GEL Laboratories LLC
a member of The GEL Group INC

PO Box 30712 Charleston, SC 29417
2040 Savage Road Charleston, SC 29407
P 843.556.8171
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gel.com

August 26, 2019

TVA Deliverables
Environmental Standards, Inc.
1140 Valley Forge Road
Valley Forge, Pennsylvania 19482

Re: JSF EIP GW
Work Order: 487575

Dear TVA Deliverables:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on August 14, 2019. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4504.

Sincerely,

Erin B Trent

Erin Trent
Project Manager

Purchase Order: 5372407
Chain of Custody: JSF_GW_20190812_1B
Enclosures

Table of Contents

Case Narrative.....3

Data Review Qualifier Definitions.....5

Chain of Custody and Supporting Documentation.....8

Laboratory Certifications.....20

Radiological Analysis.....22

Case Narrative.....23

Sample Data Summary.....27

Quality Control Summary.....35

Case Narrative

Case Narrative
for
Tennessee Valley Authority (13723)
SDG: 487575

August 26, 2019

Laboratory Identification:

GEL Laboratories LLC
2040 Savage Road
Charleston, South Carolina 29407
(843) 556-8171

Summary

Sample Receipt The samples arrived at GEL Laboratories LLC, Charleston, South Carolina on August 14, 2019 for analysis. The samples were delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. There are no additional comments concerning sample receipt.

Sample Identification The laboratory received the following samples:

Laboratory ID	Client ID
487575001	JSF-GW-FB01-20190812
487575002	JSF-GW-026-20190812
487575003	JSF-GW-022-20190813
487575004	JSF-GW-DUP01-20190813
487575005	JSF-GW-027-20190813
487575006	JSF-GW-030-20190813
487575007	JSF-GW-FB02-20190813

Case Narrative

Sample analyses were conducted using methodology as outlined in GEL Laboratories, LLC (GEL) Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

Data Package

The enclosed data package contains the following sections: General Narrative, Chain of Custody and Supporting Documentation, and data from the following fractions: Radiochemistry.

Erin Trent
Project Manager

Data Review Qualifier Definitions

Data Review Qualifier Definitions

Qualifier	Explanation
*	A quality control analyte recovery is outside of specified acceptance criteria
**	Analyte is a surrogate compound
<	Result is less than value reported
>	Result is greater than value reported
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL
A	The TIC is a suspected aldol-condensation product
B	Target analyte was detected in the associated blank
B	Metals-Either presence of analyte detected in the associated blank, or MDL/IDL < sample value < PQL
BD	Results are either below the MDC or tracer recovery is low
C	Analyte has been confirmed by GC/MS analysis
D	Results are reported from a diluted aliquot of the sample
d	5-day BOD-The 2:1 depletion requirement was not met for this sample
E	Organics-Concentration of the target analyte exceeds the instrument calibration range
E	Metals-%difference of sample and SD is >10%. Sample concentration must meet flagging criteria
H	Analytical holding time was exceeded
h	Preparation or preservation holding time was exceeded
J	Value is estimated
N	Metals-The Matrix spike sample recovery is not within specified control limits
N	Organics-Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
N/A	Spike recovery limits do not apply. Sample concentration exceeds spike concentration by 4X or more
ND	Analyte concentration is not detected above the reporting limit
UI	Gamma Spectroscopy-Uncertain identification
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
Y	QC Samples were not spiked with this compound
Z	Paint Filter Test-Particulates passed through the filter, however no free liquids were observed.

P Organics-The concentrations between the primary and confirmation columns/detectors is >40% difference. For HPLC, the difference is >70%.

U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.

Chain of Custody and Supporting Documentation

TVA Environmental Investigations

487575

Tennessee Valley Authority

COOLER No.:			of	3
COC No:	JSF_GW_20190812_1B			
1 of 1 Pages				
Task Desc:	JSF_GW			

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	GEL Laboratories LLC	Site ID #:	John Sevier Fossil Plant	Sampler:	A. Wilson / S. Stahl
Lab Address:	2040 Savage Road	Project #:	175568225	Sampling Company:	Stantec
	Charleston, SC 29407	Site Address	PLANT 611 OLD HWY 70 S	Address	601 Grassmere Park Rd, Suite 22
		City	Rogersville State, Zip: TN, 37857	City/State	Nashville, TN Phone: (615) 885-1144
Lab Manager Contact Information		Site PM Name:	Roy Quinn		
Lab PM:	Erin Trent	Phone/Fax:	423-751-3753	Sampling Team Number:	1
Phone/Fax:	843-769-7374/843-766-1178	Site PM Email:		Send EDD/Hard Copy to:	
Lab Email:					

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below _____

24 Hours

3 Business Days

5 Business Days

✓ 10 Business Days

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Depth Unit	Sample Depth: Select Unit	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/ Lab Sample I.D.	MS/MSD	Analysis: GW_RAD	Filtered: N	Preserve: HCO3
1	JSF-GW-FB01-20190812	JSF-110	NA	NA	AQ	G	FB	8/12/2019	1550	3	None	☐	X		
2	JSF-GW-026-20190812	JSF-110	17.0'	NA	GW	G	N	8/12/2019	1605	3	pH: 5.15	☐	X		
3	JSF-GW-022-20190813	JSF-106	16.0'	NA	GW	G	N	8/13/2019	0820	3	pH: 6.43	☐	X		
4	JSF-GW-DUP01-20190813	NA	NA	NA	GW	G	FD	8/13/2019	NA	3	None	☐	X		
5	JSF-GW-027-20190813	JSF-206	28.5'	NA	GW	G	N	8/13/2019	1120	3	pH: 6.87	☐	X		
6	JSF-GW-030-20190813	JSF-209	32.5'	NA	GW	G	N	8/13/2019	1510	3	pH: 7.25	☐	X		
7	JSF-GW-FB02-20190813	JSF-209	NA	NA	AQ	G	FB	8/13/2019	1548	3	None	☐	X		

Additional Comments/Special Instructions:

Additional volume collected should be used for laboratory duplicate analysis.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Anna Wilson / Stantec	8/13/2019	18:00		8/14/19	10:00

SHIPPING METHOD	SAMPLER NAME AND SIGNATURE
Fedex	Anna Wilson /
	Stefan Stahl /

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

Form TVA 30067A

TVA Environmental Investigations

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	2 of 3
COC No:	JSF_GW_20190812_1B
1 of 1 Pages	
Task Desc:	JSF_GW

Required Ship to Lab:

ame:	GEL Laboratories LLC
ddress:	2040 Savage Road
	Charleston, SC 29407

Lab Manager Contact Information

M:	Erin Trent
/Fax:	843-769-7374/843-766-1178
mail:	

Required Project Information:

Site ID #:	John Sevier Fossil Plant		
Project #:	175568225		
Site Address	PLANT 611 OLD HWY 70 S		
City	Rogersville	State, Zip:	TN, 37857
Site PM Name:	Roy Quinn		
Phone/Fax:	423-751-3753		
Site PM Email:			

Required Sampler Information

Sampler:	A. Wilson / S. Stahl		
Sampling Company:	Stantec		
Address	601 Grassmere Park Rd, Suite 22		
City/State	Nashville, TN	Phone:	(615) 885-1144
Sampling Team Number:	1		
Send EDD/Hard Copy to:			

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below _____

24 Hours

3 Business Days

5 Business Days

✓ 10 Business Days

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Depth Unit	Sample Depth: Select Unit	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/ Lab Sample I.D.	MS/MSD	Analysis: GW_RAD	Filtered: N	Preserve: HNO3
1	JSF-GW-FB01-20190812	JSF-110	NA	NA	AQ	G	FB	8/12/2019	1550	3	None	☐	X		
2	JSF-GW-026-20190812	JSF-110	17.0'	NA	GW	G	N	8/12/2019	1605	3	pH: 5.15	☐	X		
3	JSF-GW-022-20190813	JSF-106	16.0'	NA	GW	G	N	8/13/2019	0820	3	pH: 6.43	☐	X		
4	JSF-GW-DUP01-20190813	NA	NA	NA	GW	G	FD	8/13/2019	NA	3	None	☐	X		
5	JSF-GW-027-20190813	JSF-206	28.5'	NA	GW	G	N	8/13/2019	1120	3	pH: 6.87	☐	X		
6	JSF-GW-030-20190813	JSF-209	32.5'	NA	GW	G	N	8/13/2019	1510	3	pH: 7.25	☐	X		
7	JSF-GW-FB02-20190813	JSF-209	NA	NA	AQ	G	FB	8/13/2019	1548	3	None	☐	X		

AW 8/13/2019

AW 8/13/2019

ional Comments/Special Instructions:

onal volume collected should be used for oratory duplicate analysis.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Anna Wilson / Stantec	8/13/2019	18:00		8/14/19	1000

SHIPPING METHOD	SAMPLER NAME AND SIGNATURE
Fedex	Anna Wilson /
	Stefan Stahl /

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

Form TVA 30067A

TVA Environmental Investigations

Tennessee Valley Authority

Chain-of-Custody / Analytical Request Document

Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed and accurate

COOLER No.:	3 of 3
COC No:	JSF_GW_20190812_1B
1 of 1 Pages	
Task Desc:	JSF_GW

Required Ship to Lab:		Required Project Information:		Required Sampler Information	
Lab Name:	GEL Laboratories LLC	Site ID #:	John Sevier Fossil Plant	Sampler:	A. Wilson / S. Stahl
Lab Address:	2040 Savage Road	Project #:	175568225	Sampling Company:	Stantec
	Charleston, SC 29407	Site Address	PLANT 611 OLD HWY 70 S	Address	601 Grassmere Park Rd, Suite 22
		City	Rogersville State, Zip: TN, 37857	City/State	Nashville, TN Phone: (615) 885-1144
Lab Manager Contact Information		Site PM Name:	Roy Quinn		
Lab PM:	Erin Trent	Phone/Fax:	423-751-3753	Sampling Team Number:	1
Phone/Fax:	843-769-7374/843-766-1178	Site PM Email:		Send EDD/Hard Copy to:	
Lab Email:					

Analysis Turnaround Time

☐ CALENDAR DAYS ☑ WORKING DAYS

TAT if different from Below _____

24 Hours

3 Business Days

5 Business Days

✓ 10 Business Days

ITEMS #	SAMPLE ID Samples IDs MUST BE UNIQUE	SAMPLE LOCATION	Sample Depth: Start Depth (Depth Unit)	Sample Depth: End Depth (Select Unit)	MATRIX CODE	G= GRAB C=COMP	SAMPLE TYPE	SAMPLE DATE	SAMPLE TIME	# OF CONTAINERS	Comments/ Lab Sample I.D.	MS/MSD	Analysis: GW_RAD	Filtered: N	Preserve: HNO3
1	JSF-GW-FB01-20190812	JSF-110	NA	NA	AQ	G	FB	8/12/2019	1550	3	None	☐	X		
2	JSF-GW-026-20190812	JSF-110	17.0'	NA	GW	G	N	8/12/2019	1605	3	pH: 5.15	☐	X		
3	JSF-GW-022-20190813	JSF-106	16.0'	NA	GW	G	N	8/13/2019	0820	3	pH: 6.43	☐	X		
4	JSF-GW-DUP01-20190813	NA	NA	NA	GW	G	FD	8/13/2019	NA	3	None	☐	X		
5	JSF-GW-027-20190813	JSF-206	28.5'	NA	GW	G	N	8/13/2019	1120	3	pH: 6.87	☐	X		
6	JSF-GW-030-20190813	JSF-209	32.5'	NA	GW	G	N	8/13/2019	1510	3	pH: 7.25	☐	X		
7	JSF-GW-FB02-20190813	JSF-209	NA	NA	AQ	G	FB	8/13/2019	1548	3	None	☐	X		

AW 8/13/2019

AW 8/13/2019

Additional Comments/Special Instructions:

Additional volume collected should be used for laboratory duplicate analysis.

RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
Anna Wilson / Stantec	8/13/2019	18:00		8/14/19	1000

SHIPPING METHOD:	SAMPLER NAME AND SIGNATURE
Fedex	Anna Wilson /
	Stefan Stahl /

Sample Receipt Conditions

Temperature in °C	Sample on Ice?	Sample Intact?	Trip Blank?
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

Form TVA 30067A

GEL Laboratories LLC

SAMPLE RECEIPT & REVIEW FORM

Client: TVAC	**SDG/AR/COC/Work Order:** 4875169 / 4875795
Received By: NRG	**Date Received:** 8/14/19
Carrier and Tracking Number	Circle Applicable: FedEx Express FedEx Ground UPS Field Services Courier Other 1041 0958 6096 - 6°C 7909 7442 3142 - 3°C 1041 0958 6085 - 5°C 7909 7442 3120 - 4°C 7909 7442 3131 - 6°C

Suspected Hazard Information	Yes	No	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
A)Shipped as a DOT Hazardous?		✓	Hazard Class Shipped: UN#: If UN2910, Is the Radioactive Shipment Survey Compliant? Yes___ No___
B) Did the client designate the samples are to be received as radioactive?		✓	COC notation or radioactive stickers on containers equal client designation.
C) Did the RSO classify the samples as radioactive?		✓	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): 0 CPM / mR/Hr **Classified as: Rad 1 Rad 2 Rad 3**
D) Did the client designate samples are hazardous?		✓	COC notation or hazard labels on containers equal client designation.
E) Did the RSO identify possible hazards?		✓	If D or E is yes, select Hazards below. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other:

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	✓			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?	✓			Circle Applicable: Client contacted and provided COC COC created upon receipt
3	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*		✓		Preservation Method: Wet Ice Ice Packs Dry ice None Other: *all temperatures are recorded in Celsius TEMP: see above
4	Daily check performed and passed on IR temperature gun?	✓			**Temperature Device Serial #:** IR3-18 Secondary Temperature Device Serial # (If Applicable):
5	Sample containers intact and sealed?	✓			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?	✓			Sample ID's and Containers Affected: If Preservation added, Lot#:
7	Do any samples require Volatile Analysis?			✓	If Yes, are Encores or Soil Kits present for solids? Yes___ No___ NA___(If yes, take to VOA Freezer) Do liquid VOA vials contain acid preservation? Yes___ No___ NA___(If unknown, select No) Are liquid VOA vials free of headspace? Yes___ No___ NA___ Sample ID's and containers affected:
8	Samples received within holding time?	✓			ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	✓			ID's and containers affected: NRG 8/14
10	Date & time on COC match date & time on bottles?	✓		✓	Circle Applicable: No dates on containers No times on containers COC missing info Other (describe) NRG 8/14
11	Number of containers received match number indicated on COC?	✓			Circle Applicable: No container count on COC Other (describe)
12	Are sample containers identifiable as GEL provided?	✓			
13	COC form is properly signed in relinquished/received sections?	✓			Circle Applicable: Not relinquished Other (describe)

Comments (Use Continuation Form if needed):

PM (or PMA) review: Initials MO Date 8/15 Page 1 of 1

GL-CHL-SR-001 Rev 6

Work Order Containers

Sample ID: **487575001**
Client Sample ID: **JSF−GW−FB01−20190812**
Description: **JSF−110 Water**

Label: 487575001.01 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:35	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 09:43:20	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Radiochemistry Storage

Label: 487575001.02 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage

Label: 487575001.03 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:35	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 11:56:59	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Consumed By Analysis/Laboratory

Sample ID: **487575002**
Client Sample ID: **JSF−GW−026−20190812**
Description: **JSF−110 Ground Water**

Label: 487575002.01 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage

Work Order Containers

Sample ID: **487575002**
Client Sample ID: **JSF−GW−026−20190812**
Description: **JSF−110 Ground Water**

Label: 487575002.02 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 11:56:59	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Consumed By Analysis/Laboratory

Label: 487575002.03 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 09:43:20	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Radiochemistry Storage

Sample ID: **487575003**
Client Sample ID: **JSF−GW−022−20190813**
Description: **JSF−106 Ground Water**

Label: 487575003.01 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789

Work Order Containers

Sample ID: **487575003**
Client Sample ID: **JSF−GW−022−20190813**
Description: **JSF−106 Ground Water**

Label: 487575003.01 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 09:43:20	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Radiochemistry Storage

Label: 487575003.02 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 11:56:59	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Consumed By Analysis/Laboratory

Label: 487575003.03 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 09:43:20	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Radiochemistry Storage

Sample ID: **487575004**
Client Sample ID: **JSF−GW−DUP01−20190813**
Description: **Ground Water**

Label: 487575004.01 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage

Work Order Containers

Sample ID: **487575004**
Client Sample ID: **JSF−GW−DUP01−20190813**
Description: **Ground Water**

Label: 487575004.01 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 09:43:20	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Radiochemistry Storage

Label: 487575004.02 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 11:56:59	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Consumed By Analysis/Laboratory

Label: 487575004.03 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage

Sample ID: **487575005**
Client Sample ID: **JSF−GW−027−20190813**
Description: **JSF−206 Ground Water**

Label: 487575005.01 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787

Work Order Containers

Sample ID: **487575005**
Client Sample ID: **JSF−GW−027−20190813**
Description: **JSF−206 Ground Water**

Label: 487575005.01 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 11:56:59	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Consumed By Analysis/Laboratory

Label: 487575005.02 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage

Label: 487575005.03 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 09:43:20	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Radiochemistry Storage

Sample ID: **487575006**
Client Sample ID: **JSF−GW−030−20190813**
Description: **JSF−209 Ground Water**

Label: 487575006.01 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage

Label: 487575006.02 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory

Work Order Containers

Sample ID: **487575006**
Client Sample ID: **JSF−GW−030−20190813**
Description: **JSF−209 Ground Water**

Label: 487575006.02 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 09:43:20	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Radiochemistry Storage

Label: 487575006.03 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 11:56:59	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Consumed By Analysis/Laboratory

Sample ID: **487575007**
Client Sample ID: **JSF−GW−FB02−20190813**
Description: **JSF−209 Water**

Label: 487575007.01 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:43:20	Caroline Gause	Changed batch_id from 1907789 to
20−AUG−19 09:43:20	Caroline Gause	Changed sample location from Radiochemistry Prep Laboratory to Radiochemistry Storage

Label: 487575007.02 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging

Work Order Containers

Sample ID: **487575007**
Client Sample ID: **JSF−GW−FB02−20190813**
Description: **JSF−209 Water**

Label: 487575007.02 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage
16−AUG−19 15:08:43	Lois Buist	Transfered custody to batch 1907789
16−AUG−19 15:08:43	Lois Buist	Changed sample location from Radiochemistry Storage to Radiochemistry Prep Laboratory
16−AUG−19 15:09:36	Lois Buist	Transfered custody to batch 1907787
19−AUG−19 11:47:21	Lois Buist	Transfered custody to batch 1907789
20−AUG−19 09:22:52	Lois Buist	Changed batch_id from 1907789 to
20−AUG−19 09:22:52	Lois Buist	Changed sample location from Radiochemistry Prep Laboratory to Return Shelf Radiochemisty Samples
20−AUG−19 11:56:59	Caroline Gause	Changed sample location from Return Shelf Radiochemisty Samples to Consumed By Analysis/Laboratory

Label: 487575007.03 **Type: Plastic 1000 mL** **Preservative: Nitric pH<2**

14−AUG−19 13:35:47	Nina Gampe	Changed sample location from Barcode Generated to Radiochemistry Staging
16−AUG−19 08:01:47	Stacy Boone	Changed sample location from Radiochemistry Staging to Radiochemistry Storage

Laboratory Certifications

List of current GEL Certifications as of 26 August 2019

State	Certification
Alaska	17−018
Arkansas	88−0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH−0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330−15−00283, P330−15−00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C−SC−01
Kansas NELAP	E−10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M−SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE−OS−26−13
Nevada	SC000122020−1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R−158
Oklahoma	9904
Pennsylvania NELAP	68−00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235−19−15
Utah NELAP	SC000122019−28
Vermont	VT87156
Virginia NELAP	460202
Washington	C780

Radiological Analysis

Case Narrative

Product: **GFPC Radium-228, Liquid**
Analytical Method: EPA 904.0
Analytical Procedure: GL-RAD-A-009 REV# 17
Analytical Batch: 1907787

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
487575001	JSF-GW-FB01-20190812
487575002	JSF-GW-026-20190812
487575003	JSF-GW-022-20190813
487575004	JSF-GW-DUP01-20190813
487575005	JSF-GW-027-20190813
487575006	JSF-GW-030-20190813
487575007	JSF-GW-FB02-20190813
1204358679	Method Blank (MB)
1204358681	487777003(JSF-GW-025-20190814) Sample Duplicate (DUP)
1204358684	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

Product: **GFPC Radium-226, Liquid**
Analytical Method: EPA 903.0
Analytical Procedure: GL-RAD-A-010 REV# 18
Analytical Batch: 1907789

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
487575001	JSF-GW-FB01-20190812
487575002	JSF-GW-026-20190812
487575003	JSF-GW-022-20190813
487575004	JSF-GW-DUP01-20190813
487575005	JSF-GW-027-20190813
487575006	JSF-GW-030-20190813
487575007	JSF-GW-FB02-20190813
1204358685	Method Blank (MB)
1204358687	487777005(JSF-GW-031-20190814) Sample Duplicate (DUP)

1204358690 Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

Data Summary:

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

Technical Information

Recounts
Samples 1204358685 (MB), 487575002 (JSF-GW-026-20190812) and 487575004 (JSF-GW-DUP01-20190813) were recounted due to high MDCs. The recounts are reported.

Certification Statement

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Qualifier Definition Report
for

TVAC008 Tennessee Valley Authority (13723)

Client SDG: 487575 GEL Work Order: 487575

The Qualifiers in this report are defined as follows:

* A quality control analyte recovery is outside of specified acceptance criteria
** Analyte is a Tracer compound
U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Review/Validation

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

Signature: Heather M. McCarty **Name: Heather McCarty**

Date: 27 AUG 2019 **Title: Analyst II**

Sample Data Summary

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Environmental Standards, Inc.
Address : 1140 Valley Forge Road

Valley Forge, Pennsylvania 19482 — Report Date: August 27, 2019

Contact: TVA Deliverables
Project: JSF EIP GW

Client Sample ID: JSF-GW-FB01-20190812
Sample ID: 487575001
Matrix: AQ
Collect Date: 12-AUG-19
Receive Date: 14-AUG-19
Collector: Client

Project: TVAC00105
Client ID: TVAC008

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
GFPC Radium-226, Liquid "As Received"														
Radium-226	U	0.0552	+/-0.395	0.860	+/-0.395	1.00	pCi/L			KSD1	08/20/19	1613	1907789	1
GFPC Radium-228, Liquid "As Received"														
Radium-228	U	-0.127	+/-0.392	0.748	+/-0.392	1.00	pCi/L			LXB3	08/21/19	1322	1907787	2
Radium-226+Radium-228 Calculation "See Parent Products"														
Radium-226+228 Sum		0.0552	+/-0.556		+/-0.556		pCi/L		1	AEA	08/22/19	0836	1907785	3

The following Analytical Methods were performed

Method	Description
1	EPA 903.0
2	EPA 904.0
3	Calculation

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium Carrier	GFPC Radium-226, Liquid "As Received"	1907789	93.2	(30%-110%)
Barium-133 Tracer	GFPC Radium-228, Liquid "As Received"	1907787	74.9	(30%-110%)

Notes:

The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Environmental Standards, Inc.
Address : 1140 Valley Forge Road

Valley Forge, Pennsylvania 19482

Report Date: August 27, 2019

Contact: TVA Deliverables
Project: JSF EIP GW

Client Sample ID: JSF-GW-026-20190812
Sample ID: 487575002
Matrix: GW
Collect Date: 12-AUG-19
Receive Date: 14-AUG-19
Collector: Client

Project: TVAC00105
Client ID: TVAC008

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
GFPC Radium-226, Liquid "As Received"														
Radium-226	U	0.692	+/-0.613	0.913	+/-0.624	1.00	pCi/L			KSD1	08/20/19	1843	1907789	1
GFPC Radium-228, Liquid "As Received"														
Radium-228		0.928	+/-0.342	0.437	+/-0.416	1.00	pCi/L			LXB3	08/21/19	1322	1907787	2
Radium-226+Radium-228 Calculation "See Parent Products"														
Radium-226+228 Sum		1.62	+/-0.702		+/-0.750		pCi/L		1	AEA	08/22/19	0836	1907785	3

The following Analytical Methods were performed

Method	Description
1	EPA 903.0
2	EPA 904.0
3	Calculation

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium Carrier	GFPC Radium-226, Liquid "As Received"	1907789	95.4	(30%-110%)
Barium-133 Tracer	GFPC Radium-228, Liquid "As Received"	1907787	94.1	(30%-110%)

Notes:

The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC

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Certificate of Analysis

Company : Environmental Standards, Inc.
Address : 1140 Valley Forge Road

Valley Forge, Pennsylvania 19482

Report Date: August 27, 2019

Contact: TVA Deliverables
Project: JSF EIP GW

Client Sample ID: JSF-GW-022-20190813
Sample ID: 487575003
Matrix: GW
Collect Date: 13-AUG-19
Receive Date: 14-AUG-19
Collector: Client

Project: TVAC00105
Client ID: TVAC008

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
GFPC Radium-226, Liquid "As Received"														
Radium-226		0.895	+/-0.578	0.665	+/-0.598	1.00	pCi/L			KSD1	08/20/19	1613	1907789	1
GFPC Radium-228, Liquid "As Received"														
Radium-228	U	0.00814	+/-0.195	0.381	+/-0.196	1.00	pCi/L			LXB3	08/21/19	1322	1907787	2
Radium-226+Radium-228 Calculation "See Parent Products"														
Radium-226+228 Sum		0.903	+/-0.610		+/-0.629		pCi/L		1	AEA	08/22/19	0836	1907785	3

The following Analytical Methods were performed

Method	Description
1	EPA 903.0
2	EPA 904.0
3	Calculation

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium Carrier	GFPC Radium-226, Liquid "As Received"	1907789	92.8	(30%-110%)
Barium-133 Tracer	GFPC Radium-228, Liquid "As Received"	1907787	91.5	(30%-110%)

Notes:

The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

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Certificate of Analysis

Company : Environmental Standards, Inc.
Address : 1140 Valley Forge Road

Valley Forge, Pennsylvania 19482

Report Date: August 27, 2019

Contact: TVA Deliverables
Project: JSF EIP GW

Client Sample ID: JSF-GW-DUP01-20190813
Sample ID: 487575004
Matrix: GW
Collect Date: 13-AUG-19
Receive Date: 14-AUG-19
Collector: Client

Project: TVAC00105
Client ID: TVAC008

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
GFPC Radium-226, Liquid "As Received"														
Radium-226	U	0.626	+/-0.555	0.827	+/-0.565	1.00	pCi/L			KSD1	08/20/19	1843	1907789	1
GFPC Radium-228, Liquid "As Received"														
Radium-228	U	-0.0911	+/-0.297	0.578	+/-0.297	1.00	pCi/L			LXB3	08/21/19	1322	1907787	2
Radium-226+Radium-228 Calculation "See Parent Products"														
Radium-226+228 Sum		0.626	+/-0.630		+/-0.639		pCi/L		1	AEA	08/22/19	0836	1907785	3

The following Analytical Methods were performed

Method	Description
1	EPA 903.0
2	EPA 904.0
3	Calculation

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium Carrier	GFPC Radium-226, Liquid "As Received"	1907789	96.5	(30%-110%)
Barium-133 Tracer	GFPC Radium-228, Liquid "As Received"	1907787	91.2	(30%-110%)

Notes:

The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Environmental Standards, Inc.
Address : 1140 Valley Forge Road

Valley Forge, Pennsylvania 19482

Report Date: August 27, 2019

Contact: TVA Deliverables
Project: JSF EIP GW

Client Sample ID: JSF-GW-027-20190813
Sample ID: 487575005
Matrix: GW
Collect Date: 13-AUG-19
Receive Date: 14-AUG-19
Collector: Client

Project: TVAC00105
Client ID: TVAC008

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
GFPC Radium-226, Liquid "As Received"														
Radium-226	U	0.122	+/-0.449	0.925	+/-0.450	1.00	pCi/L			KSD1	08/20/19	1613	1907789	1
GFPC Radium-228, Liquid "As Received"														
Radium-228	U	0.228	+/-0.241	0.400	+/-0.248	1.00	pCi/L			LXB3	08/21/19	1322	1907787	2
Radium-226+Radium-228 Calculation "See Parent Products"														
Radium-226+228 Sum		0.350	+/-0.510		+/-0.514		pCi/L		1	AEA	08/22/19	0836	1907785	3

The following Analytical Methods were performed

Method	Description
1	EPA 903.0
2	EPA 904.0
3	Calculation

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium Carrier	GFPC Radium-226, Liquid "As Received"	1907789	97.2	(30%-110%)
Barium-133 Tracer	GFPC Radium-228, Liquid "As Received"	1907787	91.7	(30%-110%)

Notes:

The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Environmental Standards, Inc.
Address : 1140 Valley Forge Road

Valley Forge, Pennsylvania 19482

Report Date: August 27, 2019

Contact: TVA Deliverables
Project: JSF EIP GW

Client Sample ID: JSF-GW-030-20190813
Sample ID: 487575006
Matrix: GW
Collect Date: 13-AUG-19
Receive Date: 14-AUG-19
Collector: Client

Project: TVAC00105
Client ID: TVAC008

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
GFPC Radium-226, Liquid "As Received"														
Radium-226	U	0.760	+/-0.623	0.898	+/-0.636	1.00	pCi/L			KSD1	08/20/19	1613	1907789	1
GFPC Radium-228, Liquid "As Received"														
Radium-228	U	-0.0948	+/-0.209	0.437	+/-0.209	1.00	pCi/L			LXB3	08/21/19	1322	1907787	2
Radium-226+Radium-228 Calculation "See Parent Products"														
Radium-226+228 Sum		0.760	+/-0.657		+/-0.670		pCi/L		1	AEA	08/22/19	0836	1907785	3

The following Analytical Methods were performed

Method	Description
1	EPA 903.0
2	EPA 904.0
3	Calculation

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium Carrier	GFPC Radium-226, Liquid "As Received"	1907789	89.9	(30%-110%)
Barium-133 Tracer	GFPC Radium-228, Liquid "As Received"	1907787	84.4	(30%-110%)

Notes:

The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Certificate of Analysis

Company : Environmental Standards, Inc.
Address : 1140 Valley Forge Road

Valley Forge, Pennsylvania 19482

Report Date: August 27, 2019

Contact: TVA Deliverables
Project: JSF EIP GW

Client Sample ID: JSF-GW-FB02-20190813
Sample ID: 487575007
Matrix: AQ
Collect Date: 13-AUG-19
Receive Date: 14-AUG-19
Collector: Client

Project: TVAC00105
Client ID: TVAC008

Parameter	Qualifier	Result	Uncertainty	MDC	TPU	RL	Units	PF	DF	Analyst	Date	Time	Batch	Mtd.
Rad Gas Flow Proportional Counting														
GFPC Radium-226, Liquid "As Received"														
Radium-226	U	0.234	+/-0.433	0.810	+/-0.435	1.00	pCi/L			KSD1	08/20/19	1613	1907789	1
GFPC Radium-228, Liquid "As Received"														
Radium-228	U	0.144	+/-0.237	0.415	+/-0.240	1.00	pCi/L			LXB3	08/21/19	1322	1907787	2
Radium-226+Radium-228 Calculation "See Parent Products"														
Radium-226+228 Sum		0.378	+/-0.494		+/-0.497		pCi/L		1	AEA	08/22/19	0836	1907785	3

The following Analytical Methods were performed

Method	Description
1	EPA 903.0
2	EPA 904.0
3	Calculation

Surrogate/Tracer Recovery	Test	Batch ID	Recovery%	Acceptable Limits
Barium Carrier	GFPC Radium-226, Liquid "As Received"	1907789	92.4	(30%-110%)
Barium-133 Tracer	GFPC Radium-228, Liquid "As Received"	1907787	88.8	(30%-110%)

Notes:

The MDC is a sample specific MDC.
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

Column headers are defined as follows:

DF: Dilution Factor
DL: Detection Limit
Lc/LC: Critical Level
MDA: Minimum Detectable Activity
MDC: Minimum Detectable Concentration
Mtd.: Method
PF: Prep Factor
RL: Reporting Limit
TPU: Total Propagated Uncertainty

Quality Control Summary

QC Summary

Report Date: August 27, 2019
Page 1 of 2

Client : **Environmental Standards, Inc.**
1140 Valley Forge Road

Valley Forge, Pennsylvania

Contact: **TVA Deliverables**

Workorder: **487575**

Parmname	NOM	Sample	Qual	QC	Units	RER	REC%	Range	Anlst	Date Time
Rad Gas Flow										
Batch 1907787										
QC1204358681 487777003 DUP										
Radium-228	U	-0.195	U	0.302	pCi/L	1.85		(0-2)	LXB3	08/21/19 13:21
	Uncert:	+/-0.386		+/-0.351						
	TPU:	+/-0.386		+/-0.359						
	MDC:	0.750		0.591						
QC1204358684 LCS										
Radium-228	20.8			20.0	pCi/L		96.6	(80%-120%)	LXB3	08/21/19 13:21
	Uncert:			+/-1.18						
	TPU:			+/-5.21						
	MDC:			0.475						
QC1204358679 MB										
Radium-228			U	0.0357	pCi/L				LXB3	08/21/19 13:22
	Uncert:			+/-0.176						
	TPU:			+/-0.176						
	MDC:			0.338						
Batch 1907789										
QC1204358687 487777005 DUP										
Radium-226	U	0.581	U	0.302	pCi/L	0.82		(0-2)	KSD1	08/20/19 15:14
	Uncert:	+/-0.500		+/-0.428						
	TPU:	+/-0.510		+/-0.432						
	MDC:	0.702		0.745						
QC1204358690 LCS										
Radium-226	555			534	pCi/L		96.2	(80%-120%)	KSD1	08/20/19 15:14
	Uncert:			+/-13.6						
	TPU:			+/-93.8						
	MDC:			0.948						
QC1204358685 MB										
Radium-226			U	0.384	pCi/L				KSD1	08/20/19 18:43
	Uncert:			+/-0.473						
	TPU:			+/-0.477						
	MDC:			0.785						

Notes:

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

**	Analyte is a Tracer compound
<	Result is less than value reported
>	Result is greater than value reported
BD	Results are either below the MDC or tracer recovery is low
FA	Failed analysis.

QC Summary

Workorder: **487575**

Parmname	NOM	Sample	Qual	QC	Units	RER	REC%	Range	Anlst	Date	Time

H	Analytical holding time was exceeded
J	Value is estimated
K	Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L	Analyte present. Reported value may be biased low. Actual value is expected to be higher.
M	M if above MDC and less than LLD
M	REMP Result > MDC/CL and < RDL
N/A	RPD or %Recovery limits do not apply.
N1	See case narrative
ND	Analyte concentration is not detected above the detection limit
NJ	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
Q	One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
R	Sample results are rejected
U	Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
UI	Gamma Spectroscopy--Uncertain identification
UJ	Gamma Spectroscopy--Uncertain identification
UL	Not considered detected. The associated number is the reported concentration, which may be inaccurate due to a low bias.
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
Y	Other specific qualifiers were required to properly define the results. Consult case narrative.
^	RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
h	Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.
** Indicates analyte is a surrogate/tracer compound.
^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptence criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.