520	56903	123182	SOIL-1A		
ITR	10/28/98	0955	56888	123183	SOIL-1A		
ITR	10/28/98	1050	56889	123184	SOIL-1A		
ITR	10/28/98	1100	56890	123185	SOIL-1A		
ITR	10/29/98	0950	56893	123186	SOIL-1A		

SHIPMENT METHOD: AIRBILL NO.:

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [ ] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: Brian J. Powell	11-2-98	Signature:		Signature:	
Printed Name/Company: Brian J. Powell / Parsons ES	Time 1200	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	RECEIVED BY:	Date	RECEIVED BY:	Date
Signature: Michelle Purdes	11-3-98	Signature:		Signature:	
Printed Name/Company: Michelle Purdes / CORE	Time 0905	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[ ] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

« « « CORE LABORATORIES - CHAIN OF CUSTODY RECORD » » »

CUSTOMER INFORMATION		PROJECT INFORMATION	
Company..:	Parsons Engineering Science	Project..:	SEAD-12 RI
Report To:	Micheal Duchesneau	Bill To..:	As Listed Above
	30 Dan Road	Address..:	
	Canton, MA 02021		
Phone/Fax:	791-401-2262 fax: 2043	Phone/Fax:	Your Bill To Phone & Fax Numbers

\# ABC-010163

Page 2 Of 3

File = 10319801.bar

LAB JOB NUMBER

786113

SMR	DATE	TIME	BARCODE	SAMPLE ID	PARAMETERS	COMMENTS	LAB NO.
ITR	10/29/98	1135	56894	123187	SOIL-1A		
ITR	10/29/98	1145	56895	123188	SOIL-1A		
ITR	10/29/98	1430	56896	123189	SOIL-1A		
ITR	10/30/98	0750	56899	123190	SOIL-1A		
ITR	10/30/98	0900	56898	123191	SOIL-1A		
ITR	10/30/98	0910	56897	123192	SOIL-1A		
ITR	10/30/98	1530	56907	123193	SOIL-1A		
ITR	10/30/98	1610	56906	123194	SOIL-1A		

SHIPMENT METHOD: AIRBILL NO.:

REQUIRED TURNAROUND:** [ ] SAME DAY [ ] 24 HOURS [ ] 48 HOURS [ ] 72 HOURS [ ] 5 DAYS [ ] 10 DAYS [ ] ROUTINE [ ] ________ ** RUSH WORK MAY REQUIRE SURCHARGE

RELINQUISHED BY:	Date	RELINQUISHED BY:	Date	RELINQUISHED BY:	Date
Signature: Brian J. Powell	11-2-98	Signature:		Signature:	
Printed Name/Company: Brian J. Powell Parsons ES	Time 1200	Printed Name/Company:	Time	Printed Name/Company:	Time
RECEIVED BY:	Date	**RECEIVED BY:**	Date	**RECEIVED BY:**	Date
Signature: Michelle Pruder	11-3-98	Signature:		Signature:	
Printed Name/Company: Michelle Puder/CORE	Time 0705	Printed Name/Company:	Time	Printed Name/Company:	Time

[ ] Anaheim, CA (714) 937-1094
[ ] Aurora, CO (303) 751-1780
[ ] Casper, WY (307) 235-5741
[ ] Corpus Christi, TX (512) 289-2673
[ ] Edison, NJ (908) 225-6700
[ ] Houston, TX (Env) (713) 690-4444
[ ] Houston, TX (Pet) (713) 943-9776
[ ] Indianapolis, IN (317) 875-5894
[ ] Lake Charles, LA (318) 583-4926
[ ] Long Beach, CA (310) 595-8401
[ ] Tampa, FL (813) 884-8268
[ ] Valparaiso, IN (219) 464-2389

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT		UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
123179	SA1	986113	EPA 901.1	Radium-228, Activity		1.6	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/9/98 12:05	12/9/98 12:05
123179	SA1	986113	mod. HASL 300	Promethium 147	ND		pCi/g	4.5	7.7	Soil	11/3/98 9:05	12/17/98 14:43	12/17/98 14:43
123179	SA1	986113	mod. HASL 300	Uranium-233/234, Activity		0.7	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123179	SA1	986113	mod. HASL 300	Uranium-235, Activity	ND		pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123179	SA1	986113	mod. HASL 300	Uranium-238, Activity		0.7	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123179	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N		pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123179	SA1	986113	mod. HASL 300	Thorium-230, Activity		1	pCi/g	0.5	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123179	SA1	986113	mod. HASL 300	Thorium-232, Activity		0.5	pCi/g	0.3	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123179	SA1	986113	EPA 901.1	Bismuth-214, Activity		2	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/9/98 12:05	12/9/98 12:05
123179	SA1	986113	mod. HASL 300	Plutonium-239/240		0.1	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123179	SA1	986113	EPA 901.1	Radium-223, Activity		0.4	pCi/g	0.3	0.3	Soil	11/3/98 9:05	12/9/98 12:05	12/9/98 12:05
123179	SA1	986113	CA-GLR-17.0	Tritium, Activity		0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123179	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)		20.2	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123179	SA1	986113	EPA 901.1	Radium-226, Activity		2	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/9/98 12:05	12/9/98 12:05
123179	SA1	986113	EPA 901.1	Cobalt-57, Activity		0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/9/98 12:05	12/9/98 12:05
123179	SA1	986113	EPA 901.1	Cobalt-60, Activity	ND		pCi/g		0.1	Soil	11/3/98 9:05	12/9/98 12:05	12/9/98 12:05
123179	SA1	986113	EPA 901.1	Cesium-137, Activity		0.2	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/9/98 12:05	12/9/98 12:05
123179	SA1	986113	EPA 901.1	Lead-210, Activity		2.1	pCi/g	1	0.9	Soil	11/3/98 9:05	12/9/98 12:05	12/9/98 12:05
123179	SA1	986113	EPA 901.1	Lead-211, Activity	ND		pCi/g		0.8	Soil	11/3/98 9:05	12/9/98 12:05	12/9/98 12:05
123179	SA1	986113	EPA 901.1	Lead-214, Activity		1.3	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/9/98 12:05	12/9/98 12:05
123179	MD	986113	CA-GLR-17.0	Tritium, Activity		162	RPD			Soil		12/28/98 22:34	12/28/98 22:34
123179	MD	986113	mod. HASL 300	Uranium-238, Activity		0	RPD			Soil		12/23/98 9:46	12/23/98 9:46
123179	MD	986113	mod. HASL 300	Uranium-233/234, Activity		15.4	RPD			Soil		12/23/98 9:46	12/23/98 9:46
123179	MD	986113	mod. HASL 300	Promethium 147		0	RPD			Soil		12/17/98 14:43	12/17/98 14:43
123179	MD	986113	mod. HASL 300	Uranium-235, Activity		0	RPD			Soil		12/23/98 9:46	12/23/98 9:46
123180	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)		23	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123180	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N		pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123180	SA1	986113	CA-GLR-17.0	Tritium, Activity		0.5	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123180	SA1	986113	mod. HASL 300	Thorium-230, Activity		0.4	pCi/g	0.4	0.5	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123180	SA1	986113	mod. HASL 300	Plutonium-239/240	ND		pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123180	SA1	986113	mod. HASL 300	Thorium-232, Activity		0.5	pCi/g	0.3	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123180	SA1	986113	mod. HASL 300	Uranium-235, Activity	ND		pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123180	SA1	986113	mod. HASL 300	Uranium-233/234, Activity		0.7	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123180	SA1	986113	EPA 901.1	Radium-228, Activity		1.3	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/9/98 13:07	12/9/98 13:07
123180	SA1	986113	EPA 901.1	Bismuth-214, Activity		1.8	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/9/98 13:07	12/9/98 13:07
123180	SA1	986113	EPA 901.1	Radium-226, Activity		1.8	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/9/98 13:07	12/9/98 13:07
123180	SA1	986113	mod. HASL 300	Uranium-238, Activity		0.8	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123180	SA1	986113	EPA 901.1	Cobalt-57, Activity	ND		pCi/g		0.1	Soil	11/3/98 9:05	12/9/98 13:07	12/9/98 13:07
123180	SA1	986113	EPA 901.1	Radium-223, Activity	ND		pCi/g		0.4	Soil	11/3/98 9:05	12/9/98 13:07	12/9/98 13:07
123180	SA1	986113	EPA 901.1	Cobalt-60, Activity		0.3	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/9/98 13:07	12/9/98 13:07
123180	SA1	986113	EPA 901.1	Cesium-137, Activity		0.6	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/9/98 13:07	12/9/98 13:07

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
123180	SA1	986113	EPA 901.1	Lead-210, Activity	3.6	pCi/g	2.2	1.4	Soil	11/3/98 9:05	12/9/98 13:07	12/9/98 13:07
123180	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.4	Soil	11/3/98 9:05	12/9/98 13:07	12/9/98 13:07
123180	SA1	986113	EPA 901.1	Lead-214, Activity	1.4	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/9/98 13:07	12/9/98 13:07
123180	MS	986113	CA-GLR-17.0	Tritium, Activity	47.2	% REC			Soil		12/28/98 22:34	12/28/98 22:34
123180	MS	986113	mod. HASL 300	Uranium-238, Activity	102.8	% REC			Soil		12/23/98 9:46	12/23/98 9:46
123180	MS	986113	mod. HASL 300	Uranium-233/234, Activity	75	% REC			Soil		12/23/98 9:46	12/23/98 9:46
123180	MSD	986113	CA-GLR-17.0	Tritium, Activity	50.8	% REC			Soil		12/28/98 22:34	12/28/98 22:34
123180	MSD	986113	mod. HASL 300	Uranium-238, Activity	91.7	% REC			Soil		12/23/98 9:46	12/23/98 9:46
123180	MSD	986113	mod. HASL 300	Uranium-233/234, Activity	91.7	% REC			Soil		12/23/98 9:46	12/23/98 9:46
123181	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123181	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	13.8	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123181	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123181	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.6	Soil	11/3/98 9:05	12/9/98 14:18	12/9/98 14:18
123181	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.3	pCi/g	0.3	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123181	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.2	pCi/g	0.5	0.7	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123181	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123181	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123181	SA1	986113	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123181	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123181	SA1	986113	EPA 901.1	Radium-228, Activity	2.3	pCi/g	0.5	0.1	Soil	11/3/98 9:05	12/9/98 14:18	12/9/98 14:18
123181	SA1	986113	EPA 901.1	Bismuth-214, Activity	1.4	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/9/98 14:18	12/9/98 14:18
123181	SA1	986113	EPA 901.1	Radium-226, Activity	1.4	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/9/98 14:18	12/9/98 14:18
123181	SA1	986113	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/9/98 14:18	12/9/98 14:18
123181	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.2	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/9/98 14:18	12/9/98 14:18
123181	SA1	986113	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/9/98 14:18	12/9/98 14:18
123181	SA1	986113	EPA 901.1	Lead-210, Activity	5.8	pCi/g	2.6	1.3	Soil	11/3/98 9:05	12/9/98 14:18	12/9/98 14:18
123181	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		2.3	Soil	11/3/98 9:05	12/9/98 14:18	12/9/98 14:18
123181	SA1	986113	EPA 901.1	Lead-214, Activity	1.6	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/9/98 14:18	12/9/98 14:18
123182	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123182	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123182	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.5	pCi/g	0.3	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123182	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.2	pCi/g	0.3	0.5	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123182	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123182	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	8.6	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123182	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123182	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Soil	11/3/98 9:05	12/9/98 15:22	12/9/98 15:22
123182	SA1	986113	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123182	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123182	SA1	986113	EPA 901.1	Radium-228, Activity	1.8	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/9/98 15:22	12/9/98 15:22
123182	SA1	986113	EPA 901.1	Bismuth-214, Activity	1.9	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/9/98 15:22	12/9/98 15:22
123182	SA1	986113	EPA 901.1	Radium-226, Activity	1.9	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/9/98 15:22	12/9/98 15:22

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
123182	SA1	986113	EPA 901.1	Cobalt-57, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/9/98 15:22	12/9/98 15:22
123182	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/9/98 15:22	12/9/98 15:22
123182	SA1	986113	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/9/98 15:22	12/9/98 15:22
123182	SA1	986113	EPA 901.1	Lead-210, Activity	4.6	pCi/g	2.7	1.3	Soil	11/3/98 9:05	12/9/98 15:22	12/9/98 15:22
123182	SA1	986113	EPA 901.1	Lead-211, Activity	6.5	pCi/g	2.5	1.3	Soil	11/3/98 9:05	12/9/98 15:22	12/9/98 15:22
123182	SA1	986113	EPA 901.1	Lead-214, Activity	1.6	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/9/98 15:22	12/9/98 15:22
123183	SA1	986113	CA-GLR-17.0	Tritium, Activity	29.3	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123183	SA1	986113	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123183	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.5	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123183	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.5	pCi/g	0.4	0.5	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123183	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123183	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.9	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123183	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123183	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/g	0.2	0.2	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123183	SA1	986113	EPA 901.1	Radium-228, Activity	1.8	pCi/g	0.5	0.3	Soil	11/3/98 9:05	12/10/98 7:39	12/10/98 7:39
123183	SA1	986113	EPA 901.1	Bismuth-214, Activity	2	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/10/98 7:39	12/10/98 7:39
123183	SA1	986113	EPA 901.1	Radium-226, Activity	2	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/10/98 7:39	12/10/98 7:39
123183	SA1	986113	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/10/98 7:39	12/10/98 7:39
123183	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	22.8	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123183	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 7:39	12/10/98 7:39
123183	SA1	986113	EPA 901.1	Radium-223, Activity	1.3	pCi/g	0.6	0.4	Soil	11/3/98 9:05	12/10/98 7:39	12/10/98 7:39
123183	SA1	986113	EPA 901.1	Cesium-137, Activity	0.9	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/10/98 7:39	12/10/98 7:39
123183	SA1	986113	EPA 901.1	Lead-210, Activity	4.4	pCi/g	2.2	1.3	Soil	11/3/98 9:05	12/10/98 7:39	12/10/98 7:39
123183	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		1	Soil	11/3/98 9:05	12/10/98 7:39	12/10/98 7:39
123183	SA1	986113	EPA 901.1	Lead-214, Activity	1.5	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 7:39	12/10/98 7:39
123183	MD	986113	mod. HASL 300	Plutonium-239/240	0	RPD			Soil		12/21/98 16:20	12/21/98 16:20
123184	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123184	SA1	986113	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123184	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	10	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123184	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.5	pCi/g	0.4	0.4	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123184	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123184	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.9	pCi/g	0.6	0.6	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123184	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123184	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.5	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123184	SA1	986113	EPA 901.1	Radium-228, Activity	1.3	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 8:48	12/10/98 8:48
123184	SA1	986113	EPA 901.1	Bismuth-214, Activity	2.1	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/10/98 8:48	12/10/98 8:48
123184	SA1	986113	EPA 901.1	Radium-226, Activity	2.1	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/10/98 8:48	12/10/98 8:48
123184	SA1	986113	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/10/98 8:48	12/10/98 8:48
123184	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/g	0.2	0.2	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123184	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.3	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 8:48	12/10/98 8:48
123184	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Soil	11/3/98 9:05	12/10/98 8:48	12/10/98 8:48

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
123184	SA1	986113	EPA 901.1	Cesium-137, Activity	0.4	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/10/98 8:48	12/10/98 8:48
123184	SA1	986113	EPA 901.1	Lead-210, Activity	3.2	pCi/g	2.8	1.3	Soil	11/3/98 9:05	12/10/98 8:48	12/10/98 8:48
123184	SA1	986113	EPA 901.1	Lead-211, Activity	1.7	pCi/g	1	0.3	Soil	11/3/98 9:05	12/10/98 8:48	12/10/98 8:48
123184	SA1	986113	EPA 901.1	Lead-214, Activity	1.7	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 8:48	12/10/98 8:48
123184	MS	986113	mod. HASL 300	Plutonium-239/240	118.8	% REC			Soil		12/21/98 16:20	12/21/98 16:20
123184	MSD	986113	mod. HASL 300	Plutonium-239/240	110.4	% REC			Soil		12/21/98 16:20	12/21/98 16:20
123185	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123185	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123185	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	7.7	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123185	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123185	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Soil	11/3/98 9:05	12/10/98 9:51	12/10/98 9:51
123185	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.7	pCi/g	0.5	0.5	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123185	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123185	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123185	SA1	986113	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123185	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123185	SA1	986113	EPA 901.1	Radium-228, Activity	1.9	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/10/98 9:51	12/10/98 9:51
123185	SA1	986113	EPA 901.1	Bismuth-214, Activity	1.5	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 9:51	12/10/98 9:51
123185	SA1	986113	EPA 901.1	Radium-226, Activity	1.5	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 9:51	12/10/98 9:51
123185	SA1	986113	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/10/98 9:51	12/10/98 9:51
123185	SA1	986113	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/10/98 9:51	12/10/98 9:51
123185	SA1	986113	EPA 901.1	Cesium-137, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/10/98 9:51	12/10/98 9:51
123185	SA1	986113	EPA 901.1	Lead-210, Activity	4.5	pCi/g	2.1	0.9	Soil	11/3/98 9:05	12/10/98 9:51	12/10/98 9:51
123185	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		2.1	Soil	11/3/98 9:05	12/10/98 9:51	12/10/98 9:51
123185	SA1	986113	EPA 901.1	Lead-214, Activity	1.7	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 9:51	12/10/98 9:51
123185	MD	986113	mod. HASL 300	Thorium-232, Activity	0.2	RPD			Soil		12/30/98 18:25	12/30/98 18:25
123185	MD	986113	mod. HASL 300	Thorium-230, Activity	0.2	RPD			Soil		12/30/98 18:25	12/30/98 18:25
123186	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123186	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123186	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.4	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123186	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.9	pCi/g	0.5	0.4	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123186	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123186	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123186	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123186	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	12.9	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123186	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/g	0.2	0.2	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123186	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Radium-228, Activity	1.9	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Bismuth-214, Activity	1.7	pCi/g	0.7	0.3	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Radium-226, Activity	1.7	pCi/g	0.7	0.3	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Cobalt-57, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
123186	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.4	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Cesium-137, Activity	0.2	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Lead-210, Activity	5.6	pCi/g	2.7	1.3	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Lead-211, Activity	12.5	pCi/g	5	1.8	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Lead-214, Activity	2.8	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	MS	986113	mod. HASL 300	Thorium-230, Activity	150	% REC			Soil		12/30/98 18:25	12/30/98 18:25
123186	MSD	986113	mod. HASL 300	Thorium-230, Activity	110.3	% REC			Soil		12/30/98 18:25	12/30/98 18:25
123187	SA1	986113	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123187	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123187	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123187	SA1	986113	mod. HASL 300	Thorium-230, Activity	1	pCi/g	0.6	0.4	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123187	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123187	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.8	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123187	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123187	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/g	0.2	0.2	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123187	SA1	986113	EPA 901.1	Radium-228, Activity	2.2	pCi/g	0.5	0.1	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Bismuth-214, Activity	2.1	pCi/g	0.6	0.2	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Radium-226, Activity	2.1	pCi/g	0.6	0.2	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Cobalt-57, Activity	0.2	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.3	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	16.3	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123187	SA1	986113	EPA 901.1	Cesium-137, Activity	0.2	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Radium-223, Activity	0.5	pCi/g	0.4	0.4	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Lead-210, Activity	1.7	pCi/g	1.4	1.2	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		2.2	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Lead-214, Activity	1.4	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123188	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123188	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123188	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123188	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	10.1	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123188	SA1	986113	mod. HASL 300	Thorium-230, Activity	1.8	pCi/g	0.8	0.4	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123188	SA1	986113	EPA 901.1	Radium-228, Activity	2	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123188	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123188	SA1	986113	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123188	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123188	SA1	986113	EPA 901.1	Radium-226, Activity	1.4	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Bismuth-214, Activity	1.4	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Cesium-137, Activity	0.3	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
123188	SA1	986113	EPA 901.1	Radium-223, Activity	0.5	pCi/g	0.3	0.3	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Lead-210, Activity	2.2	pCi/g	2	1.2	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.5	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Lead-214, Activity	1.4	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	MD	986113	SM 2540G	Moisture (@ 104 deg. C)	1.2	RPD			Soil		11/17/98 0:00	11/17/98 0:00
123189	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123189	SA1	986113	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123189	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.7	pCi/g	0.4	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123189	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	10.5	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123189	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.8	pCi/g	0.5	0.5	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123189	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.5	Soil	11/3/98 9:05	12/10/98 14:30	12/10/98 14:30
123189	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123189	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.9	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123189	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123189	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.9	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123189	SA1	986113	EPA 901.1	Radium-228, Activity	1.3	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 14:30	12/10/98 14:30
123189	SA1	986113	EPA 901.1	Bismuth-214, Activity	2.2	pCi/g	0.6	0.3	Soil	11/3/98 9:05	12/10/98 14:30	12/10/98 14:30
123189	SA1	986113	EPA 901.1	Radium-226, Activity	2.2	pCi/g	0.6	0.3	Soil	11/3/98 9:05	12/10/98 14:30	12/10/98 14:30
123189	SA1	986113	EPA 901.1	Cobalt-57, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 14:30	12/10/98 14:30
123189	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 14:30	12/10/98 14:30
123189	SA1	986113	EPA 901.1	Cesium-137, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 14:30	12/10/98 14:30
123189	SA1	986113	EPA 901.1	Lead-210, Activity	ND	pCi/g		1.8	Soil	11/3/98 9:05	12/10/98 14:30	12/10/98 14:30
123189	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.3	Soil	11/3/98 9:05	12/10/98 14:30	12/10/98 14:30
123189	SA1	986113	EPA 901.1	Lead-214, Activity	1.9	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 14:30	12/10/98 14:30
123190	SA1	986113	CA-GLR-17.0	Tritium, Activity	14.2	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123190	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123190	SA1	986113	mod. HASL 300	Thorium-232, Activity	1.1	pCi/g	0.5	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123190	SA1	986113	mod. HASL 300	Thorium-230, Activity	1	pCi/g	0.5	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123190	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123190	SA1	986113	mod. HASL 300	Uranium-238, Activity	1.2	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123190	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123190	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	1	pCi/g	0.3	0.2	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123190	SA1	986113	EPA 901.1	Radium-228, Activity	1.2	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 15:48	12/10/98 15:48
123190	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	24.7	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123190	SA1	986113	EPA 901.1	Bismuth-214, Activity	1.7	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/10/98 15:48	12/10/98 15:48
123190	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Soil	11/3/98 9:05	12/10/98 15:48	12/10/98 15:48
123190	SA1	986113	EPA 901.1	Radium-226, Activity	1.7	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/10/98 15:48	12/10/98 15:48
123190	SA1	986113	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/10/98 15:48	12/10/98 15:48
123190	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 15:48	12/10/98 15:48
123190	SA1	986113	EPA 901.1	Cesium-137, Activity	0.6	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/10/98 15:48	12/10/98 15:48
123190	SA1	986113	EPA 901.1	Lead-210, Activity	4.3	pCi/g	2.4	1.4	Soil	11/3/98 9:05	12/10/98 15:48	12/10/98 15:48

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
123186	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.4	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Cesium-137, Activity	0.2	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Lead-210, Activity	5.6	pCi/g	2.7	1.3	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Lead-211, Activity	12.5	pCi/g	5	1.8	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	SA1	986113	EPA 901.1	Lead-214, Activity	2.8	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/10/98 10:53	12/10/98 10:53
123186	MS	986113	mod. HASL 300	Thorium-230, Activity	150	% REC			Soil		12/30/98 18:25	12/30/98 18:25
123186	MSD	986113	mod. HASL 300	Thorium-230, Activity	110.3	% REC			Soil		12/30/98 18:25	12/30/98 18:25
123187	SA1	986113	CA-GLR-17.0	Tritium, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123187	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123187	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.8	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123187	SA1	986113	mod. HASL 300	Thorium-230, Activity	1	pCi/g	0.6	0.4	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123187	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123187	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.8	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123187	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123187	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/g	0.2	0.2	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123187	SA1	986113	EPA 901.1	Radium-228, Activity	2.2	pCi/g	0.5	0.1	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Bismuth-214, Activity	2.1	pCi/g	0.6	0.2	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Radium-226, Activity	2.1	pCi/g	0.6	0.2	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Cobalt-57, Activity	0.2	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.3	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	16.3	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123187	SA1	986113	EPA 901.1	Cesium-137, Activity	0.2	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Radium-223, Activity	0.5	pCi/g	0.4	0.4	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Lead-210, Activity	1.7	pCi/g	1.4	1.2	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		2.2	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123187	SA1	986113	EPA 901.1	Lead-214, Activity	1.4	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/10/98 11:54	12/10/98 11:54
123188	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123188	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123188	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.9	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123188	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	10.1	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123188	SA1	986113	mod. HASL 300	Thorium-230, Activity	1.8	pCi/g	0.8	0.4	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123188	SA1	986113	EPA 901.1	Radium-228, Activity	2	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123188	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123188	SA1	986113	mod. HASL 300	Uranium-235, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123188	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123188	SA1	986113	EPA 901.1	Radium-226, Activity	1.4	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Cobalt-60, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Bismuth-214, Activity	1.4	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27
123188	SA1	986113	EPA 901.1	Cesium-137, Activity	0.3	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/10/98 13:27	12/10/98 13:27

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
123190	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.8	Soil	11/3/98 9:05	12/10/98 15:48	12/10/98 15:48
123190	SA1	986113	EPA 901.1	Lead-214, Activity	1.3	pCi/g	0.3	0.2	Soil	11/3/98 9:05	12/10/98 15:48	12/10/98 15:48
123191	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123191	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123191	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.5	pCi/g	0.3	0.2	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123191	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.5	pCi/g	0.3	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123191	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123191	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.8	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123191	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123191	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.6	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123191	SA1	986113	EPA 901.1	Radium-228, Activity	1.5	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/11/98 7:52	12/11/98 7:52
123191	SA1	986113	EPA 901.1	Bismuth-214, Activity	1.2	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/11/98 7:52	12/11/98 7:52
123191	SA1	986113	EPA 901.1	Radium-226, Activity	1.2	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/11/98 7:52	12/11/98 7:52
123191	SA1	986113	EPA 901.1	Cobalt-57, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/11/98 7:52	12/11/98 7:52
123191	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.2	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/11/98 7:52	12/11/98 7:52
123191	SA1	986113	EPA 901.1	Cesium-137, Activity	0.3	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/11/98 7:52	12/11/98 7:52
123191	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	10.5	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123191	SA1	986113	EPA 901.1	Lead-210, Activity	ND	pCi/g		1.5	Soil	11/3/98 9:05	12/11/98 7:52	12/11/98 7:52
123191	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Soil	11/3/98 9:05	12/11/98 7:52	12/11/98 7:52
123191	SA1	986113	EPA 901.1	Lead-211, Activity	10	pCi/g	8.6	2	Soil	11/3/98 9:05	12/11/98 7:52	12/11/98 7:52
123191	SA1	986113	EPA 901.1	Lead-214, Activity	1.5	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/11/98 7:52	12/11/98 7:52
123192	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123192	SA1	986113	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123192	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.7	pCi/g	0.5	0.4	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123192	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.2	pCi/g	0.4	0.6	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123192	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	10.4	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123192	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123192	SA1	986113	EPA 901.1	Radium-226, Activity	1.4	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/11/98 8:54	12/11/98 8:54
123192	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.4	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123192	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123192	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.5	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123192	SA1	986113	EPA 901.1	Radium-228, Activity	1.5	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/11/98 8:54	12/11/98 8:54
123192	SA1	986113	EPA 901.1	Bismuth-214, Activity	1.4	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/11/98 8:54	12/11/98 8:54
123192	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/11/98 8:54	12/11/98 8:54
123192	SA1	986113	EPA 901.1	Cesium-137, Activity	0.4	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/11/98 8:54	12/11/98 8:54
123192	SA1	986113	EPA 901.1	Cobalt-57, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/11/98 8:54	12/11/98 8:54
123192	SA1	986113	EPA 901.1	Lead-210, Activity	2.6	pCi/g	1.7	1.1	Soil	11/3/98 9:05	12/11/98 8:54	12/11/98 8:54
123192	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.3	Soil	11/3/98 9:05	12/11/98 8:54	12/11/98 8:54
123192	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.5	Soil	11/3/98 9:05	12/11/98 8:54	12/11/98 8:54
123192	SA1	986113	EPA 901.1	Lead-214, Activity	1.2	pCi/g	0.3	0.2	Soil	11/3/98 9:05	12/11/98 8:54	12/11/98 8:54
123193	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
123193	SA1	986113	mod. HASL 300	Plutonium-239/240	0.1	pCi/g	0.1	0.2	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123193	SA1	986113	mod. HASL 300	Thorium-232, Activity	0.7	pCi/g	0.4	0.3	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123193	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.9	pCi/g	0.5	0.4	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123193	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123193	SA1	986113	mod. HASL 300	Uranium-238, Activity	0.7	pCi/g	0.2	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123193	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123193	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.7	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123193	SA1	986113	EPA 901.1	Radium-228, Activity	2.6	pCi/g	0.5	0.1	Soil	11/3/98 9:05	12/11/98 9:55	12/11/98 9:55
123193	SA1	986113	EPA 901.1	Bismuth-214, Activity	2.3	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/11/98 9:55	12/11/98 9:55
123193	SA1	986113	EPA 901.1	Radium-226, Activity	2.3	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/11/98 9:55	12/11/98 9:55
123193	SA1	986113	EPA 901.1	Cobalt-57, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/11/98 9:55	12/11/98 9:55
123193	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.3	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/11/98 9:55	12/11/98 9:55
123193	SA1	986113	EPA 901.1	Cesium-137, Activity	0.5	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/11/98 9:55	12/11/98 9:55
123193	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	11.7	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123193	SA1	986113	EPA 901.1	Lead-210, Activity	4	pCi/g	3.4	1.5	Soil	11/3/98 9:05	12/11/98 9:55	12/11/98 9:55
123193	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Soil	11/3/98 9:05	12/11/98 9:55	12/11/98 9:55
123193	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.4	Soil	11/3/98 9:05	12/11/98 9:55	12/11/98 9:55
123193	SA1	986113	EPA 901.1	Lead-214, Activity	1.7	pCi/g	0.4	0.2	Soil	11/3/98 9:05	12/11/98 9:55	12/11/98 9:55
123194	SA1	986113	EPA 901.1	Radium-228, Activity	1.8	pCi/g	0.4	0.1	Soil	11/3/98 9:05	12/11/98 10:57	12/11/98 10:57
123194	SA1	986113	EPA 901.1	Bismuth-214, Activity	1.6	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/11/98 10:57	12/11/98 10:57
123194	SA1	986113	EPA 901.1	Radium-226, Activity	1.6	pCi/g	0.5	0.2	Soil	11/3/98 9:05	12/11/98 10:57	12/11/98 10:57
123194	SA1	986113	EPA 901.1	Cobalt-57, Activity	ND	pCi/g		0.1	Soil	11/3/98 9:05	12/11/98 10:57	12/11/98 10:57
123194	SA1	986113	EPA 901.1	Cobalt-60, Activity	0.4	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/11/98 10:57	12/11/98 10:57
123194	SA1	986113	EPA 901.1	Cesium-137, Activity	0.2	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/11/98 10:57	12/11/98 10:57
123194	SA1	986113	EPA 901.1	Lead-210, Activity	2.9	pCi/g	1.7	1.1	Soil	11/3/98 9:05	12/11/98 10:57	12/11/98 10:57
123194	SA1	986113	EPA 901.1	Lead-211, Activity	ND	pCi/g		1.9	Soil	11/3/98 9:05	12/11/98 10:57	12/11/98 10:57
123194	SA1	986113	SM 2540G	Moisture (@ 104 deg. C)	9.3	%			Soil	11/3/98 9:05	11/17/98 0:00	11/17/98 0:00
123194	SA1	986113	EPA 901.1	Lead-214, Activity	1.5	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/11/98 10:57	12/11/98 10:57
123194	SA1	986113	mod. HASL 300	Uranium-233/234, Activity	0.8	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123194	SA1	986113	EPA 901.1	Radium-223, Activity	ND	pCi/g		0.4	Soil	11/3/98 9:05	12/11/98 10:57	12/11/98 10:57
123194	SA1	986113	CA-GLR-17.0	Tritium, Activity	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/28/98 22:34	12/28/98 22:34
123194	SA1	986113	mod. HASL 300	Plutonium-239/240	ND	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/21/98 16:20	12/21/98 16:20
123194	SA1	986113	mod. HASL 300	Thorium-232, Activity	1	pCi/g	0.6	0.4	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123194	SA1	986113	mod. HASL 300	Thorium-230, Activity	0.8	pCi/g	0.6	0.6	Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123194	SA1	986113	mod. HASL 300	Thorium-227, Activity	C.N	pCi/g			Soil	11/3/98 9:05	12/30/98 18:25	12/30/98 18:25
123194	SA1	986113	mod. HASL 300	Uranium-238, Activity	1.1	pCi/g	0.3	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123194	SA1	986113	mod. HASL 300	Uranium-235, Activity	0.1	pCi/g	0.1	0.1	Soil	11/3/98 9:05	12/23/98 9:46	12/23/98 9:46
123194	MD	986113	EPA 901.1	Cobalt-57, Activity	0.1	RPD	0.1	0.1	Soil		12/11/98 12:04	12/11/98 12:04
123194	MD	986113	EPA 901.1	Bismuth-214, Activity	11.8	RPD	0.3	0.1	Soil		12/11/98 12:04	12/11/98 12:04
123194	MD	986113	EPA 901.1	Radium-228, Activity	36.4	RPD	0.6	0.2	Soil		12/11/98 12:04	12/11/98 12:04
123194	MD	986113	EPA 901.1	Radium-223, Activity	0	RPD		0.4	Soil		12/11/98 12:04	12/11/98 12:04

PARSONS ES SAMP ID	SAMPLE TYPE	SDG	ANALYSIS METHOD	PARAMETER	RESULT	UNIT	ERROR	LLD	MATRIX	RCVD DATE	EXTRACT DATE	ANALYZED DATE
123194	MD	986113	EPA 901.1	Radium-226, Activity	11.8	RPD	0.3	0.1	Soil		12/11/98 12:04	12/11/98 12:04
123194	MD	986113	EPA 901.1	Lead-214, Activity	23.5	RPD	0.4	0.1	Soil		12/11/98 12:04	12/11/98 12:04
123194	MD	986113	EPA 901.1	Lead-211, Activity	0	RPD		2	Soil		12/11/98 12:04	12/11/98 12:04
123194	MD	986113	EPA 901.1	Lead-210, Activity	38.9	RPD	2.3	1.3	Soil		12/11/98 12:04	12/11/98 12:04
123194	MD	986113	EPA 901.1	Cesium-137, Activity	0.1	RPD	0.1	0.1	Soil		12/11/98 12:04	12/11/98 12:04
123194	MD	986113	EPA 901.1	Cobalt-60, Activity	0	RPD	0.1	0.1	Soil		12/11/98 12:04	12/11/98 12:04
123220	MD	986137	SM 2540G	Moisture (@ 104 deg. C)	4.6	RPD			Soil		11/17/98 0:00	11/17/98 0:00
123453	MS	986245	mod. HASL 300	Promethium 147	109.5	% REC			Soil		12/17/98 14:43	12/17/98 14:43
123453	MSD	986245	mod. HASL 300	Promethium 147	99.4	% REC			Soil		12/17/98 14:43	12/17/98 14:43
D1120998CC	LCS	986113	EPA 901.1	Cesium-137, Activity	104.4	% REC			Water		12/9/98 7:11	12/9/98 7:11
D1120998CC	LCS	986113	EPA 901.1	Cobalt-60, Activity	99.4	% REC			Water		12/9/98 7:11	12/9/98 7:11
D1121098CC	LCS	986113	EPA 901.1	Cesium-137, Activity	99.5	% REC			Water		12/10/98 7:13	12/10/98 7:13
D1121098CC	LCS	986113	EPA 901.1	Cobalt-60, Activity	99.4	% REC			Water		12/10/98 7:13	12/10/98 7:13
D1121198CC	LCS	986113	EPA 901.1	Cobalt-60, Activity	99.1	% REC			Water		12/11/98 7:37	12/11/98 7:37
D1121198CC	LCS	986113	EPA 901.1	Cesium-137, Activity	100	% REC			Water		12/11/98 7:37	12/11/98 7:37
LC1PM1214	LCS	986113	mod. HASL 300	Promethium 147	78.7	% REC			Water		12/17/98 14:43	12/17/98 14:43
LC2H31228	LCS	986113	CA-GLR-17.0	Tritium, Activity	95.9	% REC			Water		12/28/98 22:34	12/28/98 22:34
LCAT122298	LCS	986113	mod. HASL 300	Thorium-230, Activity	123.1	% REC			Water		12/30/98 18:25	12/30/98 18:25
LCSAPU1211	LCS	986113	mod. HASL 300	Plutonium-239/240	100	% REC			Water		12/21/98 16:20	12/21/98 16:20
LCSAU1211	LCS	986113	mod. HASL 300	Uranium-238, Activity	100	% REC			Water		12/23/98 9:46	12/23/98 9:46
LCSAU1211	LCS	986113	mod. HASL 300	Uranium-233/234, Activity	97.2	% REC			Water		12/23/98 9:46	12/23/98 9:46
MB2H31228	MB	986113	CA-GLR-17.0	Tritium, Activity	1.7	pCi/L			Water		12/28/98 22:34	12/28/98 22:34
MB2PM1214	MB	986113	mod. HASL 300	Promethium 147	ND	pCi/L			Water		12/17/98 14:43	12/17/98 14:43
MBAPU1211	MB	986113	mod. HASL 300	Plutonium-239/240	0.1	pCi/L			Water		12/21/98 16:20	12/21/98 16:20
MBAT1222	MB	986113	mod. HASL 300	Thorium-232, Activity	ND	pCi/L			Water		12/30/98 18:25	12/30/98 18:25
MBAT1222	MB	986113	mod. HASL 300	Thorium-230, Activity	ND	pCi/L			Water		12/30/98 18:25	12/30/98 18:25
MBAU1211	MB	986113	mod. HASL 300	Uranium-233/234, Activity	ND	pCi/L			Water		12/23/98 9:46	12/23/98 9:46
MBAU1211	MB	986113	mod. HASL 300	Uranium-238, Activity	ND	pCi/L			Water		12/23/98 9:46	12/23/98 9:46
MBAU1211	MB	986113	mod. HASL 300	Uranium-235, Activity	ND	pCi/L			Water		12/23/98 9:46	12/23/98 9:46

EXAMPLE

RADIOCHEMISTRY
DATA COMPLETENESS CHECKLIST

Core Laboratories

Job/Case No. ______________________ Parameters ______________________

	Alpha Spectrometry	Gamma Spectrometry	Gas Proportional	Liquid Scintillation	Laser Phosphorimetry
1. Formulas used in Calculations					
2. Standards Certifications					
3. Instrument Performance Data					
a. Initial Calibration					
b. Continuing Calibration					
c. Instrument Background					
d. Resolution Checks		——	——	——	——
e. Plateau Information	——	——		——	——
f. Weight Curve	——	——		——	——
g. Quench Curve	——	——	——		——
4. Logs					
a. Standards Preparation Logs		——			
b. Precipitation Logs		——			——
c. Planchet Logs	——	——		——	——
d. Run Logs					
5. Instrument Printouts					
a. Analysis Information					
b. Sample Measurement Activity					
c. Results Spreadsheets					
6. QC					
a. QC Data and Calculations					
b. Control Charts					
7. Other					

EXAMPLE

ANALYSIS REQUIREMENTS SUMMARY

Core Laboratories

Analysis Type ____Alpha Spectroscopy____ Method ______________________

Parameters __Isotopic U, Th, Pu, Po, Am, and Np__________

	Description	Frequency	QC Limits - Level 4
INSTRUMENT CALIBRATION			
• Initial Calibration	Efficiency Calibration	Annually	Instrument specific
• Continuing Calibration	Energy Calibration Energy Check Resolution Check	Quarterly Weekly Weekly	Instrument specific
• Instrument Background	Background Check	Weekly	Instrument specific
BATCH QUALITY CONTROL			
• Laboratory Blank	Method blank	5% or 1 per batch	<DL
• Laboratory Control Sample	Blank spike	5% or 1 per batch	80-120% recovery
• Spike Sample	Matrix spike	5% or 1 per batch	75-125% recovery
• Duplicate Sample	Sample duplicate	5% or 1 per batch	RER ≤ 2 or RPD <30% for values ≥5X DL and ±2 X DL for values <5X DL
SAMPLE ANALYSIS			
• Preservative	HNO_3	All samples	——
• Holding time	Collection to analysis	All samples	6 months
• Tracer/carrier	Radionuclide tracer	All samples	50-100% recovery
• Detection limit			Variable

EXAMPLE

ANALYSIS REQUIREMENTS SUMMARY

Core Laboratories

Analysis Type Gamma Spectroscopy Method

Parameters Cs-134, Cs-137, Co-57, Co-60, Ba-133, Ru-106, and Zn-65

	Description	Frequency	QC Limits - Level 4
INSTRUMENT CALIBRATION			
• Initial Calibration	Efficiency Calibration	Annually	Instrument specific
• Continuing Calibration	Energy Calibration Energy Check Resolution Check	Monthly Daily Daily	Instrument specific
• Instrument Background	Background Check	Weekly	Instrument specific
BATCH QUALITY CONTROL			
• Laboratory Blank	Method blank	5% or 1 per batch	<DL
• Laboratory Control Sample	Blank spike	5% or 1 per batch	80-120% recovery
• Spike Sample	Not applicable	—	—
• Duplicate Sample	Duplicate sample	5% or 1 per batch	RER ≤ 2 or RPD <30% for values ≥5X DL and ± 2 X DL for values <5X DL
SAMPLE ANALYSIS			
• Preservative	HNO_3	All samples	—
• Holding time	Collection to analysis	All samples	6 months (16 days for I-131)
• Tracer/carrier	Not applicable	—	—
• Detection limit			Variable

EXAMPLE

ANALYSIS REQUIREMENTS SUMMARY

Core Laboratories

Analysis Type Gas Proportional Counters Method ____________

Parameters Gross Alpha, Gross Beta, Ra-226, Ra-228, Sr-90, and Cs-137

	Description	Frequency	QC Limits - Level 4
Instrument Calibration			
• Initial Calibration	Efficiency for Specific Radionuclides Self-Absorption Curve Plateau	Annually Annually Annually	Instrument specific
• Continuing Calibration	Efficiency Check	Daily	Instrument specific
• Instrument Background	Background Check	Weekly & Daily	Instrument specific
Batch Quality Control			
• Laboratory Blank	Method blank	5% or 1 per batch	<DL
• Laboratory Control Sample	Blank spike	5% or 1 per batch	80-120% recovery
• Spike Sample	Matrix spike	5% or 1 per batch	75-125% recovery
• Duplicate Sample	Sample duplicate	5% or 1 per batch	RER ≤ 2 or RPD <30% for values ≥5X DL and ± 2X MDA for values <5X DL
Sample Analysis			
• Preservative	HNO_3	All samples	—
• Holding time	Collection to analysis	All samples	6 months
• Tracer/carrier	Carrier (certain analytes)	All samples	50-100% recovery
• Detection limit			Variable

EXAMPLE

ANALYSIS REQUIREMENTS SUMMARY

Core Laboratories

Analysis Type Liquid Scintillation Method

Parameters Tritium, Radon, Tc-99, and Pb-210

	Description	Frequency	QC Limits - Level 4
INSTRUMENT CALIBRATION			
• Initial Calibration	Efficiency for Specific Radionuclides Quench Curve Interference Corrections	Annually Annually Annually	Instrument specific
• Continuing Calibration	Efficiency Check	Daily	Instrument specific
• Instrument Background	Background Check	Daily	Instrument specific
BATCH QUALITY CONTROL			
• Laboratory Blank	Method blank	5% or 1 per batch	<DL
• Laboratory Control Sample	Blank spike	5% or 1 per batch	80-120% recovery
• Spike Sample	Matrix spike	5% or 1 per batch	75-125% recovery
• Duplicate Sample	Sample duplicate	5% or 1 per batch	RER ≤ 2 or RPD <30% for values ≥5X DL and ±2 X DL for values <5X DL
SAMPLE ANALYSIS			
• Preservative	HNO_3	All samples (except for tritium analysis)	----
• Holding time	6 months	All samples	6 months (8 days for radon, 5 days tritium)
• Tracer/carrier	Carrier	All samples	50-100% recovery
• Detection limit			Variable

EXAMPLE

ANALYSIS REQUIREMENTS SUMMARY

Core Laboratories

Analysis Type Laser Phosphorimetry Method

Parameter Total Uranium

	Description	Frequency	QC Limits - Level 4
INSTRUMENT CALIBRATION			
• Initial Calibration	Calibration curve	Semi-annually & as needed	Instrument specific
• Continuing Calibration	Calibration verification	Weekly & Daily	Instrument specific
• Instrument Background	Background measurement	Semi-annually & as needed	Instrument specific
BATCH QUALITY CONTROL			
• Laboratory Blank	Method blank	5% or 1 per batch	<DL
• Laboratory Control Sample	Blank spike	5% or 1 per batch	80-120% recovery
• Spike Sample	Matrix spike	All samples	50-100% recovery
• Duplicate Sample	Sample duplicate	5% or 1 per batch	RER ≤ 2 or RPD <30% for values ≥5X DL and ± 2 X DL for values <5X DL
SAMPLE ANALYSIS			
• Preservative	HNO_3	All samples	—
• Holding time	6 months	All samples	6 months
• Tracer/carrier	Not applicable	—	—
• Detection limit			Variable

CORE LAB

RADIOCHEMISTRY DATA REVIEW CHECKLIST

Project/Job No.(s) ____________________ Parameter/Method ____________________

Reviewed By ____________________ Date Received ____________________

REVIEW ITEM	YES	NO	NA	COMMENTS
A *CALIBRATION VERIFICATION*				
1 Standard: Correct source?				
2 Frequency: Daily ____ , weekly____ , or monthly ____				
3 Acceptance criteria: Met?				
B *LABORATORY CONTROL STANDARD*				
1 Standard: Independent, certified reference material?				
2 Frequency: Each batch?				
3 % Recovery 80-120% or _______ ?				
C *METHOD BLANK*				
1 Frequency: Each batch?				
2 Matrix: Matrix specific?				
3 Preparation: Entire procedure?				
4 Analytes concentration: <DL or <5x DL?				
D *SPIKE*				
1 Frequency: Each batch?				
2 Matrix: Matrix specific?				
3 Preparation: Entire procedure?				
4 % Recovery: 75-125% or ______ ?				
E *DUPLICATE*				
1 Type: Field sample?				
2 Frequency: Each batch?				
3 Matrix: Matrix specific?				
4 Preparation: Entire procedure?				
5 % RPD: <25% for values 5.x DL or ______ ?				

CORE LAB

RADIOCHEMISTRY DATA REVIEW CHECKLIST

Project/Job No. (s) ______________________ Parameter/Method ______________________

Reviewed By ______________________ Date Received ______________________

REVIEW ITEM	YES	NO	NA	COMMENTS
F SAMPLE ANALYSIS				
1 Holding times: Met?				
2 Results: a Calculated correctly? b Within calibration curve? c Dilution factors (included)? d Rounding/significant figures acceptable? e Detection limit sample specific?				
3 Report: a Agrees with raw data? b Complete? c Correct?				

ADDITIONAL COMMENTS: *CASE NARRATIVE REQUIRED?* ☐ Yes ☐ No

REVIEWED BY ______________________ DATE ______________________

CORE LAB

RADIOCHEMICAL DATA COMPLETENESS CHECKLIST
RADIOMETRIC AND GROSS α & β ANALYSES

Analytes ________________ **Method** ________________ **Job No.** ________________

I. Case Narrative

____ Abnormalities explained
____ Matrix problems explained
____ Instrument problems explained
____ Improper collection, storage, preservation, containers explained
____ Holding time exceedances explained

II. Initial Calibration Data Package

____ Detector ID
____ Analyst initials
____ Date and time calibrated
____ Current batch date
____ Name, activities, dates of certifications of all NIST standards
____ Voltage settings, gain settings, or plot of voltage versus standard CPMs
____ Plots of net standard CPMs versus gain settings at voltage giving highest net CPM to gain ration (crosstalk plot)
____ Last service or repair date for detector

III. Continuing Calibration Data Package

____ Detector ID
____ Analyst initials
____ Date and time of calibration check
____ Name, activities, dates of certifications of all NIST standards
____ CPMs observed, count duration, mean counts
____ Control chart means
____ Background CPMs observed, results of chi square test
____ Mean of last 10 background checks and allowable limits
____ Raw data from counter to verify crosstalk values

IV. Blanks Data Package

____ ID number of each detector the blank is counted in
____ Date and time of counts
____ Samples and IDs used in set with the blank
____ Type of blank used
____ Detection limit reported

V. Lab QC Sample Data Package

_____ Sample ID, Detector ID
_____ Analyst initials
_____ Values obtained, true value of sample
_____ Statistical analysis of results
_____ Name, activities, certification date of QC samples

CORE LAB

Analytes ______________ **Method** ______________ **Job No.** ______________

VI. Lab Replicates Data Package

____ Detector ID
____ Analyst initials
____ Date and time analyzed
____ Value obtained for sample, replicates, mean values
____ Count durations of sample and background
____ Statistical analysis of range and control limits

VII. Self-Absorption, Recovery Factors Data Package

_____ Linear equation for calibration curve, coefficients
_____ Copy of self-absorption curve
_____ Raw data from counter to determine coefficients

VIII. Lower Limit of Detection

_____ Background measurements
_____ Detector ID
_____ Date and time of count, count duration
_____ Mean background CPM over long period
_____ Calculated LLD for isotope of interest

IX. Size of Aliquot in Gross α & β Determination Data Package

_____ Sample ID
_____ Data and time analyzed
_____ Measured specific conductance
_____ Calculated volume of sample to deliver 100 mg solids
_____ Efficiency factor used

X. Sample Data Package

_____ Printed report of results for sample, reruns
_____ Computer calculations
_____ Raw data from counter, copies of logbook pages

Comments:

Reviewed by: ______________________________ **Date:** ______________

CORE LAB

RADIOCHEMICAL DATA COMPLETENESS CHECKLIST
ALPHA SPECTROMETRIC ANALYSES

Analytes ________________ Method ________________ Job No. ________________

I. Case Narrative

_____ Abnormalities explained
_____ Matrix problems explained
_____ Instrument problems explained
_____ Improper collection, storage, preservation, containers explained
_____ Holding time exceedances explained

II. Initial Calibration Data Package

_____ Detector ID
_____ Analyst initials
_____ Date and time calibrated
_____ NIST traceable standards with certification dates and DPM's
_____ Observed channel numbers of isotopes of interest
_____ Book values for proper channel numbers of isotopes of interest
_____ Voltage settings, gain settings
FWHMs in spectra, peak heights
Results of chi square test for background
_____ Background data on regions of interest (ROI) for each detector

III. Blanks Data Package

_____ ID number of each detector the blank is counted in
_____ Analyst initials
_____ Date and times of counts
_____ Number and ID of samples included with the blank
_____ Type of method blank used, LLD of method

IV. Replicate Sample Data Package

_____ Detector ID
_____ Analyst Initials
_____ Date and time Analyzed
_____ Value obtained for sample, replicates, mean values
_____ Count Durations of samples and backgrounds
_____ Statistical Analysis of Range, Control Limits

V. Lab QC Sample Data Package

_____ Sample ID, Detector ID
_____ Analyst initials
_____ Values obtained, true value of sample
_____ Statistical analysis of results

CORE LAB

Analytes ________________ Method ________________ Job No. ________________

VI. Lower Limits of Detection

_____ Background Measurements
_____ Detector ID
_____ Date and time of count, counting duration
_____ Mean background CPM over long period
_____ Calculated LLD for isotope of interest

VII. Internal Recovery Factors

_____ Efficiency determined experimentally, copy of raw data, DPM values of check standards
_____ Detector ID
_____ Analyst initials
_____ Date and time of count
_____ Isotopic Tracer used and DPM value
_____ Certification Data of Tracer
_____ Net CPM obtained
_____ Count duration
_____ Overall Efficiency Factor
_____ Instrument Efficiency
_____ Calculated Chemical Recovery

VIII. Sample Data Package

_____ Printed report on results for sample, reruns
_____ Computer calculations

Comments:

Reviewed by:________________________________ **Date:**________________

CORE LAB

RADIOCHEMICAL DATA COMPLETENESS CHECKLIST
TRITIUM ANALYSES

Analytes _______________ Method _______________ Job No. _______________

I. Case Narrative

_____ Abnormalities explained
_____ Matrix problems explained
_____ Instrument problems explained
_____ Improper collection, storage, preservation, containers explained
_____ Holding time exceedances explained

II. Initial Calibration Data Package

_____ Detector ID with Program Settings
_____ Date of Performance Check
_____ Batch Number
_____ NBS Traceable Standards with Certification Date and DPMs
_____ Quench Monitor Values and CPM for Standard used to check long term performance of cocktail and instrument
_____ Background-Blank vials CPM Results

III. Blanks Data Package

_____ Detector ID
_____ Date Analyzed
_____ Collection Date
_____ Sample ID counted with blank
_____ Detection level reported

IV. Lab Replicate Data Package

_____ Detector ID
_____ Data Analyzed
_____ Collection Date
_____ Value obtained for sample, replicates, mean values
_____ Count durations of samples and backgrounds
_____ Statistical analysis of Range, Control Limits

V. Lab Control Samples Data Package

_____ Sample ID, Detector ID
_____ Values obtained, true value of sample
_____ Statistical Analysis of Results

VI. Lower Limits of Detection

_____ Background measurements
_____ Detector ID
_____ Date of count
_____ Calculated LLD comparison with Required Detection Level

CORE LAB

Analytes ________________ **Method** ________________ **Job No.** ________________

VII. Quench and Efficiency

_____ Quench Monitor used
_____ Quench Monitor Values and Efficiency Values
_____ Detector ID
_____ NBS traceable standards with certification date and DPM
_____ Batch number and sample IDs; Efficiency standard and background used
_____ Volume added to cocktail
_____ Cocktail used
_____ Vials used

VIII. Sample Data Package

_____ Printed Report of results for sample, reruns
_____ Computer calculations
_____ Analyst Initials
_____ Raw data from counter, copies of notebook pages

Comments:

Reviewed by:________________________________ **Date:**________________

CORE LAB

TITLE			
Standard Operating Procedure for Mounting of Alpha Spectroscopy Samples			
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R470	0	6/16/98	1 of 11

DOCUMENT CONTROL PAGE

Prepared By: [signature] Date 6-16-98

Reviewed By: [signature] Date 6-16-98
Technical Specialist

[signature] Date 6/16/98
QA/QC Coordinator

Approved By: [signature] Date 6/16/98
Laboratory Manager

Controlled Copy Number: UNCONTROLLED DOCUMENT

Revision No.	0					
Date	6/16/98					

1. Scope and Application

This standard operating procedure (SOP) provides guidance for the mounting of alpha spectroscopy samples by CA-GLR-R470.

This SOP applies to the environmental testing laboratories in the Environmental Services Division of Core Laboratories, Inc.

2. Summary

2.1 This procedure provides guidance for the mounting of alpha spectroscopy samples generated from any applicable alpha-emitting isotope procedure.

3. Definitions

3.1 Alpha-Spectroscopy: A measurement technique that is able to identify differences in energy levels from absorption of alpha particles on a charged silica diode. The pulses produced from the interaction between the alpha and the diode are amplified and the signals are collected on a multi-channel analyzer. By counting for a period of time, peaks are accumulated that represent specific alpha energies indicating the presence of specific alpha emitting radionuclides.

4. Responsibilities

4.1 The laboratory technician or analyst shall:

- o Perform the method in accordance with this SOP No. CA-GLR-R470 or as directed by the laboratory section supervisor,
- o Resolve nonconformances in methods and data, first individually, then, if necessary, with the help of the laboratory section supervisor or other technical resource, and
- o Report unresolved nonconformances with a Nonconformance and Corrective Action Report form in accordance with SOP No. HC-RDC-G002.

4.2 The laboratory section supervisor shall:

- o Assist the laboratory technician or analyst in resolving nonconformances, and

- o Review and approve the data, methodology, and final reports for all analyses, tests, and procedures which are performed in his or her laboratory section.

4.3 The QA/QC coordinator shall monitor adherence to this SOP and conformance to the QC criteria of the cited method.

4.4 The laboratory manager shall ensure that the necessary resources are available to accurately and successfully adhere to SOP No. CA-GLR-R470.

5. Interferences, Comments, and Helpful Hints

5.1 Interferences

5.1.1 None known

5.2 Comments

5.3 Helpful Hints

6. Sampling, Sample Preservation, and Holding Times

6.1 Sampling Procedure

The sampling procedure should conform to Chapter Three of EPA SW-846. All samples should be collected according to these guidelines. The samples are to be collected in plastic containers which have been cleaned according to EPA specifications. All sampling information should be included on a chain-of-custody (COC) record which should include all sampling dates and times, sampling requirements, temperature and atmospheric conditions, location, and the initials of individuals involved in the sampling and/or handling of the samples.

The samples should be collected in a manner which will provide the most representative sample. Drinking water samples should be collected from the free flowing source and should be large enough to provide adequate sample to achieve the detection limits required under the safe drinking water regulations. Note: 500 mL is required.

If the material, such as NORM scale, contains significant radioactivity (level 3 or higher, see CA-HPM-001,"Standard Operating

Procedure for Radioactive Sample Control and Screening"), the sample size should not exceed 40 g in order to reduce exposure to personnel who handle the materials and to comply with DOT regulations.

6.2 Sample Preservation

Aqueous samples should be preserved at the time of sampling by acidification with dilute nitric acid to a pH of <2. If it is not possible to preserve samples in the field, the samples should be preserved at the laboratory within 5 days of sampling. The samples should then be allowed to set for 16 hours prior to analysis in order to dissolve any precipitate. Solid and soil samples are not preserved in the field or laboratory.

6.3 Holding Times

Samples, if properly preserved, can be stored for up to five half-lives or six months, whichever occurs first.

7. Safety

7.1 General Safety Procedures

o Be knowledgeable of the MSDS information for each chemical which is used in the procedure.

o Comply with the instrument manufacturer's and chemical supplier's safety precautions.

o Comply with all applicable safety regulations and safety SOPs.

o Sample analysis functions shall be performed in the appropriate environment, such as canopies or fume hoods.

o Gloves, protective clothing, face shields, and protective eyewear should be worn by all analysts and technicians while they are in the laboratory. The staff shall always remove gloves and other protective clothing prior to leaving the laboratory and dispose or store them properly.

o All analysts and technicians shall wash all areas of their hands and arms which may have been exposed to contaminated materials prior to leaving the lab.

7.2 Sample Screening Procedure

Refer to SOP No. CA-HPM-001, "Standard Operating Procedure for Radioactive Sample Control and Screening."

8. Quality Control

See the quality control section for the specific isotope of interest.

9. Apparatus and Materials

9.1 Instrument type

9.1.1 N/A

9.2 Laboratory Materials

9.2.1 Filtering Apparatus

9.2.2 Vacuum Pump

9.2.3 Filters, 0.1 μm and 0.2μm

9.2.4 Plastic centrifuge tubes (C-tubes)

9.2.5 General laboratory equipment

10. Reagents and Standards

10.1 Reagents

10.1.1 Reagent Water: Refer to SOP No. CA-GLR-R120, "Standard Operating Procedure for Reagent Water Examination for Analysis of Environmental Samples."

10.1.2 3<u>N</u> HCl: 500 mL concentrated HCl to 1500 mL DI water

10.1.3 3<u>N</u> H_2So_4: 20 mL concentrated H_2So_4 to 240 mL DI water

10.1.4 Substrate Soln: To 500 mL DI water add 2 mL Nd, 40 mL concentrated HCl and 16 mL concentrated hydrofluoric acid (HF). Dilute to 1 liter with DI water.

10.1.5 10% Ascorbic Acid 10 g ascorbic acid to 100 mL DI water

10.1.6 Neodymium Carrier Metals grade neodymium standard or equivalent.

10.1.7 Titanous Chloride Reagent grade titanous chloride solution, 20%.

10.1.8 Hydrofluoric Acid Concentrated reagent grade HF

10.2 Standards

Refer to SOP No. CA-GLR-R110, "Standard Operating Procedure Radioactive Standards and Preparation."

11. Analytical Procedure

11.1 Instrument Calibration and Operation

N/A

11.2 Sample Preparation

Refer to SOP No. CA-GLR-R160, "Standard Operating Procedure for Preparation of Environmental Samples for Radiochemical Determinations."

11.3 Sample Analysis

11.3.1 Utilizing the final elution from procedure CA-GLR-R405 or any other applicable separation:

11.3.1.1 Add 1 mL 3N H_2So_4 and 3-4 mL concentrated HCl and take to fumes on medium hotplate.

11.3.1.2 Add 7-10 mL of 3N HCl to each beaker. Place on hot plate for a few seconds to dissolve sample.

11.3.1.3 Label clean C-tube with sample lab ID.

11.3.1.4 Rinse beaker solution into respective C-tube with 3N HCl. Final volume should be less than 15 mL.

11.3.1.5 Add 5 drops of 10% ascorbic acid to each C-tube.

11.3.1.6 Add 1-5 mL of neodymium solution to each C-tube.

11.3.1.7 For isotopic uranium analysis only, add 3 drops of titanous chloride to each C-tube.

11.3.1.8 Add 2 mL concentrated hydrofluoric acid (HF) to each C-tube.

11.3.1.9 Swirl and let stand for 30 minutes.

11.3.1.10 Label a petri dish and metal disk with lab sample ID.

11.3.1.11 Rinse filter area with DI water.

11.3.1.12 Place clean filter on stem of filtering apparatus and place funnel on top. (For americium use 0.1 μm filter, for all other alpha analyses use 0.2 μm filter.)

11.3.1.13 Wash each funnel/filter with DI water and check for leaks (for americium analysis only, wash funnel/filter with alcohol and check for leaks).

11.3.1.14 Add approximately 20 mL substrate solution to each funnel/filter.

11.3.1.15 Load sample onto respective funnel/filter and rinse C-tube with DI and add to funnel/filter.

11.3.1.16 Rinse each funnel with DI after sample has gone through.

11.3.1.17 Remove funnel. Remove filter and place on respective disk and then into petri dish. Set under a heat lamp for 5-10 minutes.

11.3.1.18 Desiccate for 10 minutes.

11.3.1.19 Place in counting room to be counted.

12. Data Generation and Calculations

12.1 See data generation and calculation section for analyte of interest.

13. Data Reporting

13.1 Raw Data Reporting

13.1.1 All raw data must be entered as it is acquired in the designated bound logbook. This includes test method, analyte being determined, measurement parameters, dilution factors, analyst's initials, and date of test. All information and data which is pertinent to the test should be recorded to facilitate data validation. Any unusual conditions or information on the appearance of the samples, or any other factors which may influence the results should also be noted.

13.1.2 Instrument printouts and copies of spreadsheets or graphs should be dated, initialed by the analyst, and filed chronologically in a designated area.

13.2 LABNET Data Entry Methodology

For questions concerning LABNET data entry requirements, refer to the LABNET User Manual or contact the laboratory section supervisor or QA/QC coordinator.

13.2.1 Method Reference

The analyst must verify that the proper method reference is entered for each sample analyzed. If the method which was utilized varies from the assigned LABNET default method, delete the incorrect test code for that sample and then enter the correct test code or change the designated method in the existing test code. A corrected log-in sheet will be generated and placed in the master (job) folder.

13.2.2 Method Detection Limits

Report the detection limit for the sample based on the matrix. Client specific detection limits should be reported when requested by the client.

13.2.3 Units

Report the data using the appropriate units based on the sample matrix. Use pCi/l, µg/l, or mg/l for aqueous samples and pCi/g, µg/g, or mg/g for soil and solid samples.

13.2.4 Date Analyzed

The analyst must enter the date of analysis for each batch of samples processed. Enter the date that the procedure was initiated.

13.2.5 Significant Figures

Record LABNET data to the proper number of significant figures. The number of significant figures reported must correlate with the method detection limit. Generally, no more than 3 significant figures should be used for results greater than 10, and no more than 2 significant figures for results less than 10.

Statistical rounding must be employed in determining the final reported concentration. Refer to Standard Methods, 18th Edition, for further information on statistical rounding.

13.2.6 Quality Control Data

Enter quality control data for all method blanks, sample duplicates, matrix spikes, and LCSs which were analyzed with the sample batch.

13.3 Case Narrative

When required, a case narrative will be prepared and included with the report. Each report requiring a case narrative should include the data, validation information, copies of relevant fax or phone logs, and any documentation on corrective action that was taken.

13.4 Job Files

Collect all data sheets and printouts; place copies in the job file. The job file should then be transferred to the QA/QC coordinator, or designee, for validation and report generation. All COC information, log-in information, log sheets, spectral print outs if applicable, and report sheets should be placed in the client file. For jobs requiring level 4 data validation packages, include all standard information, calibration information, and a case narrative.

14. References

15. Method Performance

16. Associated Documents and Forms

16.1 Check Off List for Alpha Mounting Procedure

___1. ADD 1 ML 3N H_2SO_4 AND 3-4 ML CONC. HCL AND TAKE TO FUMES ON MED. HOT PLATE

___2. ADD 7-10 ML OF 3N HCL TO EACH BEAKER. PLACE ON HOT PLATE FOR A FEW SECONDS JUST TO DISSOLVE SAMPLE.

___3. LABEL CLEAN C-TUBES WITH SAMPLE LAB ID.

___4. RINSE BEAKER SOLUTION INTO RESPECTIVE C-TUBES WITH 3N HCL. FINAL VOLUME SHOULD BE LESS THAN 15 ML.

___5. ADD 5 DROPS OF 10% ASCORBIC ACID TO EACH C-TUBE.

___6. ADD 1-5 ML OF NEODYMIUM SOLUTION TO EACH C-TUBE.

___7. FOR ISOTOPIC URANIUM ANALYSIS ONLY, ADD 3 DROPS OF TITANOUS CHLORIDE TO EACH C-TUBE.

___8. ADD 2 ML OF CONC. HYDROFLUORIC ACID (HF) TO EACH C-TUBE.

___9. SWIRL AND LET STAND FOR 30 MINUTES.

___10. LABEL PETRI DISH AND DISK WITH LAB SAMPLE ID.

___11. RINSE FILTER AREA WITH DI H_2O.

___12. PLACE CLEAN FILTER ON STEM AND PLACE FUNNEL ON TOP. (FOR AMERICIUM ANALYSIS USE 0.1 μm FILTER, FOR ALL OTHER ALPHA ANALYSES, USE 0.2 μm FILTER.)

CORELAB

TITLE Standard Operating Procedure for Mounting of Alpha Spectroscopy Samples			
SOP NO. CA-GLR-R470	REVISION NO. 0	EFFECTIVE DATE 6/16/98	PAGE 11 of 11

___13. WASH EACH FUNNEL/FILTER WITH DI AND CHECK FOR LEAKS (FOR AMERICIUM ANALYSIS ONLY, WASH FUNNEL/FILTER WITH ALCOHOL AND CHECK FOR LEAK).

___14. ADD ≈20 ML SUBSTRATE SOLUTION TO EACH FUNNEL/FILTER.

___16. LOAD SAMPLE ONTO RESPECTIVE FUNNEL/FILTER AND RINSE C-TUBE WITH DI AND ADD TO RESPECTIVE FUNNEL/FILTER.

___16. RINSE EACH FUNNEL WITH DI AFTER SAMPLE HAS GONE THROUGH.

___17. REMOVE FUNNEL. PLACE EACH FILTER ON RESPECTIVE DISK AND THEN INTO PETRI DISH. SET UNDER HEAT LAMP FOR 5-10 MINUTES.

___18. DESICCATE FOR 10 MINUTES.

___19. PLACE IN COUNTING ROOM TO COUNT.

CORE LAB

TITLE			
Standard Operating Procedure for Cleaning and Storing Radiochemistry Glassware			
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R105	0	7/21/95	1 of 5

DOCUMENT CONTROL PAGE

Prepared By: [signature] Date 7-21-95

Reviewed By: [signature] Date 7-21-95
Technical Specialist

Don Uhele Date 7/21/95
QA/QC Coordinator

Approved By: [signature] Date 7/21/95
Laboratory Manager

Ann Rosecrance Date 7/25/95
Corporate Quality Assurance Director

Controlled Copy Number: 01

Revision No.	0					
Date	7/21/95					

CORE LAB

TITLE			
Standard Operating Procedure for Cleaning and Storing Radiochemistry Glassware			
SOP NO. CA-GLR-R105	REVISION NO. 0	EFFECTIVE DATE 7/21/95	PAGE 2 of 5

1. Scope and Application

This standard operating procedure (SOP) provides guidance for the cleaning and storage of radiochemistry laboratory glassware.

This SOP applies to the environmental testing laboratories in the Environmental Services Division of Core Laboratories, Inc.

2. Summary

This SOP provides guidance on the cleaning and storage of radiochemistry laboratory glassware.

3. Definitions

N/A

4. Responsibilities

4.1 The laboratory technician or analyst shall:

- o Perform the method in accordance with this SOP No. CA-GLR-R105, or as directed by the laboratory section supervisor,
- o Resolve nonconformances in methods and data, first individually, then, if necessary, with the help of the laboratory section supervisor or other technical resource, and
- o Report unresolved nonconformances with a Nonconformance and Corrective Action Report form in accordance with SOP No. HC-RDC-G002.

4.2 The laboratory section supervisor shall:

- o Assist the laboratory technician or analyst in resolving nonconformances, and
- o Review and approve the data, methodology, and final reports for all analyses, tests, and procedures which are performed in his or her laboratory section.

4.3 The QA/QC coordinator shall monitor adherence to this SOP and conformance to the QC criteria of the cited method.

9. Glassware Cleaning Equipment

9.1 Wash basins with hot and cold running tap water.

9.2 Drying racks.

9.3 Scrub brushes.

10. Reagents

10.1 Reagent Water (ASTM Type II).

10.2 10% Nitric Acid - Dilute 100 ml of concentrated nitric acid to 1 liter with reagent water.

10.3 Radiacwash (a commercially available product for cleaning radiochemistry glassware) or equivalent.

11. Radiochemistry Glassware Cleaning Procedure

11.1 Rinse glassware thoroughly with tap water immediately after use. Remove all markings and any heavy organic residues.

11.2 Soak glassware in a solution of 10% Radiacwash (or equivalent) for a minimum of 2 hours. Rinse with reagent water.

11.3 Soak in a 10% nitric acid bath for approximately 5 minutes.

11.4 Rinse glassware thoroughly with reagent water.

11.5 Allow glassware to air dry on drying racks.

11.6 Segregate radiochemistry glassware from all other laboratory glassware.

11.7 Segregate Bioassay, environmental, and level 3 glassware and soaktubs.

NOTE: Follow all radiochemistry safety procedures as specified by the laboratory manager and supervisor.

12. Data Generation and Calculations

    N/A

13. Data Reporting

    N/A

14. References

    Core Laboratories' Radiochemistry Quality Assurance Manual

15. Method Performance

    N/A

16. Associated Documents and Forms

    N/A

4.4 The laboratory manager shall ensure that the necessary resources are available to accurately and successfully adhere to SOP No. CA-GLR-R105.

5. Interferences, Comments, and Helpful Hints

N/A

6. Sampling, Sample Preservation, and Holding Times

N/A

7. Safety

7.1 General Safety Procedures

- o Be knowledgeable of the MSDS information for each chemical which is used in the procedure.
- o Comply with the instrument manufacturer's and chemical supplier's safety precautions.
- o Comply with all applicable safety regulations and safety SOPs.
- o Sample analysis functions shall be performed in the appropriate environment, such as canopies or fume hoods.
- o Gloves, protective clothing, face shields, and protective eyewear should be worn by all analysts and technicians while they are in the laboratory. The staff shall always remove gloves and other protective clothing prior to leaving the laboratory and dispose or store them properly.
- o All analysts and technicians shall wash all areas of their hands and arms which may have been exposed to contaminated materials prior to leaving the lab.

8. Quality Control

The effectiveness of the glassware cleaning procedures is monitored through the analysis of blanks. Blanks must be processed with each batch of samples or at the frequency specified in the appropriate technical SOP. The blank concentration must be below the detection limit specified for the specific analyte.

CORE LAB

Reviewed by [signature]
Date 6-02-98

TITLE			
Standard Operating Procedure for Radiological Sample Preparation			
SOP NO. CA-GLR-R160	REVISION NO. 0	EFFECTIVE DATE 2/4/97	PAGE 1 of 15

DOCUMENT CONTROL PAGE

Prepared By: Peg Jacobs Date 2·4·97

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Approved By: [signature] Date 2-04-97
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Corporate Quality Assurance Director

UNCONTROLLED DOCUMENT

Controlled Copy Number: 01

Revision No.	0					
Date	2/4/97					

1. Scope and Application

In order to be confident of any results of radiochemical analyses involving wet chemistry separations, it is essential that all interferences are eliminated prior to the separation and the isotopes of interest changed to a known ionic form. The sample can then be subjected to the procedures outlined for the separation and quantification of each specific isotope. The protocols outlined here describe a variety of sample preparations that can be utilized depending on the type of material and the analytical requirements.

This SOP applies to the environmental testing laboratories in the Environmental Services Division of Core Laboratories, Inc.

2. Summary

A variety of sample preparation methods are described in this procedure. The preparation procedure used is dependent on the type of sample and the isotopes of interest. In many cases the preparations are applicable for several isotopes and a series of analyses can be performed from one sample preparation. This is very useful in consolidation of lab time and also eliminates variability due to differences generated by multiple preparations. Each sample matrix provides a different problem in preparation selection and each type is discussed here.

2.1 Liquid Samples

2.1.1 See section 6 of this procedure for proper sampling, preservation and holding time protocols.

2.1.2 If the dissolved isotope content is required, the sample should be filtered before the preservative is added. If possible, the filtration should be done at the time of collection. However, many times this is not possible in the field. In such cases, an unpreserved sample should be filtered and acidified as soon as it is received.

2.1.3 In cases where the suspended isotope content is required, the dissolved and the total isotope content should be determined. The suspended content is then reported as the difference between the total and the dissolved content. There may be instances where direct filtration and analysis of the suspended material is required. Samples of unknown origin, or samples suspected of having high activity, should be screened by running a preliminary gross alpha-beta. If the sample contains a great deal of activity, the sample aliquot taken should be reduced accordingly to minimize contamination of the glassware.

2.1.4 There are two ways to concentrate the isotopes in a water sample. The isotopes can be co-precipitated with a carrier such as lead, iron or bismuth, or the sample can be evaporated to a reduced volume and subjected to a digestion and/or a fusion to eliminate interferences. In some cases, the sample is first precipitated with a carrier and the precipitate is subjected to a fusion. The particular method utilized will depend upon the type of interference in the sample and the isotopes of interest.

2.2 Air Filters

2.2.1 Normally the air filters received for analysis are glass fiber filters. The preparation involves a HNO_3-$HClO_4$-HF digestion to solubilize the filter material and to destroy the organic material in the filter. This is followed by a HNO_3-HF digestion and KF or NaF fusion to drive off the silicate material. The residue is then subjected to a mild Na_2SO_4 fusion to destroy any residual organic material. The fusion cake is dissolved in dilute HCl or H_2SO_4 and the isotopes are re-precipitated with a carrier. An alternate method is utilized when Polonium-210 analysis is required.

2.3 Solid Samples

2.3.1 Solid samples are ashed at 500^{0}C to remove any organic material. They are then prepared in a manner similar to the air filters. Following an initial preparation (Appendix 16.1), the soil is digested with HNO_3-$HClO_4$-HF to destroy organic material.

2.3.2 The siliceous material is driven off by a HNO_3-HF digestion.

2.4 Organic Matter: Fish, Food Samples

The samples are first homogenized completely. The organic material is then solubilized and destroyed with consecutive digestions with dilute HNO_3, HNO_3-H_2O_2. Any fatty material that remains is extracted with heptane.

3. Definitions

3.1 Sample Dissolution - Destruction of sample matrix via acid digest. It is very important to reduce the sample matrix to a form free of interfering materials and to destroy any refractory components prior to separation of the isotopes via wet chemical methods. If the sample matrix is left intact, the extraction and separation techniques will not be effective, leading to poor recovery and erroneous data.

3.2 Acid Digest - The initial step for dissolution of soil and other solid matrices is to subject the materials to an acid digestion to destroy organic materials and to solubilize the silicious materials. The general digest utilized is nitric acid (HNO_3) + Hydrofluoric acid (HF) + Perchloric acid ($HClO_4$) when needed.

3.3 Fusion -On occasion, a sample will need further treatment. Once the organic materials are removed and the solid matrix is dissolved, the sample is then subjected to a high temperature fusion to remove all silicates and to destroy refractory compounds. This is done at low temperatures in glass using solid sodium sulfate (Na_2SO_4) or at high temperatures in platinum using solid sodium sulfate (Na_2SO_4) + sodium fluoride (Na_2F_4).

4. Responsibilities

4.1 The laboratory technician or analyst shall:

- o Perform the method in accordance with this SOP No. CA-GLR-R160, or as directed by the laboratory section supervisor,
- o Resolve nonconformances in methods and data, first individually, then, if necessary, with the help of the laboratory section supervisor or other technical resource, and
- o Report unresolved nonconformances with a Nonconformance and Corrective Action Report form in accordance with SOP No. HC-RDC-G002.

4.2 The laboratory section supervisor shall:

- o Assist the laboratory technician or analyst in resolving nonconformances, and
- o Review and approve the data, methodology, and final reports for all analyses, tests, and procedures which are performed in his or her laboratory section.

4.3 The QA/QC coordinator shall monitor adherence to this SOP and conformance to the QC criteria of the cited method.

4.4 The laboratory manager shall ensure that the necessary resources are available to accurately and successfully adhere to SOP No. CA-GLR-R160.

5. Interferences, Comments, and Helpful Hints

5.1 Interferences

5.1.1 In wet chemical separations, it is imperative to remove and/or destroy any matrix interference prior to performing the separations. In most instances it is necessary to treat the material in a manner that will allow complete dissolution of the material prior to proceeding to wet chemistry separations.

5.1.2 Water samples may have organic or insoluble residue that will interfere with the analysis. In such cases the water sample should be evaporated to dryness and the residue subjected to dissolution techniques to destroy the interfering matrix. Once the material has been destroyed the residue can be dissolved and the analysis complete.

5.1.3 High TDS (total dissolved solids) water samples and brines represent significant interference. The best approach to these samples is to dilute the brine and attempt to precipitate the nuclides of interest via carrier materials such as lead sulfate precipitation of radium 226-228.

5.1.4 Sample materials containing high concentrations of calcium cannot be subjected to sulfate digestion or fusions due to the formation of insoluble calcium sulfate. The best approach to these type of samples is to destroy the organic component by heat in a muffle furnace and destroy the residue with a nitric-perchloric digestion. (This cannot be done if lead 210- and polonium-210 are required).

5.1.5 The formations of perchlorates are a very significant problem - VERY EXPLOSIVE IF ALLOWED TO DRY- Samples containing high concentrations of organic materials should be handled with care. The organic material should be destroyed by heat (muffle) if possible prior to acid digestion. If there is a possibility of other hazardous components such as PCB's where the materials cannot be muffled, the amounts of material prepared should be reduced and digested with nitric and hydrogen peroxide to remove the majority of the organic prior to adding perchloric acid. IN ANY CASE WHERE PERCHLORATES COULD POSSIBLY FORM THE MATERIALS SHOULD NEVER BE ALLOWED TO DRY.

5.1.6 Solutions or materials that contain organic components but do not contain large amounts of calcium can be subjected to a nitric - perchloric digest followed by the addition of sulfuric (H_2SO_4) acid and sodium sulfate (Na_2SO_4) and heated to the point a low temperature fusion melt is formed and the sulfuric fumes are driven off. This destroys all organic components and provides a sulfate cake that is readily soluble in water. The sample can be dissolved and the analysis can precede without interfering compounds present.

5.2 Comments

5.3 Helpful Hints

6. Sampling, Sample Preservation, and Holding Times

6.1 Sampling Procedure

The sampling procedure should conform to Chapter Three of EPA SW-846. All samples should be collected according to these guidelines. The samples are to be collected in plastic containers which have been cleaned according to EPA specifications. All sampling information should be included on a chain-of-custody (COC) record which should include all sampling dates and times, sampling requirements, temperature and atmospheric conditions, location, and the initials of individuals involved in the sampling and/or handling of the samples.

The samples should be collected in a manner which will provide the most representative sample. Drinking water samples should be collected from the free flowing source and should be large enough to provide adequate sample to achieve the detection limits required under the safe drinking water regulations. Note: 500 mL is required.

If the material, such as NORM scale, contains significant radioactivity (level 3 or higher, see CA-HPM-001,"Standard Operating Procedure for Radioactive Sample Control and Screening"), the sample size should not exceed 40 g in order to reduce exposure to personnel who handle the materials and to comply with DOT regulations.

6.2 Sample Preservation

Aqueous samples should be preserved at the time of sampling by acidification with dilute nitric acid to a pH of <2. If it is not possible to preserve samples in the field, the samples should be preserved at the laboratory within 5 days of sampling. The samples should then be allowed to set for 16 hours prior to analysis in order to dissolve any precipitate. Solid and soil samples are not preserved in the field or laboratory.

6.3 Holding Times

Samples, if properly preserved, can be stored for up to five half-lives or six months, whichever occurs first.

7. Safety

7.1 General Safety Procedures

- o Be knowledgeable of the MSDS information for each chemical which is used in the procedure.
- o Comply with the instrument manufacturer's and chemical supplier's safety precautions.
- o Comply with all applicable safety regulations and safety SOPs.
- o Sample analysis functions shall be performed in the appropriate environment, such as canopies or fume hoods.
- o Gloves, protective clothing, face shields, and protective eyewear should be worn by all analysts and technicians while they are in the laboratory. The staff shall always remove gloves and other protective clothing prior to leaving the laboratory and dispose or store them properly.

- o All analysts and technicians shall wash all areas of their hands and arms which may have been exposed to contaminated materials prior to leaving the lab.

7.2 Sample Screening Procedure

Refer to SOP No. CA-HPM-001, "Standard Operating Procedure for Radioactive Sample Control and Screening."

8. Quality Control

See the quality control section for the specific isotope of interest.

9. Apparatus and Materials

9.1 Instruments

9.1.1 Fume Hoods

9.1.2 Electronic Analytical Balance

9.1.3 Top Loading Electronic Balance

9.1.4 Hot Plates

10. Reagents and Standards

10.1 Reagents

Refer to SOP No. CA-GLR-R120, "Standard Operating Procedure for Reagent Water Examination for Analysis of Environmental Samples."

10.2 Standards

Refer to SOP No. CA-GLR-R110, "Standard Operating Procedure Radioactive Standards and Preparation."

11. Analytical Procedure

11.1 Instrument Calibration and Operation

Refer to the calibration procedure for the counting instrument appropriate to the isotope of interest.

11.2 Sample Preparation Techniques

11.2.1 Separation of Nuclides in Liquid Samples by $PbSO_4$ Precipitation

This procedure can be utilized to concentrate lead-210, thorium-230, radium-226 and radium-228 in water samples. This procedure can also be used to isolate these isotopes in air filter, soil, sediment, and organic samples following a digestion.

11.2.1.1 In the case of a liquid sample, measure an appropriate aliquot and pour into a large glass beaker (1 to 2 liters).

Note: If the sample is high in chloride, dilute with DI water at least 2 volumes. If thorium-230 is required, add thorium-228 or thorium-229 tracer here.

11.2.1.2 Volume the sample to 700 ml and add appropriate spikes to quality control samples.

11.2.1.3 Add 40 gm K_2SO_4 per liter of sample.

11.2.1.4 Add 10 ml of concentrated H_2SO_4 per liter of sample.

11.2.1.5 Heat to a boil.

11.2.1.6 Slowly drip 20 ml of 0.1 N $PbNO_3$ into sample while stirring (for radium analysis, Pb-Ba carrier may be substituted).

11.2.1.7 Cool for 1 to 2 hours.

11.2.1.8 Carefully pour off the supernatant until approximately 30 ml of the supernatant and the precipitate remain.

11.2.1.9 Transfer the remaining supernatant and the precipitate using K_2SO_4 wash to a centrifuge tube and spin 20 minutes at 2000 rpm.

11.2.1.10 Discard the supernatant and save the precipitate containing the radionuclides and treat as specified in the method for the isotope of interest.

CORE LAB

Core Laboratories
Procedure/Document Change Form

Document Number: CA-GLR-R160

Document Title: Radiological Sample Preparation

Document Revision Number: 0 Controlled Copy No: 01

Document Section(s) Affected by Change: 11.2.2 + 11.2.3

Reason for Document Change: adding matrices and steps.

Change Effective From: 4/4/97 (Date)

Change: see attached

Samples or Projects Affected: any involving animals, vegetation etc.

Submitted By: Debra Shillabaum Date: 4/4/97

Approval:

_______________________ Core Laboratories Technical Specialist
Signature Date

Debra Shillabaum 4/4/97 Core Laboratories QC Coordinator
Signature Date

Form RDC-13, Revision 0, Effective Date 1/3/95

Soil/Sediment/Vegetation Physical Preparation

1.0 If required, remove aliquots of samples for percent moisture, tritium, technetium 99, and polonium 210 analysis.
2.0 If tritium analysis by cryogenic distillation is requested, aliquot sample for perfoming percent moisture analysis then send remaining sample for distillation. Upon completion of the cyogenic distillation procedure, the sample shall be returned to be prepared for other analyses.
3.0 Place the entire sample, or remainder of samples that were aliquotted, into a clean aluminum tray labeled with the sample number.
4.0 Place the sample in a drying oven (or apparatus designed to obtain the same result) set at 110°C +/- 5°C until dry. A dry sample will be either free flowing or in clumps which break apart or pulverize easily with no tendency for particles to stick together.
5.0 Remove dried samples from the oven and allow to cool.
6.0 Brake up large sample particles and rocks with a chipmunk jaw crusher or equivalent to obtain particles not greater than approximately one centimeter.
7.0 Verify that the air borne particulate safety devices are in place and working properly. Also ensure that any safety devices for the plate grinder are in place.
8.0 Turn on the plate grinder (or equivalent) and slowly add dried sample to the grinder hopper. (If using a closed container grinding machine follow manufacturer instructions)
9.0 When the entire sample has been ground, turn off the grinder then transfer the sample from the catch pan to an appropriate labeled container and store for further analysis.

To Clean the Pulverize: (To be performed between every sample).

1.0 Thoroughly remove all loose material from accessible surfaces from the grinder using a soft brush and a HEPA vacuum cleaner.
2.0 Clean grinder plate surfaces with a wire brush and remove residue with a HEPA vacuum cleaner.
3.0 Use compressed air jet to further dislodge any remaining sample material from crevices of grinding equipment.
4.0 Run ¼ to ½ cup of clean sand through grinder.
5.0 Remove sand from sample receptacle and place in waste bin. Repeat steps 3.0 and 4.0.
6.0 Remove sand from sample receptacle and place in waste bin. Repeat steps 1.0 through 3.0.
7.0 Pulverize is now ready for next sample.

Physical Preparation of Animal Skins:

Skin samples should be dried as in the soil preparation. After pelt or skin is completely dried cut into small pieces of approximately one inch square using scissors or a standard paper cutter. Mix the sample completely. Most animal skins can now be either a) mixed with the tissue sample and further homogenized to obtain hamburger like substance with uniform amounts of the skin mixed in. This can then be digested via the method in the preparation procedure, or an aliquot of the sample can be dry ashed (muffled) as in the soil fraction of this procedure and then digested as you would a soil. Or b) sample aliquots taken of the pelt directly can be digested after muffling via the soil procedure.

Physical Preparation of Unique Animal and Other Difficult Solid Materials:

This fraction pertains to things such as difficult large bones, or debris samples that are difficult to homogenize and prepare for digestion.

1. Obtain a cryogenic container you can use to prep the sample in that can take both the extreme cold of liquid nitrogen and a fast swing to warm temperatures. Place the sample in the bottom of the container.
2. Carefully warm the sample above room temperature with a common hair dryer or lab hot air blower.
3. With extreme caution (and wearing all appropriate safety gear!) pour liquid nitrogen on the warm sample. This will cause excessive stress in the sample and the sample may crackle, mildly explode or crumble. Allow the sample to warm up until no liquid forms of the liquid nitrogen remains in the sample container.
4. Repeat steps 2 and 3 several times until the sample becomes brittle enough to crush. (After three or four applications sample should be done. Crush the sample with the grinding and crushing equipment after treatments if necessary.)
5. If sample is sample is only fractional of the whole sample mix thoroughly with ground sample to homogenize prior to aliquoting.

11.2.2 Soil, Sediment, Vegetation and Air Filter Preparation

11.2.2.1 Weigh out an appropriate aliquot of prepared solid material and muffle at 500°C overnight or at 750°C for 2 hours. If lead 210, polonium 210, technetium 99 or cesium 137 are required, do not muffle sample and continue with step 11.2.2.3. For filter samples, weigh out an appropriate aliquot of filter into a teflon beaker, do not muffle, continue with step 11.2.2.4.

11.2.2.2 Weigh out an appropriate aliquot of muffled solid material into a teflon beaker. If lead 210, polonium 210 or cesium 137 are required, weigh out an aliquot of non-muffled sample into a teflon beaker. (The aliquot used should be adequate to achieve required detection limits.) Technetium 99 should not be prepared by this method.

11.2.2.3 Spike QC samples and trace samples that require tracer.

11.2.2.4 Add 5 ml HNO_3 and 5 ml HCl and cook to low volume.

11.2.2.5 Add 10 ml of concentrated HNO_3 and 70 ml of concentrated HF.

11.2.2.6 Using a hotplate, slowly cook down sample to approximately 5 ml.

11.2.2.7 Add 10 ml of concentrated HCl and 10 ml of concentrated HNO_3 to beaker.

11.2.2.8 Cook down to approximately 5 ml.

11.2.2.9 Transfer sample to a glass beaker using concentrated HNO_3.

11.2.2.10 Bring sample volume up to 20 ml using concentrated HNO_3, add 10 ml of concentrated HCl.

11.2.2.11 If sample is clear with no solids present, go to step 11.2.2.12, otherwise, if solids are present, add 2 ml to 5 ml of $HClO_4$ and 2 ml of concentrated HF.

11.2.2.12 Cook sample to dryness (until all fumes are gone), DO NOT BAKE DRY!

11.2.2.13 Cool, place back on heat, and check for fumes. If fumes are present, repeat step 11.2.2.12, otherwise slowly add 10 ml concentrated HCl or HNO_3. <u>IT IS NECESSARY THAT ALL $HClO_4$ BE FUMED OFF PRIOR TO THE ADDITION OF THE HCl OR HNO_3</u>.

11.2.2.14 If sample is for multiple aliquots, dilute to necessary volume with DI water and transfer to plastic container. Otherwise, cover with seran wrap and place in designated completion location.

11.2.3 Organic Matter: Fish, Coal, Food Samples

11.2.3.1 The samples should be ground in a food mixer to obtain a homogenous matrix.

11.2.3.2 Weigh out 10 to 200 grams or more of material depending upon the detection limits required.

11.2.3.3 Transfer the sample to a glass beaker and add approximately 100 ml of concentrated HNO_3.

11.2.3.4 Add a few mls of H_2O_2 and mix. Many matrices will foam. Add n-octonal to keep the foaming down.

11.2.3.5 Gradually heat and increase the HNO_3 concentration, occasionally adding a few drops of H_2O_2.

11.2.3.6 Heat the solution slowly, but do not allow it to darken or char.

11.2.3.7 When all the organic matter is solubilized (addition of H_2O_2 no longer produces a brown smoke), and the solution becomes clear, reduce the volume to 50 ml.

Note: If sample has fatty organics or calcium, extract for 2 minutes in heptane. Discard heptane waste in appropriate waste vessel.

11.2.3.8 Dilute sample with DI water to workable volume. Sample is now ready to aliquot and analyze according to the procedure for the isotope of interest.

11.2.4 Polonium 210 Sample Preparation By Electroplating

11.2.4.1 Aliquot 200 ml of preserved sample into a 250 ml plastic bottle.

11.2.4.2 Add concentrated ammonium hydroxide until pH is > 8.

11.2.4.3 Using concentrated HCl, readjust the sample pH to ≤ 2.

11.2.4.4 Add 200 mg of ascorbic acid.

11.2.4.5 Spike and trace sample appropriately.

11.2.4.6 Take Ni disk etched with sample ID and wash with acetone.

11.2.4.7 Place disk into sample and place on shaker.

11.2.4.8 Let sample plate for 5 - 7 hours. Sample is now ready for counting.

12. Data Generation and Calculations

12.1 See data generation and calculation section for analyte of interest.

13. Data Reporting

13.1 Raw Data Reporting

13.1.1 All raw data must be entered as it is acquired in the designated bound logbook. This includes test method, analyte being determined, measurement parameters, dilution factors, analyst's initials, and date of test. All information and data which is pertinent to the test should be recorded to facilitate data validation. Any unusual conditions or information on the appearance of the samples, or any other factors which may influence the results should also be noted.

13.1.2 Instrument printouts and copies of spreadsheets or graphs should be dated, initialed by the analyst, and filed chronologically in a designated area.

13.2 LIMS/LABNET Data Entry Methodology

For questions concerning LIMS/LABNET data entry requirements, refer to the LIMS User Manual, the LABNET users manual, or contact the laboratory section supervisor or QA/QC coordinator.

13.2.1 Method Reference

The analyst must verify that the proper method reference is entered for each sample analyzed. If the method which was utilized varies from the assigned LIMS default method, delete the incorrect test code for that sample and then enter the correct test code or change the designated method in the existing test code. A corrected log-in sheet will be generated and placed in the master (job) folder.

13.2.2 Method Detection Limits

Report the detection limit for the sample based on the matrix. Client specific detection limits should be reported when requested by the client.

13.2.3 Units

Report the data using the appropriate units based on the sample matrix. Use pCi/l, µg/l, or mg/l for aqueous samples and pCi/g, µg/g, or mg/g for soil and solid samples.

13.2.4 Date Analyzed

The analyst must enter the date of analysis for each batch of samples processed. Enter the date that the procedure was initiated.

13.2.5 Significant Figures

Record LIMS/LABNET data to the proper number of significant figures. The number of significant figures reported must correlate with the method detection limit. Generally, no more than 3 significant figures should be used for results greater than 10, and no more than 2 significant figures for results less than 10.

Statistical rounding must be employed in determining the final reported concentration. Refer to Standard Methods, 18th Edition, for further information on statistical rounding.

13.2.6 Quality Control Data

Enter quality control data for all method blanks, sample duplicates, matrix spikes, and LCSs which were analyzed with the sample batch.

13.3 Case Narrative

When required, a case narrative will be prepared and included with the report. Each report requiring a case narrative should include the data, validation information, copies of relevant fax or phone logs, and any documentation on corrective action that was taken.

13.4 Job Files

Collect all data sheets and printouts; place copies in the job file. The job file should then be transferred to the QA/QC coordinator, or designee, for validation and report generation. All COC information, log-in information, log sheets, spectral print outs if applicable, and report sheets should be placed in the client file. For jobs requiring level 4 data validation packages, include all standard information, calibration information, and a case narrative.

14. References

15. Method Performance

16. Associated Documents and Forms

Appendix

16.1 Sample preparation - Drying, splitting and grinding

16.1.1 The samples are logged in via either the LIMS or LABNET data management system and each assigned a sample number.

16.1.2 The materials are they placed in aluminum pans, numbered and listed according to job number.

16.1.3 The samples are dried at 80 Deg C.

16.1.4 The dried materials are then crushed and split on a sample splitter. The retains are put in a labeled plastic bag.

16.1.5 The split sample is then ground to 60 mesh in a plate pulverizer and placed in a labeled sample container (envelope or plastic jar).

16.1.6 The pulverized material is then ready for sample preparation described in the chemical procedure in this method.

Western Atlas International

A Litton Dresser Company

CORE LABORATORIES

TITLE			
STANDARD OPERATING PROCEDURE FOR THE DETERMINATION OF TRITIUM (HYDROGEN-3) IN WATER			
SOP NO. CA-GLR-17.0	REVISION NO. 4	EFFECTIVE DATE 09-29-92	PAGE 1 OF 23

UNCONTROLLED DOCUMENT

Reviewed by [signature]

Date 6-03-98

DOCUMENT CONTROL PAGE

Implementation date ___________

PREPARED BY: APPROVED BY:

Edward S. Wallace	Edward S. Wallace	9-29-92
	signature	date
Dave Demorest	[signature]	9-29-92
	signature	date
	signature	date

DISTRIBUTION

1. Scope and Application

The following procedure is based on the Tritium In Drinking Water Method 906.0 described in the E.P.A. publication 600-4-80-032. This method measures Tritium in the form of the monotritiated or ditritiated water(HTO and T_2O respectively) by liquid scintillation counting. This provides a test for use in monitoring tritium levels in drinking water and environmental water samples. The method is capable of detecting tritium in water at a concentration of 1000 pCi/l or 5% of the national Interim Primary Drinking Water Regulations(NIPDWR) limit of 20,000 pCi/l

The method involves the distillation of the water sample in the presence of sodium hydroxide and potassium permanganate followed by liquid scintillation counting.

1.1 Specific Method Utilized

The method is based on the Tritium In Drinking Water Method 906.0 described in the E.P.A. publication 600-4-80-032.

1.2 Specific Analyte(s) Being Determined

The method is a qualitative determination for Tritium (Hydrogen-3) in water in the form of either monotritiated or ditritiated water(HTO and T_2O respectively).

1.3 Required Reporting Limits

The EPA drinking water standard for maximum tritium activity is 20,000 pCi/l .The EPA further states that the method must be able to detect 1,000 pCi/l tritium activity.

1.4 Acceptable Range of Results

The method is sensitive to at least 500 pCi/l of Tritium in water. With Core Laboratories Packard 2260 XL Low Background Liquid Scintillation Counter sensitivities of less than 500 pCi/l may be reached with longer counting times and varying sample volumes. Please see Section 1.5 for details on lower sensitivities.

1.5 Regulatory Limits for the Analytical Results

The detection limit (sensitivity) is mandated for drinking water. The NIPDWR defined the detection limit as a concentration that can be counted with a precision of +/- 100% at 1.96 sigma or at 95% confidence level. For drinking water compliance to part 141.15 (a) of the NIPDWR, the detection limit is 1,000 pCi Tritium/l . The detection limit is calculated in the following manner:

$$LLD = \frac{4.66 \ (C_B * T)^{.5}}{(2.22 \text{ dpm/pCi})(E)(T)(V)}$$

Where LLD = Lower limit Of Detection in pCi/l
CB = Background Count Rate
E = Instrument Counting Efficiency For Tritium
T = Counting time In Minutes
V = Sample Size In Liters
2.22 dpm/pCi=Conversion for dpm from pCi

A representative sensitivity for tritium determinations may be calculated using equation 1 and the following conditions:
CB = 5 cpm
E = .40 cpm/dpm (40% efficient)
T = 30 minutes
V = .01 Liters
2.22 dpm/pCi=Conversion for dpm from pCi

$$LLD = \frac{4.66 \ (5\text{cpm}*30 \text{ min})^{.5}}{(2.22 \text{ dpm/pCi})(.40 \text{ cpm/dpm})(30\text{min})(.011)}$$

$$LLD = 214 \text{ pCi/l}$$

2. Summary of Method

100 milliliters of the water sample is treated with 0.5 g of sodium hydroxide and 0.1 g potassium permanganate and distilled. The distillate fraction from 11 to 60 ml is collected for liquid scintillation analysis. 10 ml of Pico-fluor LLT liquid scintillator is dispensed into 20 ml low background borosilicate glass liquid scintillation vial. 10 ml of the sample distilled is mixed with liquid scintillator in the vial. The vial is then counted in the liquid scintillation counter.

3. Definitions

Liquid Scintillation: The process by which alpha, beta, or gamma radionculides are measured by the interaction of the emitted radiation and fluors contained in a cocktail that the sample is dissolved in. The radiation interacts with the fluor causing a photon of light to be produced. Thsi photon of light is detected by the counter and analyzed. The instrument measures the intensity of the light pulse to determine the energy of the radiation emission and counts the number of pulse to ascertain quantity

Liquid Scintillator- The compound that the sample is mixed in to effect the counting process. The liquid scintillator may contain toluene or naphthalene as a solvent and 2,5-Diphenyloxazole(PPO) and 1,4-Bis[2-(5-phenyloxazolyl)]-benzene(POPOP) as the fluors.

4. Responsibilities

The laboratory technician performing this analysis is responsible for performing the method according to the protocols outlined in the method described here. The technician must maintain all records and identify any problems that were encountered that could cause erroneous data to be generated. The lab analyst is also responsible for maintaining documentation that the instrumentation was performing according to specifications during the time the measurements were taken and that the calibrations records are accurate and valid. In cases where the detection limits are not achieved or the QC values are not acceptable the technician should create a corrective action file and take the appropriate action if there is need for recalibration or reanalysis. If the corrective action requires attention for supervisory or management the appropriate staff should be informed by filing a corrective action form.

5. Interferences, Comments, and Precautions

5.1 Interferences

5.1.1 High count rates could be observed due to excitation of the liquid scintillator upon exposure to ambient light during preparation. Therefore, it is mandatory that the prepared liquid scintillation samples be dark adapted for a minimum of one hour in the counter before initiation of the counting procedure.

5.1.2 The use of other than low potassium borosilicate glass scintillation vials may cause an increase in count rate due to the presence of naturally occurring Potassium-40 in the glass. Also, the liquid scintillators tend to diffuse through the walls of plastic scintillation vials over time. This can cause a contamination problem in the lab and within the instrument itself. Therefore, use only low potassium borosilicate glass scintillation vials

5.1.3 The use of water for blank preparations that is not low in tritium may cause an interference. This is due to the fact that most surface waters contain elevated levels of tritium. Therefore, only deep well sources of water should be used in this method. This water must ,also, be analyzed for tritium activity prior to use in sample analyses.

5.1.3.1 Counting Efficiency Determination

5.1.3.1.1 Liquid Scintillation Counting presents special problems with respect to counting efficiency determination. The main problem is that the instrument's counting efficiency may vary with each sample. This due to interactions between the sample and the liquid scintillator called quenching. Quenching results when various components in the sample cause a reduction in the counting efficiency. The counting efficiency of a sample for Hydrogen-3 may be determined by means of internal or external standardization. Internal standardization involves counting the sample once and then adding a known quantity of Hydrogen-3 solution. The sample is the recounted and the efficiency determined. External standardization involves first counting the sample for gross sample counts. Next the sample is irradiated with gamma photons from a Ba-133 source contained in the instrument. The instrument measures the counts recorded during irradiation and compares the sample count rate with the expected count rate in the absence of quenching. The efficiency is determined in this manner. We use external standardization to determine counting efficiency.

5.2 Comments: External Standardization is the only method used at Core Laboratories due to extremely high precision, much greater analytical throughput, and less waste disposal concerns.

5.3 Precautions: Care should be taken when handling the tritium calibration solutions. Please use gloves and eye protection. Also, all pipet tips should be segregated for disposal as LLRW. Also, if you accidentally contaminate a pipet tip with sample(sample + liquid scintillator), do not allow the contaminated pipet tip to come in contact with the standard. This could contaminate our standard.

6. Sampling, Sample Preservation, and Holding Times

6.1 Sampling Methodologies: The protocol for sampling should follow those outlined in SW846. All samples should be collected according to these guidelines. All sampling information should be included on a proper Chain-of-Custody which should include all sampling dates and times, sampling requirements and initials of individuals involved in the sampling and/or handling the samples.

6.1.1 Sampling Conditions: Sampling conditions including the temperature and atmospheric conditions should be recorded on COC.

6.1.2 Sampling Locations: The sampling location should be recorded on the COC and the sampling containers in a manner that will be recognizable and can be reproduced if required at a later date.

6.1.3 Container Specifications: Samples shall be collected in amber glass containers with teflon lids. The sample container shall be filled such that zero headspace remains in the container.

6.1.4 Special Sampling Procedures: The samples should be collected in a manner that will provide the most representative sample. In the case of a drinking water sample the sample should be collected from the free flowing source and should be large enough to provide adequate sample to achieve the detection limits required for SDW. The minimum sample size for Tritium in Water should be a minimum of 250 ml.

6.2 Sample Preservation: The sample should be collected in a glass bottle as outlined in Sections 6.1.3 and 6.1.4. The samples shall be cooled to less than or equal to 4 degrees C. **Do Not Acidify Samples For Tritium Analysis**.

6.3 Holding Times: Generally the sample can be stored, if properly refrigerated, up to six months.

7. Safety and Health Considerations: In the case of drinking water samples the amount of activity present does not represent any exposure risk. The sample is basically drinking water. In cases of environmental samples or mixed waste samples there is always the potential for hazardous components(ie. PCB or Dioxin) to be present along with harmful radioactive components such as Plutonium. These samples should be handled as if they are hazardous until proven otherwise. Gloves, protective clothing, face shields and eyewear should be worn at all times in the laboratory. Sample analysis functions shall be carried out in the appropriate environment(e.g., fume hoods). The staff shall always remove disposable gloves or other protective clothing prior leaving the laboratory area and dispose of in the proper containers . Staff shall wash all areas of hands and arms that may have been exposed to contaminated materials. Generally, the best approach to laboratory safety in a low level activity area is just practicing good personal hygiene.

8. Quality Control Requirements

8.1 Type of QC Checks

The cross check program should include method blanks, instrument blanks, matrix spikes, duplicates, and LCS samples. The samples should be representative of the type of materials to be analyzed. The samples in the program should be representative of the type of materials to be analyzed.

8.2 Frequency:

The analytical group for tritium analysis should included QC at a frequency of 5% (1 per 13 samples). The laboratory's analytical sequence includes 1 method blank, 1 LCS, 1 duplicate, and 1 matrix spike for each 13 samples. The 5% frequency meets the requirements of EPA, SW846 and the CLP.

8.3 Evaluation Procedure:

The initial evaluation of the data should be done by the bench chemist. If the values do not fall within the acceptance criteria listed below the analytical set should be reviewed and corrective action taken. The quality assurance information, including corrective actions, should be included with each report and should be reviewed and verified by the Facility Quality Assurance Officer.

8.4 Acceptance/Rejection Criteria:

The following Quality Control Acceptance Criteria will be utilized as the standard limits in the LIMS.

Method Blank ....: Analyzed Value Less than or equal to the Detection Limit

Inst Blank...........: <LLD

Duplicates...........: 20% Relative Percent Difference, or +/- the Detection Limit

Matrix Spikes........: 100 +/- 25 Percent Recovery

LCS..................: 80-120%

CCV..................: 90-110%

Method Precision and Accuracy are tracked and documented on a continuing basis and Upper and Lower Warning Limits and Control Limits are maintained for use in the lab as a mean of examining trends and as a mechanism to identify non-compliances. This is done by evaluating the last 25 sets of knowns and duplicates for accuracy and precision. These limits should be updated as each net set of 25 values becomes available.

8.5 Corrective Action:

In cases where the values fall outside the acceptance range the data should be reviewed by the laboratory supervisor. If there are valid reasons, such as high solid content or matrix problems, the data can be released with qualifiers. If there is no valid reason for the nonconformance that analytical group should be re-analyzed. These issues should be tracked by filing a corrective action form and noted in the case narrative.

9. Apparatus and Materials

9.1 Required Information for Apparatus, Instruments, and Equipment:

Core presently operates one liquid scintillation counting system. The liquid scintillation counter can be utilized to measure Tritium, Carbon-14, Sulfur-35 plus other alpha and beta emitting nuclides provided the proper calibration is done prior to utilization.

9.1.1 Counting Instrumentation

9.1.1.1 Liquid Scintillation Counter

9.1.1.1.1 Manufacturer: Packard Instrument Company, Meriden, CT

9.1.1.1.2 Model Name or Number: 2260 XL Low Background Liquid Scintillation Counting System

9.1.1.1.3 Core Laboratories QC ID # LSC-1 Number(s)

9.1.1.2 Liquid Scintillation Counter Controller

9.1.1.2.1 Manufacturer: IBM, NY

9.1.1.2.2 Model Name or Number: Personal System 2 /30

9.1.1.2.3 Core Laboratories QC ID # LSC-1 Number(s)

9.1.1.3 Electronic Analytical Balance

9.1.1.3.1 Manufacturer: Mettler, Hightstown, NJ

9.1.1.3.2 Model Name or Number: AE 163 Electronic Analytical Balance

9.1.1.3.3 Core Laboratories QC ID # BAL-1

9.1.1.4 Top Loading Electronic Balance

9.1.1.4.1 Manufacturer: Mettler, Hightstown, NJ

9.1.1.4.2 Model Name or Number: P1210 Electronic Top Loading Balance

9.1.1.4.3 Core Laboratories QC ID # BAL-2

9.2 Laboratory Materials

9.2.1 250 ml Round Bottom Boiling Flasks with 24/40 joint

9.2.2 1500 ml Round Bottom Boiling Flask with 24/40 joint

9.2.3 300 mm West Type Condensers With 24/40 Joints

9.2.4 75 Degree Glass Connecting Joints With 24/40 joints

9.2.5 Heating Mantles for 250 ml Round Bottom Flask

9.2.6 Heating Mantle for 1500 ml Round Bottom Flask

9.2.7 Controllers For Heating Mantles

9.2.8 Boiling Chips

9.2.7 20 ml Low Potassium Borosilicate Glass Scintillation vials

9.2.9 Assortment of Adjustable and/or Fixed Volume Micro and Macro Pipets, Oxford or Eppendorf

9.2.10 Assortment of Disposable Pipet tips for Oxford or Eppendorf Adjustable and/or Fixed Volume pipets

9.2.11 Assortment of Class A Volumetric Ware(50ml to 2000ml)

9.2.12 Adjustable Bottle Top Solvent Dispenser

9.2.13 100 ml Graduated Cylinders

9.2.14 Assorted Clamps and Stands

9.2.15 Packard NIST Traceable Unquenched Sealed Source Tritium Standard In 20 ml Scintillation Vial. Hydrogen-3 Activity was 234,500 dpm on the TOC of 6-

12-87

9.2.16 Packard NIST Traceable Unquenched Sealed Source Carbon-14 Standard In 20 ml Scintillation Vial. Carbon-14 Activity was 108,400 dpm on the TOC of 6-8-87

9.2.17 Packard NIST Traceable Quenched Sealed Source Tritium Standard Set In 20 ml Scintillation Vial. Quenched Set Serial #7 with 255,600 dpm per vial at TOC of 6-7-89.

9.2.18 Equipment Parts and Repairs: All parts and repairs should utilize parts specified by the manufacture of the instrument.

10. Reagents and Standards Preparation

10.1 Required Information on Reagents

10.1.1 Reagent Name: List the chemical name and chemical number. List the date, time and who received the material.

10.1.2 Refer to SOP CA-SRP-0001 for Preparation of Reagents

10.1.3 Shelf Life: List the shelf life and record on the container the date of expiration. For example,a material received on 6-01-91 with a shelf life of six months will expire on 12-01-91. No material may be utilized in the lab past its date of expiration.

10.1.4 Traceability: Required information about the reagent to assure traceability is manufacturer, manufacturer's lot number, grade of material (e.g.,ACS Reagent Grade) , SRM # for NIST traceable materials, and copies of NIST certificates.

10.2 Required Information on Standards

10.2.1 Standard Name and Number: List name of standard and standard reference material number (e.g., Hydrogen-3, SRM # 4926D)

10.2.2 Type of Standard : List the type of standard such as radioactive material calibration source, radioactive material calibration solution, or chemical assay standard.

10.2.3 Physical Information On Radioactive Material Standard

10.2.3.1 Activity of Standard at Time of Calibration(TOC) Specifying Units (e.g., becquerels, dpm, nCi, uCi etc). Also, include the uncertainty in the activity measurement

10.2.3.2 Physical Form of Standard

10.2.3.3 Volume or Mass of Standard + Uncertainty

10.2.3.4 Half Life of Standard

10.2.3.5 Date and Time of Calibration of Standard

10.2.4 Physical Information on Chemical Standards

10.2.4.1 Composition of Standard by Weight or Percent + Uncertainty

10.2.4.2 Physical Form of Standard

10.2.4.3 Volume or Mass Standard + Uncertainty

10.2.5 Preparation of Reagents

10.2.5.1 Refer to SOP CA-SRP-0001 Standard Operating Procedure For The Preparation of Radioactive Material Standards for information on preparation of radioactive material standards.

10.2.5.2 Refer to SOP CA-SRP-0002 Standard Operating Procedure For The Preparation of Standards for information on preparation of chemical standards

10.2.6 Source of Certified Calibration Materials Used in Standard Preparation: List the Manufacturer,

10.2.7 Shelf Life: List the shelf life and record on the container the date of expiration. For example,a material received on 6-01-91 with a shelf life of six months will expire on 12-01-91. No material may be utilized in the lab past its date of expiration.

10.2.8 Traceability Chain

A chain of traceability must be maintained for all standards used in the laboratory. For commercially prepared calibration sources that we do not alter, the Traceability Chain is as simple as maintaining a complete documentation file on the standard , identifying the standard, and properly referencing the standard in the reporting. However, in cases where we are preparing secondary standards from an NIST Traceable Standard more documentation is required to maintain traceability. Refer to CA-SRP-0001 Standard Operating Procedure For The Preparation of Radioactive Material Standards for information on how to maintain traceability.

10.3 Reagents

10.3.1 Anhydrous Sodium Hydroxide Pellets, ACS Reagent Grade

10.3.2 Potassium Permanganate, ACS Reagent Grade

10.3.3 Packard Pico-Flour LLT Liquid Scintillation Cocktail

10.3.4 0.5 uCi NIST Traceable Tritium(Hydrogen-3) Solution in 500 ml Bottle For a Concentration of 1,000,000 pCi/l (1000 pCi/ml) From Analytics , Atlanta, Ga

10.3.5 Deep Well Water For Blank Analysis

10.3.6 1000 pCi/l Raw Water Tritium Standard Solution

Dispense 1.00 ml of the 1,000,000 pCi/l Tritium solution gravimetrically into a Class A Volumetric. Dilute to 1 liter using the undistilled Deep Well Water solution. This produces a tritium calibration solution with an activity of 1000 pCi/l(EPA standard Tritium Activity). Store in a liter bottle with ground glass stopper and refrigerate.

10.3.7 Raw Water

10.3.8 Distilled Raw Water Solution Preparation Procedure:

10.3.8.1 Weigh out 5.0 grams of ACS Reagent Grade Anhydrous Sodium Hydroxide Pellets using the electronic top loading balance(BAL-2) or equivalent into a 1 liter beaker.

10.3.8.2 Slowly add the Sodium Hydroxide Pellets to approximately 0.5 liter of the Deep Well Water in a 1 liter beaker and stir . **Remember Sodium Hydroxide has a very high heat of solution in water!! The dissolution of 5 grams of Sodium Hydroxide in a small volume of water will cause it boil. Handle the beaker carefully <u>it will become HOT!!</u>.**

10.3.8.3 Weigh out 1.0 gram of ACS Reagent Grade Potassium Permanganate using the electronic top loading balance(BAL-2) or equivalent. Dispense the 1.0 gram Potassium Permanganate into beaker of sodium hydroxide solution from Section 10.3.5.2 and mix.

10.3.8.4 Dispense the resulting solution into a 1.5 liter round bottom flask and a few boiling chips. Connect a 75 degree connecting tube and a 300 mm West condenser to the round bottom flask and distill. Collect the distillate into a 1 liter bottle with a ground glass lid.

10.3.8.5 Label as Distilled Raw Water plus put the date of preparation and analyst's initials

10.3.9 1000 pCi/l Distilled Water Tritium Standard Solution

Dispense 0.500 ml of the 1,000,000 pCi/l Tritium solution gravimetrically into a Class A Volumetric. Dilute to 0.50 liter using the Distilled Raw Water solution. This produces a tritium calibration solution with an activity of 1000 pCi/l(EPA standard Tritium Activity)

10.3.10 Raw Water Tritium Standard Distillate Solution Preparation Procedure:

10.3.10.1 Weigh out 0.5 grams of ACS Reagent Grade Anhydrous Sodium Hydroxide Pellets using the electronic top loading balance(BAL-2) or equivalent into a 250 ml round bottom flask.

10.3.10.2 Slowly add approximately 100 ml of the Raw Water Tritium Standard Solution to the 250 ml round bottm flask containing the Sodium Hydroxide Pellets and stir . **Remember Sodium Hydroxide has a very high heat of solution in water!! The dissolution of 5 grams of Sodium Hydroxide in a small volume of water will cause it boil.** Handle

the beaker carefully it will become HOT!!

10.3.10.3 Weigh out 0.1 gram of ACS Reagent Grade Potassium Permanganate using the electronic top loading balance(BAL-2) or equivalent. Dispense the 0.1 gram Potassium Permanganate into the 250 ml round bottom flask containing the basic Raw Water Tritium Standard Solution from Section 10.3.10.2 and mix.

10.3.10.4 Add a few boiling chips to the 250 ml round bottom flask. Connect a 75 degree connecting tube and a 300 mm West condenser to the round bottom flask and distill. Collect the distillate into a 100 ml graduated cylinder and discard the first 10 ml of the distillate. Collect and retain the fraction from 11 to 60 ml. Store in a VOA vial .

10.3.10.5 Label as Raw Water Tritium Standard Distillate Solution plus put the date of preparation and analyst's initials

10.3.11 Dupont Tritiated Water Certified Calibration Compound # NES-003, 10ml of 1 uCi Tritium/ml water.

11. Analytical Procedure

11.1 Instrument Calibration and Operation

11.1.1 Packard 2260 XL System Normalization and Calibration(SNC) Instrument Performance Assessment (IPA) Protocol

The System Normalization and Calibration (SNC) and Instrument Performance Assessment (IPA) is run daily to monitor instrument operating conditions, system background, Hydrogen-3 efficiency, Carbon-14 efficiency, Figure of Merit, and Chi- Squared values for both Hydrogen-3 and Carbon-14. The IPA Protocol utilizes both the Hydrogen-3 and Carbon-14 Packard Unquenched 20 ml Unquenched Liquid Scintillation Standards. The Packard Background Liquid Scintillation standard is, also, employed.

The SNC Protocol is run using the Unquenched Carbon-14 standard. The operation basically involves turning off the high voltage to one of the photomultplier tubes (PMT) and adjusting the high voltage to one-half of the normal SIS for the unquenched carbon-14 standard. The process is repeated for the other PMT. Then both PMTs are turned on and tested to check that the SIS value is correct . If not both tube are proportionally adjusted until the correct value is obtained. The system then adjusts the tSIE to 1000.

The IPA Protocol is automatically performed following the SNC Protocol. The IPA Protocol determines instrument background count rate plus both Hydrogen-3 and Carbon-14 counting efficiency. The IPa ,also, runs a Chi-Squared Test by counting both Hydrogen-3 and Carbon-14 twenty times for 0.5 minutes. The instrument, also, calculates Figure of Merit for both Hydrogen-3 and Carbon-14.

The SNC and IPA Protocols Are Performed as follows:

11.1.1.1 Verification of Correct IPA Set Up

Depress the F-9 function key on the IBM PS/30 to bring up the IPA Setup Menu. Check to see that the activities ("3H DPM" and "14C DPM" respectively) and the Date of Calibration("Reference Date") for both the Hydrogen-3 and Carbon-14 20 ml Liquid Scintillation Sealed Source Standards are correct. This information may be obtained by looking on the caps of the standards. If the information is incorrect, please reenter the correct values.

11.1.1.2 Loading of The SNC Cassette

Insert the SNC Protocol Plug into a Packard Varisette. Then load the Unquenched carbon-14 Standard into position 1. Next load the Unquenched Hydrogen-3 Standard into position 2 followed by the blank in position 3. Finally, load the Variseete cassette into the sample changer and set the cycle flag on the SNC protocol plug.

11.1.1.3 Running SNC and IPA Protocols

After the SNC Varisette has been allowed to dark adapt for a period of at least 1 hour, initiate the protocol from F2 key on the status page.

11.1.1.4 Recording Results

File the SNC/IPA Protcol printout in the LSC-1 calibration logbook.

11.1.2 Quench Curve Determination For Tritium

11.1.2.1 Preparation For Tritium Quench Curve Determination

Obtain the Packard NIST Traceable Quenched Sealed Source Tritium Standard Set In 20 ml Scintillation Vials.The Tritium Quenched Set is Serial #7X with 255,600 dpm per vial at TOC of 6-7-89. Load these samples into the Varisette with quenched source number 7-AX in position 1 , quenched source number 7-BX in position , and so on. Place the hydrogen-3 quench curve protocol plug into the Varisette and place in the sample changer. Allow at least one hour for dark adaptation to occur before counting.

11.1.2.2 Determination of Tritium Quench Curve

Select the quench curve protocol from the status page menu an initiate counting. File the quench curve printout in the LSC calibration logbook.

11.1.3 Analysis of Distilled Raw Water Solution, Raw Water Tritium Standard Solution, and Raw Water Tritium Standard Solution Distillate Solution For In Process Quality Control

11.1.3.1 Preparation Of Vials For Liquid Scintillation Counting

Procure nine 20 ml Low Potassium Borosilicate Glass Scintillation vials. Dispense 10 ml of Pico-Fluor LLT liquid Scintillator into each vial.

11.1.3.2 Dispense a 10 ml aliquot of sample into three vials for each of the following Distilled Raw Water, Raw Water Tritium Solution Standard Distillate, and Distilled Water Tritium Standard Solutions. Cap, shake, and label each vial cap with standard number.

11.1.3.3 Load the vials into a Varisette and load into the sample changer. Allow the samples to dark adapt for at least one hour.

11.1.3.4 Running Counting Protocol For Hydrogen-3 DPM

After the Varisette with the standards has been allowed to dark adapt for a period of at least 1 hour, initiate the ^{3}H protocol from the status page. File printout in the LSC Calibration logbook and with the job file.

11.2 Sample Preparation

11.2.1 Sample Distillation

11.2.1.1 Obtain sample schedule from supervisor responsible for scheduling protocol and retrieve samples from refrigerator. Document time, date and volume of samples on internal COC form upon removal for controlled storage area.

11.2.1.2 Weigh out 0.5 grams of ACS Reagent Grade Anhydrous Sodium Hydroxide Pellets using the electronic top loading balance(BAL-2) or equivalent into a 250 ml round bottom flask.

11.2.1.3 Slowly add approximately 100 ml of the sample for Tritium analysis to the 250 ml round bottom flask containing the Sodium Hydroxide Pellets and stir . **Remember Sodium Hydroxide has a very high heat of solution in water!! The dissolution of 5 grams of Sodium Hydroxide in a small volume of water will cause it boil. Handle the beaker carefully <u>it will become HOT!!</u>**\ Label the round bottom flask with the sample number.

11.2.1.4 Weigh out 0.1 gram of ACS Reagent Grade Potassium Permanganate using the electronic top loading balance(BAL-2) or equivalent. Dispense the 0.1 gram Potassium Permanganate into the 250 ml round bottom flask containing the sample for Tritium analysis from Section 11.2.1.3 and mix.

11.2.1.5 Add a few boiling chips to the 250 ml round bottom flask. Connect a 75 degree connecting tube and a 300 mm West condenser to the round bottom flask and distill. Collect the distillate into a 100 ml graduated cylinder and discard the first 10 ml of the distillate. Collect and retain the fraction from 11 to 60 ml. Store in a VOA vial .

11.2.1.6 Label as distilled water sample For tritium . Also, record the job number, the date of preparation, and analyst's initials on the label.

11.2.2 Preparation of QC Samples

In order to provide the most representative quality assurance data it is appropriate and it beneficial in providing relevant data if the samples are spiked prior to distillation. The same logic is take in splitting the duplicate sample prior to distillation. This approach will eliminate any question as to the effects of distillation on the final analytical results.

11.2.2.1 Prepare sample duplicates for analysis at a 5% frequency using 100 ml aliquots. Please follow the guidelines in Section 11.2.1. The samples for duplicate analysis shall be selected randomly.

11.2.2.2 Background Blanks are prepared by dispensing 100 ml of Distilled Raw Water.Please follow the guidelines in Section 11.2.1 for sample distillation.

11.2.2.3 Spiked Samples are prepared by adding 10ul of the Dupont/NEN Tritiated Water (catalog # NES-003) to a 100 ml sample and then subject the sample to the distillation preparation described in section 11.2.1. The samples for spike analysis shall be selected randomly.

11.2.2.4 The reference solutions are checked for contamination quarterly or upon makeup of a new standard. The solutions are examined by use of the liquid scintillation system.

11.2.3 Sample Analysis

11.2.3.1 Load all sample and QC vials into Varisette(s) and load into the sample changer. Allow the samples to dark adapt for at least one hour.

11.2.3.2 Running Counting Protocol For Hydrogen-3 DPM

After the Varisette with the standards has been allowed to dark adapt for a period of at least 1 hour, initiate the ^{3}H protocol from the status page. File printout in the LSC Analysis logbook and make a copy for the job file.

11.2.3.3 Upon completion of counting record that the samples have been counted in the appropriate book.

11.2.3.4 Performance/Verification of Instrument Calibration: Confirm that the instrumentation performance was acceptable for that counting run be examining the calibration information from that instrument. Copy the data and calibration data and place that in the data file of that series of analysis as part of the data validation package.

11.2.3.5 Quality Control: Include all Quality Control Data in the data validation package.

12. Data Generation and Calculations(Include all information required for calculations and data validation package.).

12.1 Required information includes all raw data sheets (computer printouts, copies of log information, COC information, volume measurements and counting information).

12.2 List of Required Calculations

Although the data is generated by the Packard 2260 XL Liquid Scintillation program, the basic formulas used for determining Tritium activity are provided here.

12.2.1 Determination of Instrument Efficiency

Instrument Efficiency is the measure of the number of radioactive events(counts) seen by the instrument divided by the actual number of radioactive events (disintegrations) occurring. The expression for instrument efficiency is as follows:

$$\text{Efficiency} = \frac{\text{Gross cpm} - \text{Background cpm}}{(\text{Source dpm})}$$

Gross CPM= The total number of radioactive events measured by the instrument per minute . This includes background radiation as well radiation from the sample
Background CPM= Those radioactive events measured by the instrument per minute that result from all non sample sources of radiation (e.g., Cosmic Background and Radioactive Material in the Earth's crust)

Source DPM= The number of radioactive disintegrations per minute given off by the source. This is one way to measure activity.

12.2.2 Determination of The Activity For Tritium Based Upon Measurement of Beta Particles

The determination of the activity of Tritium based upon measurement of emitted beta particles requires us to know the instruments counting efficiency, the instruments background count rate, and the number gross count rate for the radioactive sample. The following equations will demonstrate the calculations:

12.2.2.1 Equation For Total Activity In dpm

$$\text{Activity(in dpm)} = \frac{\text{Gross cpm} - \text{Background cpm}}{\text{Efficiency}}$$

For example, a 10 ml sample of water contaminated by Tritium is analyzed on a Liquid Scintillation Counter to determine Tritium activity. The sample produces 4351 counts per minute, the instrument background is 4.8 cpm, and the instrument's counting efficiency for Tritium is 0.425 cpm/dpm (42.5% efficient). From this information, activity is calculated as follows:

$$\text{Activity(in dpm)} = \frac{4351 \text{ cpm} - 4.8 \text{ cpm}}{.425 \text{ cpm/dpm}} = 10226 \text{ dpm}$$

12.2.2.2 Equation For Activity per Unit Volume or pCi/l

$$\text{Activity/l(pCi/l)} = \frac{\text{Gross cpm} - \text{Background cpm}}{(\text{Eff}) * (2.22\text{dpm/pCi}) * (\text{Vol.in l})}$$

Where: Eff= Efficiency
Vol= Volume in liters
2.22 dpm/pCi= conversion factor for dpm per pCi

As an example we will calculate activity per liter using the Tritium example from Section 12.2.2.1.

$$\frac{4351\ \text{cpm} - 4.8\text{cpm}}{(.425\ \text{cpm/dpm})*(2.22\text{dpm/pCi})*(.01\ \text{l})} = 460647\text{pCi/l}$$

12.2.3 Determination Of Error At 95% Confidence

The error is determined by taking the square root of sample count rate divided by counting time plus the background count rate divided by count time. That factor is multiplied by 1.96 and then divided by the product of the dpm conversion factor times efficiency times volume. The value is reported in + or - pCi/l.

$$\text{Error} = \frac{1.96*(\text{Sample cpm/ct} + \text{Bkg cpm/ct})^{.5}}{(2.22\text{dpm/pCi})*(\text{Eff.})*(\text{Vol.in l})}$$

12.2.3.1 Determination Of The Lower Limit of Detection (LLD) At The 95% Confidence Level

$$= \frac{4.66*(\text{Bkg cpm/ct})^{.5}}{(2.22\text{dp m/pCi})*(\text{Eff.})*(\text{Vol.in l})}$$

The above formula for LLD is valid only for situations where the background count and sample count are identical.

12.3. LIMS Data Entry and Data Reporting(see LIMS Methods Manual)

12.4 Case narrative: Each report should include a case narrative identifying what data information, validation information, copies of relevant fax or phone logs, and any corrective actions records.

12.5 Reporting Requirements

All samples analyzed shall have the following information reported:

12.5.1 Sample Activity in pCi/l

12.5.2 Analytical Error of the Sample at the 95% Confidence Limit Expressed in + or - pCi/l.

12.5.3 The Lower Limit of Detection (LLD) expressed in pCi/l

13. References

Tritium In Drinking Water, EPA Method 906.0 , Prescribed Procedures for Measurement of Radioactivity In Drinking Water, EPA 600/4-80-032

Radiochemical Determination of Tritium In Water, Emulsion Method , Eastern Environmental Radiation Facility Radiochemistry Procedures Manual, USEPA 520/5-84-006

Tri-Carb 2200 Series, Liquid Scintillation Analyzer Operations Manual, Packard Instrument Company, Publication Number 169-3094, 1988

Radiation Detection and Measurement 2ed., Knoll, Glenn F., 1989 Wiley

14. Maintenance: Refer to SOP on instrumentation CA-GLR-019.0.

15. Appendix

reported:

12.5.1 Sample Activity in pCi/l

12.5.2 Analytical Error of the Sample at the 95% Confidence Limit Expressed in + or - pCi/l.

12.5.3 The Lower Limit of Detection (LLD) expressed in pCi/l

13. References

Tritium In Drinking Water, EPA Method 906.0 , Prescribed Procedures for Measurement of Radioactivity In Drinking Water, EPA 600/4-80-032

Radiochemical Determination of Tritium In Water, Emulsion Method , Eastern Environmental Radiation Facility Radiochemistry Procedures Manual, USEPA 520/5-84-006

Tri-Carb 2200 Series, Liquid Scintillation Analyzer Operations Manual, Packard Instrument Company, Publication Number 169-3094, 1988

Radiation Detection and Measurement 2ed., Knoll, Glenn F., 1989 Wiley

14. Maintenance: Refer to SOP on instrumentation CA-GLR-019.0.

15. Appendix

CORE LAB

TITLE			
Standard Operating Procedure for Gross Alpha/Beta Analysis of Environmental Samples by Gas Flow Proportional Counting			
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R310	0	7/21/95	1 of 23

DOCUMENT CONTROL PAGE

Prepared By: [illegible] Date 7-21-95

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UNCONTROLLED DOCUMENT

Controlled Copy Number: 01

Revision No.	0					
Date	7/21/95					

1. Scope and Application

This standard operating procedure (SOP) provides guidance for the use of EPA Method 900 for analyzing gross Alpha and Beta in environmental samples by gas flow proportional counting. The useful range of the method is the detection limit of 1 pCi/l for Alpha and 4 pCi/l for Beta in water (depending on available sample volume and TDS), and 3 pCi/g for Alpha and 8 pCi for Beta in soil.

This SOP applies to the environmental testing laboratories in the Environmental Services Division of Core Laboratories, Inc.

2. Summary

An aliquot of sample water is measured so as to contain not more than 100 mg of TDS residue for Alpha counting on the planchet and not more than 200 mg for the Beta determination. Solids deposited on the planchet should be limited because Alpha and Beta particles are strongly attenuated by matter. These aliquots are evaporated carefully in a beaker on a hot plate down to a volume of 2-5 mls. The remaining residue and solution is then transferred to a planchet and carefully dried. The weight of solids is determined on the planchet to determine the efficiency and samples are counted by the appropriate equipment.

3. Definitions

Gross Alpha Activity - Activity of the Alpha-emitting components in the sample being analyzed. The major Alpha emitters usually examined with this method are the Uranium and natural Thorium series. The major components of the Uranium series are Uranium, Thorium 230, Radium 226, Radon 222, Lead 210 and Polonium 210 (Note: Lead 210 is a Beta emitter). Major contributors to Alpha from the Natural Thorium (Th232) series are Thorium 232 and Thorium 228. In cases involving sites where fission products are of concern the major Alpha contributors are from the trans-uranic series including Neptunium, Americium 241-243, Plutonium 238, 239, 240, and possibly enriched Uranium or depleted Uranium (Uranium that has been processed) or represents the used nuclear fuel.

Gross Beta Activity - Activity of the Beta-emitting components in a sample being analyzed. The major Beta emitters usually examined with this method are again from the natural decay series of Uranium or Thorium. The major Beta emitters from the Uranium decay series are Protactinium 234, Thorium 234, several short-lived decay products of Radon, mainly Lead 210 and its progeny Bismuth 210. The major contributor from the Thorium series is

Radium 228 and its progeny Actinium 228. There are a host of Beta emitters generated as fission products; however, these are mostly low-energy Beta generators and cannot be detected with most proportional counting systems. The major Beta-emitting fission products examined by gross Beta method are Strontium and Cesium. The lower-energy Beta-emitters such as Carbon 14 and Tritium are analyzed by Liquid Scintillation Detection due to the much greater efficiency of this counting technique and the volatility of H^3 and C-14.

Low Background Proportional Counting - The detection of gross Alpha and Beta emitters utilizes the EPA 900 Methodology. The instrument is a gas flow proportional counting system in which a mixed gas (normally 90% argon and 10% methane) is flowed through a thin-windowed counting chamber that has a charged potential of approximately 1500 volts. The Alpha and/or Beta particle penetrates the window and discharges its energy in the gas. There is a pulse generated and, depending on the size of the electrical pulse, the signal is placed in either a Beta or an Alpha window and counted as an event. The method as stated is a gross measurement of the amount of Alpha and Beta activity in a sample. The measurement is not preceded by any form of chemical separation of nuclide so that there is no means of identifying or characterizing the nuclide contributing to the overall activity.

4. Responsibilities

4.1 The laboratory technician or analyst shall:

- o Perform the method in accordance with this SOP No. CA-GLR-R310, and Method 900, or as directed by the laboratory section supervisor,
- o Resolve nonconformances in methods and data, first individually, then, if necessary, with the help of the laboratory section supervisor or other technical resource, and
- o Report unresolved nonconformances with a Nonconformance and Corrective Action Report form in accordance with SOP No. HC-RDC-G002.

4.2 The laboratory section supervisor shall:

- o Assist the laboratory technician or analyst in resolving nonconformances, and

o Review and approve the data, methodology, and final reports for all analyses, tests, and procedures which are performed in his or her laboratory section.

4.3 The QA/QC coordinator shall monitor adherence to this SOP and conformance to the QC criteria of the cited method.

4.4 The laboratory manager shall ensure that the necessary resources are available to accurately and successfully adhere to SOP No. CA-GLR-R310.

5. Interferences, Comments, and Helpful Hints

5.1 Interferences

5.1.1 Moisture absorbed by the sample after preparation can increase the self-absorption characteristics of the sample material and decrease counting efficiency. Steps need to be taken to ensure that there is no weight gain from the time the material is placed on the planchet to the time it is counted. The best approach is to either keep the samples in a desiccation environment prior to analysis or to hold them at 100° C until counting.

5.1.2 As noted earlier, total dissolved solids (TDS) in a sample influence the counting efficiencies of both Alpha and Beta particles. This becomes a major factor when dealing with samples containing large amounts of dissolved solids, therefore limiting the volume of sample utilized in the analysis. This should be considered when designing a sampling plan that will utilize gross Alpha and Beta as a screening procedure. If the materials to be screened are going to have significant matrix problems (such as high-solid content waters or mixed waste material) the screen will not be an adequate assessment tool and a more complete analyses should be performed. Non-uniformity of the sample can lead to erroneous results. All the material should not be consolidated at a point source on the planchet but should be dispersed over the entire area of the planchet.

5.1.3 Selection of the proper calibration procedure is important when proportional counting systems are utilized for the gross alpha and beta determination.

5.1.4 There are two major problems encountered with these type of counting systems.

5.1.4.1 Cross-Talk Determination

5.1.4.1.1 Cross-Talks(X-Talks) should be determined daily and maintained at a constant ratio. In the case of a single detector instrument the cross talk is a function of the cross contamination between the alpha and beta channels. This can be adjusted by changing the gain on the amplifier.

5.1.4.1.2 In cases where the proportional counting system has multiple windows cross-talk factors should be determined not only between the Alpha-Beta channels but also between the detectors. This type of system can potentially have significant counting error introduced if there is a high activity count in one detector and a low activity count in an adjacent detector. The best way to address this is to count high-activity samples individually. The counting time can be reduced thereby reducing the time the counter is out of function for counting low-level samples.

5.1.4.2 Counting Efficiency Determination

5.1.4.2.1 A problem arises when examining samples which contain a variety of isotopes. In an attempt to negate this problem, the type of standard utilized for calibration will depend on the type and origin of the sample. If the samples are thought to contain Uranium decay series the efficiency curves should be made utilizing Uranium. If the samples are thought to be fission products the calibration should be done utilizing Americium 241 as an Alpha and Cesium 137 as a Beta standard.

5.2 Comments

It should be emphasized that the method is a screen and should not be utilized as anything else. There is a tendency to overemphasize the data generated and make conclusions based on the screening results. The data produced by this method should be utilized to select representative samples for further characterization of the radionuclides present.

5.3 Helpful Hints

If the TDS content is known prior to analysis, it is much easier to determine the volume that can be utilized for each analysis. If the samples are high in acid content it is better to digest the sample and eliminate the acid prior to plancheting the material. This saves on time and planchets.

6. Sampling, Sample Preservation, and Holding Times

6.1 Sampling Procedure

The sampling procedure should conform to Chapter Three of EPA SW-846. All samples should be collected according to these guidelines. The samples are to be collected in plastic containers which have been cleaned according to EPA specifications. All sampling information should be included on a chain-of-custody (COC) record which should include all sampling dates and times, sampling requirements, temperature and atmospheric conditions, location, and the initials of individuals involved in the sampling and/or handling of the samples.

The samples should be collected in a manner which will provide the most representative sample. Drinking water samples should be collected from the free flowing source and should be large enough to provide adequate sample to achieve the detection limits required under the safe drinking water regulations. Note: 500 mL is required.

If the material, such as NORM scale, contains significant radioactivity (level 3 or higher, see CA-HPM-001 "Standard Operating Procedure for Radioactive Sample Control and Screening"), the sample size should not exceed 40 g in order to reduce exposure to personnel who handle the materials and to comply with DOT regulations.

6.2 Sample Preservation

Aqueous samples should be preserved at the time of sampling by acidification with dilute nitric acid to a pH of <2. If it is not possible to preserve samples in the field, the samples should be preserved at the laboratory within 5 days of sampling. The samples should then be allowed to set for 16 hours prior to analysis in order to dissolve any precipitate. Solid and soil samples are not preserved in the field or laboratory.

6.3 Holding Times

Samples can be stored up to six months if they are properly preserved.

7. Safety

7.1 General Safety Procedures

- o Be knowledgeable of the MSDS information for each chemical which is used in the procedure.
- o Comply with the instrument manufacturer's and chemical supplier's safety precautions.
- o Comply with all applicable safety regulations and safety SOPs.
- o Sample analysis functions shall be performed in the appropriate environment, such as canopies or fume hoods.
- o Gloves, protective clothing, face shields, and protective eyewear should be worn by all analysts and technicians while they are in the laboratory. The staff shall always remove gloves and other protective clothing prior to leaving the laboratory and dispose or store them properly.
- o All analysts and technicians shall wash all areas of their hands and arms which may have been exposed to contaminated materials prior to leaving the lab.

7.2 Sample Screening Procedure

Refer to SOP No. CA-HPM-001, "Standard Operating Procedure for Radioactive Sample Control and Screening."

8. Quality Control

There are four levels of quality control for the radiochemistry parameters. Each level has a specified frequency and acceptance criteria for the method blanks, sample duplicates, matrix spikes, laboratory control standards. In general, the typical reporting level that is used is Level 2. Level 1 requirements are designated for NORM clients only. Clients which require upper level QC must identify the level which will be needed to satisfy the requirements for a particular project at the time the project is accepted. Additional QC will be performed per client specifications as outlined in the project specific statement of work. Client requirements will supersede Core Laboratories' requirements. The QC requirements for each level are specified in the sections listed below.

	Level 4	Level 3	Level 2	Level 1
Blank	<Detection Limit	<Detection Limit	<Detection Limit	<Detection Limit
Duplicate	RER≤3	RER≤3	RER≤3	RER≤3
Spike Recovery	75 - 125%	70 - 125%	70 - 125%	60 - 130%
Standard Recovery	80 - 120%	70 - 125%	70 - 125%	70 - 125%

8.1 Method Blank

The method blank is a portion of ASTM Type II water which is treated as a sample throughout the test procedure. For all four QC levels, method blanks must be analyzed at a frequency of one per every 20 samples or a minimum of one per batch. The analyzed concentration of analyte in the method blank should be less than the detection limit.

8.2 Sample Duplicates

Sample duplicates should receive exactly the same treatment as the related samples throughout the procedure. For all four QC levels, sample duplicates must be analyzed at a frequency of one per every 20 samples or a minimum of one per matrix per batch. For all four QC levels (unless otherwise specified by the client), the acceptance criteria for the duplicate values is an RER ≤3.

8.3 Matrix Spikes

A separate sample aliquot shall be spiked with a known concentration of analyte and carried through the entire analytical procedure. The recommended spiking levels are two to five times the sample concentration. For all four QC levels, matrix spike samples must be analyzed at a frequency of one per every 20 samples or a minimum of one per matrix per batch. For Level 4, the acceptance criteria for the matrix spike % recovery is 75-125%. For Levels 2 and 3, the acceptance criteria for the matrix spike % recovery is 70-125%. For Level 1 (NORM clients only), the acceptance criteria for the matrix spike % recovery is 60-130%.

8.4 Laboratory Control Standard

A laboratory control standard (LCS) is a standard which is tested as if it were a sample. The LCS activity should be similar to the activity of the samples. For all four QC levels, laboratory control standards must be analyzed at a frequency of one per every 20 samples or a minimum of one per batch. For Level 4, the acceptance criteria for the LCS % recovery is 80-120%. For Levels 1, 2 and 3, the acceptance criteria for the LCS % recovery is 70-125%.

8.5 Corrective Action

If the QC limits are exceeded, notify the laboratory supervisor or QA/QC coordinator, initiate an Out of Control Event Report or Nonconformance and Corrective Action Report, and take corrective action as advised. Failure to meet client QC requirements will result in the reanalysis of all samples associated with the out of control QC. Case narratives are to be provided to the client which describe the out of control event and corrective action that was taken.

9. Apparatus and Materials

9.1 Required Information for Apparatus, Instruments, and Equipment: Any Gas Proportional Counting System can be utilized to assess gross Alpha-Beta if the proper calibration is done prior to utilization.

9.1.1 Berthold LB770 10-channel Gas Flow Proportional Counter.

9.1.2 Electronic Analytical Balance

9.1.3 Top Loading Electronic Balance

9.2 Laboratory Materials

9.2.1 Stainless Steel Planchet-2" x 1/8" with concentric rings (Specify Coy Laboratory Products #SS 75750)

9.2.2 Muffle Furnace

9.2.3 Evaporation Beakers 100 & 250 ml.

9.2.4 Disposable Pasteur Pipets(2 ml)

9.2.5 Planchet Forceps

9.2.6 Assortment of Class A Volumetric Ware (50 ml to 2000 ml)

9.2.7 Assortment of Micro and Macro Pipets

9.2.8 Membrane Filters, 45 um, 47 mm Gelman

9.2.9 Vacuum Filtration System

9.2.10 Equipment Parts and Repairs: All repairs should utilize parts specified by the manufacturer of the instrument.

10. Reagents and Standards

10.1 Reagents

Refer to SOP NO. CA-GLR-R120, "Standard Operating Procedure for Reagent Water Examination for Analysis of Environmental Samples."

10.2 Standards

Refer to SOP No. CA-GLR-R110, "Standard Operating Procedure Radioactive Standards and Preparation."

11. Analytical Procedure

11.1 Instrument Calibration and Operation

Refer to SOP No. CA-GLR-R300, "Standard Operating Procedure for LB-770 Operation."

11.2 Sample Preparation

Refer to SOP No. CA-GLR-R160, "Standard Operating Procedure for Preparation of Environmental Samples for Radiochemical Determinations."

11.3 Sample Analysis

Obtain sample schedule from supervisor responsible for scheduling protocol and retrieve samples from storage containment area. Note: Document time, date, and volume of samples on internal COC form upon removal from controlled storage area.

11.3.1 Mix the sample thoroughly.

11.3.2 Check that sample was not preserved with hydrochloric acid. If sample was preserved with HCl, ash sample aliquot in a beaker with HNO_3 to remove the chlorides prior to trying to planchet or the chloride will eat the SS planchet and change weight. Preweigh a planchet and add 5 ml of sample. Heat the sample at moderate heat on a hot plate to evaporate the aqueous material. Cool and weigh the planchet. Determine the weight difference and the amount of material in the 5 ml sample. Determine the volume that can be utilized to provide 12 ~~100~~ mg of material per planchet. Do not use more than 200 ml of sample. mls to add = 1/(2 * weight difference) - 5.

11.3.3 For air filters, soil, tissue and biomaterial, see Appendix 16.2 and 16.3.

11.3.4 Label beaker with laboratory identification number with non-removable ink marker and confirm that the sample has same ID number.

11.3.5 Measure by volume an aliquot of sample containing 100 mg or less of TDS residue into a beaker for ALPHA or if Beta counting only is to be done, 200 mg of TDS residue. See 11.3.1 for weight determination method.

11.3.6 Record the volume utilized, the sample ID number, the time and date, initials of analyst and signature of the entry to verify the accuracy of the entry.

11.3.7 Return the unused sample material to the controlled storage area, recording the date, time, sample ID number, volume remaining the initial the entry to verify the accuracy of the entry.

11.3.8 Add 1 ml of concentrated nitric acid. Place the beakers on a hot plate and evaporate until only a moist residue remains. Do not allow the samples to boil.

11.3.9 Add 5 ml of DI water to each sample and transfer the solution to a clean and tared planchet on a hot plate. The planchet should have the sample ID number written in unwashable ink on the back. Confirm that the planchet has the proper ID number on it.

11.3.10 Rinse the beaker with a few drops of 1 M nitric acid and transfer rinse to the planchet as evaporation continues.

11.3.11 Be sure planchet residue is as even as possible. Use small drops of water to even the distribution. Keep the solid residue away from the rim of the planchet.

11.3.12 Oven dry the planchet for 2 hours. If it is determined that the samples are hygroscopic (weight change), then planchet should be fired over a meeker burner until red hot for 1-2 minutes each to convert nitrates to oxides.

Note: If the Polonium 210 or Cesium 137 activity is appreciable, firing the planchet will cause volatilization of Polonium and Cesium, causing low results. Only fire when necessary. See Supervisor or designated alternate.

11.3.13 Cool the planchet, weigh on an analytical balance, and store in a desiccator until samples are to be read.

11.3.14 As a general rule, allow 24 hours before reading the planchet in order to eliminate radon decay products that could cause erroneously high data.

11.3.15 Preparation of QC samples.

11.3.15.1 Standard materials are prepared according to method CA-GLR-R110 for use as a spike material. Normally a solution of a known Alpha or Beta concentration is

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Procedure/Document Change Form

Document Number: CA-GLR-R310

Document Title: Standard Operating Procedure for Gross Alpha/Beta Analysis of Environmental Samples by Gas Flow Proportional Counting

Document Revision Number: 0 Controlled Copy No: C1

Document Section(s) Affected by Change: 12.3.1

Reason for Document Change in the equation definations, the V variable is defined twice with two different units

Change Effective From : 7/3/96 (Date)

Change: V = volume in liters (stays)
V = volume in ml - delete

Samples or Projects Affected: all gross alpha/Betas

Submitted By: Debra Shillabaum Date: 7/3/96

Approval:

[signature] 7-03-96 Core Laboratories Technical Specialist
Signature Date

[signature] 7/3/96 Core Laboratories QC Coordinator
Signature Date

Form RDC-13, Revision 0, Effective Date 1/3/95

used adding a known activity to an aliquot of samples. The spike is run with that series of samples.

11.3.15.2 Water blanks (method blanks) are prepared by evaporation of 100 ml of DI water and plancheting. Instrument blanks are simply unused blank planchets. Again, the blanks are counted in the same sample run as the samples of interest.

11.3.15.3 Laboratory Duplicate Samples are run with each set of 20 gross alpha beta analysis. Samples are poured up with identical volumes and labeled as the sample and the sample duplicate.

12. Data Generation and Calculations

12.1 The data to be generated and recorded are: measured activity values, dilution factors, and measured sample concentrations and QC parameters.

12.2 Calibration Calculations

12.2.1 Alpha Calibration Curve: Efficiency calculation for determining weight effects on Alpha absorptions. Calculate the efficiency (E) of the planchet by calculating:

A = PCI x 2.22 (total dpm/planchet)
B = observed counts/min. (net counts, background corrected)
E = B/A

12.2.2 Plot efficiency vs weight to obtain curve to be used in activity calculations.

12.2.3 Beta Calibration Curve: Follow the procedure found in 12.2.1.1 but use data from the beta source. Extend the graph to 200 mg.

12.3 Activity Calculations

12.3.1 Alpha activities

General Equation:

$$Alpha(pCi/L) = \frac{\left(\frac{A}{min} - BC\right)}{2.22*E*V}$$

A = gross counts of alpha
min = minutes of counts
BC = background counts/minute
V = volume in liters
E = Efficiency using the graph of mg/ efficiency for net count rate
V = Volume in ml

12.3.2 Beta Activity

General Equation:

$$Beta(pCi/l) = \frac{\left(\frac{b}{min} - BC\right)}{2.22*E*V}$$

B = gross counts of Beta (corrected for Alpha cross talk (equation 12.2.2.1)

All other variables and constants are as per equation 13.3.1.

12.3.3 Correction for alpha interferences in Beta channel

(B/min - BC) - X * C

X = cpm from alpha channel
C = C can be calculated empirically by the following equation for a single observation:
C = B/x
x = activity in the a channel
B = activity in the B channel

Note: C is essentially a cross talk value for a pure alpha emitter (i.e., Americium 241[1]).

12.4 Equations for the 95% confidence limits or error factor.

$$= \frac{1.96\sqrt{smp\ cpm/ct\ +\ bg\ cpm/ct}}{2.22*E*V}$$

12.5 Equation for the 99% confidence limits or Lower Limit of Detection.

$$= \frac{4.66\sqrt{bg\ cpm/ct}}{2.22*E*V}$$

12.6 Quality Control Calculations

12.6.1 Percent Recovery of Standards

$$\text{Percent Recovery} = \frac{\text{Analyzed Value x 100\%}}{\text{Known Value}}$$

12.6.2 Percent Recovery of Matrix Spike

$$\text{Percent Recovery} = \frac{\text{SSC - SC x 100\%}}{\text{SA}}$$

where:

SSC = Spiked Sample Concentration
SC = Sample concentration (previously determined)
SA = Spike Added

12.6.3 Relative Error Ratio (RER)

$$RER = \frac{|C_1 - C_2|}{[(error_1)^2 + (error_2)^2]^{1/2}}$$

C_1 & C_2 = Measured Concentrations for the sample and duplicate

Error $_{1\ \&\ 2}$ = respective errors

13. Data Reporting

13.1 Raw Data Reporting

13.1.1 All raw data must be entered as it is acquired in the designated bound logbook. This includes test method, analyte being determined, measurement parameters, dilution factors, analyst's initials, and date of test. All information and data which is pertinent to the test should be recorded to facilitate data validation. Any unusual conditions or information on the appearance of the samples, or any other factors which may influence the results should also be noted.

13.1.2 Instrument printouts and copies of spreadsheets or graphs should be dated, initialed by the analyst, and filed chronologically in a designated area.

13.2 LIMS Data Entry Methodology

If you have questions concerning LIMS data entry requirements, refer to the LIMS User Manual or contact your laboratory section supervisor or QA/QC coordinator.

13.2.1 Method Reference

The analyst must verify that the proper method reference is entered for each sample analyzed. If the method which was utilized varies from the assigned LIMS default method, delete the incorrect test code for that sample and then enter the correct test code or change the designated method in the existing test code. A corrected log-in sheet will be generated and placed in the master (job) folder.

13.2.2 Method Detection Limits

Report the detection limit for the sample based on the matrix. Client specific detection limits should be reported when requested by the client.

13.2.3 Units

Report the data using the appropriate units based on the sample matrix. Use pCi/L, µg/L, or mg/L for aqueous samples and pCi/g, µg/g, or mg/g for soil and solid samples.

13.2.4 Date Analyzed

The analyst must enter the date of analysis for each batch of samples processed. Enter the date that the procedure was initiated.

13.2.5 Significant Figures

Record LIMS data to the proper number of significant figures. The number of significant figures reported must correlate with the method detection limit. Generally, no more than 3 significant figures should be used for results greater than 10, and no more than 2 significant figures for results less than 10.

Statistical rounding must be employed in determining the final reported concentration. Refer to Standard Methods, 18th Edition, for further information on statistical rounding.

13.2.6 Quality Control Data

Enter quality control data for all method blanks, sample duplicates, matrix spikes, and LCSs which were analyzed with the sample batch.

13.3 Case Narrative

When required, a case narrative will be prepared and included with the report. Each report requiring a case narrative should include the data, validation information, copies of relevant fax or phone logs, and any documentation on corrective action that was taken.

13.4 Job Files

Collect all data sheets and printouts; place copies in the job file. The job file should then be transferred to the QA/QC coordinator for validation and report generation. All COC information, log-in information, log sheets, spectral print outs, and report sheets that are to be included in the data validation package should be placed in the client file. Include all standard information, calibration information, analytical data, calculated results, and a case narrative if required.

14. References

14.1 Prescribed Procedures for Measurement of Radioactivity in Drinking Water.

US EPA-600/4-80-032
EMSL
Cincinnati, OH 45268
Method 900

14.2 Standard Methods for Examination of Water and Wastewater

14th ed.
American Public Health Association
1015 Eighteenth St.
Washington, DC 20036
pg. 648

14.3 1980 Annual Book of ASTM Standards, Part 31, Water

American Society of Testing and Materials
1916 Race St.
Philadelphia, PA 19103
1980 D 3085-75, D 1943-66, D 1980-66

14.4 NRC Regulatory Guide 4.14, Rev. 1

US Nuclear Regulatory Commission
Washington, DC 20555
April 1980

15. Method Performance

N/A

16. Associated Documents and Forms

Appendix

16.1 Development of Weight Curve

Calibration for Counter Efficiency vs Planchet Solids: This is performed in order to determine the effect of solid interference on instrument efficiency and to develop a calibration curve to be utilized in calculation of the Alpha and Beta activity.

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Procedure/Document Change Form

Document Number: CA-GLR-R310

Document Title: Standard Operating Procedure for Gross Alpha/Beta Analysis of Environmental Samples by Gas Flow Proportional Counting

Document Revision Number: 0 Controlled Copy No: 01

Document Section(s) Affected by Change: 16.1.1.3

Reason for Document Change: audit response

Change Effective From: 7/2/96 (Date)

Change: Once the samples have been mounted on a tared planchet weigh ~~and~~ then count each sample for 20 minutes or 10,000 counts, whichever is greater as per section 12.2.

Samples or Projects Affected: all gross α/β samples

Submitted By: Debra [signature] Date: 7/2/96

Approval:

[signature] 7-02-96 Core Laboratories Technical Specialist

Signature Date

[signature] 7/3/96 Core Laboratories QC Coordinator

Signature Date

Form RDC-13, Revision 0, Effective Date 1/3/95

16.1.1 Alpha-Efficiency Vs Solids.

16.1.1.1 Pipet the following aliquot of an a standard and calibration solutions into the labeled 100 ml beakers.

Beaker #	Alpha Standard a Stand. (ml)	Solids Cal. Solution (ml)	Distilled Water
1	.5	0	25
2	.5	1	25
3	.5	2	25
4	.5	3	25
5	.5	4	25
6	.5	5	25
7	.5	6	25
8	.5	7	25
9	.5	8	25
10	.5	9	25
11	.5	10	25

16.1.1.2 Carry through the procedure starting with 5.3.

16.1.1.3 Once the samples have been mounted on tared planchet, weigh and count each sample for 20 minutes as per section 12.2.

16.1.1.4 Subtract the background from each sample to determine the efficiency for each sample (CMP/DPM std).

16.1.1.5 Determine the weight of solids in milligrams for each sample.

16.1.1.6 Graph solids vs efficiency. Observe the graph for excessive noise and redo curve if the data generated has large variations over the observed weight range.

16.1.1.7 It is recommended that at least two analysts prepare standards and include both sets of data in the graph and computer fit.

16.1.1.8 This information should be dated and retained in the procedure calibration file for permanent reference.

16.1.2 Beta-Efficiency vs Solids

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Core Laboratories
Procedure/Document Change Form

Document Number: CA-GLR-R310

Document Title: Standard Operating Procedure for Gross Alpha/Beta Analysis of Environmental Samples by Gas Flow Proportional Counting

Document Revision Number: 0 Controlled Copy No: 01

Document Section(s) Affected by Change: 16.1.2.2

Reason for Document Change: reference is the wrong section

Change Effective From: 7/3/96 (Date)

Change: Follow the same technique as is used in section 16.1.1.2 ~~and~~ 7/3/93 ~~after~~ through 16.1.1.8

Samples or Projects Affected: all gross alpha/Betas

Submitted By: Debra [signature] Date: 7/3/96

Approval:

[signature] 7-03-96 Core Laboratories Technical Specialist

Signature Date

[signature] 7/3/96 Core Laboratories QC Coordinator

Signature Date

Form RDC-13, Revision 0, Effective Date 1/3/95

16.1.2.1 As is done for alpha efficiency, pipet the following solutions of calibration solution and B standard.

Beaker #	Beta Standard b Stand. (ml)	Solids Cal. Solution (ml)	Distilled Water
1	.5	0	40
2	.5	1	40
3	.5	2	40
4	.5	3	40
5	.5	4	40
6	.5	5	40
7	.5	6	40
8	.5	7	40
9	.5	8	40
10	.5	9	40
11	.5	10	40
12	.5	12	40
13	.5	15	40
14	.5	18	40
15	.5	20	40

16.1.2.2 Follow the same technique as is used in section 11.2, except Beta count rather than Alpha count.

16.2 Evaluation of Suspended Matter in Aqueous Samples

16.2.1 Tare a flat planchet to the nearest mg on an analytical balance.

16.2.2 Secure .45 µm, 47 mm, Gelman GA-6 membrane filters to the vacuum filtration system and filter an aliquot which contains no more than 100 mg of solid material.

Note: Due to the heterogeneous nature of this type of sample, proper sampling is difficult. Therefore, before aliquoting, mix the sample vigorously, wait 3 minutes and then measure an aliquot from the suspended portion.

16.2.3 After the sample has passed through the membrane, wash the filter funnel 3 times with distilled water. Suck air through the filter to partially dry.

16.2.4 Place the filter back on the planchet and oven dry at 105° C.

16.2.5 Saturate with alcohol, ignite with a meeker burner and let the membrane burn.

16.2.6 Once the sample has burned out, direct the flame of the burner down onto the planchet to complete the ignition.

16.2.7 Then heat the planchet over the burner to a dull red glow.

16.2.8 Cool and weigh the planchet to the nearest mg on an analytical balance.

16.2.9 Store in a petri dish and allow 72 hours before counting.

Note: This technique will volatilize some of the Alpha and Beta emitting nuclide. If Polonium 210 or Cesium-137 is important in the sample, refer to <u>Standard Methods</u> 703 U.C., p. 651. Activities can be measured off of a flat membrane in some cases.

16.2.10 Read planchet in counting system.

16.3 <u>Determination of Activity on Sludge, Vegetation, Soil, etc.</u>

16.3.1 Refer to the preparation procedure for specific methodologies for sample decomposition.

16.3.2 Determine the total residue in the sample after ignition. Calculate the appropriate weight fraction to be used in calculating the final activities.

16.3.3 Carefully pulverize the residue to a fine powder by a mortar and pestle or some other efficient means.

16.3.4 Weigh not more than 100 mg onto a tared, ringed planchet and distribute the solids across the planchet as per a previous section by mixing with acetone.

16.3.5 Determine alpha and beta activities per gram of solid sample.

ANALYSIS OF GROSS ALPHA & GROSS BETA IN ENVIRONMENTAL SAMPLES

CA-GLR-02.0R4

GROSS ALPHA/BETA PREPARATION

_____1.) Label planchet with job number and sample number.

_____2.) Heat planchet on high to remove any liquid.

_____3.) Cool and pre-weigh planchet.

_____4.) Add 5 ml of sample to appropriate planchet. (Mix sample completely)

_____5.) Heat on medium to evaporate liquid.

_____6.) When samples are dry, heat on high for 2 minutes to insure that all liquid has evaporated.

_____7.) Cool and weigh the planchet.

_____8.) Determine weight differential.

_____9.) Determine the volume needed to provide 100 mg of material using the following calculation: ml to add = 1/ (2 x weight difference) - 5

_____10.) Label 250 ml beaker for each sample.

_____11.) Measure volume into corresponding beakers. Do not use more than 200 ml of sample.

PREPARATION OF QC SAMPLES

a.) QC consists of:

1 method blanks	-	100 of DI each
1 beta spike	-	spike 1 sample with 10 mls of Cs
1 alpha spike	-	spike 1 sample with 5 mls of U
1 beta standard	-	spike 50 ml of DI with 10 ml of Cs
1 alpha standard	-	spike 50 ml of DI with 5 ml of U
1 alpha eff	-	spike 50 ml of DI with 5 ml of U

b.) The QC samples will be treated as regular samples.

_____12.) Add 1 ml concentrated HNO_3 to each sample.

_____13.) Evaporate beakers on a medium hot plate until 5 ml of sample remain.

_____14.) Transfer samples to corresponding planchets.

_____15.) Rinse beakers completely with 5 ml of 1N HNO_3.

_____16.) Evaporate planchets to dryness on medium heat.

_____17.) Oven dry planchets for 24 hours.

_____18.) Record final weights of planchets after cooling.

_____19.) Return to count room.

CORELAB

TITLE			
Standard Operating Procedure for Analysis of Gamma Emitting Radionuclides in Environmental Samples			
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R600	5	6/17/98	1 of 15

DOCUMENT CONTROL PAGE

Prepared By: ______________________ Date 6/17/98

Reviewed By: ______________________ Date 6-17-98
Technical Specialist

______________________ Date 6/17/98
QA/QC Coordinator

Approved By: ______________________ Date 6/17/98
Laboratory Manager

UNCONTROLLED DOCUMENT

Controlled Copy Number: ______________________

Revision No.	4	5				
Date	9/29/92	6/17/98				

1. Scope and Application

This standard operating procedure (SOP) provides guidance for the use of CA-GLR-R600 for analyzing gamma emitting radionuclides in drinking water and other miscellaneous solid environmental samples by EPA Method 901.1 using High Purity Germanium Detectors. The useful range of the method is applicable for detection of gamma photons with energies ranging from about 10 to 2000 KeV. Acceptable detection limits for water or aqueous material is 1 pCi/L of the isotope requested. The acceptable detection limits for solid materials is 5 pCi/g of the material.

This SOP applies to the environmental testing laboratories in the Environmental Services Division of Core Laboratories, Inc.

2. Summary

A representative aliquot of sample is placed in a 0.5 liter Marinelli beaker for aqueous materials or a 60 ml sealed metal/plastic can for soil or solid materials. The samples are then placed on the HPGe detector (N-Type or P-Type) in a lead shield and counted via appropriate software for 10 to 2000 minutes depending on activity and/or sensitivity requirements. The data is collected and transformed into a format that can be analyzed by gamma assessment software purchased from EG&G Ortec. The system is calibrated for both energy and peak efficiency for each matrix, sample geometry configuration and detector. The program scans for activity across the spectrum, identifies the amounts of activity and type of activity present in the sample. A report is printed identifying the peaks utilized, the shape of and height of the peaks, the activity of each isotope identified and the error at 1 or 2 sigma. The program also quantifies the combined activity of all gamma emitting radionuclides (Gross Gamma Activity) present in that sample.

3. Definitions

Gross Gamma Activity - Activity of all the gamma emitting radionuclides in the sample being analyzed. The major gamma emitters, usually examined with this method are natural uranium decay series, natural thorium decay series, and byproduct materials (e.g., fission products). The major gamma emitting components of the uranium and thorium decay series are Thorium 232, Radium 226, Radon 222, Lead 215, and Bismuth 214. The main use of gamma analysis has been to identify and quantify fission products that represent the major release and contamination from nuclear processes. The major isotopes that historically have been characterized by gamma are

Cesium 134, Cesium 137, Cobalt 57, Cobalt 60, Iodine 131, and a variety of rare components that are difficult to isolate and count by other methods.

4. Responsibilities

4.1 The laboratory technician or analyst shall:

- Perform the method in accordance with this SOP No. CA-GLR-R600 or as directed by the laboratory section supervisor,
- Resolve nonconformances in methods and data, first individually, then, if necessary, with the help of the laboratory section supervisor or other technical resource, and
- Report unresolved nonconformances with a Nonconformance and Corrective Action Report form in accordance with SOP No. HC-RDC-G002.

4.2 The laboratory section supervisor shall:

- Assist the laboratory technician or analyst in resolving nonconformances, and
- Review and approve the data, methodology, and final reports for all analyses, tests, and procedures which are performed in his or her laboratory section.

4.3 The QA/QC coordinator shall monitor adherence to this SOP and conformance to the QC criteria of the cited method.

4.4 The laboratory manager shall ensure that the necessary resources are available to accurately and successfully adhere to SOP No. CA-GLR-R600.

5. Interferences, Comments, and Helpful Hints

5.1 Interferences

5.1.1 The main interferences in gamma counting are encountered when utilizing NaI(Tl) detectors. These type of detectors are quite efficient but have very poor resolution. The net result is that individual isotopes cannot be identified accurately with this type of detector. This problem is eliminated by utilization of high purity germanium detectors.

5.1.2 The energy range is also an issue, even when high purity germanium detectors are utilized. P-Type HPGe detectors are very accurate for detection of gamma activities above 200 Kev photopeak energy. The P-Type detector has poor resolution below 150 KeV. In cases where it is important to have good resolution below 150 KeV a N-Type detector should be employed to identify and quantify these isotopes.

5.1.3 Calibration for each sample geometry configuration and matrix types is extremely important. The geometry can drastically alter detector efficiency and different matrices can also have pronounced effects of detection capabilities.

5.1.4 In the same concept as 5.1.3 the homogeneity of the sample is extremely important. The sample must be homogenous to allow for comparison with the calibration standard. If the sample is comprised of several matrix types, the sample should be subjected to some preparation that will provide a more homogenous (representative) sample. This could be as simple as separating oil from water and counting each fraction separately. Non-homogenous samples may precipitate out or plate out on the sample container during counting changing the geometry of the counting system and altering the accuracy of the data produced.

5.1.5 Since the system is non-destructive and large amounts of material are utilized during counting, there is always the potential for contamination of the counting area and/or the detection system being utilized. It is extremely important to have all the technical staff aware of proper handling protocols. This is important for health and safety as well as for maintaining quality data. Background of the counting area and of the detection equipment should be monitored continuously for both exposure levels and for removable contamination in the form of dust and dirt.

5.2 Comments

Gamma Spectroscopy utilizing High Purity Germanium (HPGe) detectors combined with the very powerful analytical software available today provides a very effective analytical mechanism if utilized properly.

5.3 Helpful Hints

Screening results taken at the time of receipt should be utilized to identify higher activity samples prior to analysis. This is important for safety of all personnel as well as being useful in minimizing contamination in the analytical preparation areas and the counting areas.

6. Sampling, Sample Preservation, and Holding Times

6.1 Sampling Procedure

The sampling procedure should conform to Chapter Three of EPA SW-846. All samples should be collected according to these guidelines. The samples are to be collected in plastic or glass containers which have been cleaned according to EPA specifications. All sampling information should be included on a chain-of-custody (COC) record which should include all sampling dates and times, sampling requirements, temperature and atmospheric conditions, location, and the initials of individuals involved in the sampling and/or handling of the samples.

The samples should be collected in a manner which will provide the most representative sample. Drinking water samples should be collected from the free flowing source and should be large enough to provide adequate sample to achieve the detection limits required under the safe drinking water regulations. Note: 500 mL is required.

If the material, such as NORM scale, contains significant radioactivity (level 3 or higher, see CA-HPM-001,"Standard Operating Procedure for Radioactive Sample Control and Screening"), the sample size should not exceed 40 g in order to reduce exposure to personnel who handle the materials and to comply with DOT regulations.

6.2 Sample Preservation

Aqueous samples should be preserved at the time of sampling by acidification with dilute nitric acid to a pH of <2. If it is not possible to preserve samples in the field, the samples should be preserved at the laboratory within 5 days of sampling. The samples should then be allowed to set for 16 hours prior to analysis in order to solubilize any activity that may have been plated out onto the container. Solid and soil samples are not preserved in the field or laboratory. **NOTE:** Samples that require I129 analysis shall not be preserved but will be kept at 4° C until analyzed.

6.3 Holding Times

Samples, if properly preserved, can be stored for up to five half-lives or six months, whichever occurs first. There may be components in the samples that precipitate or plate out during this time period that could cause an introduction of error into the measurements. These should be noted during the analysis of samples that have been held for extended periods prior to analysis. All analysis shall be decay corrected to the time of sampling during the reporting process.

If there are isotopes with short half lives, such as I131, the analysis should be performed immediately upon receipt and the result decay corrected to the date sampled. I129 should be analyzed immediately upon receipt to minimize degradation due to temperature effects. For short half-life samples received long past sampling, notify the client to resample. This is necessary because short half-life samples can quickly decay to levels below LLD. Generally samples should not be analyzed beyond four half lives from the sampling date to give valid data.

7. Safety

7.1 General Safety Procedures

- o Be knowledgeable of the MSDS information for each chemical which is used in the procedure.
- o Comply with the instrument manufacturer's and chemical supplier's safety precautions.
- o Comply with all applicable safety regulations and safety SOPs.
- o Sample analysis functions shall be performed in the appropriate environment, such as canopies or fume hoods.
- o Gloves, protective clothing, face shields, and protective eyewear should be worn by all analys s and technicians while they are in the laboratory. The staff shall always remove gloves and other protective clothing prior to leaving the laboratory and dispose or store them properly.
- o All analysts and technicians shall wash all areas of their hands and arms which may have been exposed to contaminated materials prior to leaving the lab.

7.2 Sample Screening Procedure

Refer to SOP No. CA-HPM-001, "Standard Operating Procedure for Radioactive Sample Control and Screening."

8. Quality Control

There are four levels of quality control for the radiochemistry parameters. Each level has a specified frequency and acceptance criteria for the method blanks, sample duplicates, matrix spikes, laboratory control standards, and chemical recovery. In general, the typical reporting level that is used is Level 2. Level 1 requirements are designated for NORM clients only. Clients which require upper level QC must identify the level which will be needed to satisfy the requirements for a particular project at the time the project is accepted. Additional QC will be performed per client specifications as outlined in the project specific statement of work. Client requirements will supersede Core Laboratories' requirements. The QC requirements for each level are specified in the sections listed below.

	Level 4	Level 3	Level 2	Level 1
Blank	<Background	<Background	<Background	<Background
Duplicate	RER≤3	RER≤3	RER≤3	RER≤3
Spike Recovery	N/A	N/A	N/A	N/A
Standard Recovery	75-125%	75 - 125%	75 - 125%	75 - 125%
Chemical Recovery	N/A	N/A	N/A	N/A

8.1 Method Blank

The method blank is an empty gamma container of the same geometry as the calibration (closed can for solids and marinelli beaker for liquids). Method blanks are performed per client request.

8.2 Sample Duplicates

Sample duplicates should receive exactly the same treatment as the related samples throughout the procedure. For all four QC levels, sample duplicates must be analyzed at a frequency of one per every 20 samples or a minimum of one per matrix per batch. For all four QC levels (unless otherwise specified by the client), the acceptance criteria for the duplicate values is an RER ≤3.

8.3 Matrix Spikes

Matrix spikes are not performed for gamma analyses.

8.4 Laboratory Control Standard

A laboratory control standard (LCS) is a standard which is tested as if it were a sample. For all four QC levels, laboratory control standards must be analyzed at a frequency of one per day and must be within ± 25% of the known value.

8.5 Corrective Action

If the QC limits are exceeded, notify the laboratory supervisor or QA/QC coordinator, initiate an Out of Control Event Report or Nonconformance and Corrective Action Report, and take corrective action as advised. Failure to meet client QC requirements will result in the reanalysis of all samples associated with the out of control QC. Case narratives are to be provided to the client which describe the out of control event and corrective action that was taken.

9. Apparatus and Materials

9.1 Instrument type

Core Laboratories presently operates two High Purity Germanium Detection systems (a N-Type 30% and a P-Type 18%). Each detector can be utilized to assess gross gamma activity although the type N detector should be utilized for measurement of samples requiring assessment of low energy gamma emitters such as I129.

9.1.1 GMX Series GAMMA-X HPGe (30.1% at 1.33 MeV) with 8K trump card buffer, Ortec 572 Amplifier, Ortec 459 Power Supply and Ortec Gamma shield.

9.1.2 GEM Series HPGe (18.2% at 1.33 MeV) with Ortec 92 X Spectrum Master and Ortec Gamma shield.

9.2 Laboratory Materials

9.2.1 Marinelli Beakers (500 ml Plastic)

9.2.2 Round Plastic Cans (60 ml)

9.2.3 Electronic Balances, Ainsworth MX 2400 - with 2400 grams capacity or equivalent

9.2.4 Analytical Balance, Metler or Sartorius

9.2.5 Assortment of Class A Volumetric Ware (50 ml to 2000 ml)

9.2.6 Equipment Part and Repairs: All parts and repairs should utilize parts specified by the manufacturer of the instrument

10. Reagents and Standards

10.1 Reagents

Refer to SOP No. CA-GLR-R120, "Standard Operating Procedure for Reagent Water Examination for Analysis of Environmental Samples."

10.2 Standards

Refer to SOP No. CA-GLR-R110, "Standard Operating Procedure Radioactive Standards and Preparation."

11. Analytical Procedure

11.1 Instrument Calibration and Operation

11.1.1 The gamma detectors are calibrated quarterly for energy and efficiency using traceable standards of known gamma activity for each sample configuration and matrix that will be analyzed. NABS or NIST-Traceable standards are available from NIST catalog, EPA Quality Assurance Branch, EMSL-LV, PO BOX 152027, Las Vegas, Nevada 98114, or commercial sources such as DuPont/NEN, Analytics, and Amersham.

11.1.2 Obtain NIST Traceable Standard with at least 9 energies and Am241 in matrices of interest (closed can with clean sand) (Marinelli Beaker).

11.1.3 Count standard for 1 hour or at least 10,000 net area counts per peak.

11.1.4 Calibrate the sample for energy, shape, and efficiency according to the users manual of the current version of gamma software. Use at least 9 energy values and Am241 energy.

11.2 Sample Preparation

Refer to SOP No. CA-GLR-R160, "Standard Operating Procedure for Preparation of Environmental Samples for Radiochemical Determinations."

11.2.1 Obtain a sample schedule from supervisor responsible for scheduling protocol and retrieve samples from storage containment area. NOTE: Document time, date, and volume of samples on internal COC form upon removal from controlled storage area.

11.2.2 The sample containers required are a 500 ml Marinelli Beaker for liquids or a 60 ml sealed can for solids.

11.2.3 Label the sample container with laboratory identification number with non-removable ink marker and confirm that the sample has same ID number.

11.2.4 Homogenize the sample thoroughly.

11.2.5 Measure an aliquot of sample containing at least 500 ml if a liquid and approximately 75 g if a solid.

11.2.6 Record the volume or mass utilized, the sample ID number, the time and date, analyst's initials.

11.2.7 Return the unused sample material to the controlled storage area, recording the date, time, sample ID number, and initial the entry to verify the accuracy of the entry.

11.2.8 Duplicate samples are run with each set of 20 gross gamma analyses. Samples are poured up with identical volumes and labeled as the sample and the sample duplicate.

11.3 Sample Analysis

11.3.1 Record the date, time and instrument number in counting log book. Record the ID numbers of the samples to be counted and initial the data entry book to verify the validity of the entry. Record the counting time start and the number of samples to be counted. Enter this information in the file areas in the current software program.

11.3.2 Start the counter according to the instructions for the MCA in the current software manual.

11.3.3 Count the samples for the time necessary to achieve client required detection limits.

11.3.4 Analyze the spectra file produced and print the analysis. Save the data file to the hard disk for reanalysis, if required, at a later date.

11.3.5 Performance/Verification of Instrument Calibration: To verify the daily instrument performance, count the standard for a minimum of 10 minutes and calculate the recoveries for the Am241, Co60 and Cs137 peaks. The recoveries must be within ± 25% of the known values. If one or more of the peaks is outside ± 25%, perform the 10 minute standard count again. If one or more of the peaks remains outside of the ± 25% recovery, discontinue gamma counting in that detector until corrective action can be performed.

11.3.6 Background/Blanks Measurement Parameters: Perform a weekly background for a minimum of 10 hours, and a method blank as required by client specifications.

12. Data Generation and Calculations

12.1 The data to be generated and recorded are: known concentrations, measured gamma activities produced by the current analysis program, dilution factors, and measured sample concentrations and QC parameters.

12.2 Instrument Efficiency Calculations

Instrument efficiency is the measure of the number of radioactive events (counts) seen by the instrument divided by the actual number of radioactive events (disintegrations) occurring. See the current EGG&G Ortec software manual for the specific expression for efficiency depending on the type of calibration performed (quadratic fit, polynomial fit etc.).

12.3 Activity Calculations

See the current EG&G Ortec software manual for the activity, error and MDA calculations.

12.4 Quality Control Calculations

12.4.1 Percent Recovery of Standards

$$\text{Percent Recovery} = \frac{\text{Analyzed Value}}{\text{Known Value}} \times 100\%$$

12.4.2 Percent Recovery of Matrix Spike

$$\text{Percent Recovery} = \frac{SSC - SC}{SA} \times 100\%$$

where:

SSC = Spiked Sample Concentration
SC = Sample concentration (previously determined)
SA = Spike Added

12.4.3 Relative Error Ratio (RER)

$$RER = \frac{|C_1 - C_2|}{[(error_1)^2 + (error_2)^2]^{1/2}}$$

C_1 & C_2 = Measured Concentrations for the sample and duplicate

Error $_{1\,\&\,2}$ = respective errors

13. Data Reporting

13.1 Raw Data Reporting

13.1.1 All raw data must be entered as it is acquired in the designated bound logbook. This includes test method, analyte being determined, measurement parameters, dilution factors, analyst's initials, and date of test. All information and data which is pertinent to the test should be recorded to facilitate data validation. Any unusual conditions or information on the appearance of the samples, or any other factors which may influence the results should also be noted.

13.1.2 Instrument printouts and copies of spreadsheets or graphs should be dated, initialed by the analyst, and filed chronologically in a designated area.

13.2 LABNET Data Entry Methodology

For questions concerning LABNET data entry requirements, refer to the LABNET User Manual or contact the laboratory section supervisor or QA/QC coordinator.

13.2.1 Method Reference

The analyst must verify that the proper method reference is entered for each sample analyzed. If the method which was utilized varies from the assigned LABNET default method, delete the incorrect test code for that sample and then enter the correct test code or change the designated method in the existing test code. A corrected log-in sheet will be generated and placed in the master (job) folder.

13.2.2 Method Detection Limits

Report the detection limit for the sample based on the matrix. Client specific detection limits should be reported when requested by the client.

13.2.3 Units

Report the data using the appropriate units based on the sample matrix. Use pCi/l, μg/l, or mg/l for aqueous samples and pCi/g, μg/g, or mg/g for soil and solid samples.

13.2.4 Date Analyzed

The analyst must enter the date of analysis for each batch of samples processed. Enter the date that the procedure was initiated.

13.2.5 Significant Figures

Record LABNET data to the proper number of significant figures. The number of significant figures reported must correlate with the method detection limit. Generally, no more than 3 significant figures should be used for results greater than 10, and no more than 2 significant figures for results less than 10.

Statistical rounding must be employed in determining the final reported concentration. Refer to Standard Methods, 18th Edition, for further information on statistical rounding.

13.2.6 Quality Control Data

Enter quality control data for all method blanks, sample duplicates, matrix spikes, and LCSs which were analyzed with the sample batch.

13.3 Case Narrative

When required, a case narrative will be prepared and included with the report. Each report requiring a case narrative should include the data, validation information, copies of relevant fax or phone logs, and any documentation on corrective action that was taken.

13.4 Job Files

Collect all data sheets and printouts; place copies in the job file. The job file should then be transferred to the QA/QC coordinator, or designee, for validation and report generation. All COC information, log-in information, log sheets, spectral print outs if applicable, and report sheets should be placed in the client file. For jobs requiring level 4 data validation packages, include all standard information, calibration information, and a case narrative.

14. References

EPA-600/4-80-032 Prescribed Procedures for Measurement of Radioactivity in Drinking water.

15. Method Performance

A data log should be kept on the efficiency of each detector system and the performance of each system graphed over time.

TITLE			
Determination of Tritium by Cryogenic distillation			
SOP NO. CA-GLR-24.0	REVISION NO. 0	EFFECTIVE DATE 12-29-94	PAGE 1 of 16

UNCONTROLLED DOCUMENT

DOCUMENT CONTROL PAGE

Reviewed by Ronni Mull

Date 6-03-98

PREPARED BY:	APPROVED BY:	
Randalynn Mull	Ronni Lynn Mull signature	12-29-94 date
	Don Ulzle signature	12-29-94 date
	signature	date

DISTRIBUTION

1. SCOPE AND APPLICATION

This procedure defines approved practices, special equipment, materials and operating instructions for safe, efficient and accurate analysis of Tritium from a variety of sample matrices which contain sufficient moisture to obtain a minimum of 1 ml liquid.

1.1 Specific Method Utilized

This procedure is derived from a variety of sources including but not limited to the USDOE "Environmental Measurements Laboratory Procedures manual" (HASL-300), the USEPA "Prescribed Procedures for Measurements of Radioactivity in Drinking Water" (900 Series) and the professional experience of many radiochemists.

1.2 Specific Analyte(s) Being Determined

This method is specific to the identification of Tritium H^3.

1.3 Required Reporting Limits

1.3.1 Error Determination

NRC Regulatory Guide 4.14 requires that the magnitude of the random error of the analysis to the 95% uncertainty level should be reported and that systematic error should be reported if considered to be significant. The error is calculated in the following manner: Equations for the 95% confidence limits or error factor.

$$= \frac{1.96 \text{ X sq.rt}(((SC/min)/min)+((BC/min)/min))}{2.22 \text{ X E X V}}$$

See the specific calculation procedure for details.

1.4 Acceptable Range of Results

The acceptable reporting requirement is 10 pCi/l in water and 10 pCi/g in solid. If the activity level is 10 X the required detection limit the detection limit requirement is no longer valid.

The detection limits achievable using this procedure are affected by many analytical parameters including the size of the sample analyzed, chemical recovery and the instrument background. The effectiveness of the separation and color quench can interfere with the analysis and can affect the results and uncertainty.

2.0 SUMMARY OF METHOD

A weighed undried portion of the sample is distilled under vacuum and distillate collected in a cryogenic trap to separate the water in the sample form its non-volatile components. If required, the water collected is decolorized with 30% H_2O_2. Any excess H_2O_2 is destroyed with manganese dioxide, which is then removed by filtration. This method is applicable to water and water contained in matrices which have not been dried. Examples include fresh fruits, vegetation, silica gel (used in air monitoring), and soils. This method detects tritium present as free tritiated water and other volatile tritiated organics. The activity concentration is determined by liquid scintillation counting.

3.0 DEFINITIONS

3.1 Liquid Scintillation: The process by which alpha, beta or gamma radionuclides are measured by the interaction of the emitted radiation and fluors contained in a cocktail that the sample is dissolved in. The radiation interacts with the fluor causing a photon of light to be produced. This photon of light is detected by the counter and analyzed. The instrument measures the intensity of the light pulse to determine the energy of the radiation emission and counts the number of pulses to ascertain quantity.

3.2 Liquids scintillator: The compound that the sample is mixed in to effect the counting process. The liquid scintillator may contain toluene or naphthalene as a solvent and PPO (2,5-diphenyloxazole) and POPOP (1,4-bis(5-phenyloxazolyl-2-yl)benzene) as the fluor.

3.3 Throughout this procedure, approximate weights and measures will be designated by the use of whole numbers when referring to weights exceeding one (1) gram or volumes in excess of one (1) milliliter. Measurements of weights and volumes so designated can be made with top loading balances, graduated cylinders, etc. For approximate measures below one gram or one milliliter, the word "approximately" must be used prior to the described weight or volume.

3.4 Through this procedure, exact or critical weights and volumes will be designated by the use of one or more decimal places. Measurements of weights and volumes so designated should be made with accurate analytical instruments such as analytical balances, calibrated pipettes, etc.

4.0 RESPONSIBILITIES

4.1 Laboratory Technician

The laboratory technician performing this analysis is responsible for performing the method according to the protocols outlined in the method described here. The technician must maintain all records and identify any problems that were encountered that could cause erroneous data to be generated. The lab analyst is also responsible for maintaining documentation that the instrumentation was performing according to specifications during the time the measurements were taken and that the calibrations records are accurate and valid. In cases where the detection limits are not achieved or the QC values are not acceptable the technician should create a corrective action file and take the appropriate action if there is need for recalibration or reanalysis. If the corrective action requires attention for supervisory or management other appropriate staff should be informed by filing a corrective action form.

4.2 Laboratory Supervisor

The laboratory supervisor is responsible for overall operation of the laboratory ensuring that the laboratory is adequately staffed, trained, and equipped to handle the work load. Additionally, the laboratory supervisor is responsible for developing new methodologies and reviewiÿo laboratory reports.

5.0 INTERFERENCES, COMMENTS, AND HELPFUL HINTS

5.1 Interferences

5.1.1 Organic chelating agents and silicious materials, if present in the sample, can interfere with the determination. Therefore, such samples must receive specific treatment to eliminate any such interferences prior to analysis.

5.1.2 The effectiveness of the separation and any color quench can interfere with the analysis and can affect the results and uncertainty.

5.2 Comments: none

5.3 Helpful Hints and Precautions: Liquid Nitrogen is Corrosive HANDLE WITH CARE.

6.0 SAMPLING METHODOLOGIES:

6.1 Sampling Methodologies:

The protocol for sampling should follow those outlined in SW846. All samples should be collected according to these guidelines. All sampling information should be included on a proper Chain-of-Custody which should include all sampling dates and times, sampling requirements and initials of individuals involved in the sampling and/or handling the samples.

6.1.1 Sampling conditions:

Sampling conditions including the temperature and atmospheric conditions should be recorded on COC.

6.1.2 Sampling Locations:

The sampling location should be recorded on the COC and the sampling containers in a manner that will be recognizable and can be reproduced if required at a later date.

6.1.3 Container Specifications:

Amber glass 100 ml bottle with air tight lid is recommended for liquid. Any non permeable air tight container is acceptable.

6.1.4 Special Sampling Procedures:

The samples should be collected in a manner that will provide the most representative sample. In the case of a drinking water sample the sample should be collected from the free flowing source and should be large enough to provide adequate sample to achieve the detection limits required for SDW> (2 liters)

If the materials contain significant activity such as NORM scale the sample size should be reduced to a maximum of 40 g to reduce exposure to personnel handling the materials. Also, this will help to make shipping the samples in compliance with DOT shipping regulations simpler. **NOTE: Samples that are high in activity should be minimized in volume in order to**

reduce personnel radiation exposure during shipment and handling.

6.2 Sample Preservation:

Samples should not be preserved.

6.3 Holding Times

Generally the sample can be stored up to six months, however due to the volatility of tritium it is recommended to be ran as soon as possible. See section 6.2 for sample preservation information.

7.0 SAFETY AND HEALTH CONSIDERATIONS:

All samples received at the laboratory shall be screened for gamma exposure levels and for removable contamination upon receipt. Any materials that exceed DOT regulations and/or have activity greater than allowable by our facility license will be returned to the sender unopened. If the screening at receipt, by use of a gamma survey meter, indicates that there are significant amounts of gamma emitting materials in a sample, the samples shall be identified and labeled as radioactive. These samples along with all waste streams generated will be tracked by the radiation safety team as they are processed through the analytical process. All staff will be advised as to the hazardous nature of these materials and instructed as to the proper method of handling the material as they are brought through the facility.

In the case of drinking water samples the amount of activity present does not represent any exposure risk. The sample is basically drinking water. In cases of environmental samples or mixed waste samples there is always the potential for hazardous components (ie. PCB or Dioxin) to be present along with harmful radioactive components such as Plutonium. These samples should be handled as if they are hazardous until proven otherwise. Gloves, protective clothing, face shields and eyeware should be worn at all times in the laboratory. Sample analysis functions shall be carried out in the appropriate environment(e.g., fume hoods). The staff shall always remove disposable gloves or other protective clothing prior to leaving the laboratory area and dispose or store in proper locations. Staff shall wash all areas of hands and arms that may have been exposed to contaminated materials. Generally, the best approach to laboratory safety in a low level activity area is practicing good personal hygiene.

8.0 QUALITY CONTROL REQUIREMENTS

8.1 Type of QC Checks

The QC check program should include analysis of NIST Traceable Standards, background blank, reagent blanks, instrument blanks, sample duplicates, spikes, matrix spike duplicates and blind samples. The samples in the program should be representative of the type of materials to be analyzed.

8.2 Frequency

An analytical group for H^3 analysis should consist of 1 to 20 samples plus calibration samples. A minimum of one duplicate, one matrix spike, one method spike and one method blank should be performed with each analytical series. The calibration information for the instrumentation should be included in the job file for each analytical set.

8.3 Evaluation Procedure

The initial evaluation of the data should be done by the bench chemist. If the values do not fall within the acceptance criteria listed below the analytical set should be reviewed and corrective action taken. The quality assurance information, including corrective actions, should be reviewed and corrective action taken. The quality assurance information, including corrective actions, should be included with each report and should be reviewed and verified by the Facility Quality Assurance Officer.

8.4 Acceptance/Rejection Criteria

The following Quality Control Acceptance Criteria will be utilized as the minimum standard limits for acceptance.

Method Blank ....: $\leq$ Detection Limit
Blank Spike ....: 70 - 125 %
Duplicates ....: RER $\leq$ 3
Matrix Spike(s).....: 70 - 125 %

Method precision and Accuracy are tracked and documented on a continuing basis and Upper and Lower Warning Limits and Control Limits are maintained for use in the lab as a mean of examining trends and as a mechanism to identify non-compliances. This is done by evaluating the last 25 sets of knowns and duplicates for accuracy and precision. These limits should be updated as each net set of 25 values becomes available.

8.4.1 Corrective Action

In cases where the values fall outside the acceptance range the data should be reviewed by the laboratory supervisor, or designated alternate. If there are valid reasons, such as high solid content or matrix problems, the data can be released with qualifiers. If there is no valid reason for the non conformance that analytical group should be re-analyzed. These issues should be tracked by filing a corrective action form and noted in the case narrative.

9.0 APPARATUS AND MATERIALS

9.1 Required Information for Apparatus, Instruments, and Equipment

9.1.1 Liquid Scintillation Counter: Packard Instrument 2260 XL low background liquid scintillation counting system, or equivalent.

9.1.2 Electronic Analytical Balance capable of 4 decimal places. (0.0000 g)

9.1.3 Top Loading Electronic Balance capable of 100 g and 1 decimal place. (100.0 g)

9.1.4 Heating mantles

9.1.5 Vacuum pump

9.2 Laboratory Materials

9.2.1 Round bottom flask

9.2.2 Tubing quick connects

9.2.3 Adapter, right angle

9.2.4 Vacuum trap, separable, VWR 55096-100 or equivalent

9.2.5 Dewar flask, ~500 ml

9.2.6 Tygon tubing, 1/4" I.D. or equivalent

9.2.7 Support hardware

9.2.8 Optional Benzene synthesizer 6-position heater with associated glassware.

9.2.9 Glass wool

9.2.10 Whatman #42 filter paper and filter funnels

9.2.11 Liquid Scintillation Vial

10 REAGENTS AND STANDARDS PREPARATION

10.1 Required Information on Reagents

10.1.1 Opening of Reagents: All reagents require an open date to be placed on the outside of the bottle upon opening.

10.1.2 Shelf Life: When labeling in house dilutions list the expiration date, the analyst who prepared the solution and date prepared on the outside of the container. Also properly label the container with the reagent name, strength, and hazardous material information. All secondary source bottles (such as squeeze bottles or dropper bottles) must maintain the hazard information and chemical identification with the strength, but may be listed as "from stock" instead of analyst, date ect...

10.1.3 Traceability: All radioactive standard must NIST traceable, and labeled with the preparers name, date of preparation, expiration date, isotope of interest, concentration, and unique identification number.

10.1.4 All reagents must be of purity such that the measured radioactivity of blank samples does not exceed 1 cpm.

10.1.5 Reagent (DI) Water shall be specified to be less than 2 micro-ohms and free from radio nuclides.

10.2 Materials List

All reagents used in this procedure shall be of ACS reagent grade unless other wise specified. All reagents, standards and carriers shall be labeled and documented per CA-SRP-001, "Preparation of Radiochemical Standards" and CA-SRP-002, "Preparation of Chemical Standards".

10.2.1 Reagents

10.2.1.1 "DEAD" water, water containing little or no tritium.

10.2.1.2 Liquid Nitrogen

10.2.1.3 30% Hydrogen Peroxide

10.2.1.4 Manganese dioxide

10.2.1.8 Liquid Scintillation Cocktail

11 ANALYTICAL PROCEDURE

11.1 Instrument Calibration and Operation

See Use and Calibration of the LSC.

11.2 Sample Preparation

11.2.1 Place an appropriate amount of the sample into the flask. Typical sample wights are; fresh fruit and wet vegetation, about 20-30 g; dry (not dried) vegetation and wet soil, about 50-70 g; dry (not dried) soil about 100-150 g; silica gel about 100-125 g each (most silica gel tubes contain around 350 g of silica. Check client requirements on fractionalization of the silica into 2-4 sections bottom to top). It is desirable to obtain at least 10 ml of water from the sample but not obtain so much as to plug the trap by freezing.

11.2.2 Place aliquot into a round bottom flask and weight immediately.

11.2.3 Cover flask with parafilm or other sufficient material so as not to loose any moisture.

11.2.4 Record the net weight of the sample on the proper form by subtracting the tare weight of the flask from the gross weight of the flask and sample.

11.2.5 Repeat the preparation section 11.2.1 through 11.2.4 until all of the samples, including the QC have been aliquoted and are ready to run.

11.3 Separation Chemistry

11.3.1 Add the appropriate spikes as requested to the appropriate flasks.

11.3.2 Assemble the apparatus as shown in the diagram following this procedure, Appendix section 12.

11.3.3 Disconnect the quick-connect. Insert a small glass wool plug in the adapter.

11.3.4 Re-assemble the apparatus as shown on the diagram, including the upper heating mantle and dewar flask. Connect the valse to a vacuum pump.

11.3.5 Fill the dewar flask with liquid nitrogen to a level 1/2 way to the top of the collection tube. When it has equilibrated, turn the vacuum pump on.

11.3.6 Turn on heaters. Increase temperature as needed.

11.3.7 Allow the water to distill from the sample, adding liquid nitrogen to the dewar flask as needed. Liquid nitrogen level can be slowly raised to near the top of collection tube during the distillation.

11.3.8 Examine the sample through the flask at regular intervals to determine when all of the water has been removed. The soil will have a dry appearance and the vegetation and fruit will have a dehydrated look. The silica gel, depending on the type may turn color or change color as it looses moisture. Typical distillation times are: fresh fruit, 10 min; soil, 30-60 min; vegetation, 30-90 min; silica gel 30-120 min, depending on the moisture content.

11.3.9 Turn off heating mantles. Turn off the vacuum pump and vent the vacuum pump and line to atmosphere. Disconnect the quick-connect and remove the flask. Remove the dewar flask from the trap and allow the ice in tit melt.

11.3.10 Deliver appropriate amount of water collected in the trap to a tared scintillation vial or transfer by volume. Record the weight or volume of the water on the worksheet. Typical aliquots are 5-10 ml. Water may be stored in a C-tube and later transferred to the scintillation vial.

11.3.11 When the original sample is cool obtain the dry weight of the sample plus flask. If needed calculate the net dry weight.

11.3.12 Examine the wa|ÿr inÿÿ;p+4Xthe viÿí. Iî (particularly a the÷water is ¿ó-6Xcolored problem with vegetation), it will require further treatment to minimize quenching during liquid scintillation counting. If the sample water is clear, proceed to step 11.3.15.

11.3.13 To reduce sample color, accurately measure 1.5 ml of 30% H_2O_2 and deliver to the sample water. Mix gently and cover loosely. Allow the samples to react overnight or until the water is decolorized.

11.3.14 To destroy excess H_2O_2, add 1 g manganese dioxide. Mix gently, cover loosely, and allow to sit overnight. Filter the samples through a Whatman #42 into a glass vial to remove the manganese dioxide. The sample and the blank should be treated identically during decolorizing. Account for any dilutions in calculation.

11.3.15 Prepare the samples for liquid scintillation counting by adding 10 ml of scintillation cocktail to the vial. If the total volume of the vial is not 20 ml, add DEAD water to the vial to make it 20 ml. Record the addition of DEAD water on the appropriate form(s). Shake the sample thoroughly and submit to the count room immediately. If the count room will not be counting the sample with in 12 hours. Store the sample in a refrigerator until counted.

11.4 Counting and Calculations

See the "LSC Counting and Calibration "procedure for proper counting the H^3 sample.

For calculations see "Calculations of LSC Data"

11.5 Reporting parameters

Values for the samples are generally reported in pCi/l (or g) to two significant figures, with the counting uncertainty stated at the 95% confidence level (2 sigma).

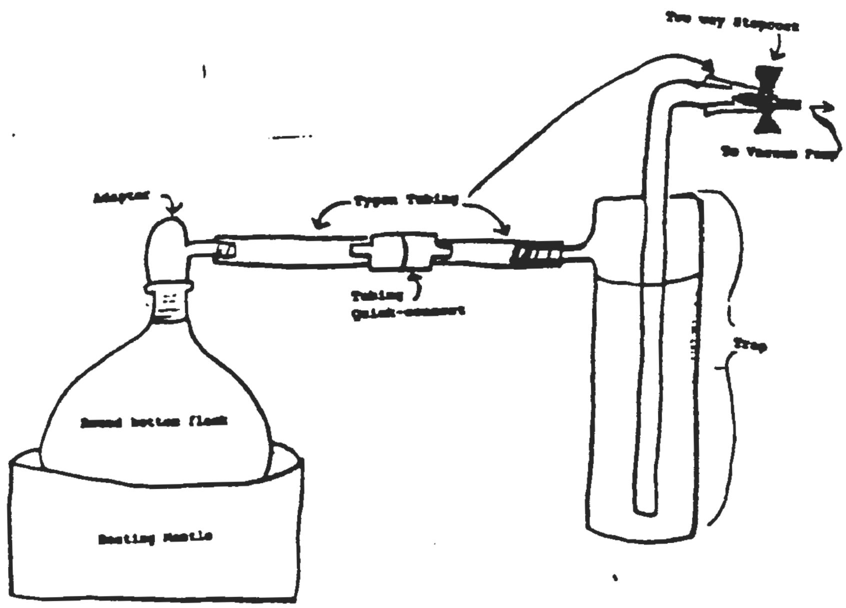
See "Reporting Criteria and Data Package assemble" for details.

12 APPENDIX

TRITIUM BY CRYOGENIC DISTILLATION APPARATUS

Note

1. The upper heating mantle on the flask is not shown.
2. The Dewar flask that the trap is immersed in is not shown.
3. The support hardware is not shown.



CORE LAB

TITLE			
Standard Operating Procedure for Radium 226 Analysis of Environmental Samples by Gas Flow Proportional Counting			
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R320	0	9/28/95	1 of 17

DOCUMENT CONTROL PAGE

Prepared By: ______________________ Date 9/28/95

Reviewed By: ______________________ Date ______
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Don Wilke ______________________ Date 9/28/95
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Approved By: ______________________ Date 9/29/95
Laboratory Manager

Ann Rosecrance ______________________ Date 10/5/95
Corporate Quality Assurance Director

Controlled Copy Number: 01

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Revision No.	0					
Date	9/28/95					

CORE LAB

TITLE			
Standard Operating Procedure for Radium 226 Analysis of Environmental Samples by Gas Flow Proportional Counting			
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R320	0	9/28/95	2 of 17

1. Scope and Application

This standard operating procedure (SOP) provides guidance for the use of CA-GLR-R320 for determining radium-226 activity in environmental samples by gas flow proportional counting. The method is capable of detecting radium-226 at 0.1 pCi/l in water with an error of +/- 30% at that activity level. The acceptable detection limits for routine analysis is 1 pCi/l in water and 1 pCi/g in soil or sediment.

This SOP applies to the environmental testing laboratories in the Environmental Services Division of Core Laboratories, Inc.

2. Summary

Initially the radium 226 is co-precipitated with lead sulfate by the addition of lead nitrate to a solution containing a high concentration of sulfate. The precipitate is dissolved in diethylenetriaminepentaacetic acid (DTPA) and the radium is reprecipitated with barium sulfate leaving thorium, lead and the actinide daughter in solution. The barium sulfate is dissolved in DTPA and the radium 226 is precipitated as barium sulfate. The barium sulfate, containing the radium 226, is plancheted and alpha counted to determine the radium 226 content.

3. Definitions

Radium 226 is the radium decay product from the decay of the natural uranium series. Radium 226 has a half life of 1600 years and decays by emission of a weak gamma and a strong alpha. It decays to radon 222 (alpha) and two other alpha decay products.

4. Responsibilities

4.1 The laboratory technician or analyst shall:

o Perform the method in accordance with this SOP No. CA-GLR-R320, and EPA Method 903.1, or as directed by the laboratory section supervisor,

o Resolve nonconformances in methods and data, first individually, then, if necessary, with the help of the laboratory section supervisor or other technical resource, and

- o Report unresolved nonconformances with a Nonconformance and Corrective Action Report form in accordance with SOP No. HC-RDC-G002.

4.2 The laboratory section supervisor shall:

- o Assist the laboratory technician or analyst in resolving nonconformances, and
- o Review and approve the data, methodology, and final reports for all analyses, tests, and procedures which are performed in his or her laboratory section.

4.3 The QA/QC coordinator shall monitor adherence to this SOP and conformance to the QC criteria of the cited method.

4.4 The laboratory manager shall ensure that the necessary resources are available to accurately and successfully adhere to SOP No. CA-GLR-R320.

5. Interferences, Comments, and Helpful Hints

5.1 Interferences

5.1.1 High chloride levels: Water samples known to contain high chloride concentrations should be diluted 1 to 2 times the original volume. The amount of K_2SO_4 should also be increased accordingly before proceeding with the initial lead sulfate precipitation.

5.1.2 Organic material in water: Water samples containing noticeable amounts of organic matter should be evaporated and digested with HNO_3-$HClO_4$. The residue should then be subjected to a mild $NaHSO_4$ fusion. The resulting fusion cake can be dissolved and diluted to an appropriate volume.

5.1.3 Siliceous material in water: Water samples containing silicate should be evaporated and the residue subjected to a KF fusion. The resulting cake can be dissolved in H_2SO_4 and diluted to an appropriate volume.

5.1.4 Solid samples containing organic or siliceous materials must be subjected to preliminary treatments described in SOP CA-GLR-R160 before proceeding with the radium-226 procedure described below.

5.1.5 Samples containing large amounts of natural thorium will contain significant amounts of radium 224 which generates radon 220. However, after chemical separation and long ingrowth periods (>8 days), radium 224 will decay until its activity is low compared with that of radium 226.

5.2 Comments

A problem can occur when barium sulfate is first precipitated out of the DTPA solution. If no precipitation occurs after the addition of $BaCl_2$, 20% Na_2SO_4, 6 M acetic acid and heating five minutes, check the pH. If the pH is above 7, add one more ml of 6 M acetic acid. If the pH is less than 7, add 1 ml more of the 20% Na_2SO_4.

5.3 Helpful Hints

6. Sampling, Sample Preservation, and Holding Times

6.1 Sampling Procedure

The sampling procedure should conform to Chapter Three of EPA SW-846. All samples should be collected according to these guidelines. The samples are to be collected in plastic containers which have been cleaned according to EPA specifications. All sampling information should be included on a chain-of-custody (COC) record which should include all sampling dates and times, sampling requirements, temperature and atmospheric conditions, location, and the initials of individuals involved in the sampling and/or handling of the samples.

The samples should be collected in a manner which will provide the most representative sample. Drinking water samples should be collected from the free flowing source and should be large enough to provide adequate sample to achieve the detection limits required under the safe drinking water regulations.

If the material, such as NORM scale, contains significant radioactivity (level 3 or higher, see CA-HPM-001,"Standard Operating Procedure for Radioactive Sample Control and Screening"), the sample size should not exceed 40 g in order to reduce exposure to personnel who handle the materials and to comply with DOT regulations.

6.2 Sample Preservation

Aqueous samples should be preserved at the time of sampling by acidification with dilute nitric acid to a pH of <2. If it is not possible to preserve samples in the field, the samples should be preserved at the laboratory within 5 days of sampling. The samples should then be allowed to set for 16 hours prior to analysis in order to dissolve any precipitate. Solid and soil samples are not preserved in the field or laboratory.

6.3 Holding Times

Samples, if properly preserved, can be stored for up to five half-lives or six months, whichever occurs first.

7. Safety

7.1 General Safety Procedures

- o Be knowledgeable of the MSDS information for each chemical which is used in the procedure.
- o Comply with the instrument manufacturer's and chemical supplier's safety precautions.
- o Comply with all applicable safety regulations and safety SOPs.
- o Sample analysis functions shall be performed in the appropriate environment, such as canopies or fume hoods.
- o Gloves, protective clothing, face shields, and protective eyewear should be worn by all analysts and technicians while they are in the laboratory. The staff shall always remove gloves and other protective clothing prior to leaving the laboratory and dispose of or store them properly.
- o All analysts and technicians shall wash all areas of their hands and arms which may have been exposed to contaminated materials prior to leaving the lab.

7.2 Sample Screening Procedure

Refer to SOP No. CA-HPM-001, "Standard Operating Procedure for Radioactive Sample Control and Screening."

8. Quality Control

There are four levels of quality control for the radiochemistry parameters. Each level has a specified frequency and acceptance criteria for the method blanks, sample duplicates, matrix spikes and laboratory control standards. In general, the typical reporting level that is used is Level 2. Level 1 requirements are designated for NORM clients only. Clients which require upper level QC must identify the level which will be needed to satisfy the requirements for a particular project at the time the project is accepted. Additional QC will be performed per client specifications as outlined in the project specific statement of work. Client requirements will supersede Core Laboratories' requirements. The QC requirements for each level are specified in the sections listed below.

	Level 4	Level 3	Level 2	Level 1
Blank	<Detection Limit	<Detection Limit	<Detection Limit	<Detection Limit
Duplicate	RER≤3	RER≤3	RER≤3	RER≤3
Spike Recovery	75 - 125%	70 - 125%	70 - 125%	60 - 130%
Standard Recovery	80 - 120%	70 - 125%	70 - 125%	70 - 125%

8.1 Method Blank

The method blank is a portion of ASTM Type II water which is treated as a sample throughout the test procedure. For all four QC levels, method blanks must be analyzed at a frequency of one per every 20 samples or a minimum of one per batch. The analyzed concentration of analyte in the method blank should be less than the detection limit.

8.2 Sample Duplicates

Sample duplicates should receive exactly the same treatment as the related samples throughout the procedure. For all four QC levels, sample duplicates must be analyzed at a frequency of one per every 20 samples or a minimum of one per matrix per batch. For all four QC levels (unless otherwise specified by the client), the acceptance criteria for the duplicate values is an RER ≤3.

8.3 Matrix Spikes

A separate sample aliquot shall be spiked with a known concentration of analyte and carried through the entire analytical procedure. The recommended spiking levels are two to five times the sample concentration. For all four QC levels, matrix spike samples must be analyzed at a frequency of one per every 20 samples or a minimum of one per matrix per batch. For Level 4, the acceptance criteria for the matrix spike % recovery is 75-125%. For Levels 2 and 3, the acceptance criteria for the matrix spike % recovery is 70-125%. For Level 1 (NORM clients only), the acceptance criteria for the matrix spike % recovery is 60-130%.

8.4 Laboratory Control Standard

A laboratory control standard (LCS) is a standard which is tested as if it were a sample. The LCS activity should be similar to the activity of the samples. For all four QC levels, laboratory control standards must be analyzed at a frequency of one per every 20 samples or a minimum of one per batch. For Level 4, the acceptance criteria for the LCS % recovery is 80-120%. For Levels 1, 2 and 3, the acceptance criteria for the LCS % recovery is 70-125%.

8.5 Corrective Action

If the QC limits are exceeded, notify the laboratory supervisor or QA/QC coordinator, initiate an Out of Control Event Report or Nonconformance and Corrective Action Report, and take corrective action as advised. Failure to meet client QC requirements will result in the reanalysis of all samples associated with the out of control QC. Case narratives are to be provided to the client which describe the out of control event and corrective action that was taken.

9. Apparatus and Materials

9.1 Instrument type

9.1.1 Counting Instrumentation

Berthold LB770-L2 10 Detector Gas Flow Proportional Counter or equivalent.

9.2 Laboratory Materials

9.2.1 Graduated 2 liter beakers

9.2.2 Graduated, 1 liter beakers

9.2.3 Disposable pipet and micropipet tips

9.2.4 Assortment of pipettors, 0.05, 0.2, 1.0, 5 ml, and 10 ml.

9.2.5 Stir bars ½", 1 ½", stirring rods 6"

9.2.6 Microwave oven in place of water bath

9.2.7 Centrifuge

9.2.8 Centrifuge tubes, 50 ml polyethylene with caps

9.2.9 Stainless steel planchet

10. Reagents and Standards

10.1 Reagents

10.1.1 Perchloric Acid, concentrated

10.1.2 Sodium Bisulfate - $NaHSO_4$

10.1.3 0.17 M DTPA

Dissolve 67 g of diethylenetriaminepentaAcetic acid (DTPA) and 32 g of sodium hydroxide in approximately 300 ml of water. Dilute to 1 liter with DI water.

10.1.4 Lead Sulfate Wash Solution

Dissolve 25 g of potassium sulfate in 1% H_2SO_4 and dilute to 1 liter.

10.1.5 1M Lead Nitrate

Dissolve 33.1 g of $Pb(NO_3)_2$ in water and dilute to 200 ml (final concentration of Pb = 104 mg/ml)

10.1.6 0.1M Lead Nitrate = 100ml 1M $Pb(NO_3)_2$ diluted to 1 liter

10.1.7 0.0172M $BaCl_2$

Dissolve 3.57 g of $BaCl_2$ in water and dilute to 1 liter. Final concentration of Ba = 2.4mg/ml)

10.1.8 20% Sodium Sulfate

Dissolve 200 g of Na_2SO_4 in water and dilute to 1 liter

10.1.9 6M Acetic acid

Dilute 345 ml of glacial acetic acid to 1 liter

10.1.10 Sodium Acetate solution, saturated

Add 200 ml of water to 360 g of sodium acetate

10.1.11 Radium 226 standard from an NIST traceable source. Refer to SOP No. CA-GLR-R110, "Standard Operating Procedure for Radioactive Standards and Preparation."

10.1.12 Radioactive purity of reagents shall be such that the measured radioactivity of blank samples does not exceed 1 cpm.

10.1.13 Reagent water, Refer to SOP No. CA-GLR-R120, "Standard Operating Procedure for Reagent Water Examination for Analysis of Environmental Samples."

10.1.14 Acetone - Anhydrous

10.1.15 Ammonium Hydroxide 15N: NH_4OH (concentrated)

10.1.16 Ammonium Hydroxide 1.0N: Dilute 66.7 ml of concentrated NH_4OH to 1 liter with reagent water.

10.1.17 Ethanol, 95%

10.1.18 Ethanol, 80%: Dilute 200 ml of absolute ethanol with 50 ml of water and store in polyethylene ware.

10.1.19 Hydrochloric acid, 12M HCl (concentrated)

10.1.20 Hydrochloric acid 8M: Mix 2 volumes of conc. HCl with 1 volume of water.

10.1.21 Hydrochloric acid 3N. Dilute 250 ml of conc. HCl to 1 liter with reagent water.

10.1.22 Hydrofluoric Acid 29N: HF (concentrated)

10.1.23 Hydrogen Peroxide, 30%: H_2O_2

10.1.24 Nitric Acid, 16N: HNO_3 (concentrated)

10.1.25 Nitric Acid 8N: Mix 1 volume of 16N HNO_3 with 1 volume of H_2O.

10.1.26 Nitric Acid 1N: Mix 62.6 ml of concentrated HNO_3 with reagent water and dilute to 1 liter.

10.1.27 Nitric Acid, 0.25N: Mix 1 volume of 1N with 3 volumes of water. Prepare 16 liters.

10.1.28 Sodium Hydrogen Sulfate - Sulfuric Acid Solution: Dissolve 10 g of $NaHSO_4$ in 100 ml of water and then carefully add 100 ml of 36N H_2SO_4 (concentrated) while stirring.

10.1.29 Sodium Hydroxide, 6N: Dissolve 48 g of NaOH into 124 ml of distilled water and dilute to 200 ml. This solution should be prepared fresh for each use if uranium is to be analyzed.

10.1.30 Sodium Hydroxide, 0.1N - Dissolve 4 g NaOH into 800 ml of water and dilute to 1 liter in a volumetric flask.

10.1.31 Sulfuric Acid, 36N: H_2SO_4 (concentrated), 96%.

10.1.32 Sulfuric Acid 0.6N: Mix 16.7 ml, 36N H_2SO_4 (concentrated) with 200 ml of reagent water and dilute to 1.00 liters.

10.2 Standards

Refer to SOP No. CA-GLR-R110, "Standard Operating Procedure Radioactive Standards and Preparation."

11. Analytical Procedure

11.1 Instrument Calibration and Operation

Refer to SOP No. CA-GLR-R300, "Standard Operating Procedure for LB-770 Operation."

11.2 Sample Preparation

Refer to SOP No. CA-GLR-R160, "Standard Operating Procedure for Preparation of Environmental Samples for Radiochemical Determinations."

11.3 Sample Analysis

Note: Check to see if samples were precipitated with Pb-Ba user solution or 0.1N $PbNO_3$. Steps 11.3.3 and 11.3.6 will be omitted if Pb -Ba user soln was used.

11.3.1 Sample is received in a 50 ml centrifuge tube from the preparation procedure (CA-GLR-R160). Dissolve the ppt in 15 ml of 0.17M DTPA stirring in a hot water bath. (May use up to 25 ml DTPA.)

11.3.2 Add 10 ml DI H_2O.

11.3.3 Add 2 ml of 0.0172M $BaCl_2$ to the lead sulfate solution and mix. If prepped with Pb-Ba user solution, omit this step.

11.3.4 Add 2 ml of 20% Na_2SO_4 and mix thoroughly.

11.3.5 Heat until hot.

11.3.6 While swirling the solution, add 2 ml of 6M acetic acid. While stirring, add an additional 1 ml of 0.0172M $BaCl_2$; **If Pb-Ba user soln. was used, omit the 1 ml addition of 0.0172M** $BaCl_2$. After mixing thoroughly, place the centrifuge tube in a hot bath for 5 to 10 minutes sirring occasionally. The $BaCl_2$ should precipitate at this point. (If no precipitation occurs, add an additional 1 ml of 20% Na_2SO_4.) If none, then add a third ml of 6M acetic acid.

11.3.7 Centrifuge and pour the supernate into a second centrifuge tube if Pb 210 is needed, otherwise discard the supernate.

11.3.8 Transfer precipitate with small additions of DI H_2O to a clean, labeled, pre-weighed planchet. (Use stir rod to scrape off bottom of c-tube.) Dry planchets on hot plate at low setting. Cool samples and re-weigh.

11.3.9 Turn samples in to the count room for counting by procedure CA-GLR-R300, "Standard Operating Procedure for LB-770 Operation." Allow the samples to eqilibrate 24 to 36 hours and count in low background proportional counter. **Note:** A known standard and blank should be included with each set in the 10 channel Berthold counter in order to determine the efficiency at that time. This eliminates the need to determine ingrowth and decay corrections, because the efficiency of the system is measured as a function of the internal standard with each run. If there is a significant amount of radium 228 present it is advisable to recount the radium 226 planchet after 12 to 14 days to account for any radium 224 present as a decay product from radium 228. The software program utilizes the calibration information from each individual detector and adjusts for differences in efficiencies between each detector in calculating the radium activity of each sample.

12. Data Generation and Calculations

12.1 Activity Calculations

12.1.1 Activity (pCi/Unit Vol)

$$= \frac{SC/\text{min} - BC/\text{min}}{2.22 * E * V}$$

min = minutes of counts
BC = gross background counts
V = volume of sample utilized (liters, gm, etc.)
E = Batch efficiency
SC = gross sample counts

12.2 Equation for error at the 95% confidence level.

$$= \frac{1.96\sqrt{\left(\frac{SC/\min}{\min}\right) + \left(\frac{BC/\min}{\min}\right)}}{2.22*E*V}$$

12.3 Equation for the Lower Limit of Detection.

$$= \frac{4.66\sqrt{\frac{BC/\min}{\min}}}{2.22*E*V}$$

12.4 Quality Control Calculations

12.4.1 Percent Recovery of Standards

$$\text{Percent Recovery} = \frac{\text{Analyzed Value}}{\text{Known Value}} \times 100\%$$

12.4.2 Percent Recovery of Matrix Spike

$$\text{Percent Recovery} = \frac{SSC - SC}{SA} \times 100\%$$

where:

SSC = Spiked Sample Concentration
SC = Sample concentration (previously determined)
SA = Spike Added

12.5 Relative Error Ratio (RER)

$$RER = \frac{|C_1 - C_2|}{[(error_1)^2 + (error_2)^2]^{1/2}}$$

C_1 & C_2 = Measured Concentrations for the sample and duplicate

Error $_{1\,\&\,2}$ = respective errors

13. Data Reporting

13.1 Raw Data Reporting

13.1.1 All raw data must be entered as it is acquired in the designated bound logbook. This includes test method, analyte being determined, measurement parameters, dilution factors, analyst's initials, and date of test. All information and data which is pertinent to the test should be recorded to facilitate data validation. Any unusual conditions or information on the appearance of the samples, or any other factors which may influence the results should also be noted.

13.1.2 Instrument printouts and copies of spreadsheets or graphs should be dated, initialed by the analyst, and filed chronologically in a designated area.

13.2 LIMS Data Entry Methodology

For questions concerning LIMS data entry requirements, refer to the LIMS User Manual or contact the laboratory section supervisor or QA/QC coordinator.

13.2.1 Method Reference

The analyst must verify that the proper method reference is entered for each sample analyzed. If the method which was utilized varies from the assigned LIMS default method, delete the incorrect test code for that sample and then enter the correct test code or change the designated method in the existing test code. A corrected log-in sheet will be generated and placed in the master (job) folder.

13.2.2 Method Detection Limits

Report the detection limit for the sample based on the matrix. Client specific detection limits should be reported when requested by the client.

13.2.3 Units

Report the data using the appropriate units based on the sample matrix. Use pCi/L for aqueous samples and pCi/g for soil and solid samples.

13.2.4 Date Analyzed

The analyst must enter the date of analysis for each batch of samples processed. Enter the date that the procedure was initiated.

13.2.5 Significant Figures

Record LIMS data to the proper number of significant figures. The number of significant figures reported must correlate with the method detection limit. Generally, no more than 3 significant figures should be used for results greater than 10, and no more than 2 significant figures for results less than 10.

Statistical rounding must be employed in determining the final reported concentration. Refer to Standard Methods, 18th Edition, for further information on statistical rounding.

13.2.6 Quality Control Data

Enter quality control data for all method blanks, sample duplicates, matrix spikes, and LCSs which were analyzed with the sample batch.

13.3 Case Narrative

When required, a case narrative will be prepared and included with the report. Each report requiring a case narrative should include the data, validation information, copies of relevant fax or phone logs, and any documentation on corrective action that was taken.

13.4 Job Files

Collect all data sheets and printouts; place copies in the job file. The job file should then be transferred to the QA/QC coordinator, or designee, for validation and report generation. All COC information, log-in information, log sheets, spectral print outs if applicable, and report sheets should be placed in the client file. For jobs requiring level 4 data validation packages, include all standard information, calibration information, and a case narrative.

14. References

- Percival, D.R., & Martin, D.B., Analytical Chemistry, 46, 1742 (1974).
- Prescribed Procedures for Measurement of Radioactivity in Drinking Water, Krieger, H.L., Whittaker, E.L., Ed., EMSL, Environmental Protection Agency, EPA-600/4-80-032, August, 1980, pp. 31 and 38.
- Radiochemical Procedures for Determination of Selected Members of the Uranium and Thorium Series, Gammet Report 78-22, ERP Mineral Sciences Laboratory, 1978, p.41.
- Blais, Jean Simon and Marshall, William D., 1988 "Determination of Lead 210 in Admixture and Bismuth 210 and Polonium 210 in Quenched Samples by Liquid Scintillation Counting."

15. Method Performance

N/A

16. Associated Documents and Forms

ANALYSIS OF RA 226 IN ENVIRONMENTAL SAMPLES

CA-GLR-06.0R6

NOTE: Check to see if samples were precipitated with Pb-Ba user soln. or 0.1N Pb(NO3) - steps 3 & 7 will be deleted if Pb-Ba user soln. was used.

_____1.) Add 15 ml 0.17M DTPA to ppt. and heat sample until dissolved (may use up to 25 ml with DTPA).

_____2.) Add 10 ml DI H_2O.

Step 3 should be omitted if Pb-Ba user soln. was used.

_____3.) Add 2 ml 0.0172M $BaCl_2$.

_____4.) Add 2 ml 20% Na_2SO_4. Stir.

_____5.) Heat until hot.

_____6.) Add 2 ml 6M Acetic Acid while stirring.

Step 7 should be omitted if Pb-Ba user soln. was used.

_____7.) Add an additional 1 ml 0.0172M $BaCl_2$ while stirring.

_____8.) Cool samples. Centrifuge.

_____9.) Pour off supernate. (If Pb210 is needed, save supernate in clean centrifuge tube, otherwise discard.)

_____10.) Transfer precipitate with small additions of DI H_2O to a clean, labeled, pre-weighed, planchet. (Use stir rod to scrape off bottom of centrifuge tube.)

_____11.) Dry planchets on hot plate at low setting.

_____12.) Cool planchets and re-weigh.

_____13.) Allow 24 - 36 hours before counting.

CORELAB

TITLE			
Standard Operating Procedure for Americium Analysis of Environmental Samples by Alpha Spectroscopy			
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R430	0	6/8/98	1 of 14

DOCUMENT CONTROL PAGE

Prepared By: [signature] Date 6-08-98

Reviewed By: [signature] Date 60898
Technical Specialist

[signature] Date 6/8/98
QA/QC Coordinator

Approved By: [signature] Date 6/8/98
Laboratory Manager

UNCONTROLLED DOCUMENT

Controlled Copy Number: 1

Revision No.	0					
Date	6/08/98					

1. Scope and Application

This standard operating procedure (SOP) provides guidance for the use of CA-GLR-R430 for analyzing Americium in Environmental Samples by Alpha Spectroscopy.

This SOP applies to the environmental testing laboratories in the Environmental Services Division of Core Laboratories, Inc.

2. Summary

The sample is prepped (CA-GLR-R160) and, if necessary, purified as described in CA-GLR-R405. Upon completion of these, the sample is received in a dried form. The sample is then taken through an iron hydroxide precipitation to separate the metals. This precipitate is dissolved and the americium is purified on an Eichrom anion-exchange column. Once the column is purified, it is sent to CA-GLR-R470 for final mounting.

3. Definitions

3.1 Internal Isotope Tracers: In alpha-spectroscopy, radioactive isotopes not found in nature are often used as internal markers to determine the concentration of their natural counterparts. A known amount of activity is added to the sample at the start of the procedure. The activity of that tracer recovery measured during alpha spectroscopy represents total efficiency including both chemical and counter efficiency. This gives us a very simple and accurate means of determining the amount of the natural isotopes in that sample.

3.2 Alpha-Spectroscopy: This is a measurement technique that is able to identify differences in energy levels from absorption of alpha-particles on a charged silica diode. The pulses produced from the interaction between the alpha particle and the diode are amplified and the signals are collected on a multi-channel analyzer. By counting for a period of time, peaks are accumulated that represent specific alpha energies indicating the presence of specific alpha emitting radionuclides.

4. Responsibilities

4.1 The laboratory technician or analyst shall:

- o Perform the method in accordance with this SOP No. CA-GLR-R430, or as directed by the laboratory section supervisor,
- o Resolve nonconformances in methods and data, first individually, then, if necessary, with the help of the laboratory section supervisor or other technical resource.
- o Report unresolved nonconformances with a Nonconformance and Corrective Action Report form in accordance with SOP No. HC-RDC-G002.

4.2 The laboratory section supervisor shall:

- o Assist the laboratory technician or analyst in resolving nonconformances, and
- o Review and approve the data, methodology, and final reports for all analyses, tests, and procedures which are performed in his or her laboratory section.

4.3 The QA/QC coordinator shall monitor adherence to this SOP and conformance to the QC criteria of the cited method.

4.4 The laboratory manager shall ensure that the necessary resources are available to accurately and successfully adhere to SOP No. CA-GLR-R430.

5. Interferences, Comments, and Helpful Hints

5.1 Interferences

Self absorption may occur if sample is not isolated completely.

5.2 Comments

5.3 Helpful Hints

6. Sampling, Sample Preservation, and Holding Times

6.1 Sampling Procedure

The sampling procedure should conform to Chapter Three of EPA SW-846. All samples should be collected according to these guidelines. The samples are to be collected in plastic containers which have been cleaned according to EPA specifications. All sampling information should be included on a chain-of-custody (COC) record which should include all sampling dates and times, sampling requirements, temperature and atmospheric conditions, location, and the initials of individuals involved in the sampling and/or handling of the samples.

The samples should be collected in a manner which will provide the most representative sample. Drinking water samples should be collected from the free flowing source and should be large enough to provide adequate sample to achieve the detection limits required under the safe drinking water regulations. Note: 500 mL is required.

If the material, such as NORM scale, contains significant radioactivity (level 3 or higher, see CA-HPM-001, "Standard Operating Procedure for Radioactive Sample Control and Screening"), the sample size should not exceed 40 g in order to reduce exposure to personnel who handle the materials and to comply with DOT regulations.

6.2 Sample Preservation

Aqueous samples should be preserved at the time of sampling by acidification with concentrated nitric acid to a pH of <2. If it is not possible to preserve samples in the field, the samples should be preserved at the laboratory within 5 days of sampling. The samples should then be allowed to set for 16 hours prior to analysis in order to dissolve any precipitate. Solid and soil samples are not preserved in the field or laboratory.

6.3 Holding Times

Samples can be stored up to six months if they are properly preserved.

7. Safety

7.1 General Safety Procedures

- o Be knowledgeable of the MSDS information for each chemical which is used in the procedure.
- o Comply with the instrument manufacturer's and chemical supplier's safety precautions.
- o Comply with all applicable safety regulations and safety SOPs.
- o Sample analysis functions shall be performed in the appropriate environment, such as canopies or fume hoods.
- o Gloves, protective clothing and protective eyewear should be worn by all analysts and technicians while they are in the laboratory. The staff shall always remove gloves and other protective clothing prior to leaving the laboratory and dispose or store them properly.
- o All analysts and technicians shall wash all areas of their hands and arms which may have been exposed to contaminated materials prior to leaving the lab.

7.2 Sample Screening Procedure

Refer to SOP No. CA-HPM-001, "Standard Operating Procedure for Radioactive Sample Control and Screening."

8. Quality Control

There are four levels of quality control for the radiochemistry parameters. Each level has a specified frequency and acceptance criteria for the method blanks, sample duplicates, matrix spikes, laboratory control standards, and chemical recovery. In general, the typical reporting level that is used is Level 2. Level 1 requirements are designated for NORM clients only. Clients which require upper level QC must identify the level which will be needed to satisfy the requirements for a particular project at the time the project is accepted. Additional QC will be performed per client specifications as outlined in the project specific statement of work. Client requirements will supersede Core Laboratories' requirements. The QC requirements for each level are specified in the sections listed below.

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Duplicate	RER≤3	RER≤3	RER≤3	RER≤3
Spike Recovery	75 - 125%	70 - 125%	70 - 125%	60 - 130%
Standard Recovery	80 - 120%	70 - 125%	70 - 125%	70 - 125%
Chemical Recovery	50 - 100%	35 - 110%	20 - 110%	20 - 120%

8.1 Method Blank

The method blank is a portion of ASTM Type II water which is treated as a sample throughout the test procedure. For all four QC levels, method blanks must be analyzed at a frequency of one per every 20 samples or a minimum of one per batch. The analyzed concentration of analyte in the method blank should be less than the detection limit.

8.2 Sample Duplicates

Sample duplicates should receive exactly the same treatment as the related samples throughout the procedure. For all four QC levels, sample duplicates must be analyzed at a frequency of one per every 20 samples or a minimum of one per matrix per batch. For all four QC levels (unless otherwise specified by the client), the acceptance criteria for the duplicate values is an RER ≤3.

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A separate sample aliquot shall be spiked with a known concentration of analyte and carried through the entire analytical procedure. The recommended spiking levels are two to five times the sample concentration. For all four QC levels, matrix spike samples must be analyzed at a frequency of one per every 20 samples or a minimum of one per matrix per batch. For Level 4, the acceptance criteria for the matrix spike % recovery is 75-125%. For Levels 2 and 3, the acceptance criteria for the matrix spike % recovery is 70-125%. For Level 1 (NORM clients only), the acceptance criteria for the matrix spike % recovery is 60-130%.

8.4 Laboratory Control Standard

A laboratory control standard (LCS) is a standard which is tested as if it were a sample. The LCS activity should be similar to the activity of the samples. For all four QC levels, laboratory control standards must be analyzed at a frequency of one per every 20 samples or a minimum of one per batch. For Level 4, the acceptance criteria for the LCS % recovery is 80-120%. For Levels 1, 2 and 3, the acceptance criteria for the LCS % recovery is 70-125%.

8.5 Corrective Action

If the QC limits are exceeded, notify the laboratory supervisor or QA/QC coordinator, initiate an Out of Control Event Report or Nonconformance and Corrective Action Report, and take corrective action as advised. Failure to meet client QC requirements will result in the reanalysis of all samples associated with the out of control QC. Case narratives are to be provided to the client which describe the out of control event and corrective action that was taken.

9. Apparatus and Materials

9.1 Instrument type

9.1.1 Alpha Spectroscopy System

9.1.2 Electronic Analytical Balance

9.1.3 Top Loading Electronic Balance

9.2 Laboratory Materials

9.2.1 Hot plate

9.2.2 Column support

9.2.3 Disposable 5-10 ml column with bottom frit

9.2.4 Centrifuge

9.2.5 Eichrom tru-spec resin

9.2.6 Membrane filter, 47 mm

9.2.7 Whatman 540, 15 cm or equivalent

9.2.8 Plastic centrifuge tubes

9.2.9 Other general laboratory equipment

10. Reagents and Standards

10.1 Reagents

Refer to SOP No. CA-GLR-R120, "Standard Operating Procedure for Reagent Water Examination for Analysis of Environmental Samples."

10.1.1 8N HNO_3

10.1.2 conc NH_4OH

10.1.3 3N HNO_3

10.1.4 4N HNO_3

10.1.5 8M HCl

10.1.6 3M HCL

10.1.7 Iron carrier

10.2 Standards

Refer to SOP No. CA-GLR-R110, "Standard Operating Procedure Radioactive Standards and Preparation."

11. Analytical Procedure

11.1 Instrument Calibration and Operation

Refer to SOP No. CA-GLR-R400, "Standard Operating Procedure for Alpha Spectroscopy Operation."

11.2 Sample Preparation

Refer to SOP No. CA-GLR-R160, "Standard Operating Procedure for Preparation of Environmental Samples for Radiochemical Determinations."

11.3 Sample Analysis

11.3.1 Ferric Hydroxide Precipitation

11.3.1.1 Dissolve the residue from CA-GLR-R405, step XXXX (Am Elution) with about 10 ml of 8N HNO_3, swirling and heating briefly if needed.

11.3.1.2 Transfer the sample solution to a clean labeled c-tube with DI H_20. Bring the solution level up to the 30 ml maker with DI H_20. Add 1 ml of iron carrier (10 mg Fe/ml).

11.3.1.3 Add conc. NH_4OH slowly and while stirring the sample. A red-brown precipitate will form. Check pH with pH strip. pH should be 8 to 10. Add more conc NH_4OH if necessary to achieve the correct pH.

11.3.2 Final Am column

11.3.2.1 Prepare column by adding ≈0.35 g Tru-spec resin (add resin to the 1.2 ml mark on column) to the column add 10 ml 4N HNO_3 let soak for 1 hour.

11.3.2.2 Dissolve precipitate from ferric hydroxide process with 30 ml of 3N HNO_3.

11.3.2.3 Add a small amount of solid ascorbic acid to sample, stir gently, allow the sample to set for about 10 min.

11.3.2.4 Wash column with 15 ml 4N HNO_3 and then with 5 ml of 3N HNO_3.

11.3.2.5 Load sample onto column rinse beaker with a very small amount of 3N $HN0_3$. (Elute is waste)

11.3.2.6 Add 2 ml 8M HCl. (Elute is waste)

11.3.2.7 Elute Am with 15 ml 3M HCl. Catch elute into clean label ed c-tubes. (Don't use more than 15 ml of 3M HCl or you'll be eluting the Pu out with the Am.)

Proceed with final am precipitation, CA-GLR-R405

12. Data Generation and Calculations

12.1 12.1.0.1. Data Generation and Calculations

12.2 The data to be generated and recorded are: known activity, measured values, dilution factors, and measured sample concentrations and QC parameters.

12.3 Calibration Calculations

12.4 Concentration Calculations

12.4.1 Calculate alpha spectromety isotopic region activity (pCi/L).

$$ACT_{TSC}=\frac{(TSC-BKG)*SDPM}{2.22*(SC-SBC)*AVOL}$$

12.4.2 Calculate 2-sigma Error Term where region activity <> 0.

$$ERR_{TSC}=(2)\,|ACT_{TSC}|\sqrt{\frac{TSC+BKG}{(TSC-BKG)^2}+\frac{SC+SBC}{(SC-SBC)^2}+0.0025}$$

12.4.3 Calculate 2-sigma Error Term where region activity = 0 and TSC = BKG.

$$ERR_{TSC}=\frac{2*SPDM}{2.22*(SC-SBC)*AVOL}\sqrt{(TSC+BKG)+\frac{SC+SBC}{(SC-SBC)^2}+0.0025}$$

12.4.4 Calculate the Lower Level of Detection (LLD) for region activity.

12.5 Quality Control Calculations

$$LLD_{TSC}=\frac{(4.65\sqrt{BKG}+3)SPDM}{2.22*(SC-SBC)*AVOL}$$

12.5.1 Percent Recovery of Standards

$$\text{Percent Recovery} = \frac{\text{Analyzed Value}}{\text{Known Value}} \times 100\%$$

12.5.2 Percent Recovery of Matrix Spike

$$\text{Percent Recovery} = \frac{SSC - SC}{SA} \times 100\%$$

where:

SSC = Spiked Sample Concentration
SC = Sample concentration (previously determined)
SA = Spike Added

$$RER=\frac{|C_1 - C_2|}{\left[(error_1)^2+(error_2)^2\right]^{1/2}}$$

12.5.3 Relative Error Ratio (RER)

C_1 & C_2 = Measured Concentrations for the sample and duplicate

Error $_{1\ \&\ 2}$ = respective errors

13. Data Reporting

13.1 Raw Data Reporting

13.1.1 All raw data must be entered as it is acquired in the designated bound logbook. This includes test method, analyte being determined, measurement parameters, dilution factors, analyst's initials, and date of test. All information and data which is pertinent to the test should be recorded to facilitate data validation. Any unusual conditions or information on the appearance of the samples, or any other factors which may influence the results should also be noted.

13.2 LIMS Data Entry Methodology

If you have questions concerning LIMS data entry requirements, refer to the LIMS User Manual or contact your laboratory section supervisor or QA/QC coordinator.

13.2.1 Method Reference

The analyst must verify that the proper method reference is entered for each sample analyzed. If the method which was utilized varies from the assigned LIMS default method, delete the incorrect test code for that sample and then enter the correct test code or change the designated method in the existing test code. A corrected log-in sheet will be generated and placed in the master (job) folder.

13.2.2 Method Detection Limits

Report the detection limit for the sample based on the matrix. Client specific detection limits should be reported when requested by the client.

13.2.3 Units

Report the data using the appropriate units based on the sample matrix. Use pCi/L, μg/L, or mg/L for aqueous samples and pCi/g, μg/g, or mg/g for soil and solid samples.

13.2.4 Date Analyzed

The analyst must enter the date of analysis for each batch of samples processed. Enter the date that the procedure was initiated.

13.2.5 Significant Figures

Record LIMS data to the proper number of significant figures. The number of significant figures reported must correlate with the method detection limit. Generally, no more than 3 significant figures should be used for results greater than 10, and no more than 2 significant figures for results less than 10.

Statistical rounding must be employed in determining the final reported concentration. Refer to Standard Methods, 18th Edition, for further information on statistical rounding.

13.2.6 Quality Control Data

Enter quality control data for all method blanks, sample duplicates, matrix spikes, and LCSs which were analyzed with the sample batch.

13.3 Case Narrative

When required, a case narrative will be prepared and included with the report. Each report requiring a case narrative should include the data, validation information, copies of relevant fax or phone logs, and any documentation on corrective action that was taken.

13.4 Job Files

Collect all data sheets and printouts; place copies in the job file. The job file should then be transferred to the QA/QC coordinator for validation and report generation. All COC information, log-in information, log sheets, spectral print outs, and report sheets that are to be included in the data validation package should be placed in the client file. Include all standard information, calibration information, analytical data, calculated results, and a case narrative if required.

14. References

15. Method Performance

16. Associated Documents and Forms

FERRIC HYDROXIDE PRECIPITATION

___1. DISSOLVE THE RESIDUE FROM STEP XXXX (AM ELUTION) WITH ABOUT 10 ML OF 8N HNO_3, SWIRLING AND HEATING BRIEFLY IF NEEDED.

___2. TRANSFER THE SAMPLE SOLUTION TO A CLEAN LABELED C-TUBE WITH DI H_2O. BRING THE SOLUTION LEVEL UP TO THE 30 ML MAKE WITH DI H_2O. ADD 1 ML OF IRON CARRIER (10 mg Fe/ml).

___3. ADD CONC. NH_4OH SLOWLY AND WHILE STIRRING THE SAMPLE. A RED-BROWN PRECIPITATE WILL FORM. CHECK PH WITH PH STRIP. PH SHOULD BE 8 TO 10. ADD MORE CONC NH_4OH IF NECESSARY TO ACHIEVE THE CORRECT PH.

PROCEED TO THE FINAL AM COLUMN, STEP XXXX.

16.0.1 FINAL AM COLUMN

THIS COLUMN IS TO BE DONE AFTER FERRIC HYDROXIDE PRECIPITATION

___1. PREPARE COLUMN BY ADDING 0.35 g TRU-SPEC RESIN (ADD RESIN TO THE 1.2 ML MARK ON COLUMN) TO THE COLUMN ADD 10 ML 4N HNO_3 LET SOAK FOR 1 HOUR.

___2. DISSOLVE PRECIPITATE FROM FERRIC HYDROXIDE PROCESS WITH 30 ML OF 3 M HNO_3.

___3. ADD A SMALL AMOUNT OF SOLID ASCORBIC ACID TO SAMPLE, STIR GENTLY, ALLOW THE SAMPLE TO SET FOR ABOUT 10 MIN.

___4. WASH COLUMN WITH 15 ML 4N HNO_3 AND THEN WITH 5 ML OF 3N HNO_3.

___5. LOAD SAMPLE ONTO COLUMN RINSE BEAKER WITH A VERY SMALL AMOUNT OF 3N HNO_3. (ELUTE IS WASTE)

___6. ADD 2 ML 8N HCL. (ELUTE IS WASTE)

___7. ELUTE AM WITH 15 ML 3M HCL. CATCH ELUTE INTO CLEAN LABEL ED C-TUBES. (DON'T USE MORE THAN 15 ML OF 3M HCL OR YOU'LL BE ELUTING THE PU OUT WITH THE AM.)

PROCEED WITH FINAL AM PRECIPITATION, STEP XXXX.

CORE LAB

Date 6-02-98

TITLE	Standard Operating Procedure for Sequential Separation of Alpha-emitting Isotopes		
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R405	0	9/29/95	1 of 41

DOCUMENT CONTROL PAGE

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Reviewed By: [signature] Date 9-29-95
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UNCONTROLLED DOCUMENT

Controlled Copy Number: 01

Revision No.	0					
Date	9/29/95					

1. Scope and Application

This standard operating procedure (SOP) provides guidance for the use of CA-GLR-R405 for determining dissolved uranium 233/234, 235/236 & 238; thorium 227, 228, 230, & 232; plutonium 238 & 239/240; and the separation of americium 241; and curium 242 radioactivity in aqueous samples.

This SOP applies to the environmental testing laboratories in the Environmental Services Division of Core Laboratories, Inc.

2. Summary

This procedure provides for the sequential separation of various alpha emitting radionuclides by elution from anion/cation exchange resin columns. Separation is based on the differences in absorption and chemical properties of the radionuclides of interest.

3. Definitions

3.1 Internal Isotope Tracers: In alpha-spectroscopy, radioactive isotopes not found in nature are often used as internal markers to determine the concentration of their natural counterparts. A known amount of tracer activity is added to the sample at the start of the procedure. The tracer recovery is then measured by alpha spectroscopy. The total efficiency comprises both the tracer (chemical) recovery and detector efficiency. Utilizing internal tracers is a simple and accurate means of determining the amount of the natural isotopes in a sample.

3.2 Alpha-Spectroscopy: A measurement technique that is able to identify differences in energy levels from absorption of alpha-particles on a charged silica diode. The pulses produced from the interaction between the alpha and the diode are amplified and the signals are collected on a multi-channel analyzer. By counting for a period of time, peaks are accumulated that represent specific alpha energies indicating the presence of specific alpha emitting radionuclides.

4. Responsibilities

4.1 The laboratory technician or analyst shall:

o Perform the method in accordance with this SOP No. CA-GLR-R405, or as directed by the laboratory section supervisor,

- o Resolve nonconformances in methods and data, first individually, then, if necessary, with the help of the laboratory section supervisor or other technical resource, and

- o Report unresolved nonconformances with a Nonconformance and Corrective Action Report form in accordance with SOP No. HC-RDC-G002.

4.2 The laboratory section supervisor shall:

- o Assist the laboratory technician or analyst in resolving nonconformances, and

- o Review and approve the data, methodology, and final reports for all analyses, tests, and procedures which are performed in his or her laboratory section.

4.3 The QA/QC coordinator shall monitor adherence to this SOP and conformance to the QC criteria of the cited method.

4.4 The laboratory manager shall ensure that the necessary resources are available to accurately and successfully adhere to SOP No. CA-GLR-R405.

5. Interferences, Comments, and Helpful Hints

5.1 Interferences

5.1.1 Dissolved solids greater than 500 ppm may interfere with the ion exchange separation.

5.1.2 Reducing agents in the matrix may prevent achieving the proper oxidation state for loading, eluting, complexation and coprecipitation of the elements of interest.

5.1.3 Excessive quantities of single isotopes or elements may result in separation and spectral interferences if decontamination is not adequately achieved.

5.1.4 It is NOT recommended to run thorium and uranium together from the same sample since thorium 228 is a daughter of the uranium tracer U-232. This will cause problems with the thorium accuracy.

5.2 Comments

5.3 Helpful Hints

6. Sampling, Sample Preservation, and Holding Times

6.1 Sampling Procedure

The sampling procedure should conform to Chapter Three of EPA SW-846. All samples should be collected according to these guidelines. The samples are to be collected in plastic containers which have been cleaned according to EPA specifications. All sampling information should be included on a chain-of-custody (COC) record which should include all sampling dates and times, sampling requirements, temperature and atmospheric conditions, location, and the initials of individuals involved in the sampling and/or handling of the samples.

The samples should be collected in a manner which will provide the most representative sample. Drinking water samples should be collected from the free flowing source and should be large enough to provide adequate sample to achieve the detection limits required under the safe drinking water regulations.

If the material, such as NORM scale, contains significant radioactivity (level 3 or higher, see CA-HPM-001, "Standard Operating Procedure for Radioactive Sample Control and Screening"), the sample size should not exceed 40 g in order to reduce exposure to personnel who handle the materials and to comply with DOT regulations.

6.2 Sample Preservation

Aqueous samples should be preserved at the time of sampling by acidification with dilute nitric acid to a pH of <2. If it is not possible to preserve samples in the field, the samples should be preserved at the laboratory within 5 days of sampling. The samples should then be allowed to set for 16 hours prior to analysis in order to dissolve any precipitate. Solid and soil samples are not preserved in the field or laboratory.

6.3 Holding Times

Samples can be stored up to six months if they are properly preserved.

7. Safety

7.1 General Safety Procedures

- Be knowledgeable of the MSDS information for each chemical which is used in the procedure.
- Comply with the instrument manufacturer's and chemical supplier's safety precautions.
- Comply with all applicable safety regulations and safety SOPs.
- Sample analysis functions shall be performed in the appropriate environment, such as canopies or fume hoods.
- Gloves, protective clothing, face shields, and protective eyewear should be worn by all analysts and technicians while they are in the laboratory. The staff shall always remove gloves and other protective clothing prior to leaving the laboratory and dispose of or store them properly.
- All analysts and technicians shall wash all areas of their hands and arms which may have been exposed to contaminated materials prior to leaving the lab.

7.2 Sample Screening Procedure

Refer to SOP No. CA-HPM-001, "Standard Operating Procedure for Radioactive Sample Control and Screening."

8. Quality Control

There are four levels of quality control for the radiochemistry parameters. Each level has a specified frequency and acceptance criteria for the method blanks, sample duplicates, matrix spikes, laboratory control standards, and chemical recovery. In general, the typical reporting level that is used is Level 2. Level 1 requirements are designated for NORM clients only. Clients which require upper level QC must identify the level which will be needed to satisfy the requirements for a particular project at the time the project is accepted. Additional QC will be performed per client specifications as outlined in the project specific statement of work. Client requirements will supersede Core Laboratories' requirements. The QC requirements for each level are specified in the sections listed below.

	Level 4	Level 3	Level 2	Level 1
Blank	<Detection Limit	<Detection Limit	<Detection Limit	<Detection Limit
Duplicate	RER≤3	RER≤3	RER≤3	RER≤3
Spike Recovery	75 - 125%	70 - 125%	70 - 125%	60 - 130%
Standard Recovery	80 - 120%	70 - 125%	70 - 125%	70 - 125%
Chemical Recovery	50 - 100%	35 - 110%	20 - 110%	20 - 120%

8.1 Method Blank

The method blank is a portion of ASTM Type II water which is treated as a sample throughout the test procedure. For all four QC levels, method blanks must be analyzed at a frequency of one per every 20 samples or a minimum of one per batch. The analyzed concentration of analyte in the method blank should be less than the detection limit.

8.2 Sample Duplicates

Sample duplicates should receive exactly the same treatment as the related samples throughout the procedure. For all four QC levels, sample duplicates must be analyzed at a frequency of one per every 20 samples or a minimum of one per matrix per batch. For all four QC levels (unless otherwise specified by the client), the acceptance criteria for the duplicate values is an RER ≤3.

8.3 Matrix Spikes

A separate sample aliquot shall be spiked with a known concentration of analyte and carried through the entire analytical procedure. The recommended spiking levels are two to five times the sample concentration. For all four QC levels, matrix spike samples must be analyzed at a frequency of one per every 20 samples or a minimum of one per matrix per batch. For Level 4, the acceptance criteria for the matrix spike % recovery is 75-125%. For Levels 2 and 3, the acceptance criteria for the matrix spike % recovery is 70-125%. For Level 1 (NORM clients only), the acceptance criteria for the matrix spike % recovery is 60-130%.

8.4 Laboratory Control Standard

A laboratory control standard (LCS) is a standard which is tested as if it were a sample. The LCS activity should be similar to the activity of the samples. For all four QC levels, laboratory control standards must be analyzed at a frequency of one per every 20 samples or a minimum of one per batch. For Level 4, the acceptance criteria for the LCS % recovery is 80-120%. For Levels 1, 2 and 3, the acceptance criteria for the LCS % recovery is 70-125%.

8.5 Corrective Action

If the QC limits are exceeded, notify the laboratory supervisor or QA/QC coordinator, initiate an Out of Control Event Report or Nonconformance and Corrective Action Report, and take corrective action as advised. Failure to meet client QC requirements will result in the reanalysis of all samples associated with the out of control QC. Case narratives are to be provided to the client which describe the out of control event and corrective action that was taken.

9. Apparatus and Materials

9.1 Required Information for Apparatus, Instruments, and Equipment:

9.1.1 Alpha Spectroscopy System

9.1.2 Electronic Analytical Balance

9.1.3 Top Loading Electronic Balance

9.2 Laboratory Materials

9.2.1 Hot plate

9.2.2 Column support

9.2.3 Disposable 20 ml polypropylene columns with 35 μm porous polypropylene frit

9.2.4 Centrifuge

9.2.5 Anion exchange resin, Bio-Rad AG 1-X8, 50 - 100 mesh (chloride form) or equivalent

9.2.6 Membrane filter, 47 mm

9.2.7 Whatman 540, 15 cm or equivalent

9.2.8 Plastic centrifuge tubes

9.2.9 General laboratory equipment

10. Reagents and Standards

10.1 Reagents

Refer to SOP NO. CA-GLR-R120, "Standard Operating Procedure for Reagent Water Examination for Analysis of Environmental Samples."

10.1.1 Ammonium Iodide - (NH_4I) - reagent grade crystals

10.1.2 Hydrochloric Acid, - (HCl) - 37%, 12N, concentrated, reagent grade.

10.1.3 Hydroflouric Acid, - (HF) - 48%, 29N, concentrated, reagent grade

10.1.4 Hydrogen Peroxide - (H_2O_2) - reagent grade

10.1.5 Nitric Acid - (HNO_3) - 70%, 16N, concentrated, reagent grade

10.1.6 Perchloric Acid - ($HClO_4$) - 71%, 12N, concentrated, reagent grade

10.1.7 Sodium Hydroxide - ($NaOH$)- Pellets

10.1.8 Sulfuric Acid - (H_2SO_4) - 95%, 36N, concentrated, reagent grade

10.1.9 Hydrochloric Acid (9M) - Purchase prepared solution or prepare as follows. In a 1-L graduated cylinder, while stirring, SLOWLY and CAREFULLY add 750 ml concentrated hydrochloric acid to 300 ml deionized water. Upon cooling to room temperature, dilute to a final volume of 1 L with deionized water.

10.1.10 Hydrochloric Acid (6.5M) - Purchase preprepared solution or prepare as follows. In a 1-L graduate cylinder, while stirring, SLOWLY and CAREFULLY add 542 ml concentrated hydrochloric acid to 400 ml deionized water. Upon cooling to room temperature, dilute to a final volume of 1 L with deionized water.

10.1.11 Hydrochloric Acid (1M) - Purchase preprepared solution or prepare as follows. In a 1-L graduated cylinder, while stirring, SLOWLY and CAREFULLY add 84 ml concentrated hydrochloric acid to 900 ml deionized water. Upon cooling to room temperature, dilute to a final volume of 1 L with deionized water.

10.1.12 Hydrochloric Acid (0.5M) - Purchase preprepared solution or prepare as follows. In a 1-L graduated cylinder, while stirring, SLOWLY and CAREFULLY add 42 ml concentrated hydrochloric acid to 900 ml deionized water. Upon cooling to room temperature, dilute to a final volume of 1 L with deionized water.

Note: Shelf-life of the Hydrochloric Acid-Ammonium Iodide Solution is one (1) day.

10.1.13 Hydrochloric Acid-Ammonium Iodide Solution (9M HCl + 0.1 M NH_4I) - In an appropriate size beaker or equivalent container, and on stirrer hot plate, dissolve 3 g of ammonium iodide in 150 ml of 9M HCl. Mix thoroughly. Dilute to 200 ml with 9M HCl.

10.1.14 Hydrochloric Acid - Hydroflouric Acid Solution (6.5N HCl + 0.04N HF) - In a 1-L graduated cylinder, add 1.5 ml concentrated HF to 1 L of 6.5N HCl. Mix thoroughly.

10.1.15 Nitric Acid (8N) - Purchase preprepared solution or prepare as follows. To a 1-L graduated cylinder containing 400 ml deionized water, add 506 ml concentrated HNO_3. Mix, and after cooling to room temperature, dilute to a final volume of 1 L with deionized water.

10.2 Standards

Refer to SOP No. CA-GLR-R110, "Standard Operating Procedure Radioactive Standards and Preparation."

11. Analytical Procedure

11.1 Instrument Calibration and Operation

Refer to SOP No. CA-GLR-R400, "Standard Operating Procedure for Alpha Spectroscopy Operation."

11.2 Sample Preparation

Refer to SOP No. CA-GLR-R160, "Standard Operating Procedure for Preparation of Environmental Samples for Radiochemical Determinations."

11.3 Sample Analysis

11.3.1 Initiate appropriate worksheet and laboratory notebook for the sample to be analyzed and complete as required.

11.3.2 Prepare the aqueous and solid matrix samples in accordance with the instructions contained in CA-GLR-R160.

11.3.3 To the residues from step 11.3.2, add 5 ml of concentrated HNO_3 and ≈ 100 μL of 30% H_2O_2. Evaporate to dryness using a hot plate on low heat.

NOTE: If U, Am/Cm or Pm analyses only are requested, go to step 11.3.29.

11.3.4 Dissolve residue form step 11.3.3 in 70 ml 8N HNO_3.

11.3.5 Heat as necessary to dissolve the sample.

11.3.6 Add seven drops of hydrogen peroxide. If running Th, also add 1 ml 0.5M $Al(NO_3)_3$ to the sample. Place a watch glass over the beaker and place on a hot plate on low heat for one hour. The sample is now valance adjusted and ready for the column.

11.3.7 Cool to room temperature.

11.3.8 Sample should be completely dissolved and in solution. If not, see Supervisor or designated alternate for instruction.

11.3.9 Add 15 ml previously cleaned AG 1-X8 (50 - 100 mesh) anion exchange resin to a column.

11.3.10 Precondition the column by passing 100 ml 8N HNO_3 through the column, in two increments.

11.3.11 Discard preconditioning wash in appropriate waste container.

11.3.12 Collect the eluent from the next step (11.3.13) in an appropriately labeled 250 ml beaker. This is the U, Am/Cm, and pm fraction. Since U, Am/Cm, and Pm are not adsorbed on the column, they will wash through the column in the eluent.

11.3.13 Quantitatively transfer sample to preconditioned AG 1 X8 column. Allow the solution to pass through the column. Wash the container walls three times with small amounts (≈5 ml) of 8N HNO3 and add wash to the column.

11.3.14 Wash the column with an additional 100 ml 8N HNO_3, collecting the eluent in the beaker used in step 11.3.13.

11.3.15 Once the eluent and wash have been collected (steps 11.3.13 and 11.3.14), transfer the beaker to a hot plate on low heat.

11.3.16 Add 1 ml hydrogen peroxide (30%).

11.3.17 Evaporate to dryness using a hot plate on low heat.

11.3.18 Based on the radionuclides that are to be quantified in the sample, do the following:

11.3.18.1 For Am/Cm and/or Pm only, and if environmental levels of uranium are suspected, go to Eichrom Separation of Am, Sop No. CA-GLR-R430, "Standard Operating Procedure for Americium Analysis of Environmental Samples by Alpha Spectroscopy."

11.3.18.2 For uranium only or for U, Am/Cm and/or Pm only, proceed to step 11.3.29.

11.3.18.3 If samples are expected to contain low or environmental levels of uranium go to step 11.3.27 for elution of thorium, plutonium and neptunium. If samples are expected to contain significant quantities, continue to step 11.3.19.

11.3.19 Elute Th and Pu together with 50 ml of 0.5N HCl. Collect in one clean labeled 250 ml beaker. Transfer beaker to low heat hot plate and evaporate to dryness.

11.3.20 Convert sample to nitrate form by adding ≈5 ml HNO_3 and evaporating to dryness. Dissolve residue in 7 ml of 8N HNO_3.

11.3.21 Add seven drops of hydrogen peroxide and 1 ml 0.5M $Al(NO_3)_3$ to the sample, place a watch glass over the beaker and place on a hot plate on low heat for one hour. The sample is now valance adjusted and ready for the column.

11.3.22 Add 15 ml AG 1-X8 (50 - 100) mesh) anion exchange resin to a column.

11.3.23 Pre-condition the column by passing 100 ml 8N HNO_3 through the column.

11.3.24 Discard preconditioning wash in appropriate waste container.

11.3.25 Quantitatively transfer the solution to the preprepared column above.

11.3.26 Allow the solution to pass through the column. Wash the container walls three times with small amounts (≈15 ml) of 8N HNO_3 and add to the column. Discard wash waste in an appropriate waste container.

If high levels of uranium are suspected, wash column with an additional 100 ml 8N HNO_3. Discard wash waste in an appropriate waste container.

11.3.27 To Elute Thorium

11.3.27.1 Label a 250 ml beaker to collect eluent from following step (11.3.27.2).

11.3.27.2 Elute thorium from the column with 3 - 30 ml elutions of 9M HCl (collect eluent).

11.3.27.3 Evaporate eluent to dryness using a hot plate on low heat.

11.3.27.4 To mount the thorium, proceed to SOP CA-GLR-R470.

11.3.28 To Elute and Prepare Plutonium

11.3.28.1 Collect eluent in an appropriately labeled 250 ml beaker.

11.3.28.2 Elute Pu from the column with 2-20 ml and 1-30ml addition of the hydrochloric acid + ammonium iodide solution (9M HCl + 0.1M NH_4I).

11.3.28.3 Add 5 ml concentrated HNO_3.

11.3.28.4 Evaporate to dryness using a hot plate on low heat.

11.3.28.5 If Pu241 is required, accurately add 20 ml of 8<u>N</u> HNO_3 to sample, and warm slightly to get sample into solution. Do not heat too much - volume must stay at 20 ml.

Cool sample.

Remove 10 ml of sample using a calibrated volumetric pipet or equivalent, and place in a liquid scintillation vial.

Place vial in a sand bath that is on a medium warm hot plate. Allow sample to evaporate to less than 0.5 ml, but NOT dry. Add 9.5 ml DI water and mix completely. Add 10 ml of scintillation cocktail and mix thoroughly. Submit to count room for measurement of Pu241 by alpha spectroscopy.

Take the remaining 10 ml sample and continue with step 11.3.28.6 of this procedure.

11.3.28.6 Add 5 ml concentrated HCl.

11.3.28.7 Evaporate to dryness using a hot plate on low heat.

11.3.28.8 To mount the plutonium, proceed to SOP CA-GLR-R470.

11.3.29 To prepare the U and the Am/Cm and Pm Samples

11.3.29.1 To the dried residue from steps 11.3.3 or 11.3.18.2, add 5 ml concentrated HCl.

11.3.29.2 Evaporate to dryness using a hot plate on low heat.

11.3.29.3 Dissolve the residue in 70 ml of 9M HCl.

11.3.29.4 Heat as necessary to dissolve.

11.3.29.5 Cool to room temperature.

11.3.29.6 Sample should be completely dissolved and in solution. If not, see Supervisor or designated alternate for instruction.

11.3.29.7 Add 7 drops of hydrogen peroxide to the sample. Warm the sample slightly and allow the peroxide to effervesce. At the conclusion of effervescence, the sample is valance adjusted and ready for the column.

11.3.29.8 Add 15 ml previously cleaned AG 1-X8 (50 - 100 mesh) anion exchange resin to a column.

11.3.29.9 Precondition the column by passing 50 ml 9<u>M</u> HCl through the column in two increments.

11.3.29.10 Discard preconditioning solution acid in the appropriate container.

11.3.29.11 Label a 250 ml beaker to collect the eluent of the next step (11.3.29.12) for Am/Cm or Pm analysis.

11.3.29.12 Quantitatively transfer sample to preconditioned AG 1-X8 column. Allow the solution to pass through the column. Wash the container walls three times with small amounts (≈5 ml) of 9<u>M</u> HCl and add wash to the column.

11.3.29.13 If Am/Cm and Pm analyses are required, wash the column with 15 ml 9<u>N</u> HCl, catching in same 250 ml beaker.

11.3.29.14 Evaporate eluent and combined washes to dryness using a hot plate on low heat.

11.3.29.15 To complete preparation of the Am/Cm and/or Pm radionuclides, go to Eichrom Separation of Am, Sop No. CA-GLR-R430, "Standard Operating Procedure for Americium Analysis of Environmental Samples by Alpha Spectroscopy."

11.3.29.16 To elute the uranium from the column, wash the column with the following solutions, discarding all washes in the appropriate waste container.

11.3.29.17 Wash column with 35 ml of the hydrochloric acid + ammonium iodide solution (9M HCl + 0.1N NH_4I).

11.3.29.18 Wash column with 35 ml of the hydrochloric acid + hydroflouric acid solution (6.5M HCl + 0.004N HF).

11.3.29.19 Wash the column with 10 ml of 6.5M HCl.

11.3.29.20 Elute the uranium with 50 ml of 0.5M HCl into an appropriately labeled 250 ml beaker.

11.3.29.21 Evaporate to dryness using a hot plate on low heat.

11.3.29.22 To mount the uranium, proceed to SOP CA-GLR-R470.

12. Data Generation and Calculations

12.1 Calculation of Chemical Recovery

$$Cr = \frac{CPM_{tr}/Ef_d}{DPM_e} * \frac{V_t}{V_a}$$

where:
Cr - Chemical Recovery
CPM_{tr} - Net Counts per minute for the Tracer
DPM_e - Disintegrations per minute for the Tracer
Ef_d - Detector Efficiency
V_t - Volume total
V_a - Volume aliquot

12.2 Calculation for Total Efficiency

$$Ef_t = Ef_d * Cr$$

where: Ef_t - Total Efficiency

12.3 Calculation for DPM of Analyte

$$DPM_a = \frac{CPM_n}{Ef_t}$$

where: DPM_a - Disintegrations per minute computed for an analyte (nuclide)
CPM_n - Net Counts per minute for nuclide

To determine final activity, divide the DPM results by the aliquot volume and 2.22 to convert to pCi/unit volume.

12.4 Calculation for Detection Limit

$$L_d = \frac{k^2}{T_s} + 2k\sqrt{\left(\frac{R_b}{T_b}\right)\left(1+\frac{T_b}{T_s}\right)}$$

Where: L_d - Detection limit
k - 1.96 2 sigma
R_b - Background counts per minute for a nuclide
T_b - Live time background in minutes
T_s - Live time samples in minutes

12.5 Calculation for MDA

$$MDA = \frac{L_d}{Ef_t}$$

12.6 Calculation of Error

$$Err_a = \frac{\sqrt{\left(\frac{R_g}{T_s}\right) + \left(\frac{R_b}{T_b}\right)}}{R_n}$$

where: R_g - Gross counts per minute for a nuclide
R_n - net counts per minute for a nuclide

12.7 Quality Control Calculations

12.7.1 Percent Recovery of Standards

$$\text{Percent Recovery} = \frac{\text{Analyzed Value}}{\text{Known Value}} \times 100\%$$

12.7.2 Percent Recovery of Matrix Spike

$$\text{Percent Recovery} = \frac{SSC - SC}{SA} \times 100\%$$

where:

SSC = Spiked Sample Concentration
SC = Sample concentration (previously determined)
SA = Spike Added

12.7.3 Relative Error Ratio (RER)

$$RER = \frac{|C_1 - C_2|}{\left[(error_1)^2 + (error_2)^2\right]^{1/2}}$$

C_1 & C_2 = Measured Concentrations for the sample and duplicate

Error $_{1\,\&\,2}$ = respective errors

13. Data Reporting

13.1 Raw Data Reporting

13.1.1 All raw data must be entered as it is acquired in the designated bound logbook. This includes test method, analyte being determined, measurement parameters, dilution factors, analyst's initials, and date of test. All information and data which is pertinent to the test should be recorded to facilitate data validation. Any unusual conditions or information on the appearance of the samples, or any other factors which may influence the results should also be noted.

13.1.2 Instrument printouts and copies of spreadsheets or graphs should be dated, initialed by the analyst, and filed chronologically in a designated area.

13.2 LIMS Data Entry Methodology

If you have questions concerning LIMS data entry requirements, refer to the LIMS User Manual or contact your laboratory section supervisor or QA/QC coordinator.

13.2.1 Method Reference

The analyst must verify that the proper method reference is entered for each sample analyzed. If the method which was utilized varies from the assigned LIMS default method, delete the incorrect test code for that sample and then enter the correct test code or change the designated method in the existing test code. A corrected log-in sheet will be generated and placed in the master (job) folder.

13.2.2 Method Detection Limits

Report the detection limit for the sample based on the matrix. Client specific detection limits should be reported when requested by the client.

13.2.3 Units

Report the data using the appropriate units based on the sample matrix. Use pCi/L, μg/L, or mg/L for aqueous samples and pCi/g, μg/g, or mg/g for soil and solid samples.

13.2.4 Date Analyzed

The analyst must enter the date of analysis for each batch of samples processed. Enter the date that the procedure was initiated.

13.2.5 Significant Figures

Record LIMS data to the proper number of significant figures. The number of significant figures reported must correlate with the method detection limit. Generally, no more than 3 significant figures should be used for results greater than 10, and no more than 2 significant figures for results less than 10.

Statistical rounding must be employed in determining the final reported concentration. Refer to Standard Methods, 18th Edition, for further information on statistical rounding.

13.2.6 Quality Control Data

Enter quality control data for all method blanks, sample duplicates, matrix spikes, and LCSs which were analyzed with the sample batch.

13.3 Case Narrative

When required, a case narrative will be prepared and included with the report. Each report requiring a case narrative should include the data, validation information, copies of relevant fax or phone logs, and any documentation on corrective action that was taken.

13.4 Job Files

Collect all data sheets and printouts; place copies in the job file. The job file should then be transferred to the QA/QC coordinator for validation and report generation. All COC information, log-in information, log sheets, spectral print outs, and report sheets that are to be included in the data validation package should be placed in the client file. Include all standard information, calibration information, analytical data, calculated results, and a case narrative if required.

14. References

14.1 U. S. Nuclear Regulatory Commission, Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operation) - Effluent Streams and the Environment."

14.2 "Quality Assurance Program Requirements for Nuclear Facilities," ANSI/ASME NQA-1, 1989.

14.3 Core Laboratories Corporate QA Manual.

14.4 Radiochemistry QA Manual.

14.5 "Radioisotope Techniques, " R. T. Overton and H. M. Clark, McGraw-Hill Book Co., Inc., New York, Chapter 6, 1960.

14.6 "Procedures for Determination of Stable Elements and Radionuclides in Environmental Samples," Public Health Service Publication 999-RH-10, January 1965.

14.7 "The Radiochemistry of Uranium,' J. E. Grindler, NAS-NS-3050, National Academy of Sciences, 1962.

14.8 "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," H. L. Krieger and E. L. Whittaker, EPA-600/4-80-032, August 1980.

14.9 "Standard Methods for the Examination of Water and Waste Water," APHA, AWWA, WPCF, American Public Health Association, Washington, D.C.

14.10 "Annual Book of ASTM Standards," Section 11.02, Water and Environmental Technology, American Society for Testing and Materials, Philadelphia, PA 19103, 1991.

14.11 "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," L. A. Currie, NUREG/CR-4007, U. S. Nuclear Regulatory Commission, September, 1984.

14.12 "Handbook for Analytical Quality Control in Radioanalytical Laboratories," L. G. Kanipe, EPA-600/7-77-088, August 1977.

14.13 "Establishing a Quality Assurance Program for Analytical Chemistry Laboratories Within the Nuclear Industry," Annual Book of ASTM Standards, Volume 12, C1009-83.

14.14 "Radiometric Method for the Determination of Uranium in Water: Single Laboratory Evaluation and Interlaboratory Collaborative Study," C. T. Bishop, V. R. Casella, and A. A. Glosby, EPA-600/7-79-093, U. S. Environmental Protection Agency, April 1979.

14.15 "The Radiochemistry of Plutonium," G. H. Coleman, NAS-NS-3058, National Academy of Sciences, September, 1965.

14.16 "The Radiochemistry of Thorium," E. K. Hyde, NAS-NS-3004, National Academy of Science, January 1960.

14.17 Guseva, L. I., and Tikhomirova, G. S.; Radiokhimya, 16, 152-156, 1974.

15. Method Performance

16. Associated Documents and Forms

CORE LAB

TITLE			
Standard Operating Procedure for Sequential Separation of Alpha-emitting Isotopes			
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R405	0	9/29/95	22 of 41

16.1 CHECK OFF LIST PROCEDURE FOR AM241, ISO PU AND PU241
rev. 1-11-95 WP(bioradisoampu)

JOB#____________SAMPLE #__________

16.1.1 SAMPLE PREP.

___1. LABEL BEAKERS WITH LAB SAMPLE ID (WITH EACH SET OF 20 RUN 1-MS, 1 MD, 2-MB, 1-LC AND 1-ST.)

___2. MEASURE A ALIQUOT OF SAMPLE TO MEET DET.LIMIT INTO APPROPRIATE BEAKERS.

___3. PIPET A CALIBRATED VOL. OF PLUTONIUM STANDARD AND AMERICIUM STANDARD INTO EACH STANDARD AND SPIKE.

___4. PIPET A CALIBRATED VOL. OF PLUTONIUM TRACER AND AMERICIUM TRACER INTO ALL SAMPLES, STANDARDS AND ONE DESIGNATED BLANK.

___5. ADD ≈2 ML CON. HNO_3 EVAPORATE SAMPLES TO DRYNESS. (DO NOT BAKE.)

___6. TO THE RESIDUES FROM STEP 5 ADD 5 ML CON. HNO_3 AND 7 DROPS OF 30% H_2O_2. EVAPORATE TO DRYNESS USING A HOT PLATE ON LOW HEAT. (DO NOT BAKE.)

___7. DISSOLVE RESIDUE IN AT LEAST 20 ML OF CON. HNO_3. EVAPORATE TO DRYNESS ON A LOW HEAT HOT PLATE. REPEAT ONCE.

(1)____20 ML CONC. HNO_3 (2)____20 ML CONC. HNO_3

___8. DISSOLVE RESIDUE IN 75 ML OF 8N HNO_3.

___9. ADD SEVEN DROPS OF H_2O_2. **FOR SAMPLES NEEDING PU, ADD 1 ML OF 25% $NaNO_2$ TO THE SAMPLE.** PLACE A WATCH GLASS OVER THE BEAKER AND PLACE ON LOW HEAT, WARM SAMPLE SLIGHTLY AND ALLOW THE H_2O_2 TO EFFERVESCE FOR 1 HOUR. THE COLUMN IS NOW READY TO CHARGE.

PROCEED TO STEP 16.1.2, 1st COLUMN - SEPARATION OF AM FROM PU

STOP!!!

NOTE: MAKE SURE YOU HAVE EVERYTHING READY TO START COLUMNS BEFORE YOU GET TO STEP 1 OF COLUMNS. LABEL ALL BEAKERS, SET UP COLUMNS, MAKE UP ALL REAGENTS. ONCE YOU GET STARTED WITH THE COLUMNS, YOU CAN NOT STOP UNTIL THEY ARE DONE! DO NOT LET COLUMNS GO DRY!

16.1.2 <u>1ST COLUMN - SEPARATION OF AM FROM PU</u>

___1. ADD 9 CM AG 1-X8 (50-100 MESH) ANION EXCHANGE RESIN TO A COLUMN.

___2. PRE-CONDITION THE COLUMN BY PASSING 100 MLS OF 8N HNO_3 THROUGH THE COLUMN. DISCARD PRECONDITIONING WASH IN AN APPROPRIATE WASTE CONTAINER.

NOTE: FOR SAMPLES NEEDING PU ONLY, DISCARD THE ELUTE FROM THE STEP 16.1.3 "TO ELUTE AMERICIUM." (THIS ELUTE IS WASTE.)

16.1.3 <u>TO ELUTE AMERICIUM</u>

___1. PLACE LABELED AM BEAKERS UNDER RESPECTIVE COLUMN.

___2. QUANTITATIVELY TRANSFER THE SAMPLE SOLUTION TO THE COLUMN PREPARED ABOVE. COLLECT ELUTE INTO THE AM BEAKERS.

___3. ALLOW SOLUTION TO PASS THROUGH THE COLUMN. WASH THE CONTAINER WALLS THREE TIMES WITH SMALL AMOUNTS ≈15 ML OF 8N HNO_3 AND ADD TO THE COLUMN. COLLECT ELUTE INTO THE AM BEAKERS.

___4. TO THE AM ELUTION ADD 5 ML HNO_3 AND 7 DROPS OF H_2O_2, EVAPORATE TO DRYNESS. (DO NOT BAKE)

NOTE: FOR THE AM SAMPLES, PROCEED TO THE FERRIC HYDROXIDE PRECIPITATION, STEP 16.1.6. UNLESS SAMPLES ARE HIGH IN URANIUM. IF THIS IS THE CASE, RUN THE COLUMN FOR URANIUM INTERFERENCES IN AMERICIUM, STEP 16.1.11.

CORE LAB

TITLE			
Standard Operating Procedure for Sequential Separation of Alpha-emitting Isotopes			
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R405	0	9/29/95	

16.1.4 **TO ELUTE TH**

___1. ELUTE TH FROM COLUMN WITH 2 INCREMENTS OF 9N HCL ___ 25 ML ___ 25 ML (50 ML 9N HCL PER SAMPLE). (ELUTE IS WASTE.)

16.1.5 **TO ELUTE PLUTONIUM**

___1. LABEL BEAKERS WITH LAB ID AND PLACE UNDER RESPECTIVE COLUMN. (DO THIS BEFORE YOU PRE-COND. COLUMNS.)

___2. ELUTE PU FROM THE COLUMN WITH 3 INCREMENTS OF THE HYDROCHLORIC ACID + AMMONIUM IODIDE SOLUTION (SEE REAGENTS) (9N HCL + 0.1 NH_4I)
30 ML ___ 20 ML ___ 20 ML ___(70 ML TOTAL PER SAMPLE)

___3. ADD 5 ML CONCENTRATED HNO_3 TO BEAKER AND 7 DROPS OF H_2O_2, EVAPORATE TO DRYNESS USING HOT PLATE ON LOW HEAT. (DON'T BAKE) YOU MAY HAVE TO WET ASH SAMPLES MORE THAN ONCE TO GET RID OF THE AMMONIUM IODIDE SOLUTION.

NOTE: FOR ISO PU PROCEED TO STEP 16.1.5.2, "FINAL PRECIPITATION FOR PU." IF PU241 IS REQUIRED, THEN PROCEED TO STEP 16.1.5.1, "PU241."

16.1.5.1 **PU 241**

___1. PIPET 20 ML OF 4N HNO_3 TO THE PU BEAKERS.

___2. WARM SAMPLES JUST ENOUGH TO DISSOLVE RESIDUE.

NOTE: DON'T REDUCE THE VOLUME OF THE SAMPLE - YOU NEED AN EVEN SPLIT.

___3. COOL SAMPLE AND PIPET 10 ML OF THE SAMPLE INTO THE APPROPRIATE MARKED LSC VIAL.

___4. PLACE INTO A SAND BATH AND EVAPORATE DOWN TO ABOUT 1 OR 2 DROPS. DON'T LET SAMPLE DRY OUT.

___5. PIPET 5 ML OF DI INTO EACH LSC VIAL.

___6. PIPET 15 ML OF ULTIMA GOLD AB INTO EACH LSC VIAL CAP AND SHAKE.

___7. MAKE COPIES OF ALL TRACKING SHEETS AND PLACE THE COPIES WITH THE PU241'S.

___8. PLACE THE PU241 AND PAPER WORK INTO THE COUNT ROOM.

___9. EVAPORATE THE REMAINING 10 ML OF SAMPLES LEFT IN THE BEAKER. THEN PROCEED TO STEP 1 OF THE FINAL PU PRECIPITATION. THIS STEP IS NEEDED FOR TRACER RECOVERY.

16.1.5.2 <u>FINAL PRECIPITATION FOR PU</u>

___1. ADD 5 ML CONC. HCL AND EVAPORATE TO DRYNESS (DON'T BAKE)

___2. ADD 1 ML 3N H_2SO_4 AND 3-4 ML CONC HCL. COVER WITH WATCH GLASS AND TAKE TO FUMES ON MED. HOT PLATE.

___3. ADD 7-10 ML OF 3N HCL TO EACH BREAKER. PLACE ON HOT PLATE FOR A FEW SECONDS JUST TO DISSOLVE SAMPLE.

___4. RINSE BEAKER SOLUTION INTO CLEAN LABELED C-TUBES WITH 3N HCl. FINAL VOLUME SHOULD BE LESS THAN 15 ML.

___5. ADD 5 DROPS OF 10% ASCORBIC ACID TO EACH C-TUBE.

___6. ADD 100 UL OF NEODYMIUM SOLUTION (5mg/ml) TO EACH C-TUBE.

___7. ADD 1 ML OF CONC HYDROFLUORIC (HF) TO EACH C-TUBE.

___8. SWIRL AND LET STAND FOR 30 MINUTES.

PROCEED TO FILTRATION, STEP 16.1.9

16.1.6 <u>FERRIC HYDROXIDE PRECIPITATION</u>

___1. DISSOLVE THE RESIDUE FROM STEP 4 OF AM ELUTION WITH ABOUT 10 ML OF 8N HNO_3, SWIRLING AND HEATING BRIEFLY IF NEEDED.

___2. TRANSFER THE SAMPLE SOLUTION TO A CLEAN LABELED C-TUBE WITH DI H_2O. BRING THE SOLUTION LEVEL UP TO THE 30 ML MAKE WITH DI H_2O. ADD 1 ML OF IRON CARRIER (10 mg Fe/ml).

___3. ADD CONC. NH_4OH SLOWLY AND WHILE STIRRING THE SAMPLE. A RED-BROWN PRECIPITATE WILL FORM. CHECK PH WITH PH STRIP. PH

SHOULD BE 8 TO 10. ADD MORE CONC NH_4OH IF NECESSARY TO ACHIEVE THE CORRECT PH.

PROCEED TO THE FINAL AM COLUMN, STEP 16.1.7.

16.1.7 <u>FINAL AM COLUMN</u>

THIS COLUMN IS TO BE DONE AFTER FERRIC HYDROXIDE PRECIPITATION

___1. PREPARE COLUMN BY ADDING 0.35 g TRU-SPEC RESIN (ADD RESIN TO THE 1.2 ML MARK ON COLUMN) TO THE COLUMN ADD 10 ML 4N HNO_3 LET SOAK FOR 1 HOUR.

___2. DISSOLVE PRECIPITATE FROM FERRIC HYDROXIDE PROCESS WITH 30 ML OF 3 M HNO_3.

___3. ADD A SMALL AMOUNT OF SOLID ASCORBIC ACID TO SAMPLE, STIR GENTLY, ALLOW THE SAMPLE TO SET FOR ABOUT 10 MIN.

___4. WASH COLUMN WITH 15 ML 4N HNO_3 AND THEN WITH 5 ML OF 3N HNO_3.

___5. LOAD SAMPLE ONTO COLUMN RINSE BEAKER WITH A VERY SMALL AMOUNT OF 3N HNO_3. (ELUTE IS WASTE)

___6. ADD 2 ML 8N HCL. (ELUTE IS WASTE)

___7. ELUTE AM WITH 15 ML 3M HCL. CATCH ELUTE INTO CLEAN LABELED C-TUBES. (DON'T USE MORE THAN 15 ML OF 3M HCL OR YOU'LL BE ELUTING THE PU OUT WITH THE AM.)

PROCEED WITH FINAL AM PRECIPITATION, STEP 16.1.8.

16.1.8 <u>FINAL AM PRECIPITATION</u>

___1. ADD 5 DROPS OF 10% ASCORBIC ACID AND 100 UL OF NEODYMIUM SOLUTION (5mg/ml) TO EACH C-TUBE.

___2. PLACE SAMPLES WITH OUT CAPS INTO A HOT WATER BATH FOR 1 HOUR.

___3. REMOVE SAMPLES AND ADD 5 ML HF TO EACH C-TUBE.

___4. CAP AND PLACE SAMPLES INTO A SHAKER AND SHAKE FOR 2 MIN.

___5. PLACE SAMPLES INTO ICE BATH FOR 10 MIN.

PROCEED TO FILTRATION, STEP 16.1.9

16.1.9 <u>FILTRATION</u>

___1. LABEL PETRI DISH AND DISK WITH LAB SAMPLE ID.

___2. RINSE FILTER AREA WITH DI H_2O.

___3. RINSE FILTER AREA WITH DI.

___4. PLACE CLEAN FILTER ON STEM AND PLACE FUNNEL ON TOP.

___5. WASH EACH FUNNEL/FILTER WITH DI AND CHECK FOR LEAKS.

___6. ADD ≈20 ML SUBSTRATE SOLUTION TO EACH FUNNEL/FILTER.

___7. LOAD SAMPLE ONTO RESPECTIVE FUNNEL/FILTER AND RINSE C-TUBE WITH DI AND ADD TO RESPECTIVE FUNNEL/FILTER.

___8. RINSE EACH FUNNEL WITH DI AFTER SAMPLE HAS GONE THROUGH.

___9. TURN OFF PUMP REMOVE FUNNEL PLACE EACH FILTER ON RESPECTIVE DISK AND THEN INTO PETRI DISH. SET UNDER HEAT LAMP FOR 5-10 MINUTES.

__10. DESICCATE FOR 10 MINUTES.

__11. SCAN SAMPLES.

__12. PLACE IN COUNTING ROOM TO COUNT.

16.1.10 <u>REAGENTS</u>

16.1.10.1 <u>REAGENTS*</u> FOR 1ST COLUMN

8<u>N</u> HNO_3 1 L CONC. HNO_3 TO 1 L DI H_20
(MAKES 2.0 L NEED ≈220 ML PER SAMPLE)

9<u>N</u> HCL 1500 ML CONC. HCL TO 500 ML DI H_20
(MAKES 2.0 L NEED ≈120 ML PER SAMPLE)

3N HCL 500 ML CONC. HCL TO 1500 ML DI H_2O
(MAKES 2.0 L NEED ≈10 ML PER SAMPLE)

3N H_2SO_4 20 ML CONC. H_2SO_4 TO 240 ML DI H_20
(NEED 1 ML PER SAMPLE)

HYDROCHLORIC ACID-AMMONIUM IODIDE SOLUTION (9N HCL + 0.1 M NH_4I)
MAKE FRESH DAILY. SHELF LIFE OF 9N HCL + 0.1M NH_4I IS ONE DAY

IN APPROPRIATE SIZE BEAKER AND ON STIRRING PLATE, DISSOLVE 6 gm OF AMMONIUM IODIDE IN 300 MLS OF 9N HCL. MIX THOROUGHLY. DILUTE TO 400 MLS 9N HCL. STORE IN APPROPRIATE SIZE DARK CONTAINER. (NEED ≈70 ML PER SAMPLE)

1.5g NH_4I	DILUTE TO 0.1L	9N HCL	=	1 SAMPLE
7.5g NH_4I	DILUTE TO 0.5L	9N HCL	=	7 SAMPLES
15.0g NH_4I	DILUTE TO 1.0L	9N HCL	=	14 SAMPLES
22.5g NH_4I	DILUTE TO 1.5L	9N HCL	=	21 SAMPLES
30.0g NH_4I	DILUTE TO 2.0L	9N HCL	=	28 SAMPLES
37.5g NH_4I	DILUTE TO 2.5L	9N HCL	=	35 SAMPLES
45.0g NH_4I	DILUTE TO 3.0L	9N HCL	=	42 SAMPLES

16.1.10.2 **REAGENTS*** FOR 2ND AM COLUMN

4N HNO_3 500 ML CONC. HNO_3 TO 1500 ML DI H_2O
(NEED 25 ML PER SAMPLE)

3N HNO_3 375 ML CONC. HNO_3 TO 1625 ML DI H_2O
(NEED 40 ML PER SAMPLE)

8N HCL 1333.3 CONC. HCL TO 666.6 DI H_2O
(NEED 2 ML PER SAMPLE)

3N HCL 500 ML CONC. HCL TO 1500 DI H_2O
(NEED 15 ML PER SAMPLE)

16.1.10.3 **REAGENTS*** FOR FINAL PRECIP. AND FILTRATION

NEODYMIUM SOLUTION (5mg/ml0

CONC. HF

10% ASCORBIC ACI	10 g ASCORBIC ACID DILUTE TO 100 ML DI (NEED 5 DROPS PER SAMPLE)
SUBSTRATE SOLUTION	ADD ≈500 ML DI, 2 ML ND, 40 ML CONC. HCL, AND 16 ML CONC. HF. DILUTE TO 1 L DI H_2O (NEED 20 ML PER SAMPLE)

16.1.11 COLUMN FOR URANIUM INTERFERENCES IN AMERICIUM

16.1.11.1 SAMPLE PREP.

___1. TO THE RESIDUES FROM STEP 16.1.3, "TO ELUTE AMERICIUM," ADD 5 ML CONC. HCL AND 7 DROPS OF 30% H_2O_2. EVAPORATE TO DRYNESS USING A HOT PLATE ON LOW HEAT. (DON'T BAKE)

___2. DISSOLVE RESIDUE IN AT LEAST 20 ML OF CONC HCL. EVAPORATE TO DRYNESS USING A HOT PLATE ON LOW HEAT. REPEAT ONCE.
1) ____20 ML CONC HCL 2) ____ 20 ML CONC HCL

___3. DISSOLVE RESIDUE IN 75 ML 9N HCL. HEAT AS NECESSARY TO DISSOLVE.

___4. ADD 7 DROPS OF H_2O_2 TO THE SAMPLE, PLACE WATCH GLASS OVER THE BEAKER, WARM THE SAMPLE SLIGHTLY AND ALLOW TO EFFERVESCE FOR 1 HOUR. AT THE CONCLUSION OF EFFERVESCENCE, THE COLUMN IS READY TO CHARGE.

16.1.11.2 COLUMN

___1. ADD 9 CM AG 1-X8 (50-100 MESH) ANION EXCHANGE BIO-RAD RESIN TO COLUMN.

___2. PRE-CONDITION THE COLUMN BY PASSING 100 ML OF 9N HCL THROUGH THE COLUMN. (ELUTE IS WASTE)

___3. PLACE A LABELED BEAKER UNDER EACH COLUMN.

___4. QUANTITATIVELY TRANSFER THE SAMPLE SOLUTION TO THE COLUMN PREPARED ABOVE. ALLOW THE SOLUTION TO PASS THROUGH THE COLUMN. RINSE THE CONTAINER WALLS 3 TIMES WITH SMALL AMOUNTS OF 9N HCL AND CATCH ELUTE INTO THE BEAKERS.

___5. REMOVE THE BEAKERS AND SET ASIDE.

___6. TO ELUTE THE URANIUM FLUSH THE COLUMN WITH 3 INCREMENTS OF 50 ML 0.5N HCL. (ELUTE IS WASTE)
1)____50 ML 2)____50 ML 3)____50 ML

___7. RECHARGE RESIN BY PASSING 150 ML 9N HCL THROUGH THE COLUMN. (ELUTE IS WASTE)

___8. PLACE A LABELED BEAKER UNDER EACH COLUMN.

___9. QUANTITATIVELY TRANSFER THE SAMPLE THAT WAS ELUTED AND SAVED FROM STEP 4 TO THE COLUMN. RINSE THE BEAKER WALLS WITH SMALL AMOUNTS OF 9N HCL AND ADD TO THE COLUMN. COLLECT ELUTE IN THE BEAKERS.

___10. TO THE AM ELUTION ADD 5 ML HNO_3 AND 7 DROPS OF H_2O_2, EVAPORATE TO DRYNESS ON A HOT PLATE SET ON LOW. (DON'T BAKE)

PROCEED TO FERRIC HYDROXIDE PRECIPITATION, STEP 16.1.6.

16.2 <u>CHECK OFF LIST PROCEDURE FOR ISO TH AND PU - BIO-RAD COLUMN</u>
rev. 01-31-95 WP(bioradisothpu)

JOB #____________ SAMPLE #__________

16.2.1 SAMPLE PREP.

___1. LABEL BEAKERS WITH LAB SAMPLE ID (WITH EACH SET OF 20 RUN 1-MS, 1-MD, 2-MB, 1-LC AND 1-ST.) (FOR CLIENT 64 ADD 1-MSD)

___2. MEASURE A ALIQUOT OF SAMPLE TO MEET DET. LIMIT INTO APPROPRIATE BEAKERS

___3. PIPET A CALIBRATED VOL. OF PLUTONIUM STANDARD AND THORIUM STANDARD INTO EACH STANDARD AND SPIKE.

___4. PIPET A CALIBRATED VOL. OF PLUTONIUM TRACER AND THORIUM TRACER INTO ALL SAMPLES, STANDARDS AND ONE DESIGNATED BLANK

___5. ADD ≈2 ML CONC. HNO_3 EVAPORATE SAMPLES TO DRYNESS. (DO NOT BAKE)

___6. TO THE RESIDUES FROM STEP 5 ADD 5 ML CONC. HNO_3 AND 7 DROPS OF 30% H_2O_2. EVAPORATE TO DRYNESS USING A HOT PLATE ON LOW HEAT. (DO NOT BAKE)

___7. DISSOLVE RESIDUE IN AT LEAST 20 ML OF CONC. HNO_3. EVAPORATE TO DRYNESS ON A LOW HEAT HOT PLATE. REPEAT ONCE. (DO NOT BAKE)
(1)____20 ML CONC. HNO_3 (2)____20 ML CONC. HNO_3

___8. DISSOLVE RESIDUE IN 75 ML OF 8N HNO_3. (IF SAMPLE WILL NOT DISSOLVE ADD UP TO 200 ML OF 8N HNO_3 HEAT SLIGHTLY.)

___9. ADD SEVEN DROPS OF H_2O_2 TO THE SAMPLES **(NOTE: FOR THORIUM ADD 3 ML 0.25 M $AL(NO_3)_3$ - FOR PU ADD 1 ML 25% $NaNO_2$)** PLACE A WATCH GLASS OVER THE BEAKER AND WARM THE SAMPLE SLIGHTLY ON LOW HEAT AND ALLOW THE PEROXIDE TO EFFERVESCE FOR ONE HOUR. THE COLUMN IS NOW READY TO CHARGE.

STOP !!!

NOTE: MAKE SURE YOU HAVE EVERYTHING READY TO START COLUMNS BEFORE YOU GET TO STEP 1 OF COLUMNS. LABEL ALL BEAKERS, SET UP COLUMNS AND MAKE UP ALL REAGENTS. ONCE YOU GET STARTED WITH THE COLUMNS, YOU CAN'T STOP UNTIL THEY ARE DONE! DO NOT LET COLUMNS GO DRY!

PROCEED TO COLUMNS STEP 16.2.2

16.2.2 COLUMN

___1. ADD 9 CM AG 1-X8 (50-100 MESH) ANION EXCHANGE BIO-RAD RESIN TO A COLUMN.

___2. PRE-CONDITION THE COLUMN BY PASSING 100 MLS OF 8N HNO_3 THROUGH THE COLUMN. DISCARD PRECONDITIONING WASH IN APPROPRIATE WASTE CONTAINER.

___3. QUANTITATIVELY TRANSFER THE SAMPLE SOLUTION TO THE COLUMN PREPARED ABOVE.

___4. ALLOW SOLUTION TO PASS THROUGH THE COLUMN. WASH THE CONTAINER WALLS THREE TIMES WITH SMALL AMOUNTS ≈15 ML OF 8N HNO_3 AND ADD TO THE COLUMN. (ELUTE IS WASTE)

___5. FOR SAMPLES QUESTIONABLE OR KNOWN TO BE HIGH IN URANIUM, WASH COLUMN WITH AN ADDITIONAL 100 ML OF 8N HNO_3. (ELUTE IS WASTE)

16.2.3 TO ELUTE THORIUM

___1. PLACE THORIUM BEAKERS UNDER RESPECTIVE COLUMN.

___2. ELUTE THE THORIUM FROM COLUMN WITH 2 INCREMENTS OF 9N HCL
25 ML ___ 25 ML ___ (50 ML 9N HCL PER SAMPLE)

NOTE: ELUTE IS WASTE IF SAMPLES ARE FOR PU ONLY. PROCEED TO STEP 16.2.4, "TO ELUTE PLUTONIUM."

___3. EVAPORATE ELUTE TO DRYNESS USING A HOT PLATE ON LOW HEAT. (DO NOT BAKE) **PROCEED TO FINAL PRECIPITATION, STEP 16.2.5.**

16.2.4 TO ELUTE PLUTONIUM

___1. PLACE PLUTONIUM BEAKERS UNDER RESPECTIVE COLUMN.

___2. ELUTE PU FROM THE COLUMN WITH 3 INCREMENTS OF THE HYDROCHLORIC ACID + AMMONIUM IODIDE SOLUTION (SEE REAGENTS) (9N HCL + 0.1 NH_4I)
30 ML ___ 20 ML ___ 20 ML ___(70 ML TOTAL PER SAMPLE)

___3. ADD 5 ML CONC. HNO_3 AND 7 DROPS OF H_2O_2 TO BEAKER, EVAPORATE TO DRYNESS USING A HOT PLATE ON LOW HEAT. (DO NOT BAKE) REPEAT 3 TIMES.
(1)___ (2)___ (3)___

NOTE: IF ONLY ISO PU IS NEEDED, PROCEED TO STEP 16.2.5, FINAL PRECIPITATION

IF PU241 IS REQUIRED THEN PROCEED TO STEP 16.2.4.1, PU241

16.2.4.1 PU 241

___1. PIPET 20 ML OF 4N HNO_3 INTO THE PU BEAKERS

___2. WARM SAMPLES JUST LONG ENOUGH TO DISSOLVE RESIDUE.

NOTE: DON'T REDUCE THE VOLUME OF THE SAMPLE. AN EVEN SPLIT IS NEEDED.

___3. COOL SAMPLE AND PIPET 10 ML OF THE SAMPLE INTO THE APPROPRIATE MARKED LSC VIAL. SAVE REMAINDER OF SAMPLE IN BEAKER FOR STEP 9.

___4. PLACE LSC VIAL INTO SAND BATH EVAPORATE SAMPLE DOWN TO 1 OR 2 DROPS. DON'T LET SAMPLE DRY OUT.

___5. COOL SAMPLE. PIPET 5 ML DI H_2O INTO EACH LSC VIAL.

___6. PIPET 15 ML OF ULTIMA GOLD AB INTO EACH LSC VIAL, CAP AND SHAKE. SAMPLES WILL BE CLEAR.

___7. MAKE COPIES OF ALL TRACKING SHEETS.

___8. PLACE PU241'S AND COPIES OF THE PAPERWORK INTO THE COUNT ROOM.

___9. EVAPORATE THE REMAINING 10 ML OF SAMPLE FROM STEP 3. THEN PROCEED TO STEP 1 OF THE FINAL PRECIPITATION. THIS STEP IS USED FOR TRACER RECOVERY.

16.2.5 <u>FINAL PRECIPITATION</u>

___1. ADD 1 ML 3<u>N</u> H_2SO_4 AND 3-4 ML CONC. HCL AND TAKE TO FUMES ON MED. HOT PLATE

___2. ADD 7-10 ML OF 3<u>N</u> HCL TO EACH BEAKER. PLACE ON HOT PLATE FOR A FEW SECONDS JUST TO DISSOLVE SAMPLE.

___3. LABEL CLEAN C-TUBES WITH SAMPLE LAB ID.

___4. RINSE BEAKER SOLUTION INTO RESPECTIVE C-TUBES WITH 3<u>N</u> HCL. FINAL VOLUME SHOULD BE LESS THAN 15 ML.

___5. ADD 5 DROPS OF 10% ASCORBIC ACID TO EACH C-TUBE.

___6. ADD 100 UL (YELLOW TIP) OF NEODYMIUM SOLUTION (5 mg/ml) TO EACH C-TUBE.

___7. ADD 1 ML OF CONC. HYDROFLUORIC ACID (HF) TO EACH C-TUBE.

CORE LAB

TITLE			
Standard Operating Procedure for Sequential Separation of Alpha-emitting Isotopes			
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R405	0	9/29/95	

___8. SWIRL AND LET STAND FOR 30 MINUTES.

PROCEED TO STEP 16.2.6, FILTRATION

16.2.6 **FILTRATION**

___1. LABEL PETRI DISH AND DISK WITH LAB SAMPLE ID.

___2. RINSE FILTER AREA WITH DI H_2O.

___3. PLACE CLEAN FILTER ON STEM AND PLACE FUNNEL ON TOP.

___4. WASH EACH FUNNEL/FILTER WITH DI AND CHECK FOR LEAKS.

___5. ADD ≈20 ML SUBSTRATE SOLUTION TO EACH FUNNEL/FILTER.

___6. LOAD SAMPLE ONTO RESPECTIVE FUNNEL/FILTER AND RINSE C-TUBE WITH DI AND ADD TO RESPECTIVE FUNNEL/FILTER.

___7. RINSE EACH FUNNEL WITH DI AFTER SAMPLE HAS GONE THROUGH.

___8. REMOVE FUNNEL. PLACE EACH FILTER ON RESPECTIVE DISK AND THEN INTO PETRI DISH. SET UNDER HEAT LAMP FOR 5-10 MINUTES.

___9. DESICCATE FOR 10 MINUTES.

__10. SCAN SAMPLES.

__11. PLACE IN COUNTING ROOM TO COUNT.

16.2.7 **REAGENTS***

8N HNO_3 — 1 L CONC. HNO_3 TO 1 L DI H_2O
(MAKES 2.0 L NEED ≈220 ML PER SAMPLE)

9N HCL — 1500 ML CONC. HCL TO 500 ML DI H_2O
(MAKES 2.0 L NEED ≈120ML PER SAMPLE)

3N HCL — 500 ML CONC. HCL TO 1500 ML DI H_2O
(MAKES 2.0 L NEED ≈10 ML PER SAMPLE)

3N H_2SO_4 — 20 ML CONC. H_2SO_4 TO 240 ML DI H_2O
(NEED 1 ML PER SAMPLE)

HYDROCHLORIC ACID-AMMONIUM IODIDE SOLUTION (9N HCL + 0.1 M NH_4I)
MAKE FRESH DAILY - SHELF LIFE OF 9N HCL + 0.1 M NH_4I IS ONE DAY

IN APPROPRIATE SIZE BEAKER, AND ON STIRRING PLATE DISSOLVE 6 gm OF AMMONIUM IODIDE IN 300 ML OF 9N HCL. MIX THOROUGHLY. DILUTE TO 400 ML 9N HCL. STORE IN APPROPRIATE SIZE DARK CONTAINER.
(NEED ≈70 ML PER SAMPLE)

1.5g NH_4I DILUTE TO 100 ML 9N HCL = 1 SAMPLE
7.5g NH_4I DILUTE TO 500 ML 9N HCL = 7 SAMPLES
15.0g NH_4I DILUTE TO 1.0 L 9N HCL = 14 SAMPLES
22.5g NH_4I DILUTE TO 1.5 L 9N HCL = 21 SAMPLES
30.0g NH_4I DILUTE TO 2.0 L 9N HCL = 28 SAMPLES
37.5g NH_4I DILUTE TO 2.5 L 9N HCL = 35 SAMPLES
45.0g NH_4I DILUTE TO 3.0 L 9N HCL = 42 SAMPLES

10% ASCORBIC ACID	10 g ASCORBIC ACID DILUTE TO 100 ML WITH DI H_2O (NEED 5 DROPS PER SAMPLE)
SUBSTRATE SOLUTION	TO 500 ML DI ADD 2 ML ND, 40 ML CONC. HCL AND 16 ML CONC. HF. DILUTE TO 1 L WITH DI H_2O (NEED 20 ML PER SAMPLE)
0.25 M $AL(NO_3)_3$	TO 500 ML 8N HNO_3 ADD 93.78 G OF $AL(NO_3)_3$ DILUTE TO 1.0 L WITH 8N HNO_3

16.3 CHECK OFF LIST PROCEDURE FOR ISO U - BIO-RAD COLUMN
rev. 05-01-95 WP(bioradisou)

JOB #__________SAMPLE #________

16.3.1 SAMPLE PREP. - **cookdown (for precipitation see Step 16.3.2)**

___1. LABEL BEAKERS WITH LAB SAMPLE ID (WITH EACH SET OF 20 RUN 1-MS, 1-MD, 2-MB, 1-LC AND 1-ST.)

___2. MEASURE A ALIQUOT OF SAMPLE TO MEET DET. LIMIT INTO APPROPRIATE BEAKERS

___3. PIPET A CALIBRATED VOL. OF UNAT(U238,U235,U234) STANDARD INTO EACH STANDARD AND SPIKE.

___5. POUR OFF WASTE ONCE PRECIPITATE HAS DROPPED TO BOTTOM.

___6. RINSE BEAKERS USING PH 8 DI WATER AND COLLECT ALL PRECIPITATE INTO CLEAN MARKED C-TUBES.

___7. SPIN FOR 10 MINS AND DECANT.

___8. GO TO STEP 16.3.1, SAMPLE PREP.

16.3.3 <u>COLUMN</u>

___1. ADD 9 CM AG 1-X8 (50-100 MESH) ANION EXCHANGE BIO-RAD RESIN TO A COLUMN.

___2. PRE-CONDITION THE COLUMN BY PASSING 100 ML OF 9<u>N</u> HCL THROUGH THE COLUMN. DISCARD PRECONDITIONING WASH IN APPROPRIATE WASTE CONTAINER.

___3. QUANTITATIVELY TRANSFER THE SAMPLE SOLUTION TO THE COLUMN PREPARED ABOVE.

___4. ALLOW SOLUTION TO PASS THROUGH THE COLUMN. WASH THE CONTAINER WALLS THREE TIMES WITH SMALL AMOUNTS ≈5 ML OF 9<u>N</u> HCL AND ADD WASH TO THE COLUMN (ELUTE IS WASTE)

___5. WASH COLUMN WITH 2 INCREMENTS OF THE HYDROCHLORIC ACID + AMMONIUM IODIDE SOLUTION (9<u>N</u> HCL + 0.1<u>N</u> NH_4I)
___30 ML ___20 ML (TOTAL OF 50 ML PER SAMPLE)

___6. WASH COLUMN WITH 2 INCREMENTS OF 35 ML EACH OF THE HYDROCHLORIC ACID + HYDROFLUORIC ACID SOLUTION. (6.5<u>N</u> HCL + 0.004<u>N</u> HF)
___35 ML ___35ML (TOTAL OF 70 ML PER SAMPLE)

NOTE: IF IRON RING IS STILL PRESENT WASH COLUMN AGAIN WITH 35 ML OF THE 6.5<u>N</u> HCL + 0.004<u>N</u> HF.

___7. WASH THE COLUMN WITH 20 ML OF 6.5<u>N</u> HCL.

PROCEED TO STEP 16.3.4, TO ELUTE URANIUM

16.3.4 TO ELUTE URANIUM

___1. PLACE URANIUM BEAKERS UNDER RESPECTIVE COLUMN.

___2. ELUTE URANIUM FROM THE COLUMN INTO APPROPRIATELY LABELED BREAKERS WITH 2 INCREMENTS OF 0.5N HCL.
___50 ML ___50 ML (TOTAL OF 100 ML PER SAMPLE)

___3. ADD 5 ML CONC. HNO_3 TO EACH BEAKER. EVAPORATE ELUTE TO DRYNESS USING A HOT PLATE ON LOW HEAT.

PROCEED TO STEP 16.3.5, FINAL PRECIPITATION

16.3.5 FINAL PRECIPITATION

___1. ADD 1 ML 3N H_2SO_4 AND 3-4 ML CONC. HCL AND TAKE TO FUMES ON MED. HOT PLATE

___2. ADD 7-10 ML OF 3N HCL TO EACH BEAKER. PLACE ON HOT PLATE FOR A FEW SECONDS JUST TO DISSOLVE SAMPLE.

___3. LABEL CLEAN C-TUBES WITH SAMPLE LAB ID.

___4. RINSE BEAKER SOLUTION INTO RESPECTIVE C-TUBES WITH 3N HCL. FINAL VOLUME SHOULD BE 15 ML OR LESS.

___5. ADD 5 DROPS OF 10% ASCORBIC ACID TO EACH C-TUBE.

___6. ADD 100 UL (YELLOW TIP) OF NEODYMIUM SOLUTION (5 mg/ml) TO EACH C-TUBE.

___7. ADD 3 DROPS OF TITANIUM CHLORIDE TO EACH C-TUBE.

___8. ADD 1 ML OF CONC. HYDROFLUORIC ACID (HF) TO EACH C-TUBE.

___9. SWIRL AND LET STAND FOR 30 MINUTES.

PROCEED TO STEP 1 OF FILTRATION

16.3.6 FILTRATION

___1. LABEL PETRI DISH AND DISK WITH LAB SAMPLE ID.

___2. RINSE FILTER AREA WITH DI H_2O.

___3. RINSE FILTER AREA WITH DI.

___4. PLACE CLEAN FILTER ON STEM AND PLACE FUNNEL ON TOP.

___5. WASH EACH FUNNEL/FILTER WITH DI AND CHECK FOR LEAKS.

___6. ADD ≈20 ML SUBSTRATE SOLUTION TO EACH FUNNEL/FILTER.

___7. LOAD SAMPLE ONTO RESPECTIVE FUNNEL/FILTER AND RINSE C-TUBE WITH DI AND ADD TO RESPECTIVE FUNNEL/FILTER.

___8. RINSE EACH FUNNEL WITH DI AFTER SAMPLE HAS GONE THROUGH.

___9. REMOVE FUNNEL, REMOVE FILTER AND PLACE EACH FILTER ON RESPECTIVE DISK AND THEN INTO PETRI DISH. SET UNDER HEAT LAMP FOR 5-10 MINUTES.

__10. DESICCATE FOR 10 MINUTES.

__11. PLACE IN COUNTING ROOM TO COUNT.

16.3.7 <u>REAGENTS*</u>

9<u>N</u> HCL 1500 ML CONC. HCL TO 500 ML DI H_20
(MAKES 2.0 L NEED ≈250 ML PER SAMPLE)

6.5<u>N</u> HCL 1084 ML CONC. HCL TO 916 ML DI H_20
(MAKES 2.0 L NEED ≈90 ML PER SAMPLE)

0.5<u>N</u> HCL 84 ML CONC. HCL TO 1916 ML DI H_2O
(MAKES 2.0 L NEED ≈100 ML PER SAMPLE)

3<u>N</u> HCL 500 ML TO 1500 ML DI H_2O
(MAKES 2.0 L NEED ≈10 ML PER SAMPLE)

3<u>N</u> H_2SO_4 20 ML CONC. H_2SO_4 TO 240 ML DI H_20
(NEED 1 ML PER SAMPLE)

HYDROCHLORIC ACID-AMMONIUM IODIDE SOLUTION (9N HCL + 0.1 M NH_4I)
MAKE FRESH DAILY SHELF LIFE OF 9N HCL + 0.1 M NH_4I IS ONE DAY

IN APPROPRIATE SIZE BEAKER, AND ON STIRRING PLATE DISSOLVE 30 gm OF AMMONIUM IODIDE IN 1.0 L OF 9N HCL. MIX THOROUGHLY. DILUTE TO 2.0 L 9NH CL. STORE IN APPROPRIATE SIZE DARK CONTAINER.
(MAKES 2.0 L NEED ≈50 ML PER SAMPLE)

1.5g NH_4I DILUTE TO 100 ML 9N HCL = 2 SAMPLES
7.5g NH_4I DILUTE TO 500 ML 9N HCL = 10 SAMPLES
15.0g NH_4I DILUTE TO 1.0 L 9N HCL = 20 SAMPLES
22.5g NH_4I DILUTE TO 1.5 L 9N HCL = 30 SAMPLES
30.0g NH_4I DILUTE TO 2.0 L 9N HCL = 40 SAMPLES
37.5g NH_4I DILUTE TO 2.5 L 9N HCL = 50 SAMPLES
45.0g NH_4I DILUTE TO 3.0 L 9N HCL = 60 SAMPLES

HYDROCHLORIC ACID - HYDROFLUORIC ACID (6.5 HCL + 0.04N HF)IN A 1 L PLASTIC BOTTLE, ADD 1.5 ML CONC. HF TO 1 L 6.5N HCL. MIX THOROUGHLY.

10% ASCORBIC ACID 10 g ASCORBIC ACID DILUTE TO 100 ML DI
(NEED 5 DROPS PER SAMPLE)

SUBSTRATE SOLUTION ADD ≈500 ML DI ADD 2 ML ND, 40 ML CONC.HCL, AND 16 ML CONC. HF DILUTE TO 1 L DI H_2O
(NEED 20 ML PER SAMPLE)

CORELAB

TITLE	Standard Operating Procedure for Sequential Separation of Alpha-emitting Isotopes		
SOP NO.	REVISION NO.	EFFECTIVE DATE	PAGE
CA-GLR-R405	0	9/29/95	

___2. MEASURE A ALIQUOT OF SAMPLE TO MEET 30 to 40 pCi/ml FOR WATER SAMPLES: INST. READING Ug OF U308 X .59
(FOR KPA X .69) = pCi/Unat per liter ÷ 1000 = pCi/ml
0 to 60 ug/l use 900 mls
70 ug/l use 700 mls
80 ug/l use 600 mls
90 ug/l use 550 mls
100 ug/l use 500 mls
for any other use the above cal.

FOR SOIL SAMPLES: INST. READING Ug OF U308 X .1 X .59 = pCi/Unat per liter ÷ 1000 = pCi/ml

___3. IF NEEDED, DILUTE SAMPLES TO 900 ML WITH DI WATER.

___4. PLACE STIR BAR IN EACH BEAKER.

___5. ADD ABOUT 5 ML OF HNO_3 AND ABOUT 2-3MLS H_2O_2

___6. PIPET A CALIBRATED VOL. OF UNAT(U238,U235,U234) STANDARD INTO EACH STANDARD AND SPIKE.

___7. PIPET A CALIBRATED VOL. OF U232 TRACER INTO ALL SAMPLES, STANDARDS AND ONE DESIGNATED BLANK

___8. CHECK PH <1. PLACE ALL BEAKERS ON HOT PLATE UNTIL THEY REACH BOILING POINT. CHECK PH AGAIN MAKING SURE PH IS <1.

II PRECIPITATION

___1. ADD ABOUT 5 ML $HN0_3$ TO EACH SAMPLE.

___2. ADD 2 MLS FE^{+3} TO EACH SAMPLE.

___3. ADD SMALL QUANTITIES OF NH_4OH TO SPINNING SAMPLES ON HOT PLATE UNTIL PH IS AT 8-9 FOR COMPLETE PRECIPITATION (SAMPLE WILL TURN GOLDEN YELLOW) ALLOW SAMPLES TO STAY ON HOT PLATE AN ADDITIONAL 2-3 MINUTES.

___4. REMOVE BEAKERS FROM HOT PLATE, SLIDE STIR BAR OUT WITH THE USE OF ANOTHER STIR BAR, SET BEAKER ASIDE TO COOL ABOUT 15 MINS. BUT NO LONGER THAN 30 MINS - URANIUM WILL PLATE OUT ON SIDE OF GLASSWARE.