AE Order Number Banner

Report Description

This report shows an AE Order Number in Barcode format for purposes of scanning. The Barcode format is Code 39.

App Number: pENV000GW00034

GW - 33

WESTERN GAS PROCESSING

9/29/2016

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

OIL CONS. DIV DIST. 3
AUG 23 2016

Form C-141
Revised August 8, 2011

Submit 1 Copy to appropriate District Office in accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

OPERATOR

☐ Initial Report ☒ Final Report

Name of Company: **CCI San Juan LLC**	Contact: **Josh Tuttle**
Address: **#99 Road 6500**	Telephone No: **435-686-7610**
Facility Name: **San Juan River Plant**	Facility Type: **Gas Processing and Treating facility**

Surface Owner: Ute Mountain Ute Tribe	Mineral Owner: Ute Mountain Ute Tribe	API No. N/A

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
	27	32N	14W	120'	North	90'	West	San Juan

Latitude: 36° 57'31.05"N **Longitude:** 108° 18'02.37"W

NATURE OF RELEASE

Type of Release: **Pipeline Release**	Volume of Release: 12 bbls.	Volume Recovered: 0
Source of Release: **24' Barker Inlet Pipeline**	Date and Hour of Occurrence: **12/10/2014 and Unknown**	Date and Hour of Discovery: **12/10/2014 7:14 PM**
Was Immediate Notice Given? ☒ Yes ☐ No ☐ Not Required	If YES, To Whom? **NMOCD office in Aztec (Charlie Perrin)**	
By Whom? **Ryan Kelly**	Date and Hour: **12/11/2014 13:00**	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse. N/A	

If a Watercourse was Impacted, Describe Fully.*

N/A

Describe Cause of Problem and Remedial Action Taken.*

24' Gathering Pipeline located in the Barker dome area had developed a small leak. All contamination was contained within the soil surrounding the underground pipeline. The pipeline was isolated and depressured to begin excavation and repair. Weeminuche Construction Authority (WCA) was called to excavate the contaminated soil and expose the pipeline that was leaking. All contaminated soil was placed on plastic liner on the right of way and covered properly. Envirotech was called on Friday December 12, 2014 to collect disposal and confirmation samples on Monday, December 15th. The results from the samples are expected to be completed within five business days. We are processing remediation and closure through the Ute Mountain Ute Tribe.

Describe Area Affected and Cleanup Action Taken.*

The soil that surrounded the underground pipeline became contaminated from the constituents contained in the pipeline. The contaminated soil has been excavated of all visible contamination and placed on plastic liners with berms and plastic covering. Upon receiving sample results the contaminated soil was profiled for waste and properly disposed of at an NMOCD approved dirt farm. (See attached envirotech report – Project Number 14038-0011)

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature:	OIL CONSERVATION DIVISION	
Printed Name: Josh Tuttle	Approved by Environmental Specialist:	
Title: ES&H Specialist II	Approval Date: 9/20/16	Expiration Date:
E-mail Address: joshua.tuttle@cci.com	Conditions of Approval:	Attached ☐
Date: 8/18/2016 Phone: (435) 686-7610		

* Attach Additional Sheets If Necessary

#NCS1501339487

81

envirotech

CONFIRMATION SAMPLING REPORT

LOCATED AT:
24" BARKER DOME PIPELINE LEAK
SECTION 27, TOWNSHIP 32N, RANGE 15W
SAN JUAN COUNTY, NEW MEXICO

PREPARED FOR:
CCI SAN JUAN LLC
MR. RYAN KELLY
99 COUNTY ROAD 6500
KIRTLAND, NEW MEXICO 87417

PROJECT NUMBER 14038-0011
MAY 2015

5796 US Highway 64, Farmington, NM 87401 Ph (505) 632-0615 Fx (505) 632-1865
Three Springs • 65 Mercado Street, Suite 115, Durango, CO 81301 Ph (970) 259-0615 Fr (800) 362-1879
envirotech-inc.com
info@envirotech-inc.com

CCI SAN JUAN LLC
CONFIRMATION SAMPLING REPORT
LOCATED AT THE 24" BARKER DOME PIPELINE LEAK
SEC 27, TWP 32N, RNG 14W
SAN JUAN COUNTY, NEW MEXICO

TABLE OF CONTENTS

INTRODUCTION

Envirotech, Inc. of Farmington, New Mexico, was contracted by CCI San Juan LLC to provide confirmation sampling activities for a release from the 24" Barker Dome Pipeline Leak located in Section 27, Township 32N Range 14W, San Juan County, New Mexico; see enclosed ***Figure 1, Vicinity Map***. Activities included confirmation sampling and analysis, documentation, and reporting.

ACTIVITIES PERFORMED

Envirotech, Inc. arrived on site on December 15, 2014 to perform confirmation sampling activities. Upon Envirotech's arrival, a brief site assessment was conducted and the regulatory standards for the site were determined to be 500 parts per million (ppm) for total petroleum hydrocarbons (TPH) and pursuant to Ute Mountain Ute Tribe Standards for Spill Clean-up and Reclamation.

The impacted area had been excavated prior to Envirotech's arrival to approximately 10 feet by 10 feet by four (4) feet deep. Four (4) samples were collected from the excavation. Two (2) five (5)-point composite samples from the bottom of the excavation and two (2) five (5)-point composites from the walls of the excavation; see enclosed ***Figure 2, Site Map 1*** for sample locations. The samples were placed into four (4)-ounce glass jars, capped headspace free, and transported on ice, under chain of custody, to Envirotech's Analytical Laboratory to be analyzed for TPH using USEPA Method 8015 and for benzene and BTEX using USEPA Method 8021. All of the samples returned results below regulatory standards for all constituents analyzed except the West Bottom sample that returned results above regulatory standards for benzene; see enclosed ***Table 1, Summary of analytical Results*** and ***Appendix A, Analytical Results***. Based on the above stated results, Envirotech recommended further excavation of the west bottom of the excavation.

On January 9, 2015, Envirotech, Inc. returned to the site to perform confirmation sampling activities. The impacted area had been excavated prior to Envirotech's arrival to approximately 10 feet by 10 feet by five (5) feet deep, reaching a coal seam. One (1) five (5)-point composite sample was collected from the west bottom of the excavation and was placed into a four (4)-ounce glass jar, capped headspace free, and transported on ice, under chain of custody, to Envirotech's Analytical Laboratory to be analyzed for Ute Mountain Ute Tribe Standards for Spill Clean-up and Reclamation Table of Constituents. The sample returned results below regulatory standards for all constituents except Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Arsenic, and pH; see enclosed ***Table 1, Summary of analytical Results*** and ***Appendix A, Analytical Results***. Based on the above stated results, Envirotech recommended further excavation.

On March 6, 2015, Envirotech, Inc. returned to the site to perform confirmation sampling activities. The impacted area had been excavated one (1) foot into the coal seam prior to Envirotech's arrival to a total extent of approximately 10 feet x 10 feet to 6 feet deep. One (1) five (5)-point composite sample was collected from the west bottom of the excavation. The sample was placed into a four (4)-ounce glass jar, capped headspace free and transported on ice, under chain of custody, to Envirotech's Analytical Laboratory to be analyzed for Ute Mountain Ute Tribe Standards for Spill Clean-up and Reclamation Table of Constituents. The sample returned results below regulatory standards for all constituents analyzed except for Arsenic and pH; see enclosed ***Table 1, Summary of Analytical Results***.

Based on the above stated results, the Colorado Department of Public Health and Environment's Risk management guidance for evaluation Arsenic Concetrations in Soil and research on the affects of coal on pH, Envirotech, Inc. concludes that the arsenic concentrations are due to common background concentrations in the area and that the pH levels are due to the coal seam found in the excavation. Therefore, Envirotech, Inc. recommends no further action in regards to this incident if approved by the Ute Mountain Ute Tribe; see enclosed ***Appendix B, References.***

SUMMARY AND CONCLUSIONS

Envirotech, Inc. performed site assessment, confirmation sampling, and remediation treatment activities at the 24" Barker Dome Pipeline Leak. Approximately 286 cubic yards of contaminated soil was removed by CCI San Juan LLC and transported to Industrial Ecosystems Inc's Soil Reclamation Center. Envirotech, Inc. recommends no further action in regards to this incident.

STATEMENT OF LIMITATIONS

Envirotech, Inc. has completed the spill closure activities related to the contamination found at the 24" Barker Dome Pipeline Leak located in Section 27, Township 32N Range 14W, San Juan County, New Mexico. All observations and conclusions provided here are based on the information and current site conditions found at the site of the incident.

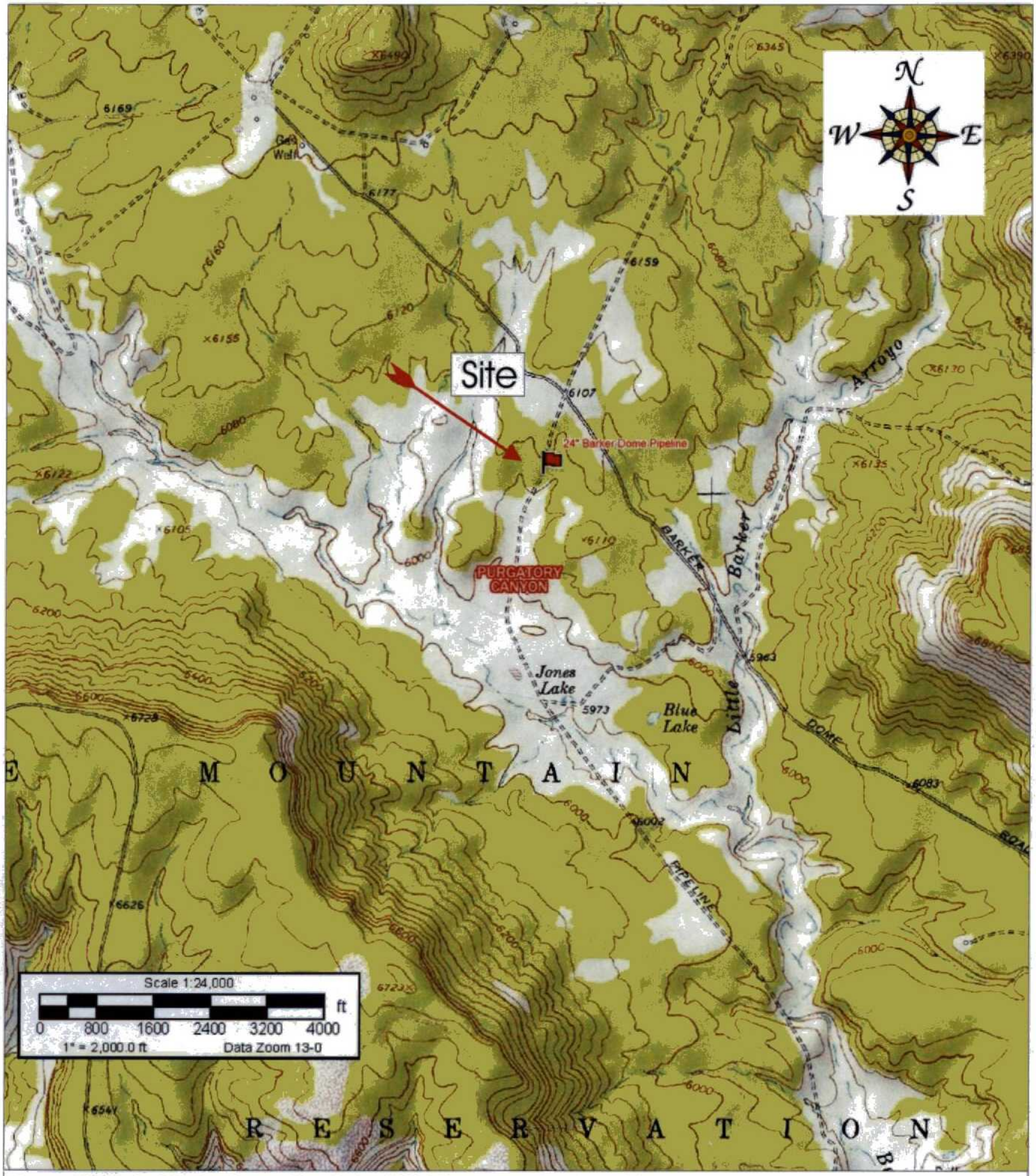
The undersigned has conducted this service at the above referenced site. This work has been conducted and reported in accordance with generally accepted professional practices in geology, engineering, environmental chemistry, and hydrogeology.

We appreciate the opportunity to be of service. If you have any questions or require additional information, please contact our office at (505) 632-0615.

Respectfully submitted,
ENVIROTECH, INC.

Sheena Leon
Environmental Field Technician
sleon@envirotech-inc.com

FIGURES



Source: 7.5 Minute, Purgatory Canyon, New Mexico U.S.G.S. Topographic Quadrangle Map
Scale: 1:24,000 1" = 2000'

CCI San Juan LLC 24" Barker Dome Pipeline leak Section 27, Township 32N, Range 14W San Juan County, New Mexico		envirotech ENVIRONMENTAL SCIENTISTS & ENGINEERS	Vicinity Map
			Figure #1
PROJECT Number: 14038-0011	Date Drawn: 5/14/15	5796 U.S. HIGHWAY 64 Farmington, New Mexico 87401 505.632.0615	DRAWN BY: Felipe Aragon / PROJECT MANAGER: Greg Crabtree

LEGEND

Excavation

Pipeline

X West Bottom Sample

X West Walls Sample

X East Bottom Sample

X East Walls Sample

SITE MAP 1
CCI San Juan LLC
24" Barker Dome Pipeline Leak
SECTION 27, TWP 32 NORTH, RANGE 14 WEST
SAN JUAN COUNTY, NEW MEXICO

SCALE: NTS	FIGURE NO. 2		REV
PROJECT NO.14038-0011			

REVISIONS

NO.	DATE	BY	DESCRIPTION

MAP DRWN	SL	3/19/15	BASE DRWN	

envirotech

5796 U.S. HIGHWAY 64, FARMINGTON, NM 87401 505-632-0615

LEGEND

- Excavation
- Pipeline
- X West Bottom Sample

SITE MAP 2
CCI San Juan LLC
24" Barker Dome Pipeline Leak
SECTION 27, TWP 32 NORTH, RANGE 14 WEST
SAN JUAN COUNTY, NEW MEXICO

SCALE: NTS	FIGURE NO. 3		REV
PROJECT NO.14038-0011			

REVISIONS

NO.	DATE	BY	DESCRIPTION

MAP DRWN	SL	3/19/15	BASE DRWN	

envirotech

5796 U.S. HIGHWAY 64, FARMINGTON, NM 87401 505-632-0615

LEGEND

Excavation

Pipeline

X West Bottom Sample

SITE MAP 3
CCI San Juan LLC
24" Barker Dome Pipeline Leak
SECTION 27, TWP 32 NORTH, RANGE 14 WEST
SAN JUAN COUNTY, NEW MEXICO

SCALE: NTS	FIGURE NO. 4	REV
PROJECT NO.14038-0011		

REVISIONS

NO.	DATE	BY	DESCRIPTION

MAP DRWN	SL	3/19/15	BASE DRWN	

envirotech

5796 U.S. HIGHWAY 64, FARMINGTON, NM 87401 505-632-0615

TABLES

Table 1, Summary of Analytical Results
24' Barker Dome Pipeline Leak
Project No. 14038-0011
March 2015

Constituents Analyzed	Ut Mt. Ute Tribal Limit	units	West Bottom 12/15/14	West Walls 12/15/14	East Bottom 12/15/14	East Walls 12/15/14	West Bottom 1/9/15	West Bottom 3/6/15
TPH	500	mg/kg	33.8	15.9	<35	<35	177.9	<35
Benzene	0.17	mg/kg	0.33	<0.1	0.12	<0.1	0.12	<0.1
Toluene	85	mg/kg	0.84	0.64	0.5	0.16	0.45	<0.1
Ethylbenzene	100	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Xylene	175	mg/kg	1.04	1.15	0.43	<0.2	1.1	<0.1
Anthracene	1000	mg/kg	NS	NS	NS	NS	0.3	<0.0070
Acenaphthene	1000	mg/kg	NS	NS	NS	NS	0.15	<0.0070
Benzo(a)anthracene	0.22	mg/kg	NS	NS	NS	NS	0.42	0.023
Benzo(a)pyrene	0.022	mg/kg	NS	NS	NS	NS	0.18	0.0079
Benzo(b)fluoranthene	0.22	mg/kg	NS	NS	NS	NS	0.48	0.069
Benzo(k)fluoranthene	2.2	mg/kg	NS	NS	NS	NS	0.095	0.012
Chrysene	22	mg/kg	NS	NS	NS	NS	0.43	0.058
Dibenz(a,h)anthracene	0.022	mg/kg	NS	NS	NS	NS	0.045	<0.0070
Fluoranthene	1000	mg/kg	NS	NS	NS	NS	0.99	0.061
Fluorene	1000	mg/kg	NS	NS	NS	NS	0.16	<0.0070
Indeno(1,2,3-cd)pyrene	0.22	mg/kg	NS	NS	NS	NS	0.13	0.015
Naphthalene	23	mg/kg	NS	NS	NS	NS	0.045	<0.0070
Pyrene	1000	mg/kg	NS	NS	NS	NS	0.86	0.055
Arsenic	0.39	mg/kg	NS	NS	NS	NS	1.61	2.04
Barium	15000	mg/kg	NS	NS	NS	NS	117	118
Cadmiuim	70	mg/kg	NS	NS	NS	NS	1.08	1.28
Chromium	12000	mg/kg	NS	NS	NS	NS	19.8	28.00
Copper	3100	mg/kg	NS	NS	NS	NS	15.1	23.2
Lead	400	mg/kg	NS	NS	NS	NS	10.1	10.5
Mercury	23	mg/kg	NS	NS	NS	NS	<0.99	0.99
Selenium	390	mg/kg	NS	NS	NS	NS	3.18	3.52
Silver	390	mg/kg	NS	NS	NS	NS	<0.99	<0.99
Zinc	23000	mg/kg	NS	NS	NS	NS	43.6	78.00
Boron	2	mg/kg	NS	NS	NS	NS	<.50	<0.49
Nickel	1600	mg/kg	NS	NS	NS	NS	11.00	16.3
pH	6-9	n/a	NS	NS	NS	NS	4.03	4.47
Sodium Absorbtion Ratio	<12[5]	n/a	NS	NS	NS	NS	0.894	1.32
Electrical Conductivity	<4	mmhos/cm	NS	NS	NS	NS	826	1760

* NS - Parameter not screened
* Red - Parameter above Ute Mt Ute Tribe regulatory limit

APPENDIX A

Analytical Results

envirotech
Analytical Laboratory

Analytical Report

Report Summary

Client: CCI, LLC

Chain Of Custody Number: 17589

Samples Received: 12/15/2014 4:50:00PM

Job Number: 14038-0011

Work Order: P412054

Project Name/Location: Kirtland Plant Pipeline Leak

Entire Report Reviewed By: ______________________ Date: 12/24/14

Tim Cain, Laboratory Manager

The results in this report apply to the samples submitted to Envirotech's Analytical Laboratory and were analyzed in accordance with the chain of custody document supplied by you, the client, and as such are for your exclusive use only. The results in this report are based on the sample as received unless otherwise noted. Partial or incomplete reproduction of this report is prohibited, unless approved by Envirotech, Inc. If you have any questions regarding this analytical report, please don't hesitate to contact Envirotech's Laboratory Staff.

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	24-Dec-14 09:31

Analyical Report for Samples

Client Sample ID	Lab Sample ID	Matrix	Sampled	Received	Container
West Bottom	P412054-01A	Soil	12/15/14	12/15/14	Glass Jar, 4 oz.
West Walls	P412054-02A	Soil	12/15/14	12/15/14	Glass Jar, 4 oz.
East Bottom	P412054-03A	Soil	12/15/14	12/15/14	Glass Jar, 4 oz.
East Walls	P412054-04A	Soil	12/15/14	12/15/14	Glass Jar, 4 oz.
Soil Pile	P412054-05A	Soil	12/15/14	12/15/14	Glass Jar, 4 oz.

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	**Reported:**
Kirtland NM, 87417	Project Manager:	Sheena Leon	24-Dec-14 09:31

West Bottom

P412054-01 (Solid)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Volatile Organics by EPA 8021									
Benzene	0.33	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Toluene	0.84	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Ethylbenzene	ND	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
p,m-Xylene	0.78	0.20	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
o-Xylene	0.26	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Total Xylenes	1.04	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Total BTEX	2.21	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Surrogate: 4-Bromochlorobenzene-PID		*118 %*	*50-150*		*1451026*	*12/18/14*	*12/22/14*	*EPA 8021B*	
Nonhalogenated Organics by 8015									
Gasoline Range Organics (C6-C10)	33.8	9.98	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8015D	
Diesel Range Organics (C10-C28)	ND	34.9	mg/kg	1	1451025	12/18/14	12/18/14	EPA 8015D	
Surrogate: o-Terphenyl		*104 %*	*50-200*		*1451025*	*12/18/14*	*12/18/14*	*EPA 8015D*	
Surrogate: 4-Bromochlorobenzene-FID		*107 %*	*50-150*		*1451026*	*12/18/14*	*12/22/14*	*EPA 8015D*	

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak		
PO Box 70	Project Number:	14038-0011		Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon		24-Dec-14 09:31

West Walls
P412054-02 (Solid)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Volatile Organics by EPA 8021									
Benzene	ND	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Toluene	0.64	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Ethylbenzene	ND	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
p,m-Xylene	0.88	0.20	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
o-Xylene	0.27	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Total Xylenes	1.15	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Total BTEX	1.79	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Surrogate: 4-Bromochlorobenzene-PID		*116 %*	*50-150*		*1451026*	*12/18/14*	*12/22/14*	*EPA 8021B*	
Nonhalogenated Organics by 8015									
Gasoline Range Organics (C6-C10)	15.9	9.97	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8015D	
Diesel Range Organics (C10-C28)	ND	35.0	mg/kg	1	1451025	12/18/14	12/18/14	EPA 8015D	
Surrogate: o-Terphenyl		*116 %*	*50-200*		*1451025*	*12/18/14*	*12/18/14*	*EPA 8015D*	
Surrogate: 4-Bromochlorobenzene-FID		*104 %*	*50-150*		*1451026*	*12/18/14*	*12/22/14*	*EPA 8015D*	

envirotech
Analytical Laboratory

CCI, LLC	**Project Name:**	Kirtland Plant Pipeline Leak	
PO Box 70	**Project Number:**	14038-0011	**Reported:**
Kirtland NM, 87417	**Project Manager:**	Sheena Leon	24-Dec-14 09:31

East Bottom

P412054-03 (Solid)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Volatile Organics by EPA 8021									
Benzene	**0.12**	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Toluene	**0.50**	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Ethylbenzene	ND	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
p,m-Xylene	**0.32**	0.20	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
o-Xylene	**0.11**	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Total Xylenes	**0.43**	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Total BTEX	**1.04**	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Surrogate: 4-Bromochlorobenzene-PID		*114 %*	*50-150*		*1451026*	*12/18/14*	*12/22/14*	*EPA 8021B*	
Nonhalogenated Organics by 8015									
Gasoline Range Organics (C6-C10)	ND	9.97	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8015D	
Diesel Range Organics (C10-C28)	ND	35.0	mg/kg	1	1451025	12/18/14	12/18/14	EPA 8015D	
Surrogate: o-Terphenyl		*108 %*	*50-200*		*1451025*	*12/18/14*	*12/18/14*	*EPA 8015D*	
Surrogate: 4-Bromochlorobenzene-FID		*102 %*	*50-150*		*1451026*	*12/18/14*	*12/22/14*	*EPA 8015D*	

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	24-Dec-14 09:31

East Walls
P412054-04 (Solid)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Volatile Organics by EPA 8021									
Benzene	ND	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Toluene	0.16	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Ethylbenzene	ND	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
p,m-Xylene	ND	0.20	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
o-Xylene	ND	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Total Xylenes	ND	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Total BTEX	0.16	0.10	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8021B	
Surrogate: 4-Bromochlorobenzene-PID		*113 %*	*50-150*		*1451026*	*12/18/14*	*12/22/14*	*EPA 8021B*	
Nonhalogenated Organics by 8015									
Gasoline Range Organics (C6-C10)	ND	9.98	mg/kg	1	1451026	12/18/14	12/22/14	EPA 8015D	
Diesel Range Organics (C10-C28)	ND	34.9	mg/kg	1	1451025	12/18/14	12/18/14	EPA 8015D	
Surrogate: o-Terphenyl		*108 %*	*50-200*		*1451025*	*12/18/14*	*12/18/14*	*EPA 8015D*	
Surrogate: 4-Bromochlorobenzene-FID		*102 %*	*50-150*		*1451026*	*12/18/14*	*12/22/14*	*EPA 8015D*	

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	24-Dec-14 09:31

Soil Pile

P412054-05 (Solid)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
TCLP Metals									
Arsenic	ND	0.01	mg/L	1	1452001	12/22/14	12/22/14	EPA 6010C	
Barium	0.19	0.05	mg/L	1	1452001	12/22/14	12/22/14	EPA 6010C	
Cadmium	ND	0.01	mg/L	1	1452001	12/22/14	12/22/14	EPA 6010C	
Chromium	ND	0.01	mg/L	1	1452001	12/22/14	12/22/14	EPA 6010C	
Lead	ND	0.01	mg/L	1	1452001	12/22/14	12/22/14	EPA 6010C	
Selenium	0.03	0.01	mg/L	1	1452001	12/22/14	12/22/14	EPA 6010C	
Silver	0.06	0.01	mg/L	1	1452001	12/22/14	12/22/14	EPA 6010C	
TCLP Mercury by EPA 7470A									
Mercury	ND	0.0002	mg/L	1	1452002	12/22/14	12/23/14	EPA 7470A	

envirotech
Analytical Laboratory

CCI, LLC PO Box 70 Kirtland NM, 87417	Project Name: Kirtland Plant Pipeline Leak Project Number: 14038-0011 Project Manager: Sheena Leon	Reported: 24-Dec-14 09:31

Volatile Organics by EPA 8021 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1451026 - Purge and Trap EPA 5030A										
Blank (1451026-BLK1)				Prepared & Analyzed: 18-Dec-14						
Benzene	ND	0.10	mg/kg							
Toluene	ND	0.10	"							
Ethylbenzene	ND	0.10	"							
p,m-Xylene	ND	0.20	"							
o-Xylene	ND	0.10	"							
Total Xylenes	ND	0.10	"							
Total BTEX	ND	0.10	"							
Surrogate: 4-Bromochlorobenzene-PID	*0.423*		"	*0.400*		*106*	*50-150*			
LCS (1451026-BS1)				Prepared & Analyzed: 18-Dec-14						
Benzene	22.1	0.10	mg/kg	20.0		111	75-125			
Toluene	22.5	0.10	"	20.0		113	70-125			
Ethylbenzene	22.9	0.10	"	20.0		115	75-125			
p,m-Xylene	45.9	0.20	"	39.9		115	80-125			
o-Xylene	22.8	0.10	"	20.0		114	75-125			
Surrogate: 4-Bromochlorobenzene-PID	*0.427*		"	*0.399*		*107*	*50-150*			
Matrix Spike (1451026-MS1)		Source: P412060-01		Prepared & Analyzed: 18-Dec-14						
Benzene	20.7	0.10	mg/kg	20.0	ND	104	75-125			
Toluene	21.1	0.10	"	20.0	ND	106	70-125			
Ethylbenzene	21.4	0.10	"	20.0	ND	107	75-125			
p,m-Xylene	43.7	0.20	"	39.9	ND	109	80-125			
o-Xylene	21.5	0.10	"	20.0	0.14	107	75-125			
Surrogate: 4-Bromochlorobenzene-PID	*0.429*		"	*0.399*		*107*	*50-150*			
Matrix Spike Dup (1451026-MSD1)		Source: P412060-01		Prepared & Analyzed: 18-Dec-14						
Benzene	21.9	0.10	mg/kg	20.0	ND	110	75-125	5.76	15	
Toluene	22.5	0.10	"	20.0	ND	113	70-125	6.19	15	
Ethylbenzene	22.7	0.10	"	20.0	ND	114	75-125	5.95	15	
p,m-Xylene	46.3	0.20	"	39.9	ND	116	80-125	5.86	15	
o-Xylene	22.9	0.10	"	20.0	0.14	114	75-125	6.26	15	
Surrogate: 4-Bromochlorobenzene-PID	*0.424*		"	*0.399*		*106*	*50-150*			

envirotech
Analytical Laboratory

CCI, LLC	Project Name: Kirtland Plant Pipeline Leak	
PO Box 70	Project Number: 14038-0011	Reported:
Kirtland NM, 87417	Project Manager: Sheena Leon	24-Dec-14 09:31

Nonhalogenated Organics by 8015 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1451025 - DRO Extraction EPA 3550M										
Blank (1451025-BLK1)				Prepared & Analyzed: 18-Dec-14						
Diesel Range Organics (C10-C28)	ND	29.9	mg/kg							
Surrogate: o-Terphenyl	*39.1*		"	*39.9*		*98.1*	*50-200*			
LCS (1451025-BS1)				Prepared & Analyzed: 18-Dec-14						
Diesel Range Organics (C10-C28)	508	29.9	mg/kg	499		102	38-132			
Surrogate: o-Terphenyl	*45.1*		"	*39.9*		*113*	*50-200*			
Matrix Spike (1451025-MS1)		Source: P412060-01		Prepared & Analyzed: 18-Dec-14						
Diesel Range Organics (C10-C28)	599	30.0	mg/kg	499	ND	120	38-132			
Surrogate: o-Terphenyl	*50.6*		"	*39.9*		*127*	*50-200*			
Matrix Spike Dup (1451025-MSD1)		Source: P412060-01		Prepared & Analyzed: 18-Dec-14						
Diesel Range Organics (C10-C28)	537	30.0	mg/kg	500	ND	108	38-132	10.8	20	
Surrogate: o-Terphenyl	*47.0*		"	*40.0*		*118*	*50-200*			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	24-Dec-14 09:31

Nonhalogenated Organics by 8015 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1451026 - Purge and Trap EPA 5030A										
Blank (1451026-BLK1)				Prepared & Analyzed: 18-Dec-14						
Gasoline Range Organics (C6-C10)	ND	9.99	mg/kg							
Surrogate: 4-Bromochlorobenzene-FID	*0.380*		"	*0.400*		*95.1*	*50-150*			
LCS (1451026-BS1)				Prepared & Analyzed: 18-Dec-14						
Gasoline Range Organics (C6-C10)	316	9.98	mg/kg	291		109	80-120			
Surrogate: 4-Bromochlorobenzene-FID	*0.382*		"	*0.399*		*95.9*	*50-150*			
Matrix Spike (1451026-MS1)		Source: P412060-01		Prepared & Analyzed: 18-Dec-14						
Gasoline Range Organics (C6-C10)	301	9.99	mg/kg	292	ND	103	75-125			
Surrogate: 4-Bromochlorobenzene-FID	*0.382*		"	*0.399*		*95.7*	*50-150*			
Matrix Spike Dup (1451026-MSD1)		Source: P412060-01		Prepared & Analyzed: 18-Dec-14						
Gasoline Range Organics (C6-C10)	319	9.99	mg/kg	292	ND	110	75-125	5.91	15	
Surrogate: 4-Bromochlorobenzene-FID	*0.379*		"	*0.399*		*94.9*	*50-150*			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	24-Dec-14 09:31

TCLP Metals - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1452001 - Metal Water/TCLP (EPA 1311) Digestion EPA 3015A										
Blank (1452001-BLK1)				Prepared & Analyzed: 22-Dec-14						
Arsenic	ND	0.01	mg/L							
Barium	ND	0.05	"							
Cadmium	ND	0.01	"							
Chromium	ND	0.01	"							
Lead	ND	0.01	"							
Selenium	ND	0.01	"							
Silver	ND	0.01	"							
Duplicate (1452001-DUP1)		Source: P412037-02		Prepared & Analyzed: 22-Dec-14						
Arsenic	0.02	0.01	mg/L		0.01			62.6	30	DI
Barium	0.39	0.05	"		0.28			32.2	30	DI
Cadmium	0.02	0.01	"		0.02			13.1	30	
Chromium	0.01	0.01	"		0.02			10.7	30	
Lead	0.17	0.01	"		0.19			15.7	30	
Selenium	0.04	0.01	"		0.04			17.2	30	
Silver	0.03	0.01	"		0.04			19.2	30	
Matrix Spike (1452001-MS1)		Source: P412037-02		Prepared & Analyzed: 22-Dec-14						
Arsenic	0.26		mg/L	0.250	0.01	101	75-125			
Barium	5.48		"	5.00	0.24	105	75-125			
Cadmium	0.27		"	0.250	0.02	98.6	75-125			
Chromium	0.50		"	0.500	0.01	96.5	75-125			
Lead	0.64		"	0.500	0.17	95.5	75-125			
Selenium	0.14		"	0.100	0.03	105	75-125			
Silver	0.12		"	0.100	0.03	88.8	75-125			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	24-Dec-14 09:31

TCLP Mercury by EPA 7470A - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1452002 - Mercury Water/TCLP Digestion KMNO4										
Blank (1452002-BLK1)				Prepared: 22-Dec-14 Analyzed: 23-Dec-14						
Mercury	ND	0.0002	mg/L							
LCS (1452002-BS1)				Prepared: 22-Dec-14 Analyzed: 23-Dec-14						
Mercury	0.002	0.0002	mg/L	0.00229		108	80-120			
Matrix Spike (1452002-MS1)		Source: P412054-05		Prepared: 22-Dec-14 Analyzed: 23-Dec-14						
Mercury	0.002	0.0002	mg/L	0.00229	ND	106	75-125			
Matrix Spike Dup (1452002-MSD1)		Source: P412054-05		Prepared: 22-Dec-14 Analyzed: 23-Dec-14						
Mercury	0.002	0.0002	mg/L	0.00229	ND	107	75-125	1.27	15	

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak		
PO Box 70	Project Number:	14038-0011		Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon		24-Dec-14 09:31

Notes and Definitions

D1	Duplicates or Matrix Spike Duplicates Relative Percent Difference exceeds control limits.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

CHAIN OF CUSTODY RECORD

17589

Client: CCI

Project Name / Location: Kirtland Plant Pipeline Leak

Email results to: S. Leon

Sampler Name: S. Leon

Client Phone No.:

Client No.: 14038-0011

ANALYSIS / PARAMETERS

Sample No./ Identification	Sample Date	Sample Time	Lab No.	No./Volume of Containers	Preservative HNO_3	Preservative HCl		TPH (Method 8015)	BTEX (Method 8021)	VOC (Method 8260)	RCRA 8 Metals	Cation / Anion	RCI	TCLP ~~with H/P~~ Metals	CO Table 910-1	TPH (418.1)	CHLORIDE				Sample Cool	Sample Intact
West Bottom	12/5/14	11:50	P412054-01	1-4oz glass jar				+	+												Y	Y
West Walls	↓	12:00	P412054-02	↓				+	+												↓	↓
East Bottom	↓	12:20	P412054-03	↓				+	+												↓	↓
East Walls	↓	12:10	P412054-04	↓				+	+												↓	↓
Soil Pile	↓	12:30	P412054-05	↓										+							↓	↓

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Sheena Leon	12/5/14	16:50	[illegible]	12/5/14	16:50
Relinquished by: (Signature)			Received by: (Signature)		

Sample Matrix

Soil ☒ Solid ☐ Sludge ☐ Aqueous ☐ Other ☐ ____________

☐ Sample(s) dropped off after hours to secure drop off area.

envirotech
Analytical Laboratory

11.2, 11.8, 11.4

5795 US Highway 64 • Farmington, NM 87401 • 505-632-0615 • Three Springs • 65 Mercado Street, Suite 115, Durango, CO 81301 • laboratory@envirotech-inc

envirotech
Analytical Laboratory

Analytical Report

Report Summary

Client: CCI, LLC

Chain Of Custody Number: 17598

Samples Received: 1/9/2015 9:00:00AM

Job Number: 14038-0011

Work Order: P501024

Project Name/Location: Kirtland Plant Pipeline Leak

Entire Report Reviewed By: ______________________ Date: 1/27/15

Tim Cain, Laboratory Manager

Supplement to analytical report generated on: 1/20/15 1:56 pm

The results in this report apply to the samples submitted to Envirotech's Analytical Laboratory and were analyzed in accordance with the chain of custody document supplied by you, the client, and as such are for your exclusive use only. The results in this report are based on the sample as received unless otherwise noted. Partial or incomplete reproduction of this report is prohibited, unless approved by Envirotech, Inc. If you have any questions regarding this analytical report, please don't hesitate to contact Envirotech's Laboratory Staff.

envirotech
Analytical Laboratory

CCI, LLC PO Box 70 Kirtland NM, 87417	Project Name: Kirtland Plant Pipeline Leak Project Number: 14038-0011 Project Manager: Sheena Leon	Reported: 27-Jan-15 15:31

Analyical Report for Samples

Client Sample ID	Lab Sample ID	Matrix	Sampled	Received	Container
West Bottom	P501024-01A	Soil	01/08/15	01/09/15	Glass Jar, 4 oz.
	P501024-01B	Soil	01/08/15	01/09/15	Glass Jar, 4 oz.

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	27-Jan-15 15:31

West Bottom
P501024-01 (Solid)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Volatile Organics by EPA 8021									
Benzene	0.12	0.10	mg/kg	1	1503011	01/13/15	01/15/15	EPA 8021B	
Toluene	0.45	0.10	mg/kg	1	1503011	01/13/15	01/15/15	EPA 8021B	
Ethylbenzene	ND	0.10	mg/kg	1	1503011	01/13/15	01/15/15	EPA 8021B	
p,m-Xylene	0.78	0.20	mg/kg	1	1503011	01/13/15	01/15/15	EPA 8021B	
o-Xylene	0.32	0.10	mg/kg	1	1503011	01/13/15	01/15/15	EPA 8021B	
Total Xylenes	1.10	0.10	mg/kg	1	1503011	01/13/15	01/15/15	EPA 8021B	
Total BTEX	1.68	0.10	mg/kg	1	1503011	01/13/15	01/15/15	EPA 8021B	
Surrogate: 4-Bromochlorobenzene-PID		*118 %*	*50-150*		*1503011*	*01/13/15*	*01/15/15*	*EPA 8021B*	
Nonhalogenated Organics by 8015									
Gasoline Range Organics (C6-C10)	25.9	9.99	mg/kg	1	1503011	01/13/15	01/15/15	EPA 8015D	
Diesel Range Organics (C10-C28)	152	24.9	mg/kg	1	1503010	01/13/15	01/16/15	EPA 8015D	
Surrogate: o-Terphenyl		*107 %*	*50-200*		*1503010*	*01/13/15*	*01/16/15*	*EPA 8015D*	
Surrogate: 4-Bromochlorobenzene-FID		*115 %*	*50-150*		*1503011*	*01/13/15*	*01/15/15*	*EPA 8015D*	
Total Metals by 6010									
Arsenic	1.61	0.99	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	
Barium	117	4.95	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	
Cadmium	1.08	0.99	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	
Chromium	19.8	0.99	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	
Copper	15.1	0.99	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	
Lead	10.1	0.99	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	
Mercury	ND	0.99	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	
Nickel	11.0	0.99	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	
Selenium	3.18	0.99	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	
Silver	ND	0.99	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	
Zinc	43.6	0.99	mg/kg	1	1504007	01/19/15	01/19/15	EPA 6010C	

envirotech
Analytical Laboratory

CCI, LLC PO Box 70 Kirtland NM, 87417	Project Name: Kirtland Plant Pipeline Leak Project Number: 14038-0011 Project Manager: Sheena Leon	Reported: 27-Jan-15 15:31

West Bottom
P501024-01 (Solid)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Cation/Anion Analysis									
pH @25°C	4.03		pH Units	1	1503007	01/13/15	01/13/15	EPA 9045D	
Electrical Conductivity	826		umhos/cm	1	1503007	01/13/15	01/13/15	EPA 120.1	
Sodium Absorption Ratio	0.894		N/A	1	1504008	01/19/15	01/19/15	[CALC]	
Calcium	53.9	0.01	mg/L	1	1503023	01/16/15	01/19/15	EPA 6010C	
Magnesium	22.3	0.01	mg/L	1	1503023	01/16/15	01/19/15	EPA 6010C	
Sodium	30.9	0.01	mg/L	1	1503023	01/16/15	01/19/15	EPA 6010C	
Boron-Hot Water Soluble by EPA 6010									
Boron	ND	0.50	mg/L	1	1504006	01/19/15	01/19/15	EPA 6010C	

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	27-Jan-15 15:31

Volatile Organics by EPA 8021 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1503011 - Purge and Trap EPA 5030A										
Blank (1503011-BLK1)				Prepared: 13-Jan-15 Analyzed: 15-Jan-15						
Benzene	ND	0.10	mg/kg							
Toluene	ND	0.10	"							
Ethylbenzene	ND	0.10	"							
p,m-Xylene	ND	0.20	"							
o-Xylene	ND	0.10	"							
Total Xylenes	ND	0.10	"							
Total BTEX	ND	0.10	"							
Surrogate: 4-Bromochlorobenzene-PID	*0.463*		"	*0.399*		*116*	*50-150*			
LCS (1503011-BS1)				Prepared: 13-Jan-15 Analyzed: 15-Jan-15						
Benzene	17.0	0.10	mg/kg	19.9		85.3	75-125			
Toluene	17.6	0.10	"	19.9		88.4	70-125			
Ethylbenzene	18.0	0.10	"	19.9		90.0	75-125			
p,m-Xylene	36.2	0.20	"	39.9		90.6	80-125			
o-Xylene	17.8	0.10	"	19.9		89.3	75-125			
Surrogate: 4-Bromochlorobenzene-PID	*0.466*		"	*0.399*		*117*	*50-150*			
Matrix Spike (1503011-MS1)		Source: P501024-01		Prepared: 13-Jan-15 Analyzed: 15-Jan-15						
Benzene	18.6	0.10	mg/kg	19.9	0.12	92.6	75-125			
Toluene	19.3	0.10	"	19.9	0.45	94.7	70-125			
Ethylbenzene	19.4	0.10	"	19.9	ND	97.1	75-125			
p,m-Xylene	40.0	0.20	"	39.9	0.78	98.3	80-125			
o-Xylene	19.7	0.10	"	19.9	0.32	97.3	75-125			
Surrogate: 4-Bromochlorobenzene-PID	*0.479*		"	*0.399*		*120*	*50-150*			
Matrix Spike Dup (1503011-MSD1)		Source: P501024-01		Prepared: 13-Jan-15 Analyzed: 15-Jan-15						
Benzene	18.3	0.10	mg/kg	20.0	0.12	91.1	75-125	1.51	15	
Toluene	19.2	0.10	"	20.0	0.45	94.2	70-125	0.418	15	
Ethylbenzene	19.3	0.10	"	20.0	ND	96.7	75-125	0.369	15	
p,m-Xylene	41.2	0.20	"	39.9	0.78	101	80-125	3.06	15	
o-Xylene	20.1	0.10	"	20.0	0.32	99.0	75-125	1.87	15	
Surrogate: 4-Bromochlorobenzene-PID	*0.522*		"	*0.399*		*131*	*50-150*			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	27-Jan-15 15:31

Nonhalogenated Organics by 8015 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1503010 - DRO Extraction EPA 3550M										
Blank (1503010-BLK1)				Prepared: 13-Jan-15 Analyzed: 16-Jan-15						
Diesel Range Organics (C10-C28)	ND	24.9	mg/kg							
Surrogate: o-Terphenyl	*47.9*		"	*39.9*		*120*	*50-200*			
LCS (1503010-BS1)				Prepared: 13-Jan-15 Analyzed: 16-Jan-15						
Diesel Range Organics (C10-C28)	574	25.0	mg/kg	499		115	38-132			
Surrogate: o-Terphenyl	*45.9*		"	*39.9*		*115*	*50-200*			
Matrix Spike (1503010-MS1)	Source: P501024-01			Prepared: 13-Jan-15 Analyzed: 16-Jan-15						
Diesel Range Organics (C10-C28)	616	24.9	mg/kg	499	152	92.9	38-132			
Surrogate: o-Terphenyl	*43.6*		"	*39.9*		*109*	*50-200*			
Matrix Spike Dup (1503010-MSD1)	Source: P501024-01			Prepared: 13-Jan-15 Analyzed: 16-Jan-15						
Diesel Range Organics (C10-C28)	573	25.0	mg/kg	499	152	84.3	38-132	7.23	20	
Surrogate: o-Terphenyl	*45.8*		"	*39.9*		*115*	*50-200*			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	27-Jan-15 15:31

Nonhalogenated Organics by 8015 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1503011 - Purge and Trap EPA 5030A										
Blank (1503011-BLK1)				Prepared: 13-Jan-15 Analyzed: 15-Jan-15						
Gasoline Range Organics (C6-C10)	ND	9.98	mg/kg							
Surrogate: 4-Bromochlorobenzene-FID	*0.416*		"	*0.399*		*104*	*50-150*			
LCS (1503011-BS1)				Prepared: 13-Jan-15 Analyzed: 15-Jan-15						
Gasoline Range Organics (C6-C10)	248	9.97	mg/kg	291		85.3	80-120			
Surrogate: 4-Bromochlorobenzene-FID	*0.419*		"	*0.399*		*105*	*50-150*			
Matrix Spike (1503011-MS1)		Source: P501024-01		Prepared: 13-Jan-15 Analyzed: 15-Jan-15						
Gasoline Range Organics (C6-C10)	281	9.96	mg/kg	291	25.9	87.6	75-125			
Surrogate: 4-Bromochlorobenzene-FID	*0.450*		"	*0.399*		*113*	*50-150*			
Matrix Spike Dup (1503011-MSD1)		Source: P501024-01		Prepared: 13-Jan-15 Analyzed: 15-Jan-15						
Gasoline Range Organics (C6-C10)	401	9.98	mg/kg	291	25.9	129	75-125	35.3	15	D1
Surrogate: 4-Bromochlorobenzene-FID	*0.609*		"	*0.399*		*153*	*50-150*			*Surr1*

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	27-Jan-15 15:31

Total Metals by 6010 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1504007 - Metal Solid Digestion EPA 3051A										
Blank (1504007-BLK1)				Prepared & Analyzed: 19-Jan-15						
Arsenic	ND	1.00	mg/kg							
Barium	ND	5.00	"							
Cadmium	ND	1.00	"							
Chromium	ND	1.00	"							
Copper	ND	1.00	"							
Lead	ND	1.00	"							
Mercury	ND	1.00	"							
Nickel	ND	1.00	"							
Selenium	ND	1.00	"							
Silver	ND	1.00	"							
Zinc	ND	1.00	"							
Duplicate (1504007-DUP1)		Source: P501024-01		Prepared & Analyzed: 19-Jan-15						
Arsenic	2.47	0.97	mg/kg		1.61			41.8	30	D1
Barium	128	4.85	"		117			9.02	30	
Cadmium	1.32	0.97	"		1.08			20.2	30	
Chromium	23.6	0.97	"		19.8			17.5	30	
Copper	18.8	0.97	"		15.1			21.9	30	
Lead	10.7	0.97	"		10.1			5.84	30	
Mercury	ND	0.97	"		ND				30	
Nickel	13.3	0.97	"		11.0			18.7	30	
Selenium	3.45	0.97	"		3.18			8.16	30	
Silver	ND	0.97	"		ND				30	
Zinc	59.0	0.97	"		43.6			30.0	30	
Matrix Spike (1504007-MS1)		Source: P501024-01		Prepared & Analyzed: 19-Jan-15						
Arsenic	0.25		mg/L	0.250	0.02	95.0	75-125			
Barium	6.71		"	5.00	1.12	112	75-125			
Cadmium	0.25		"	0.250	0.01	95.0	75-125			
Chromium	0.73		"	0.500	0.19	108	75-125			
Copper	0.64		"	0.500	0.14	98.4	75-125			
Lead	0.55		"	0.500	0.10	90.1	75-125			
Mercury	0.10		"	0.100	0.009	89.9	75-125			
Nickel	0.59		"	0.500	0.11	97.0	75-125			
Selenium	0.13		"	0.100	0.03	95.3	75-125			
Silver	0.09		"	0.100	-0.006	90.5	75-125			
Zinc	0.96		"	0.500	0.42	109	75-125			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon	27-Jan-15 15:31

Boron-Hot Water Soluble by EPA 6010 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1504006 - Boron HW Soluble Digestion										
Blank (1504006-BLK1)				Prepared & Analyzed: 19-Jan-15						
Boron	ND	0.50	mg/L							
Duplicate (1504006-DUP1)		Source: P501024-01		Prepared & Analyzed: 19-Jan-15						
Boron	ND	0.50	mg/L		ND				30	
Matrix Spike (1504006-MS1)		Source: P501024-01		Prepared & Analyzed: 19-Jan-15						
Boron	0.63		mg/L	0.500	0.07	112	75-125			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak		
PO Box 70	Project Number:	14038-0011		Reported:
Kirtland NM, 87417	Project Manager:	Sheena Leon		27-Jan-15 15:31

Notes and Definitions

Surr1	Surrogate recovery was above acceptable limits.
D1	Duplicates or Matrix Spike Duplicates Relative Percent Difference exceeds control limits.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

17598

CHAIN OF CUSTODY RECORD

Client: CCI	Project Name / Location: Kirtland Plant Pipeline Leak
Email results to: S Leon	Sampler Name: S. Leon
Client Phone No.:	Client No.: 14038-0011

ANALYSIS / PARAMETERS

Sample No./ Identification	Sample Date	Sample Time	Lab No.	No./Volume of Containers	Preservative HNO_3	Preservative HCl	Preservative Cool	TPH (Method 8015)	BTEX (Method 8021)	VOC (Method 8260)	RCRA 8 Metals	Cation / Anion	RCI	TCLP with H/P	CO Table 910-1	TPH (418.1)	CHLORIDE				Sample Cool	Sample Intact
West Bottom	1/8/15	11:30	P501024-01	2-4oz glass jars			X								X						✓	✓

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Sheena Leon	1/9/15		[signature]	1/9/15	9:30
Relinquished by: (Signature)			Received by: (Signature)		

Sample Matrix
Soil ☒ Solid ☐ Sludge ☐ Aqueous ☐ Other ☐ ____________

☐ Sample(s) dropped off after hours to secure drop off area.

envirotech
Analytical Laboratory

6.7
6.1

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

Lynn Cook
EnviroTech- NM
5796 US. Highway 64
Farmington, NM 87401

Report Summary

Monday January 26, 2015

Report Number: L742965
Samples Received: 01/13/15
Client Project: 14038-0011

Description: Kirtland Plant Pipeline Leak

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Entire Report Reviewed By: Daphne R Richards
Daphne Richards , ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 100789, AL - 40660, CA - 01157CA, CT - PH-0197,
FL - E87487, GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016,
NC - ENV375/DW21704/BIO041, ND - R-140. NJ - TN002, NJ NELAP - TN002,
SC - 84004, TN - 2006, VA - 460132, WV - 233, AZ - 0612,
MN - 047-999-395, NY - 11742, WI - 998093910, NV - TN000032011-1,
TX - T104704245-11-3, OK - 9915, PA - 68-02979, IA Lab #364, EPA - TN002

Accreditation is only applicable to the test methods specified on each scope of accreditation held by ESC Lab Sciences.

Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Lynn Cook
EnviroTech- NM
5796 US. Highway 64
Farmington, NM 87401

January 26,2015

ESC Sample # : L742965-01

Date Received : January 13, 2015
Description : Kirtland Plant Pipeline Leak

Site ID : P501024

Sample ID : WEST BOTTOM

Project # : 14038-0011

Collected By : S. Leon
Collection Date : 01/08/15 11:30

Parameter	Dry Result	Det. Limit	Units	Method	Date	Dil.
Total Solids	86.1		%	2540 G-2011	01/16/15	1
Polynuclear Aromatic Hydrocarbons						
Anthracene	0.30	0.0070	mg/kg	8270C-SIM	01/23/15	1
Acenaphthene	0.15	0.0070	mg/kg	8270C-SIM	01/23/15	1
Acenaphthylene	BDL	0.0070	mg/kg	8270C-SIM	01/23/15	1
Benzo(a)anthracene	0.42	0.0070	mg/kg	8270C-SIM	01/23/15	1
Benzo(a)pyrene	0.18	0.0070	mg/kg	8270C-SIM	01/23/15	1
Benzo(b)fluoranthene	0.48	0.0070	mg/kg	8270C-SIM	01/23/15	1
Benzo(g,h,i)perylene	0.13	0.0070	mg/kg	8270C-SIM	01/23/15	1
Benzo(k)fluoranthene	0.095	0.0070	mg/kg	8270C-SIM	01/23/15	1
Chrysene	0.43	0.0070	mg/kg	8270C-SIM	01/23/15	1
Dibenz(a,h)anthracene	0.045	0.0070	mg/kg	8270C-SIM	01/23/15	1
Fluoranthene	0.99	0.0070	mg/kg	8270C-SIM	01/23/15	1
Fluorene	0.16	0.0070	mg/kg	8270C-SIM	01/23/15	1
Indeno(1,2,3-cd)pyrene	0.13	0.0070	mg/kg	8270C-SIM	01/23/15	1
Naphthalene	0.045	0.023	mg/kg	8270C-SIM	01/23/15	1
Phenanthrene	1.3	0.0070	mg/kg	8270C-SIM	01/23/15	1
Pyrene	0.86	0.0070	mg/kg	8270C-SIM	01/23/15	1
1-Methylnaphthalene	BDL	0.023	mg/kg	8270C-SIM	01/23/15	1
2-Methylnaphthalene	0.030	0.023	mg/kg	8270C-SIM	01/23/15	1
2-Chloronaphthalene	BDL	0.023	mg/kg	8270C-SIM	01/23/15	1
Surrogate Recovery						
Nitrobenzene-d5	65.2		% Rec.	8270C-SIM	01/23/15	1
2-Fluorobiphenyl	70.8		% Rec.	8270C-SIM	01/23/15	1
p-Terphenyl-d14	75.1		% Rec.	8270C-SIM	01/23/15	1

Results listed are dry weight basis.
BDL - Below Detection Limit
Det. Limit - Practical Quantitation Limit(PQL)
Note:

The reported analytical results relate only to the sample submitted
Reported: 01/23/15 16:55 Revised: 01/26/15 09:30

ESC LAB SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

EnviroTech- NM
Lynn Cook
5796 US. Highway 64

Farmington, NM 87401

Quality Assurance Report
Level II

L742965

January 26, 2015

Laboratory Blank

Analyte	Result	Units	% Rec	Limit	Batch	Date Analyzed
Total Solids	< .1	%			WG764605	01/16/15 07:16
1-Methylnaphthalene	< .02	mg/kg			WG766057	01/23/15 10:34
2-Chloronaphthalene	< .02	mg/kg			WG766057	01/23/15 10:34
2-Methylnaphthalene	< .02	mg/kg			WG766057	01/23/15 10:34
Acenaphthene	< .006	mg/kg			WG766057	01/23/15 10:34
Acenaphthylene	< .006	mg/kg			WG766057	01/23/15 10:34
Anthracene	< .006	mg/kg			WG766057	01/23/15 10:34
Benzo(a)anthracene	< .006	mg/kg			WG766057	01/23/15 10:34
Benzo(a)pyrene	< .006	mg/kg			WG766057	01/23/15 10:34
Benzo(b)fluoranthene	< .006	mg/kg			WG766057	01/23/15 10:34
Benzo(g,h,i)perylene	< .006	mg/kg			WG766057	01/23/15 10:34
Benzo(k)fluoranthene	< .006	mg/kg			WG766057	01/23/15 10:34
Chrysene	< .006	mg/kg			WG766057	01/23/15 10:34
Dibenz(a,h)anthracene	< .006	mg/kg			WG766057	01/23/15 10:34
Fluoranthene	< .006	mg/kg			WG766057	01/23/15 10:34
Fluorene	< .006	mg/kg			WG766057	01/23/15 10:34
Indeno(1,2,3-cd)pyrene	< .006	mg/kg			WG766057	01/23/15 10:34
Naphthalene	< .02	mg/kg			WG766057	01/23/15 10:34
Phenanthrene	< .006	mg/kg			WG766057	01/23/15 10:34
Pyrene	< .006	mg/kg			WG766057	01/23/15 10:34
2-Fluorobiphenyl		% Rec.	91.20	38.2-135	WG766057	01/23/15 10:34
Nitrobenzene-d5		% Rec.	93.00	28.4-151	WG766057	01/23/15 10:34
p-Terphenyl-d14		% Rec.	89.40	34.2-141	WG766057	01/23/15 10:34

Duplicate

Analyte	Units	Result	Duplicate	RPD	Limit	Ref Samp	Batch
Total Solids	%	88.5	87.9	0.682	5	L742995-01	WG764605

Laboratory Control Sample

Analyte	Units	Known Val	Result	% Rec	Limit	Batch
Total Solids	%	50	50.0	100.	85-115	WG764605
1-Methylnaphthalene	mg/kg	.08	0.0682	85.3	48.9-127	WG766057
2-Chloronaphthalene	mg/kg	.08	0.0655	81.9	48.8-125	WG766057
2-Methylnaphthalene	mg/kg	.08	0.0686	85.7	45.7-131	WG766057
Acenaphthene	mg/kg	.08	0.0668	83.5	48.7-127	WG766057
Acenaphthylene	mg/kg	.08	0.0676	84.4	47.9-128	WG766057
Anthracene	mg/kg	.08	0.0722	90.2	51.3-136	WG766057
Benzo(a)anthracene	mg/kg	.08	0.0629	78.6	55-126	WG766057
Benzo(a)pyrene	mg/kg	.08	0.0567	70.8	51.9-127	WG766057
Benzo(b)fluoranthene	mg/kg	.08	0.0605	75.7	54-125	WG766057
Benzo(g,h,i)perylene	mg/kg	.08	0.0628	78.5	53.8-136	WG766057
Benzo(k)fluoranthene	mg/kg	.08	0.0716	89.5	53.9-132	WG766057
Chrysene	mg/kg	.08	0.0700	87.5	55.7-133	WG766057
Dibenz(a,h)anthracene	mg/kg	.08	0.0695	86.9	52.6-137	WG766057
Fluoranthene	mg/kg	.08	0.0691	86.4	54-132	WG766057
Fluorene	mg/kg	.08	0.0657	82.1	48.7-127	WG766057
Indeno(1,2,3-cd)pyrene	mg/kg	.08	0.0696	87.0	53.8-138	WG766057
Naphthalene	mg/kg	.08	0.0679	84.8	42-127	WG766057
Phenanthrene	mg/kg	.08	0.0626	78.2	49.6-126	WG766057
Pyrene	mg/kg	.08	0.0629	78.6	54-129	WG766057
2-Fluorobiphenyl				81.80	38.2-135	WG766057
Nitrobenzene-d5				83.80	28.4-151	WG766057
p-Terphenyl-d14				80.70	34.2-141	WG766057

* Performance of this Analyte is outside of established criteria.
For additional information, please see Attachment A 'List of Analytes with QC Qualifiers.'

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

EnviroTech- NM
Lynn Cook
5796 US. Highway 64

Farmington, NM 87401

Quality Assurance Report
Level II

L742965

January 26, 2015

Laboratory Control Sample Duplicate

Analyte	Units	Result	Ref	%Rec	Limit	RPD	Limit	Batch
1-Methylnaphthalene	mg/kg	0.0662	0.0682	83.0	48.9-127	3.07	20	WG766057
2-Chloronaphthalene	mg/kg	0.0636	0.0655	79.0	48.8-125	3.01	20	WG766057
2-Methylnaphthalene	mg/kg	0.0670	0.0686	84.0	45.7-131	2.39	20	WG766057
Acenaphthene	mg/kg	0.0645	0.0668	81.0	48.7-127	3.47	20	WG766057
Acenaphthylene	mg/kg	0.0652	0.0676	81.0	47.9-128	3.55	20	WG766057
Anthracene	mg/kg	0.0703	0.0722	88.0	51.3-136	2.63	20	WG766057
Benzo(a)anthracene	mg/kg	0.0608	0.0629	76.0	55-126	3.47	20	WG766057
Benzo(a)pyrene	mg/kg	0.0571	0.0567	71.0	51.9-127	0.670	20	WG766057
Benzo(b)fluoranthene	mg/kg	0.0612	0.0605	76.0	54-125	1.06	20	WG766057
Benzo(g,h,i)perylene	mg/kg	0.0620	0.0628	77.0	53.8-136	1.28	20	WG766057
Benzo(k)fluoranthene	mg/kg	0.0683	0.0716	85.0	53.9-132	4.74	20	WG766057
Chrysene	mg/kg	0.0672	0.0700	84.0	55.7-133	4.02	20	WG766057
Dibenz(a,h)anthracene	mg/kg	0.0686	0.0695	86.0	52.6-137	1.26	20	WG766057
Fluoranthene	mg/kg	0.0675	0.0691	84.0	54-132	2.31	20	WG766057
Fluorene	mg/kg	0.0634	0.0657	79.0	48.7-127	3.66	20	WG766057
Indeno(1,2,3-cd)pyrene	mg/kg	0.0688	0.0696	86.0	53.8-138	1.22	20	WG766057
Naphthalene	mg/kg	0.0662	0.0679	83.0	42-127	2.53	20	WG766057
Phenanthrene	mg/kg	0.0606	0.0626	76.0	49.6-126	3.21	20	WG766057
Pyrene	mg/kg	0.0617	0.0629	77.0	54-129	1.78	20	WG766057
2-Fluorobiphenyl				79.90	38.2-135			WG766057
Nitrobenzene-d5				82.10	28.4-151			WG766057
p-Terphenyl-d14				78.80	34.2-141			WG766057

Matrix Spike

Analyte	Units	MS Res	Ref Res	TV	% Rec	Limit	Ref Samp	Batch
1-Methylnaphthalene	mg/kg	0.0966	0.0305	.08	83.0	41.8-133	L744637-02	WG766057
2-Chloronaphthalene	mg/kg	0.0554	0.0	.08	69.0	42.4-129	L744637-02	WG766057
2-Methylnaphthalene	mg/kg	0.154	0.0739	.08	100.	37.5-137	L744637-02	WG766057
Acenaphthene	mg/kg	0.0608	0.0	.08	76.0	39.4-132	L744637-02	WG766057
Acenaphthylene	mg/kg	0.0651	0.0	.08	81.0	41.3-132	L744637-02	WG766057
Anthracene	mg/kg	0.0599	0.0	.08	75.0	36.7-144	L744637-02	WG766057
Benzo(a)anthracene	mg/kg	0.0531	0.0	.08	66.0	28-144	L744637-02	WG766057
Benzo(a)pyrene	mg/kg	0.0482	0.0	.08	60.0	23.8-147	L744637-02	WG766057
Benzo(b)fluoranthene	mg/kg	0.0506	0.0	.08	63.0	18.2-147	L744637-02	WG766057
Benzo(g,h,i)perylene	mg/kg	0.0495	0.00627	.08	54.0	9.2-155	L744637-02	WG766057
Benzo(k)fluoranthene	mg/kg	0.0466	0.0	.08	58.0	26.5-143	L744637-02	WG766057
Chrysene	mg/kg	0.0570	0.00693	.08	63.0	27.4-150	L744637-02	WG766057
Dibenz(a,h)anthracene	mg/kg	0.0474	0.0	.08	59.0	13.8-150	L744637-02	WG766057
Fluoranthene	mg/kg	0.0628	0.00674	.08	70.0	23.2-158	L744637-02	WG766057
Fluorene	mg/kg	0.0631	0.0106	.08	66.0	30.8-139	L744637-02	WG766057
Indeno(1,2,3-cd)pyrene	mg/kg	0.0468	0.0	.08	58.0	10.7-155	L744637-02	WG766057
Naphthalene	mg/kg	0.0934	0.0240	.08	87.0	34.9-133	L744637-02	WG766057
Phenanthrene	mg/kg	0.0804	0.0372	.08	54.0	20.2-150	L744637-02	WG766057
Pyrene	mg/kg	0.0613	0.0154	.08	57.0	22.6-151	L744637-02	WG766057
2-Fluorobiphenyl					74.80	38.2-135		WG766057
Nitrobenzene-d5					76.20	28.4-151		WG766057
p-Terphenyl-d14					69.50	34.2-141		WG766057

Matrix Spike Duplicate

Analyte	Units	MSD	Ref	%Rec	Limit	RPD	Limit	Ref Samp	Batch
1-Methylnaphthalene	mg/kg	0.0800	0.0966	61.9	41.8-133	18.8	20.9	L744637-02	WG766057
2-Chloronaphthalene	mg/kg	0.0579	0.0554	72.3	42.4-129	4.41	20	L744637-02	WG766057
2-Methylnaphthalene	mg/kg	0.114	0.154	50.1	37.5-137	29.8*	20.4	L744637-02	WG766057
Acenaphthene	mg/kg	0.0620	0.0608	77.5	39.4-132	2.01	20	L744637-02	WG766057
Acenaphthylene	mg/kg	0.0646	0.0651	80.7	41.3-132	0.720	20	L744637-02	WG766057
Anthracene	mg/kg	0.0618	0.0599	77.3	36.7-144	3.15	20.7	L744637-02	WG766057
Benzo(a)anthracene	mg/kg	0.0540	0.0531	67.5	28-144	1.75	24.7	L744637-02	WG766057

* Performance of this Analyte is outside of established criteria.
For additional information, please see Attachment A 'List of Analytes with QC Qualifiers.'

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

EnviroTech- NM
Lynn Cook
5796 US. Highway 64

Farmington, NM 87401

Quality Assurance Report
Level II

L742965

January 26, 2015

Analyte	Units	MSD	Ref	%Rec	Limit	RPD	Limit	Ref Samp	Batch
		Matrix Spike Duplicate							
Benzo(a)pyrene	mg/kg	0.0495	0.0482	61.8	23.8-147	2.59	25.3	L744637-02	WG766057
Benzo(b)fluoranthene	mg/kg	0.0489	0.0506	61.1	18.2-147	3.49	29.5	L744637-02	WG766057
Benzo(g,h,i)perylene	mg/kg	0.0483	0.0495	52.5	9.2-155	2.56	29.2	L744637-02	WG766057
Benzo(k)fluoranthene	mg/kg	0.0515	0.0466	64.3	26.5-143	10.0	26.1	L744637-02	WG766057
Chrysene	mg/kg	0.0594	0.0570	65.6	27.4-150	4.13	25.7	L744637-02	WG766057
Dibenz(a,h)anthracene	mg/kg	0.0480	0.0474	60.0	13.8-150	1.14	25.8	L744637-02	WG766057
Fluoranthene	mg/kg	0.0649	0.0628	72.7	23.2-158	3.29	26	L744637-02	WG766057
Fluorene	mg/kg	0.0673	0.0631	70.9	30.8-139	6.48	20	L744637-02	WG766057
Indeno(1,2,3-cd)pyrene	mg/kg	0.0480	0.0468	60.0	10.7-155	2.68	26.9	L744637-02	WG766057
Naphthalene	mg/kg	0.0785	0.0934	68.1	34.9-133	17.4	20.4	L744637-02	WG766057
Phenanthrene	mg/kg	0.0874	0.0804	62.8	20.2-150	8.40	24.6	L744637-02	WG766057
Pyrene	mg/kg	0.0639	0.0613	60.7	22.6-151	4.18	25.1	L744637-02	WG766057
2-Fluorobiphenyl				82.60	38.2-135				WG766057
Nitrobenzene-d5				84.90	28.4-151				WG766057
p-Terphenyl-d14				75.70	34.2-141				WG766057

Batch number /Run number / Sample number cross reference

WG764476: R3014690 R3014691: L742965-01
WG764605: R3014892: L742965-01
WG766057: R3016124: L742965-01

* * Calculations are performed prior to rounding of reported values.
* Performance of this Analyte is outside of established criteria.
For additional information, please see Attachment A 'List of Analytes with QC Qualifiers.'

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

EnviroTech- NM
Lynn Cook
5796 US. Highway 64

Farmington, NM 87401

Quality Assurance Report
Level II

L742965

January 26, 2015

The data package includes a summary of the analytic results of the quality control samples required by the SW-846 or CWA methods. The quality control samples include a method blank, a laboratory control sample, and the matrix spike/matrix spike duplicate analysis. If a target parameter is outside the method limits, every sample that is effected is flagged with the appropriate qualifier in Appendix B of the analytic report.

Method Blank - an aliquot of reagent water carried through the entire analytic process. The method blank results indicate if any possible contamination exposure during the sample handling, digestion or extraction process, and analysis. Concentrations of target analytes above the reporting limit in the method blank are qualified with the "B" qualifier.

Laboratory Control Sample - is a sample of known concentration that is carried through the digestion/extraction and analysis process. The percent recovery, expressed as a percentage of the theoretical concentration, has statistical control limits indicating that the analytic process is "in control". If a target analyte is outside the control limits for the laboratory control sample or any other control sample, the parameter is flagged with a "J4" qualifier for all effected samples.

Matrix Spike and Matrix Spike Duplicate - is two aliquots of an environmental sample that is spiked with known concentrations of target analytes. The percent recovery of the target analytes also has statistical control limits. If any recoveries that are outside the method control limits, the sample that was selected for matrix spike/matrix spike duplicate analysis is flagged with either a "J5" or a "J6". The relative percent difference (%RPD) between the matrix spike and the matrix spike duplicate recoveries is all calculated. If the RPD is above the method limit, the effected samples are flagged with a "J3" qualifier.

EnviroTech- NM 5796 US. Highway 64 Farmington, NM 87401	Billing Information: Doris Moore 5796 US. Highway 64 Farmington, NM 87401	Chain of Custody Page 1 of 1 ESC L·A·B S·C·I·E·N·C·E·S YOUR LAB OF CHOICE 12065 Lebanon Rd Mount Juliet, TN 37122 Phone: 615-758-5858 Phone: 800-767-5859 Fax: 615-758-5859
Report to: Lynn & Tim	Email To: Lynn & Tim	L# L742565 A230
Project Description: Kirtland Plant Pipeline Leak	City/State Collected:	
Phone: 505-632-0615 Fax:	Client Project # 14038-0011	Lab Project #
Collected by (print): S. Leon	Site/Facility ID # P5•1•24	P.O. # 141650
Collected by (signature): Immediately Packed on Ice N ___ Y ✓	*Rush?* (Lab MUST Be Notified) ___ Same Day ....200% ___ Next Day ....100% ___ Two Day ....50% ___ Three Day 25%	Date Results Needed Email? ___No ✓Yes FAX? ✓No ___Yes

Acctnum: ENVIROFNM
Template:
Prelogin:
TSR: 288 - Daphne Richards
PB:
Shipped Via:

Analysis / Container / Preservative: PAH sim by 8270/4oz jar/cool

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	PAH sim by 8270/4oz jar/cool	Rem./Contaminant	Sample # (lab only)
West Bottom		SS		01-08-15	11:30	1	✓		-01

* Matrix: SS - Soil GW - Groundwater WW - WasteWater DW Drinking Water OT - Other ________

Remarks:

pH ________ Temp ________
Flow ________ Other ________

5781 0509 0611

Hold #

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Samples returned via: ☐ UPS ☐ FedEx ☐ Courier ☐ ____	Condition: (lab use only)
Diane Brown	01-12-15	16:05			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 3.2 °C Bottles Received: 1 4oz	COC Seal Intact: ___Y ___N ___NA
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature) [signature]	Date: 1-13-15 Time: 0900	pH Checked: NCF:

envirotech
Analytical Laboratory

Analytical Report

Report Summary

Client: CCI, LLC

Chain Of Custody Number:

Samples Received: 3/6/2015 1:43:00PM

Job Number: 14038-0011

Work Order: P503024

Project Name/Location: Kirtland Plant Pipeline Leak

Entire Report Reviewed By: ______ Date: 3/12/15

Tim Cain, Laboratory Manager

The results in this report apply to the samples submitted to Envirotech's Analytical Laboratory and were analyzed in accordance with the chain of custody document supplied by you, the client, and as such are for your exclusive use only. The results in this report are based on the sample as received unless otherwise noted. Partial or incomplete reproduction of this report is prohibited, unless approved by Envirotech, Inc. If you have any questions regarding this analytical report, please don't hesitate to contact Envirotech's Laboratory Staff.

5796 US Highway 64, Farmington, NM 87401 Ph (505) 632-0615 Fx (505) 632-1865
Three Springs - 65 Mercado Street, Suite 115, Durango, CO 81301 Ph (970) 259-0615 Fr (800) 362-1879
envirotech-inc.com
laboratory@envirotech-inc.com

envirotech
Analytical Laboratory

CCI, LLC PO Box 70 Kirtland NM, 87417	Project Name: Kirtland Plant Pipeline Leak Project Number: 14038-0011 Project Manager: Greg Crabtree	Reported: 12-Mar-15 11:52

Analyical Report for Samples

Client Sample ID	Lab Sample ID	Matrix	Sampled	Received	Container
West Bottom	P503024-01A	Soil	03/06/15	03/06/15	Glass Jar, 4 oz.
	P503024-01B	Soil	03/06/15	03/06/15	Glass Jar, 4 oz.

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Greg Crabtree	12-Mar-15 11:52

West Bottom

P503024-01 (Solid)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Volatile Organics by EPA 8021									
Benzene	ND	0.10	mg/kg	1	1510023	03/11/15	03/11/15	EPA 8021B	
Toluene	ND	0.10	mg/kg	1	1510023	03/11/15	03/11/15	EPA 8021B	
Ethylbenzene	ND	0.10	mg/kg	1	1510023	03/11/15	03/11/15	EPA 8021B	
p,m-Xylene	ND	0.20	mg/kg	1	1510023	03/11/15	03/11/15	EPA 8021B	
o-Xylene	ND	0.10	mg/kg	1	1510023	03/11/15	03/11/15	EPA 8021B	
Total Xylenes	ND	0.10	mg/kg	1	1510023	03/11/15	03/11/15	EPA 8021B	
Total BTEX	ND	0.10	mg/kg	1	1510023	03/11/15	03/11/15	EPA 8021B	
Surrogate: 4-Bromochlorobenzene-PID		*94.5 %*	*50-150*		*1510023*	*03/11/15*	*03/11/15*	*EPA 8021B*	
Nonhalogenated Organics by 8015									
Gasoline Range Organics (C6-C10)	ND	9.94	mg/kg	1	1510023	03/11/15	03/11/15	EPA 8015D	
Diesel Range Organics (C10-C28)	ND	34.4	mg/kg	1	1510024	03/10/15	03/10/15	EPA 8015D	
Surrogate: o-Terphenyl		*109 %*	*50-200*		*1510024*	*03/10/15*	*03/10/15*	*EPA 8015D*	
Surrogate: 4-Bromochlorobenzene-FID		*88.8 %*	*50-150*		*1510023*	*03/11/15*	*03/11/15*	*EPA 8015D*	
Total Metals by 6010									
Arsenic	2.04	0.99	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	
Barium	118	4.95	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	
Cadmium	1.28	0.99	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	
Chromium	28.0	0.99	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	
Copper	23.2	0.99	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	
Lead	10.5	0.99	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	
Mercury	0.99	0.99	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	
Nickel	16.3	0.99	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	
Selenium	3.52	0.99	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	
Silver	ND	0.99	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	
Zinc	78.0	0.99	mg/kg	1	1511005	03/09/15	03/10/15	EPA 6010C	

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Greg Crabtree	12-Mar-15 11:52

West Bottom

P503024-01 (Solid)

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Cation/Anion Analysis									
pH @°C	4.47		pH Units	1	1511004	03/09/15	03/09/15	EPA 9045D	
Electrical Conductivity	1760		umhos/cm	1	1511004	03/09/15	03/09/15	EPA 120.1	
Sodium Absorption Ratio	1.32		N/A	1	1511018	03/12/15	03/12/15	[CALC]	
Calcium	16.3	0.01	mg/L	1	1510026	03/06/15	03/09/15	EPA 6010C	
Magnesium	12.7	0.01	mg/L	1	1510026	03/06/15	03/09/15	EPA 6010C	
Sodium	29.3	0.01	mg/L	1	1510026	03/06/15	03/09/15	EPA 6010C	
Boron-Hot Water Soluble by EPA 6010									
Boron	ND	0.49	mg/L	1	1510032	03/06/15	03/10/15	EPA 6010C	

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Greg Crabtree	12-Mar-15 11:52

Volatile Organics by EPA 8021 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1510023 - Purge and Trap EPA 5030A										
Blank (1510023-BLK1)				Prepared: 05-Mar-15 Analyzed: 11-Mar-15						
Benzene	ND	0.10	mg/kg							
Toluene	ND	0.10	"							
Ethylbenzene	ND	0.10	"							
p,m-Xylene	ND	0.20	"							
o-Xylene	ND	0.10	"							
Total Xylenes	ND	0.10	"							
Total BTEX	ND	0.10	"							
Surrogate: 4-Bromochlorobenzene-PID	*0.346*		"	*0.393*		*87.9*	*50-150*			
LCS (1510023-BS1)				Prepared: 05-Mar-15 Analyzed: 11-Mar-15						
Benzene	21.4	0.10	mg/kg	19.8		108	75-125			
Toluene	20.0	0.10	"	19.8		101	70-125			
Ethylbenzene	19.0	0.10	"	19.8		96.1	75-125			
p,m-Xylene	36.7	0.20	"	39.6		92.6	80-125			
o-Xylene	17.8	0.10	"	19.8		89.8	75-125			
Surrogate: 4-Bromochlorobenzene-PID	*0.350*		"	*0.396*		*88.2*	*50-150*			
Matrix Spike (1510023-MS1)		Source: P503020-01		Prepared: 05-Mar-15 Analyzed: 11-Mar-15						
Benzene	23.4	0.10	mg/kg	19.9	ND	118	75-125			
Toluene	23.1	0.10	"	19.9	ND	116	70-125			
Ethylbenzene	22.5	0.10	"	19.9	ND	113	75-125			
p,m-Xylene	44.6	0.20	"	39.7	ND	112	80-125			
o-Xylene	21.4	0.10	"	19.9	ND	108	75-125			
Surrogate: 4-Bromochlorobenzene-PID	*0.370*		"	*0.397*		*93.2*	*50-150*			
Matrix Spike Dup (1510023-MSD1)		Source: P503020-01		Prepared: 05-Mar-15 Analyzed: 11-Mar-15						
Benzene	20.8	0.10	mg/kg	19.8	ND	105	75-125	11.9	15	
Toluene	20.4	0.10	"	19.8	ND	103	70-125	12.3	15	
Ethylbenzene	20.2	0.10	"	19.8	ND	102	75-125	10.9	15	
p,m-Xylene	40.5	0.20	"	39.7	ND	102	80-125	9.60	15	
o-Xylene	19.5	0.10	"	19.8	ND	98.4	75-125	9.34	15	
Surrogate: 4-Bromochlorobenzene-PID	*0.373*		"	*0.397*		*94.0*	*50-150*			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Greg Crabtree	12-Mar-15 11:52

Nonhalogenated Organics by 8015 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1510023 - Purge and Trap EPA 5030A										
Blank (1510023-BLK1)				Prepared: 05-Mar-15 Analyzed: 11-Mar-15						
Gasoline Range Organics (C6-C10)	ND	9.83	mg/kg							
Surrogate: 4-Bromochlorobenzene-FID	*0.325*		"	*0.393*		*82.6*	*50-150*			
LCS (1510023-BS1)				Prepared: 05-Mar-15 Analyzed: 11-Mar-15						
Gasoline Range Organics (C6-C10)	237	9.91	mg/kg	264		89.9	80-120			
Surrogate: 4-Bromochlorobenzene-FID	*0.329*		"	*0.396*		*83.0*	*50-150*			
Matrix Spike (1510023-MS1)		Source: P503020-01		Prepared: 05-Mar-15 Analyzed: 11-Mar-15						
Gasoline Range Organics (C6-C10)	291	9.93	mg/kg	265	ND	110	75-125			
Surrogate: 4-Bromochlorobenzene-FID	*0.350*		"	*0.397*		*88.0*	*50-150*			
Matrix Spike Dup (1510023-MSD1)		Source: P503020-01		Prepared: 05-Mar-15 Analyzed: 11-Mar-15						
Gasoline Range Organics (C6-C10)	258	9.91	mg/kg	264	ND	97.7	75-125	12.0	15	
Surrogate: 4-Bromochlorobenzene-FID	*0.352*		"	*0.397*		*88.9*	*50-150*			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	**Reported:**
Kirtland NM, 87417	Project Manager:	Greg Crabtree	12-Mar-15 11:52

Nonhalogenated Organics by 8015 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1510024 - DRO Extraction EPA 3550M										
Blank (1510024-BLK1)				Prepared: 05-Mar-15 Analyzed: 06-Mar-15						
Diesel Range Organics (C10-C28)	ND	24.7	mg/kg							
Surrogate: o-Terphenyl	*45.9*		"	*39.4*		*116*	*50-200*			
LCS (1510024-BS1)				Prepared: 05-Mar-15 Analyzed: 06-Mar-15						
Diesel Range Organics (C10-C28)	529	24.7	mg/kg	494		107	38-132			
Surrogate: o-Terphenyl	*44.9*		"	*39.5*		*114*	*50-200*			
Matrix Spike (1510024-MS1)	**Source: P503020-01**			Prepared: 05-Mar-15 Analyzed: 06-Mar-15						
Diesel Range Organics (C10-C28)	517	24.6	mg/kg	492	ND	105	38-132			
Surrogate: o-Terphenyl	*45.6*		"	*39.4*		*116*	*50-200*			
Matrix Spike Dup (1510024-MSD1)	**Source: P503020-01**			Prepared: 05-Mar-15 Analyzed: 06-Mar-15						
Diesel Range Organics (C10-C28)	539	24.6	mg/kg	492	ND	110	38-132	4.28	20	
Surrogate: o-Terphenyl	*45.1*		"	*39.3*		*115*	*50-200*			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak	
PO Box 70	Project Number:	14038-0011	Reported:
Kirtland NM, 87417	Project Manager:	Greg Crabtree	12-Mar-15 11:52

Total Metals by 6010 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1511005 - Metal Solid Digestion EPA 3051A										
Blank (1511005-BLK1)				Prepared: 09-Mar-15 Analyzed: 10-Mar-15						
Arsenic	ND	1.00	mg/kg							
Barium	ND	5.00	"							
Cadmium	ND	1.00	"							
Chromium	ND	1.00	"							
Copper	ND	1.00	"							
Lead	ND	1.00	"							
Mercury	ND	1.00	"							
Nickel	ND	1.00	"							
Selenium	ND	1.00	"							
Silver	ND	1.00	"							
Zinc	ND	1.00	"							
Duplicate (1511005-DUP1)		Source: P503024-01		Prepared: 09-Mar-15 Analyzed: 10-Mar-15						
Arsenic	1.86	0.94	mg/kg		2.04			9.16	30	
Barium	102	4.70	"		118			15.0	30	
Cadmium	1.05	0.94	"		1.28			19.3	30	
Chromium	23.1	0.94	"		28.0			19.1	30	
Copper	17.5	0.94	"		23.2			28.1	30	
Lead	8.83	0.94	"		10.5			17.1	30	
Mercury	ND	0.94	"		0.99				30	
Nickel	13.8	0.94	"		16.3			16.8	30	
Selenium	3.35	0.94	"		3.52			5.21	30	
Silver	ND	0.94	"		ND				30	
Zinc	57.7	0.94	"		78.0			29.9	30	
Matrix Spike (1511005-MS1)		Source: P503024-01		Prepared: 09-Mar-15 Analyzed: 10-Mar-15						
Arsenic	0.22		mg/L	0.250	0.02	78.2	75-125			
Barium	6.02		"	5.00	1.13	97.6	75-125			
Cadmium	0.22		"	0.250	0.01	82.5	75-125			
Chromium	0.66		"	0.500	0.27	78.7	75-125			
Copper	0.62		"	0.500	0.22	78.9	75-125			
Lead	0.49		"	0.500	0.10	78.5	75-125			
Mercury	0.09		"	0.100	0.01	78.8	75-125			
Nickel	0.56		"	0.500	0.16	80.6	75-125			
Selenium	0.12		"	0.100	0.03	87.0	75-125			
Silver	0.09		"	0.100	0.008	83.9	75-125			
Zinc	1.07		"	0.500	0.75	65.0	75-125			SPK1

envirotech
Analytical Laboratory

CCI, LLC PO Box 70 Kirtland NM, 87417	Project Name: Kirtland Plant Pipeline Leak Project Number: 14038-0011 Project Manager: Greg Crabtree	Reported: 12-Mar-15 11:52

Boron-Hot Water Soluble by EPA 6010 - Quality Control

Envirotech Analytical Laboratory

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1510032 - Boron HW Soluble Digestion										
Blank (1510032-BLK1)				Prepared: 06-Mar-15 Analyzed: 10-Mar-15						
Boron	ND	0.50	mg/L							
Duplicate (1510032-DUP1)	Source: P503024-01			Prepared: 06-Mar-15 Analyzed: 10-Mar-15						
Boron	ND	0.50	mg/L		ND				30	
Matrix Spike (1510032-MS1)	Source: P503024-01			Prepared: 06-Mar-15 Analyzed: 10-Mar-15						
Boron	0.48		mg/L	0.500	0.10	76.0	75-125			

envirotech
Analytical Laboratory

CCI, LLC	Project Name:	Kirtland Plant Pipeline Leak		
PO Box 70	Project Number:	14038-0011		Reported:
Kirtland NM, 87417	Project Manager:	Greg Crabtree		12-Mar-15 11:52

Notes and Definitions

SPK1	The spike recovery is outside of quality control limits.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Client: CCT

Project: Kirtland Plant Pipeline leak

Sampler: E. Garcia

Phone:

Email(s): Esaac G.

Project Manager: Greg Crabtree

RUSH? [✓] 1d [ ] 3d

Lab Use Only
Lab WO# P503024
Job Number 14038-0011

Page 1 of 1

Sample ID	Sample Date	Sample Time	Matrix	Containers QTY - Vol/TYPE/Preservative	GRO/DRO by 8015	BTEX by 8021	TPH by 418.1	Chloride by 300.0	C.O 910 Table					Lab Number	Correct Cont/Prsrv (s) Y/N
West Bottom	3/6/15	1038	S	2-4oz/G/cool					X					1	Y

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]	3/6/15	13:43	[signature]	3/6/15	13:43
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time

Lab Use Only

**Received on Ice Y / N

T1 16.6 T2 12.7 T3____

AVG Temp °C______

Sample Matrix: S - Soil, Sd - Solid, Sg - Sludge, A - Aqueous, O - Other ______

Container Type: g - glass, p - poly/plastic, ag - amber glass

**Samples requiring thermal preservation must be received on ice the day they are sampled or received packed in ice at an avg temp above 0 but less than 6 °C on subsequent days.

[ ] Sample(s) dropped off after hours to a secure drop off area.

Chain of Custody

Notes/Billing info:

envirotech Analytical Laboratory

5796 US Highway 64, Farmington, NM 87401 Ph (505) 632-0615 Fx (505) 632-1865

Three Springs • 65 Mercado Street, Suite 115, Durango, CO 81301 Ph (970) 259-0615 Fr (800) 362-1879

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

Lynn Cook
EnviroTech- NM
5796 US. Highway 64
Farmington, NM 87401

Report Summary

Tuesday March 10, 2015

Report Number: L752132
Samples Received: 03/07/15
Client Project: 14038-0011

Description: Kirkland Plant Pipeline Leak

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Entire Report Reviewed By: Daphne R Richards
Daphne Richards , ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 100789, AL - 40660, CA - 01157CA, CT - PH-0197,
FL - E87487, GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016,
NC - ENV375/DW21704/BIO041, ND - R-140. NJ - TN002, NJ NELAP - TN002,
SC - 84004, TN - 2006, VA - 460132, WV - 233, AZ - 0612,
MN - 047-999-395, NY - 11742, WI - 998093910, NV - TN000032011-1,
TX - T104704245-11-3, OK - 9915, PA - 68-02979, IA Lab #364, EPA - TN002

Accreditation is only applicable to the test methods specified on each scope of accreditation held by ESC Lab Sciences.

Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Lynn Cook
EnviroTech- NM
5796 US. Highway 64
Farmington, NM 87401

March 10,2015

ESC Sample # : L752132-01

Date Received : March 07, 2015
Description : Kirkland Plant Pipeline Leak

Site ID : P503024

Sample ID : WEST BOTTOM

Project # : 14038-0011

Collected By : Issac Garcia
Collection Date : 03/06/15 10:38

Parameter	Dry Result	Det. Limit	Units	Method	Date	Dil.
Total Solids	85.8		%	2540 G-2011	03/10/15	1
Polynuclear Aromatic Hydrocarbons						
Anthracene	BDL	0.0070	mg/kg	8270C-SIM	03/09/15	1
Acenaphthene	BDL	0.0070	mg/kg	8270C-SIM	03/09/15	1
Acenaphthylene	BDL	0.0070	mg/kg	8270C-SIM	03/09/15	1
Benzo(a)anthracene	0.023	0.0070	mg/kg	8270C-SIM	03/09/15	1
Benzo(a)pyrene	0.0079	0.0070	mg/kg	8270C-SIM	03/09/15	1
Benzo(b)fluoranthene	0.069	0.0070	mg/kg	8270C-SIM	03/09/15	1
Benzo(g,h,i)perylene	0.019	0.0070	mg/kg	8270C-SIM	03/09/15	1
Benzo(k)fluoranthene	0.012	0.0070	mg/kg	8270C-SIM	03/09/15	1
Chrysene	0.058	0.0070	mg/kg	8270C-SIM	03/09/15	1
Dibenz(a,h)anthracene	BDL	0.0070	mg/kg	8270C-SIM	03/09/15	1
Fluoranthene	0.061	0.0070	mg/kg	8270C-SIM	03/09/15	1
Fluorene	BDL	0.0070	mg/kg	8270C-SIM	03/09/15	1
Indeno(1,2,3-cd)pyrene	0.015	0.0070	mg/kg	8270C-SIM	03/09/15	1
Naphthalene	BDL	0.023	mg/kg	8270C-SIM	03/09/15	1
Phenanthrene	0.092	0.0070	mg/kg	8270C-SIM	03/09/15	1
Pyrene	0.055	0.0070	mg/kg	8270C-SIM	03/09/15	1
1-Methylnaphthalene	BDL	0.023	mg/kg	8270C-SIM	03/09/15	1
2-Methylnaphthalene	BDL	0.023	mg/kg	8270C-SIM	03/09/15	1
2-Chloronaphthalene	BDL	0.023	mg/kg	8270C-SIM	03/09/15	1
Surrogate Recovery						
Nitrobenzene-d5	93.3		% Rec.	8270C-SIM	03/09/15	1
2-Fluorobiphenyl	84.0		% Rec.	8270C-SIM	03/09/15	1
p-Terphenyl-d14	87.4		% Rec.	8270C-SIM	03/09/15	1

Results listed are dry weight basis.
BDL - Below Detection Limit
Det. Limit - Practical Quantitation Limit(PQL)
Note:

The reported analytical results relate only to the sample submitted
Reported: 03/10/15 14:45 Printed: 03/10/15 14:45

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

EnviroTech- NM
Lynn Cook
5796 US. Highway 64

Farmington, NM 87401

Quality Assurance Report
Level II

L752132

March 10, 2015

Laboratory Blank

Analyte	Result	Units	% Rec	Limit	Batch	Date Analyzed
1-Methylnaphthalene	< .02	mg/kg			WG774359	03/09/15 12:04
2-Chloronaphthalene	< .02	mg/kg			WG774359	03/09/15 12:04
2-Methylnaphthalene	< .02	mg/kg			WG774359	03/09/15 12:04
Acenaphthene	< .006	mg/kg			WG774359	03/09/15 12:04
Acenaphthylene	< .006	mg/kg			WG774359	03/09/15 12:04
Anthracene	< .006	mg/kg			WG774359	03/09/15 12:04
Benzo(a)anthracene	< .006	mg/kg			WG774359	03/09/15 12:04
Benzo(a)pyrene	< .006	mg/kg			WG774359	03/09/15 12:04
Benzo(b)fluoranthene	< .006	mg/kg			WG774359	03/09/15 12:04
Benzo(g,h,i)perylene	< .006	mg/kg			WG774359	03/09/15 12:04
Benzo(k)fluoranthene	< .006	mg/kg			WG774359	03/09/15 12:04
Chrysene	< .006	mg/kg			WG774359	03/09/15 12:04
Dibenz(a,h)anthracene	< .006	mg/kg			WG774359	03/09/15 12:04
Fluoranthene	< .006	mg/kg			WG774359	03/09/15 12:04
Fluorene	< .006	mg/kg			WG774359	03/09/15 12:04
Indeno(1,2,3-cd)pyrene	< .006	mg/kg			WG774359	03/09/15 12:04
Naphthalene	< .02	mg/kg			WG774359	03/09/15 12:04
Phenanthrene	< .006	mg/kg			WG774359	03/09/15 12:04
Pyrene	< .006	mg/kg			WG774359	03/09/15 12:04
2-Fluorobiphenyl		% Rec.	83.60	38.2-135	WG774359	03/09/15 12:04
Nitrobenzene-d5		% Rec.	89.20	28.4-151	WG774359	03/09/15 12:04
p-Terphenyl-d14		% Rec.	94.80	34.2-141	WG774359	03/09/15 12:04
Total Solids	< .1	%			WG774417	03/10/15 07:49

Duplicate

Analyte	Units	Result	Duplicate	RPD	Limit	Ref Samp	Batch
Total Solids	%	85.8	85.8	0.0882	5	L752132-01	WG774417

Laboratory Control Sample

Analyte	Units	Known Val	Result	% Rec	Limit	Batch
1-Methylnaphthalene	mg/kg	.08	0.0712	89.0	48.9-127	WG774359
2-Chloronaphthalene	mg/kg	.08	0.0697	87.1	48.8-125	WG774359
2-Methylnaphthalene	mg/kg	.08	0.0678	84.7	45.7-131	WG774359
Acenaphthene	mg/kg	.08	0.0686	85.7	48.7-127	WG774359
Acenaphthylene	mg/kg	.08	0.0648	81.1	47.9-128	WG774359
Anthracene	mg/kg	.08	0.0754	94.3	51.3-136	WG774359
Benzo(a)anthracene	mg/kg	.08	0.0709	88.6	55-126	WG774359
Benzo(a)pyrene	mg/kg	.08	0.0703	87.9	51.9-127	WG774359
Benzo(b)fluoranthene	mg/kg	.08	0.0666	83.3	54-125	WG774359
Benzo(g,h,i)perylene	mg/kg	.08	0.0722	90.3	53.8-136	WG774359
Benzo(k)fluoranthene	mg/kg	.08	0.0809	101.	53.9-132	WG774359
Chrysene	mg/kg	.08	0.0792	98.9	55.7-133	WG774359
Dibenz(a,h)anthracene	mg/kg	.08	0.0679	84.9	52.6-137	WG774359
Fluoranthene	mg/kg	.08	0.0722	90.2	54-132	WG774359
Fluorene	mg/kg	.08	0.0651	81.3	48.7-127	WG774359
Indeno(1,2,3-cd)pyrene	mg/kg	.08	0.0706	88.3	53.8-138	WG774359
Naphthalene	mg/kg	.08	0.0706	88.2	42-127	WG774359
Phenanthrene	mg/kg	.08	0.0775	96.8	49.6-126	WG774359
Pyrene	mg/kg	.08	0.0964	121.	54-129	WG774359
2-Fluorobiphenyl				76.00	38.2-135	WG774359
Nitrobenzene-d5				82.70	28.4-151	WG774359
p-Terphenyl-d14				85.50	34.2-141	WG774359
Total Solids	%	50	50.0	99.9	85-115	WG774417

* Performance of this Analyte is outside of established criteria.
For additional information, please see Attachment A 'List of Analytes with QC Qualifiers.'

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

EnviroTech- NM
Lynn Cook
5796 US. Highway 64

Farmington, NM 87401

Quality Assurance Report
Level II

L752132

March 10, 2015

Laboratory Control Sample Duplicate

Analyte	Units	Result	Ref	%Rec	Limit	RPD	Limit	Batch
1-Methylnaphthalene	mg/kg	0.0765	0.0712	96.0	48.9-127	7.17	20	WG774359
2-Chloronaphthalene	mg/kg	0.0761	0.0697	95.0	48.8-125	8.77	20	WG774359
2-Methylnaphthalene	mg/kg	0.0731	0.0678	91.0	45.7-131	7.49	20	WG774359
Acenaphthene	mg/kg	0.0738	0.0686	92.0	48.7-127	7.34	20	WG774359
Acenaphthylene	mg/kg	0.0697	0.0648	87.0	47.9-128	7.18	20	WG774359
Anthracene	mg/kg	0.0819	0.0754	102.	51.3-136	8.21	20	WG774359
Benzo(a)anthracene	mg/kg	0.0753	0.0709	94.0	55-126	6.05	20	WG774359
Benzo(a)pyrene	mg/kg	0.0716	0.0703	90.0	51.9-127	1.91	20	WG774359
Benzo(b)fluoranthene	mg/kg	0.0738	0.0666	92.0	54-125	10.2	20	WG774359
Benzo(g,h,i)perylene	mg/kg	0.0754	0.0722	94.0	53.8-136	4.32	20	WG774359
Benzo(k)fluoranthene	mg/kg	0.0831	0.0809	104.	53.9-132	2.68	20	WG774359
Chrysene	mg/kg	0.0861	0.0792	108.	55.7-133	8.46	20	WG774359
Dibenz(a,h)anthracene	mg/kg	0.0703	0.0679	88.0	52.6-137	3.44	20	WG774359
Fluoranthene	mg/kg	0.0765	0.0722	96.0	54-132	5.79	20	WG774359
Fluorene	mg/kg	0.0693	0.0651	87.0	48.7-127	6.27	20	WG774359
Indeno(1,2,3-cd)pyrene	mg/kg	0.0738	0.0706	92.0	53.8-138	4.31	20	WG774359
Naphthalene	mg/kg	0.0755	0.0706	94.0	42-127	6.81	20	WG774359
Phenanthrene	mg/kg	0.0831	0.0775	104.	49.6-126	7.00	20	WG774359
Pyrene	mg/kg	0.0954	0.0964	119.	54-129	1.04	20	WG774359
2-Fluorobiphenyl				86.10	38.2-135			WG774359
Nitrobenzene-d5				84.90	28.4-151			WG774359
p-Terphenyl-d14				86.90	34.2-141			WG774359

Matrix Spike

Analyte	Units	MS Res	Ref Res	TV	% Rec	Limit	Ref Samp	Batch
1-Methylnaphthalene	mg/kg	0.0654	0.00122	.08	80.0	41.8-133	L751941-01	WG774359
2-Chloronaphthalene	mg/kg	0.0614	0.0	.08	77.0	42.4-129	L751941-01	WG774359
2-Methylnaphthalene	mg/kg	0.0612	0.00115	.08	75.0	37.5-137	L751941-01	WG774359
Acenaphthene	mg/kg	0.0595	0.00126	.08	73.0	39.4-132	L751941-01	WG774359
Acenaphthylene	mg/kg	0.0583	0.0	.08	73.0	41.3-132	L751941-01	WG774359
Anthracene	mg/kg	0.0659	0.00531	.08	76.0	36.7-144	L751941-01	WG774359
Benzo(a)anthracene	mg/kg	0.0549	0.0128	.08	53.0	28-144	L751941-01	WG774359
Benzo(a)pyrene	mg/kg	0.0509	0.0129	.08	48.0	23.8-147	L751941-01	WG774359
Benzo(b)fluoranthene	mg/kg	0.0470	0.0194	.08	34.0	18.2-147	L751941-01	WG774359
Benzo(g,h,i)perylene	mg/kg	0.0471	0.0103	.08	46.0	9.2-155	L751941-01	WG774359
Benzo(k)fluoranthene	mg/kg	0.0526	0.00683	.08	57.0	26.5-143	L751941-01	WG774359
Chrysene	mg/kg	0.0590	0.0164	.08	53.0	27.4-150	L751941-01	WG774359
Dibenz(a,h)anthracene	mg/kg	0.0428	0.00153	.08	52.0	13.8-150	L751941-01	WG774359
Fluoranthene	mg/kg	0.0661	0.0405	.08	32.0	23.2-158	L751941-01	WG774359
Fluorene	mg/kg	0.0513	0.000836	.08	63.0	30.8-139	L751941-01	WG774359
Indeno(1,2,3-cd)pyrene	mg/kg	0.0451	0.00818	.08	46.0	10.7-155	L751941-01	WG774359
Naphthalene	mg/kg	0.0857	0.0123	.08	92.0	34.9-133	L751941-01	WG774359
Phenanthrene	mg/kg	0.0693	0.0287	.08	51.0	20.2-150	L751941-01	WG774359
Pyrene	mg/kg	0.0778	0.0371	.08	51.0	22.6-151	L751941-01	WG774359
2-Fluorobiphenyl					81.50	38.2-135		WG774359
Nitrobenzene-d5					100.0	28.4-151		WG774359
p-Terphenyl-d14					72.00	34.2-141		WG774359

Matrix Spike Duplicate

Analyte	Units	MSD	Ref	%Rec	Limit	RPD	Limit	Ref Samp	Batch
1-Methylnaphthalene	mg/kg	0.0631	0.0654	77.4	41.8-133	3.51	20.9	L751941-01	WG774359
2-Chloronaphthalene	mg/kg	0.0596	0.0614	74.5	42.4-129	2.99	20	L751941-01	WG774359
2-Methylnaphthalene	mg/kg	0.0623	0.0612	76.4	37.5-137	1.77	20.4	L751941-01	WG774359
Acenaphthene	mg/kg	0.0577	0.0595	70.6	39.4-132	2.93	20	L751941-01	WG774359
Acenaphthylene	mg/kg	0.0566	0.0583	70.7	41.3-132	3.10	20	L751941-01	WG774359
Anthracene	mg/kg	0.0614	0.0659	70.1	36.7-144	7.03	20.7	L751941-01	WG774359
Benzo(a)anthracene	mg/kg	0.0631	0.0549	62.9	28-144	13.9	24.7	L751941-01	WG774359

* Performance of this Analyte is outside of established criteria.
For additional information, please see Attachment A 'List of Analytes with QC Qualifiers.'

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

EnviroTech- NM
Lynn Cook
5796 US. Highway 64

Farmington, NM 87401

Quality Assurance Report
Level II

L752132

March 10, 2015

Matrix Spike Duplicate

Analyte	Units	MSD	Ref	%Rec	Limit	RPD	Limit	Ref Samp	Batch
Benzo(a)pyrene	mg/kg	0.0587	0.0509	57.2	23.8-147	14.3	25.3	L751941-01	WG774359
Benzo(b)fluoranthene	mg/kg	0.0622	0.0470	53.5	18.2-147	27.9	29.5	L751941-01	WG774359
Benzo(g,h,i)perylene	mg/kg	0.0528	0.0471	53.0	9.2-155	11.3	29.2	L751941-01	WG774359
Benzo(k)fluoranthene	mg/kg	0.0576	0.0526	63.5	26.5-143	9.01	26.1	L751941-01	WG774359
Chrysene	mg/kg	0.0691	0.0590	65.9	27.4-150	15.8	25.7	L751941-01	WG774359
Dibenz(a,h)anthracene	mg/kg	0.0416	0.0428	50.1	13.8-150	2.74	25.8	L751941-01	WG774359
Fluoranthene	mg/kg	0.0965	0.0661	70.0	23.2-158	37.3*	26	L751941-01	WG774359
Fluorene	mg/kg	0.0498	0.0513	61.3	30.8-139	2.91	20	L751941-01	WG774359
Indeno(1,2,3-cd)pyrene	mg/kg	0.0498	0.0451	52.0	10.7-155	10.0	26.9	L751941-01	WG774359
Naphthalene	mg/kg	0.0891	0.0857	95.9	34.9-133	3.89	20.4	L751941-01	WG774359
Phenanthrene	mg/kg	0.0912	0.0693	78.1	20.2-150	27.3*	24.6	L751941-01	WG774359
Pyrene	mg/kg	0.104	0.0778	84.2	22.6-151	29.2*	25.1	L751941-01	WG774359
2-Fluorobiphenyl				87.10	38.2-135				WG774359
Nitrobenzene-d5				107.0	28.4-151				WG774359
p-Terphenyl-d14				84.50	34.2-141				WG774359

Batch number /Run number / Sample number cross reference

WG774359: R3023620: L752132-01
WG774417: R3023731: L752132-01

* * Calculations are performed prior to rounding of reported values.
* Performance of this Analyte is outside of established criteria.
For additional information, please see Attachment A 'List of Analytes with QC Qualifiers.'

L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

EnviroTech- NM
Lynn Cook
5796 US. Highway 64

Farmington, NM 87401

Quality Assurance Report
Level II

L752132

March 10, 2015

The data package includes a summary of the analytic results of the quality control samples required by the SW-846 or CWA methods. The quality control samples include a method blank, a laboratory control sample, and the matrix spike/matrix spike duplicate analysis. If a target parameter is outside the method limits, every sample that is effected is flagged with the appropriate qualifier in Appendix B of the analytic report.

Method Blank - an aliquot of reagent water carried through the entire analytic process. The method blank results indicate if any possible contamination exposure during the sample handling, digestion or extraction process, and analysis. Concentrations of target analytes above the reporting limit in the method blank are qualified with the "B" qualifier.

Laboratory Control Sample - is a sample of known concentration that is carried through the digestion/extraction and analysis process. The percent recovery, expressed as a percentage of the theoretical concentration, has statistical control limits indicating that the analytic process is "in control". If a target analyte is outside the control limits for the laboratory control sample or any other control sample, the parameter is flagged with a "J4" qualifier for all effected samples.

Matrix Spike and Matrix Spike Duplicate - is two aliquots of an environmental sample that is spiked with known concentrations of target analytes. The percent recovery of the target analytes also has statistical control limits. If any recoveries that are outside the method control limits, the sample that was selected for matrix spike/matrix spike duplicate analysis is flagged with either a "J5" or a "J6". The relative percent difference (%RPD) between the matrix spike and the matrix spike duplicate recoveries is all calculated. If the RPD is above the method limit, the effected samples are flagged with a "J3" qualifier.

EnviroTech- NM 5796 US. Highway 64 Farmington, NM 87401	Billing Information: Doris Moore 5796 US. Highway 64 Farmington, NM 87401
Report to: Tim + Lynn	Email To: Tim + Lynn
Project Description: Kirtland Plant Pipeline Leak	City/State Collected:
Phone: 505-632-0615 Fax:	Client Project # 14038-0011	Lab Project #
Collected by (print): Isaac Garcia	Site/Facility ID # P503024	P.O. # 141650
Collected by (signature): Immediately Packed on Ice N ___ Y X	Rush? (Lab MUST Be Notified) ___ Same Day .... 200% X Next Day .... 100% ___ Two Day .... 50% ___ Three Day 25%	Date Results Needed Email? ___ No X Yes FAX? ___ No ___ Yes

Analysis / Container / Preservative: PAH SIM by 8270/4oz Clr Jar/Cool

Chain of Custody Page ___ of ___

ESC LAB SCIENCES
YOUR LAB OF CHOICE
12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

L# L756132
I194

Acctnum: ENVIROFNM
Template:
Prelogin:
TSR: 288 - Daphne Richards
PB:
Shipped Via:

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	PAH SIM by 8270/4oz Clr Jar/Cool	Rem./Contaminant	Sample # (lab only)
West Bottom		SS		03-06-15	1038	1	X		01

* Matrix: SS - Soil GW - Groundwater WW - WasteWater DW - Drinking Water OT - Other ________

Remarks:

5704 6056 6920

pH ______ Temp ______
Flow ______ Other ______
Hold #

Relinquished by: (Signature)	Date: 03-06-15	Time: 1530	Received by: (Signature) FedEx	Samples returned via: ☐ UPS ☒ FedEx ☐ Courier ☐ ____	Condition: (lab use only)
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp: 2.4 °C Bottles Received: 1-4oz	COC Seal Intact: ___ Y ___ N ___ NA
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 3-7-15 Time: 1100	pH Checked: NCF:

L752132

Client: CCT	RUSH? ☑ 1d ☐ 3d	Lab Use Only — Lab WO#: P503024
Project: Kirtland Plant Pipeline leak		Job Number: 14038-0011
Sampler: E. Garcia		
Phone:		
Email(s): Eisaac G.		
Project Manager: Greg Crabtree	Page 1 of 1	

Sample ID	Sample Date	Sample Time	Matrix	Containers QTY - Vol/TYPE/Preservative	GRO/DRO by 8015	BTEX by 8021	TPH by 418.1	Chloride by 300.0						Lab Number	Correct Cont/Prsrv (s) Y/N
West Bottom	3/6/15	1038	S	2-4oz/G/cool					X					1	Y

01

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	Lab Use Only
[signature]	3/6/15	13:43	[signature]	3/6/15	13:43	**Received on Ice Y / N
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time	T1 16.6 T2 12.7 T3___
			[signature]	3-7-15	1100	AVG Temp °C_____

Sample Matrix: S - Soil, Sd - Solid, Sg - Sludge, A - Aqueous, O - Other ______

Container Type: g - glass, p - poly/plastic, ag - amber glass

**Samples requiring thermal preservation must be received on ice the day they are sampled or received packed in ice at an avg temp above 0 but less than 6 °C on subsequent days.

☐ Sample(s) dropped off after hours to a secure drop off area.

Chain of Custody

Notes/Billing info: 24

14

envirotech Analytical Laboratory
5796 US Highway 64, Farmington
Three Springs - 65 Mercado Street,

APPENDIX B

References

Colorado Department of Public Health and Environment

Arsenic Concentrations in Soil

Risk management guidance for evaluating reviewed/revised July 2014

Regulatory Limitation

This guidance does not modify, replace, or pre-empt any existing statutory or regulatory requirements, enforcement actions, agreements, policies or other legal mechanisms that may govern actions within the Hazardous Materials and Waste Management Division's (the "division's") various remedial programs. In the event of a conflict between this guidance and existing risk assessment guidance and other programmatic requirements, this guidance defers to the various legal and operating mechanisms of those remedial programs.

This guidance was developed with the division's remedial programs in mind. Other state and federal agencies are not obligated to use the process outlined herein, although the same analysis could apply to other sites undergoing investigation and cleanup where testing for arsenic is required and it may be present in sampled environmental media. Parties wanting to use this guidance at their site must seek approval to do so from the regulatory agency responsible for overseeing their remedial activities.

Purpose

The division has prepared this guidance for the purpose of making preliminary determinations when screening data collected from sites that don't necessarily have a reason to believe arsenic contamination may be present, such as a routine Phase II investigation conducted prior to a property transaction. This guidance is simply meant to inform the regulated community of their responsibilities in managing arsenic risks: it is not regulation, nor does it constitute an enforceable standard that must be complied with.

Background

Arsenic is naturally occurring in some geologic environments in Colorado due to weathering and erosion of bedrock and soil, including highly mineralized areas that are mined for metal ores. It is present in more than 200 different minerals, the most common of which is called arsenopyrite. It may also be present in the environment due to a number of anthropogenic activities including: military operations and firing ranges; mining, especially sulfide ores; smelting copper, gold and lead ores; preservation of wood (CCA); chicken feed operations and associated manures (CAFO) due to arsenic-containing growth promoters; tanning and taxidermy operations; coal-burning emissions and ash-derived residues from power plants; and may be present in landfills and landfill-derived leachate. Arsenic may also be found due to the manufacture, use and disposal of: ammunition; fireworks; pigments (paint, paper, ceramics, etc.); older herbicides, insecticides, and pesticides (examples: monosodium methanearsonate (MSMA), disodium methanearsonate (DSMA) and lead-arsonate); electronics containing Gallium-Arsenide-Selenium (GAS) semi-conductors; lead acid battery plates; glass; and some pharmaceuticals. Other anthropogenic arsenic sources may likely exist. Arsenic contamination in soil is of public health concern due to its toxic effects as a carcinogen and a non-carcinogen. Making risk management decisions about arsenic can be difficult because natural occurring concentrations in soil often exceed carcinogenic risk based exposure values.

This guidance was prepared by the division using a data set of background arsenic concentrations developed by the U.S. EPA Region 8. The data set includes over 2,700 samples from 44 counties in Colorado. The areas sampled included: native grasslands; agricultural areas; urban mixed land use; and mining. A summary of the data set is presented in the table below. The complete data set may be found on the U.S. EPA Region 8's website at http://www2.epa.gov/region8/hh-exposure-assessment.

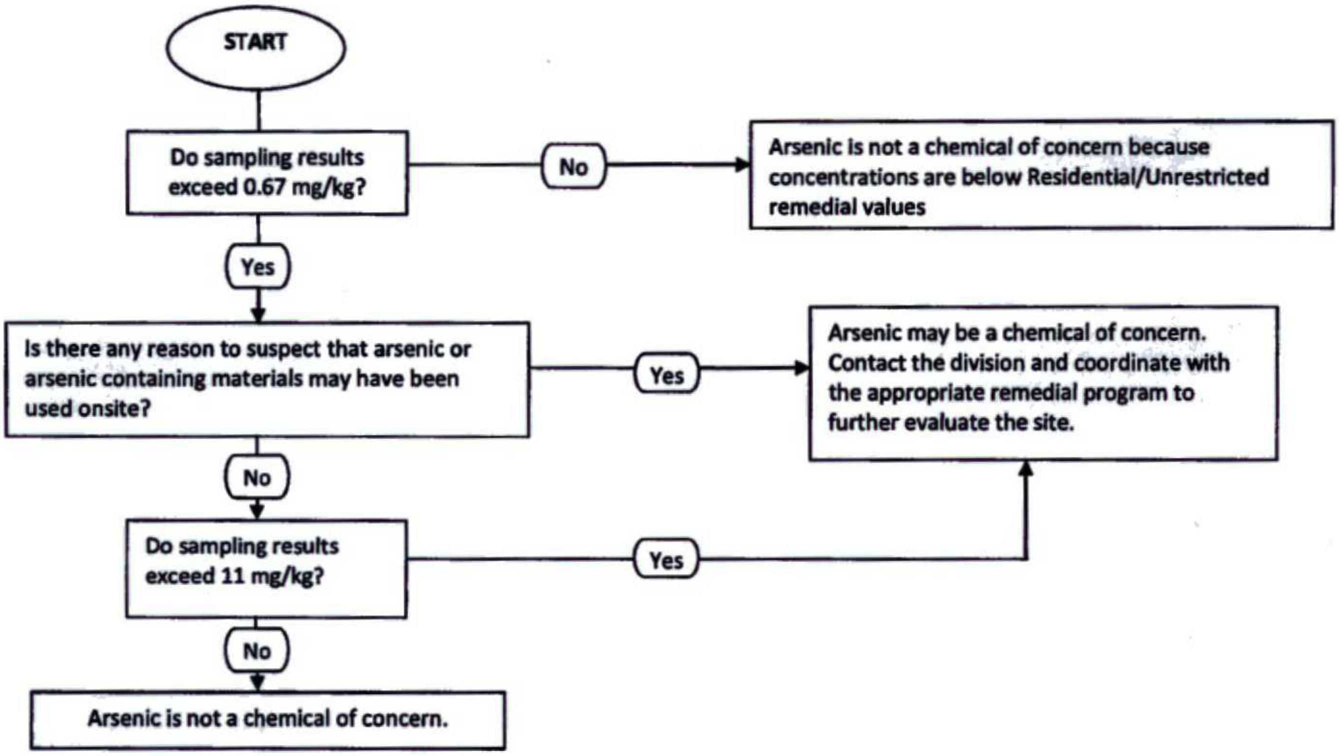
Region 8 U.S. EPA 95% UCLM Background Soil Arsenic Concentrations in Colorado

Land Use	Concentration (mg/kg)
Native Grassland, Rangeland, or Agriculture	3-14
Urban Mixed Use	6-19
Mining	10
Average of all land uses	11

Division Guidance Regarding Background Arsenic Concentration

The division's approach to evaluating arsenic in soil is depicted in the following flowchart. This guidance assumes that, based upon the size, history and environmental concerns associated with a particular site, an adequate amount of arsenic data has been obtained to make a determination regarding arsenic concentrations in soil. It isn't meant to be a guide on how to conduct a background study for risk assessment and/or site closure purposes. Guidance on the subject of data collection and analysis needs for conducting a background study should be sought from other published sources. Soil samples should be collected and analyzed for arsenic if the site history suggests it may be present as a result of anthropogenic activities. However, since arsenic is one of the chemicals included as part of a standard "metals" analysis package from a laboratory, you may already have obtained arsenic data for your site.

The current residential/unrestricted land use remedial objective for inorganic arsenic is 0.67 mg/kg (U.S. EPA regional screening level). If arsenic concentrations at your site are lower than 0.67 mg/kg, the division will require no further action to address arsenic in soil. If arsenic concentrations are lower than 11 mg/kg (the average of the 95% UCLM of background concentrations found by the U.S. EPA in Colorado), and releases of arsenic could not have occurred at the site, based on historical data or process knowledge, the division will require no further action to address arsenic in soil. If arsenic concentrations are greater than 0.67 mg/kg, and the available information suggests that a release of arsenic could have occurred at the site, the division will require additional evaluation of the data and possibly additional sampling to determine whether corrective measures for arsenic are required. This evaluation may include a site specific background study with sampling from offsite locations, and/or additional sampling in areas of the site where activities that could have contributed to environmental contamination never occurred. Please consult with the division prior to performing any background study. If it can be demonstrated that arsenic concentrations in soil are unrelated to site activities, the division will require no further action regarding arsenic. It should be noted that material such as arsenic-bearing mine tailings or oil and gas drill cuttings, although derived from a naturally occurring source material, are not considered to be naturally occurring background once they have been generated through human activity. Therefore, mine tailings and drill cuttings may be subject to remediation if ecological or health-based concentrations are exceeded.



For more information please contact:
Colorado Department of Public Health and Environment
Hazardous Materials and Waste Management Division
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Customer Technical Assistance Line:
(303) 692-3320
(888) 569-1831 ext. 3320 toll-free
E-mail: comments.hmwmd@state.co.us
Website: **www.colorado.gov/cdphe/hm**

Frequency Distribution of the pH of Coal-Mine Drainage in Pennsylvania

By Charles A. Cravotta III, Keith B.C. Brady, Arthur W. Rose, and Joseph B. Douds

ABSTRACT

The pH of coal-mine drainage in Pennsylvania has a bimodal frequency distribution, with modes at pH 2.5 to 4 (acidic) and pH 6 to 7 (near neutral). Although iron-disulfide and calcareous minerals comprise only a few percent, or less, of the coal-bearing rock, these minerals are highly reactive and are mainly responsible for the bimodal pH distribution. Field and laboratory studies and computer simulations indicate that pH will be driven toward one mode or the other depending on the relative abundance and extent of weathering of pyrite (FeS_2; acid-forming) and calcite ($CaCO_3$; acid-neutralizing). The pH values in the near-neutral mode result from carbonate buffering (HCO_3^- /H_2CO_3 and HCO_3^- /$CaCO_3$) and imply the presence of calcareous minerals; acid produced by pyrite oxidation is neutralized. The pH values in the acidic mode result from pyrite oxidation and imply a deficiency of calcareous minerals and the absence of carbonate buffering. The oxidation of only a small quantity of pyrite can acidify pure water (0.012 $g{\cdot}L^{-1}$ FeS_2 produces pH~4 and 20 $mg{\cdot}L^{-1}$ SO_4^{2-}); however, because of the log scale for pH and ion complexation (SO_4^{2-} /HSO_4^- and Fe^{3+}/$FeOH^{2+}$), orders of magnitude greater oxidation is required to produce pH < 3. Laboratory leaching experiments showed that for a specific proportion of FeS_2:$CaCO_3$, effluents produced under variably saturated hydrologic conditions, in which oxygen availability and pyrite oxidation were enhanced, had lower pH and greater dissolved solids concentrations than effluents produced under continuously saturated conditions, in which oxygen availability and pyrite oxidation were diminished.

INTRODUCTION

In the northern Appalachian Plateau of the eastern United States, drainage from abandoned coal mines affects more than 8,000 km of streams and associated ground water (Boyer and Sarnoski, 1995). Most affected streams are in Pennsylvania, where contaminated mine runoff and mine discharges impair water quality in 45 of 67 counties (Pennsylvania Department of Environmental Protection, 1998). An understanding of factors affecting the chemistry of coal-mine drainage is needed for the effective planning and implementation of future mining and remediation of abandoned mine lands. This paper evaluates geochemical and hydrological factors affecting the pH of coal-mine drainage. Data for ground-water and discharge samples and laboratory leaching experiments are presented to explain regional water-quality trends for the northern Appalachian coalfields. Geochemical simulations demonstrate the range of effects on pH from different variables, including the amount of pyrite oxidized, buffering by carbonate minerals, and the formation of secondary minerals.

Geochemistry of Coal Mine Drainage

Ground water and associated mine discharges in the coalfields of Pennsylvania range widely in quality from near-neutral, or "alkaline" (alkalinity > acidity; pH ≥ 6), to strongly acidic (Rose and Cravotta, 1998). The pH of coal-mine drainage in Pennsylvania has a bimodal frequency distribution (Brady and others, 1997, 1998); most samples are either near neutral (pH 6 to 7) or distinctly acidic (pH 2.5 to 4), with few samples having pH 4.5 to 5.5 (fig.1). The bimodal pH distribution is apparent for other regional compilations of water-quality data for coalfields in West Virginia (diPretoro, 1986), Ohio (Helsel and Hirsch, 1992, p. 61), and Germany (Klapper and Schultze, 1995). Whether near neutral or acidic, the drainage from most coal mines has elevated concentrations of dissolved solids, ranging from about 200 $mg{\cdot}L^{-1}$ to greater than 10,000 $mg{\cdot}L^{-1}$. In contrast, ground water and spring water from unmined areas typically are near neutral and are dilute compared to water from mined areas (Brady and others, 1996; Rose and Cravotta, 1998).

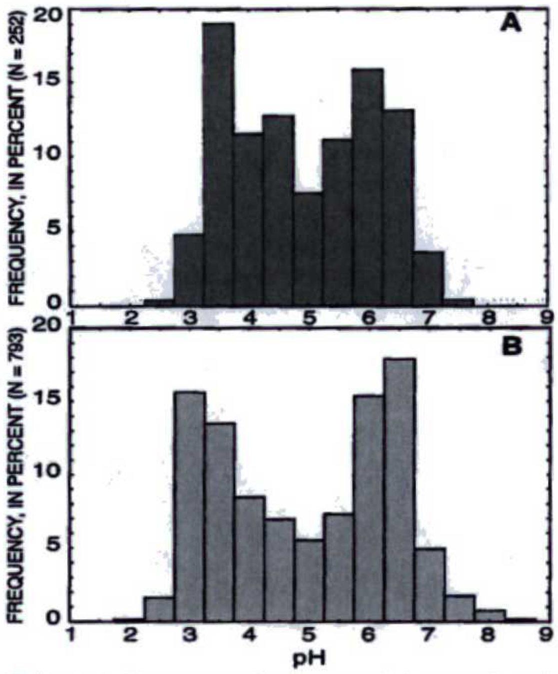


Figure 1. Frequency distribution of the pH of coal-mine discharges in Pennsylvania. *A,* Data for 252 coal-mine discharges in the anthracite coalfield (source: Growitz and others, 1985); *B,* Data for 793 surface coal-mine discharges in the bituminous coalfield (source: Hellier, 1994). Class intervals for pH $\pm$ 0.25.

Acidic mine drainage (AMD) is characterized by elevated concentrations of dissolved and particulate iron (Fe) and dissolved sulfate (SO_4^{2-}) produced by the oxidation of pyrite (FeS_2):

$$FeS_2 + 3.5\,O_2 + H_2O \rightarrow Fe^{2+} + 2\,SO_4^{2-} + 2\,H^+ \quad (1)$$

$$Fe^{2+} + 0.25\,O_2 + 2.5\,H_2O \rightarrow Fe(OH)_3(s) + 2\,H^+ \quad (2)$$

Half the acid (H^+) is produced by the oxidation of pyritic S (reaction 1), and half results from the oxidation and hydrolysis of pyritic Fe (reaction 2). Generally, mines that produce AMD feature interconnected underground "workings" (voids and rock rubble) or aboveground "spoil" (rubble and rejected coal) where pyrite has been exposed to oxygenated air and water and where the calcareous minerals, calcite ($CaCO_3$) and dolomite ($CaMg(CO_3)_2$), are absent or deficient relative to pyrite (Hornberger and others, 1990; Brady and others, 1994; Cravotta, 1994; Rose and Cravotta, 1998; Nordstrom and Alpers, 1999). Concentrations of manganese (Mn^{2+}), aluminum (Al^{3+}), and other solutes in AMD commonly are elevated due to aggressive dissolution of carbonate, oxide, and aluminosilicate minerals by acidic water.

Near-neutral mine drainage can form from rock that lacks pyrite or can originate as AMD that has been neutralized by reaction with calcareous minerals (Cravotta and others, 1994; Blowes and Ptacek, 1994). In near-neutral mine waters, bicarbonate (HCO_3^-) is a significant anion along with SO_4^{2-}; concentrations of dissolved calcium (Ca^{2+}) and magnesium (Mg^{2+}) generally are elevated relative to dissolved Fe^{3+} and Al^{3+}, which precipitate as pH increases to above 4 to 5. For example, dissolution of calcite neutralizes acid and can increase the pH and alkalinity ($[OH^-] + [HCO_3^-] + 2\,[CO_3^{2-}]$) of mine water:

$$CaCO_3(s) + 2H^+ \leftrightarrow Ca^{2+} + H_2CO_3^* \quad (3)$$

$$CaCO_3(s) + H_2CO_3^* \leftrightarrow Ca^{2+} + 2\,HCO_3^- \quad (4)$$

where $[H_2CO_3^*] = [CO_2\,(aq)] + [H_2CO_3^0]$ (Stumm and Morgan, 1996). However, because the rate of pyrite oxidation can exceed the rate of calcite dissolution, particularly where oxygen is abundant, the pH and alkalinity of mine water will not necessarily increase in the presence of calcite.

Ion complexation, principally the protolysis of anions and the hydrolysis of cations (Stumm and Morgan, 1996), also can be a significant process that stabilizes, or "buffers," the pH of mine water. For example, pH can be buffered in the near-neutral range by the protolysis reaction involving bicarbonate and carbonic acid (pK=6.35; thermodynamic data from Ball and Nordstrom, 1991):

$$HCO_3^- + H^+ \leftrightarrow H_2CO_3^* \quad (5)$$

Similarly, pH can be buffered in the acidic range by the protolysis reaction involving sulfate and bisulfate (pK=2.0)

$$SO_4^{2-} + H^+ \leftrightarrow HSO_4^-, \quad (6)$$

and by hydrolysis reactions involving ferric ions, such as the initial hydrolysis step (pK=2.2),

$$Fe^{3+} + H_2O \leftrightarrow FeOH^{2+} + H^+. \quad (7)$$

The importance of the above reactions will depend on the dissolved solute content of the water, the nature and abundance of acid-producing and neutralizing materials along flow paths, the sequence and intimacy of contact between the water and these materials, as well as the ability of the rock to transmit water and air.

Geologic and Hydrologic Framework

Bituminous coal deposits underlie western and north-central Pennsylvania, and anthracite deposits underlie east-central and northeastern Pennsylvania (fig. 2). The mineable coals, mostly of Pennsylvanian Age, are interbedded with shale, siltstone, sandstone, and occasional limestone (Brady and others, 1998). The bituminous coalfield lies within the Appalachian Plateaus Physiographic Province and is characterized by gently dipping strata; nearly horizontal coalbeds commonly crop out in the incised stream valleys. The anthracite coalfield lies within the adjacent Ridge and Valley Physiographic Province, which is characterized by complexly deformed strata. Mineable anthracite beds are present primarily in steeply folded and fractured synclinal troughs.

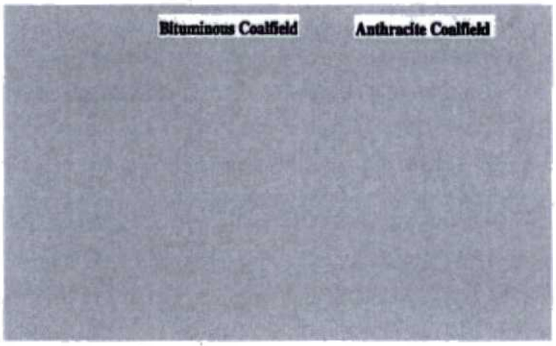


Figure 2. Locations of bituminous and anthracite coalfields in Pennsylvania (modified from Pennsylvania Geological Survey, 1964).

Coal-bearing rocks in the northern Appalachians have variable potential to produce AMD; the pyritic and calcareous contents of the rocks vary. Because weathering over many centuries has depleted reactive minerals from near-surface strata, the acid-forming and acid-neutralizing minerals generally are most abundant in rock deeper than about 10 m (Cravotta and others, 1994; Brady and others, 1996, 1998). Upon mining, however, pyrite in the deep-lying, unweathered strata is exposed to oxygenated air and water within underground workings or surface mine spoil. The spoil commonly consists of a heterogeneous mixture of rocks that are inverted stratigraphically relative to their original positions (Cravotta and others, 1994). Thus, although the relative abundance and vertical distribution of pyritic and calcareous materials at a proposed mine commonly are evaluated before mining to indicate the potential for AMD formation and to develop a materials handling plan (Brady and others, 1994), the quality and movement of water within the resultant mine spoil and backfill are difficult to predict.

Surface mines and underground mines in the bituminous coalfield generally can be categorized as "updip" or "downdip" depending on the direction that mining proceeded relative to the dip of the coal bed. In the past, most bituminous mines were mined updip so that water would drain freely and pumping costs would be minimized. Updip mines also provided greater access of oxygen to the subsurface, however, which facilitates the oxidation of pyrite and the formation of AMD (Hornberger, 1985). In contrast, downdip mines tend to fill with ground water, which requires pumping during active mining but also reduces the access of oxygen to pyritic rock. Upon mine closure, substantial parts of downdip mines can be permanently inundated thereby minimizing oxygen transport and pyrite oxidation. Hence, the downdip mines generally produce less acidic water than updip mines; however, unless calcareous strata are present, they may not produce near-neutral water.

Most anthracite mines were developed as large underground mine complexes, where shafts and tunnels connected mine workings within multiple coalbeds. Because anthracite mines commonly were developed hundreds of meters below the regional water table and because of the large size of most underground mine complexes, their discharge volumes (overflows or tunnels) tend to be substantially greater than those from surface mines. Upon closure, large volumes of the mine complexes flooded, as expected for downdip mines, producing underground "mine pools." Discharges emanated where the mine pools overflowed from topographically low points overlying the mine complex.

During active mining, the potential for catastrophic flooding of anthracite mine complexes was a major concern. Partly due to the high cost of pumping as the mines were developed to greater and greater depths, most mines had closed by 1960. At some mines, the flooding problem was solved by the construction of extensive drainage tunnels. By promoting the circulation of water and air within the mine workings, the drainage tunnels promoted the formation of AMD where pyritic strata were present. For example, the Jeddo Tunnel, the largest drainage tunnel system in the anthracite coalfield, drains a 70-km^2 area in the Eastern Middle Anthracite Field (LeRigina, 1988). Acidic water from the Jeddo Tunnel (pH < 4; SO_4 > 400 $mg{\cdot}L^{-1}$) discharges at a rate of 175,000 to 270,000 $m^3{\cdot}d^{-1}$ (Wood, 1996).

In addition to the mineralogical and hydrological factors described above, the age of the mine, the time elapsed since initial flooding, the origin and composition of the inflow water, the potential for stratification within the mine pool, and the location of the mine outflow can affect the mine-discharge composition. For example, water can be stratified in a mine pool, with generally older, poorer quality water at depth; overflows from the top of the pool generally will be better quality than outflows from boreholes, shafts, or tunnels tapping deeper zones (Ladwig and others, 1984). Regional data pertaining to all these factors are not generally available in digital format and, hence, their evaluation is beyond the scope of this paper.

STUDY METHODS

Available data for pH and concentrations of alkalinity, acidity, sulfate, and metals in groundwater and discharge samples from coal mines in Pennsylvania were compiled from several sources. Water-quality data for 793 bituminous surface mine discharges were obtained from the Mine Drainage Inventory data base (Hellier, 1994) maintained by the Pennsylvania Department of Environmental Protection (PaDEP). If multiple samples were reported for a discharge site, arithmetic means of concentration and discharge rate were used for that site. Data for 252 anthracite mine discharges reported by Growitz and others (1985) were obtained from the USGS National Water Information System (NWIS); the anthracite data are predominantly for underground mines. Additional water-chemistry data for selected large anthracite discharges reported by Wood (1996) and for recent USGS investigations at four surface mines in the bituminous field (Dugas and others, 1993; Cravotta and others, 1994; Cravotta, 1998) also were obtained from NWIS. Finally, data for laboratory leaching experiments were added to the compilation.

For the leaching experiments, reported in detail by Cravotta (1996), coaly shale that consisted mostly of quartz, kaolinite, and pyrite was obtained at a coal mine and taken to the laboratory to be crushed, and placed in vertical columns open to the atmosphere. The columns were leached biweekly with water simulating two different hydrologic conditions: variably saturated, aerobic (flooded for 2 days with 1.4 pore volumes, followed by 12-day drying period) or continuously saturated, stagnant (flooded continuously with 1.4 pore volumes). Powdered calcite was added on top of the shale to achieve molar ratios for $CaCO_3$:FeS_2 of 0:1, 1:1, and 2:1.

The pH data for the bituminous mines (fig. 1A) were determined in the laboratory on chilled samples. These laboratory pH values could be greater than field pH because of the exsolution of CO_2 or less than the field pH because of the oxidation and precipitation of Fe (reactions 2 and 3). Nevertheless, pH data for the anthracite mines (fig. 1B) and for the other field and laboratory data sets were determined at the time and location of sample collection. The similarity between field and laboratory pH values for the USGS mine-scale and laboratory leaching data compilations and the similarity between the pH frequency distributions for the bituminous and anthracite discharges (fig. 1) imply that the laboratory pH values are representative of field conditions. The USGS mine-scale and laboratory leaching data compilations also included values for redox potential (Eh). The Eh was determined on fresh samples using Pt and Ag/AgCl reference electrodes according to methods of Wood (1976) and Nordstrom (1977). The water-quality data were evaluated by use of computerized graphical, statistical, and geochemical routines.

The PHREEQC computer program (Parkhurst, 1995) was used to conduct "titration" simulations, where small increments of pyrite were added to a 1 L solution and oxidized. By adjusting different variables, these simulations evaluated the effects on pH, Eh, and sulfate concentrations as a function of the amount of pyrite reacted; oxygen availability; equilibrium with carbonate minerals; partial pressure of CO_2 (P_{CO_2}); and precipitation of different hydrous iron oxide or sulfate minerals. A typical simulation involved 100 or more incremental steps with small additions of pyrite. After each of these steps, the pH, Eh, and dissolved species were calculated. The pH was plotted as a function of the total SO_4 concentration to indicate the resulting water quality for a given amount of pyrite oxidized.

RESULTS

Regional Studies

Although the bimodal frequency distribution of pH is similar for discharges from bituminous and anthracite mines (fig. 1), the relations between pH and SO_4 concentration or load differ between the two coalfields (fig. 3). The median SO_4 concentrations for bituminous discharges exceed those for anthracite discharges at each pH class interval and over the range of pH (fig. 3). Conversely, because discharge rates for most anthracite mines are significantly greater than those for the bituminous mines, the medians for SO_4 transport, or "loads," for anthracite discharges exceed those for bituminous discharges at each pH class interval (fig. 3). The anthracite mine discharges are characterized by median SO_4 concentrations of 100 to 300 $mg{\cdot}L^{-1}$ and loads of 20 to 400 $kg{\cdot}day^{-1}$ that are independent of pH. In contrast, the median concentrations and loads for bituminous discharges increase with decreasing pH, from about 500 $mg{\cdot}L^{-1}$ and 10 $kg{\cdot}day^{-1}$, respectively, for pH > 5.5 to greater than 1,200 $mg{\cdot}L^{-1}$ and 40 $kg{\cdot}day^{-1}$, respectively, for pH ≤3.5 (fig. 3). The inversely correlated pH and SO_4 data (loads and concentrations) for bituminous mines imply that the extent of pyrite oxidation increases with decreasing pH, which is consistent with laboratory rate data (McKibben and Barnes, 1986; Moses and Herman, 1991; Cravotta, 1996). However, the lack of similar correlations between the pH and SO_4 data for anthracite mine discharges suggest other processes are important.

The anthracite mines generally were flooded for decades before most bituminous surface mines had been developed. Although discharges from the anthracite mines are primarily overflows from stagnant mine pools, historical data indicate that when the anthracite mines first flooded, the water chemistry was similar to that of present bituminous mine discharges, with lower pH and higher concentrations of SO_4 and Fe (Ladwig and others, 1984; Wood, 1996). Comparing data collected in 1975 and 1991 for selected anthracite discharges, pH increased from the acidic mode to the near-neutral mode while SO_4 concentrations decreased for most mines in the Southern and Western Middle Anthracite Fields (Wood, 1996). In contrast, pH data for

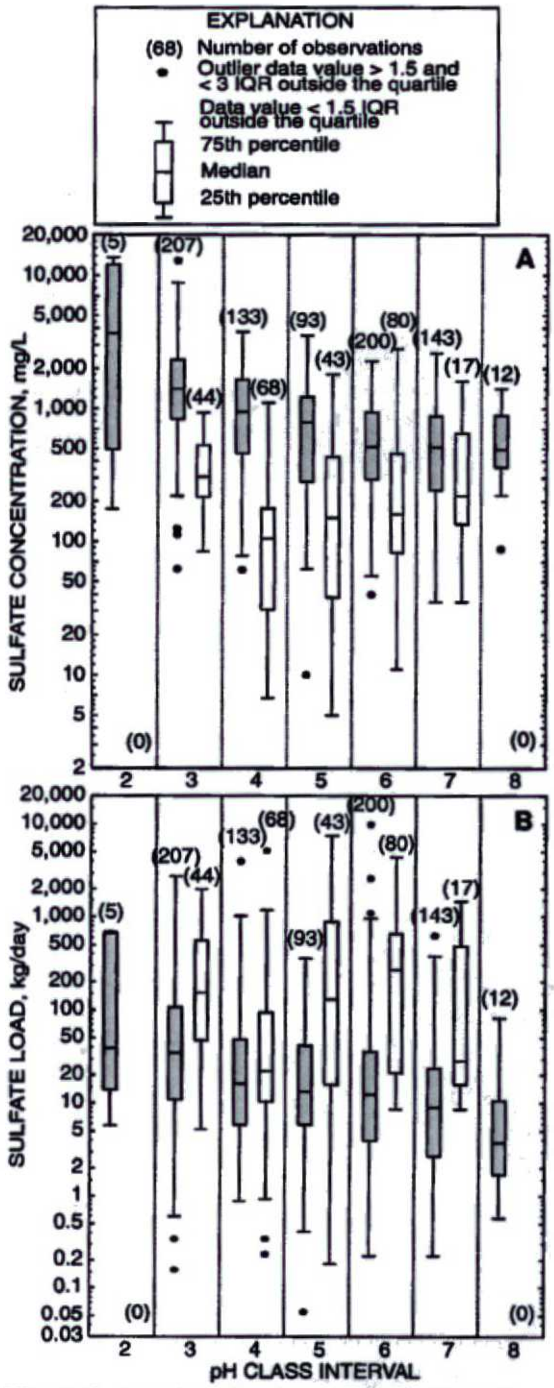


Figure 3. Boxplots showing sulfate data by pH class interval for 793 bituminous (shaded) and 252 anthracite coal-mine discharges in Pa. *A*, Sulfate concentration. *B*, Sulfate load. Class intervals for pH ± 0.5; interquartile range, IQR = 75th - 25th percentile.

the Eastern Middle Anthracite Field, which is largely drained by the Jeddo Tunnel, showed no change from the acidic pH mode. Hence, as pyrite and/or carbonate minerals are depleted and/or rates of reactions decrease, the pH and SO_4 frequency distributions and correlations are likely to change, but the time period for this change could span decades.

Mine-Scale and Laboratory Studies

Data for ground water and associated discharge samples from four surface mines in the bituminous coalfield, when combined so that each mine is represented equally (total frequency of 25 percent for each mine), also show a bimodal distribution of pH (fig. 4A). The pH of the ground water at each mine commonly ranges over several units, mainly caused by spatial variability or heterogeneity. Although acidic and near-neutral waters were sampled at three of the four mines, individual wells or discharges generally reflected locally acidic or near-neutral conditions. A few wells in mixed pyritic and calcareous spoil had water quality that varied temporally between acidic and alkaline (Cravotta and others, 1994; Rose and Cravotta, 1998). The effects of spoil composition and hydrology are indicated by the relations between pH and concentrations of SO_4^{2-} and Ca^{2+} (figs. 4B and 4C). Alkaline to weakly acidic water (pH $\geq$ 5) that has relatively low SO_4^{2-} is characteristic of unmined bedrock and spoil that contain calcareous minerals and have low permeability (e.g. mine 1 in fig. 4). Strongly acidic water (pH $\leq$ 4) that has high SO_4^{2-} is characteristic of high-permeability, well-drained, pyritic spoil (e.g. mines 2 and 3 in fig. 4). Moderately acidic water (pH 4 to 5) that has high SO_4^{2-} is characteristic of spoil or underlying bedrock that lacks dissolved oxygen (e.g. mines 2 and 4 in fig. 4). Although concentrations of Ca^{2+} and SO_4^{2-} are positively correlated, the linear relation between Ca^{2+} and SO_4^{2-} is evidently site specific with slopes differing among the mines. In general, calcareous strata produced water with the highest concentrations of Ca^{2+}, and noncalcareous, pyritic strata produced water with the highest concentrations of SO_4^{2-}. Lowest concentrations of Ca^{2+} and SO_4^{2-} were in water from unmined rock upgradient from the mines.

Laboratory leaching experiments demonstrate the bimodal pH distribution for water at coal mines generally results from the weathering of pyritic rocks that have a deficiency (low pH) or an abundance (near-neutral pH) of calcareous minerals necessary to buffer the pH (fig. 5A). Pyritic shale was subjected to leaching under continuously or variably saturated hydrologic conditions; calcite was added in different proportions to evaluate effects on the oxidation of pyrite and the transport of sulfate and metals (Cravotta, 1996). Without the addition of calcite, the leachate from the shale typically had pH 1.5 to 3.5 and high concentrations of sulfate and iron. However, with the addition of calcite, the leachate had pH 4.5 to 7 and lower concentrations of sulfate and iron. The dissolution of calcite not only neutralized acid but decreased pyrite oxidation rates, as indicated by higher pH and Ca^{2+} concentrations and lower SO_4^{2-} concentrations for leachate from shale with added calcite (figs. 5B and 5C). All the leachate samples were undersaturated with respect to gypsum; only leachate in continuously saturated columns with added calcite was saturated or supersaturated with respect to calcite.

The leaching tests also showed the hydrology of a mine has an important effect on pyrite oxidation. By maintaining stagnant, water-saturated conditions, which minimized the oxygen available for reactions, pyrite oxidation was minimized, as indicated by low SO_4^{2-} concentrations in leachate (figs. 5A and 5B). The leaching data can be summarized generally as follows:

- pH < 3 and SO_4 > 1,500 $mg{\cdot}L^{-1}$ for variably saturated conditions without $CaCO_3$;
- pH 3.2-3.5 and SO_4 < 1,000 $mg{\cdot}L^{-1}$ for continuously saturated conditions without $CaCO_3$;
- pH 4.5–6.5 and SO_4 < 1,000 $mg{\cdot}L^{-1}$ for variably saturated conditions with $CaCO_3$ present; and
- pH $\geq$ 6.0 and SO_4 < 1,000 $mg{\cdot}L^{-1}$ for water-saturated conditions with $CaCO_3$ present.

For each $CaCO_3$:FeS_2 molar ratio, ranging from 0:1 to 2:1, lower pH and higher SO_4^{2-} and Ca^{2+} concentrations were produced under variably saturated, oxygenated conditions than under continuously water-saturated, stagnant conditions (figs. 5B and 5C) because of greater extent and rate of pyrite oxidation and the consequent dissolution of calcite and other minerals under oxygenated, acidic conditions.

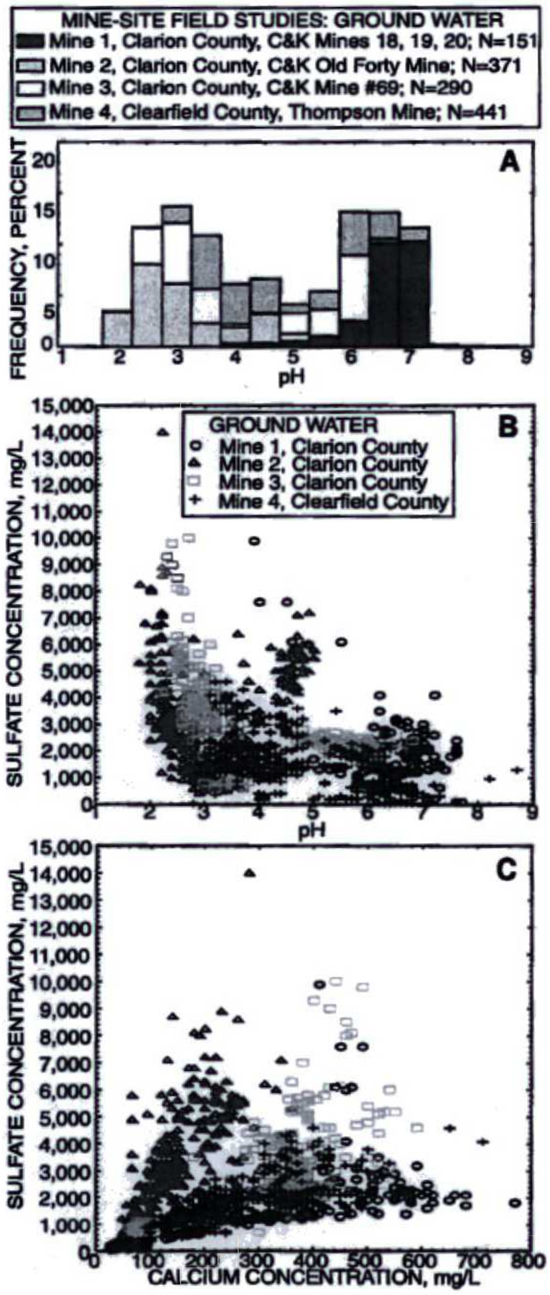


Figure 4. Chemistry data for 1,253 ground-water and discharge samples, collected monthly for 2 to 6 years, from four surface mines in the bituminous coalfield, Pa. (source: Dugas and others, 1993; Cravotta and others, 1994; Cravotta, 1996). *A,* Frequency distribution of pH; data for each mine weighted to represent 25% of the total. *B,* Relation between sulfate concentration and pH. *C,* Relation between sulfate and calcium concentrations.

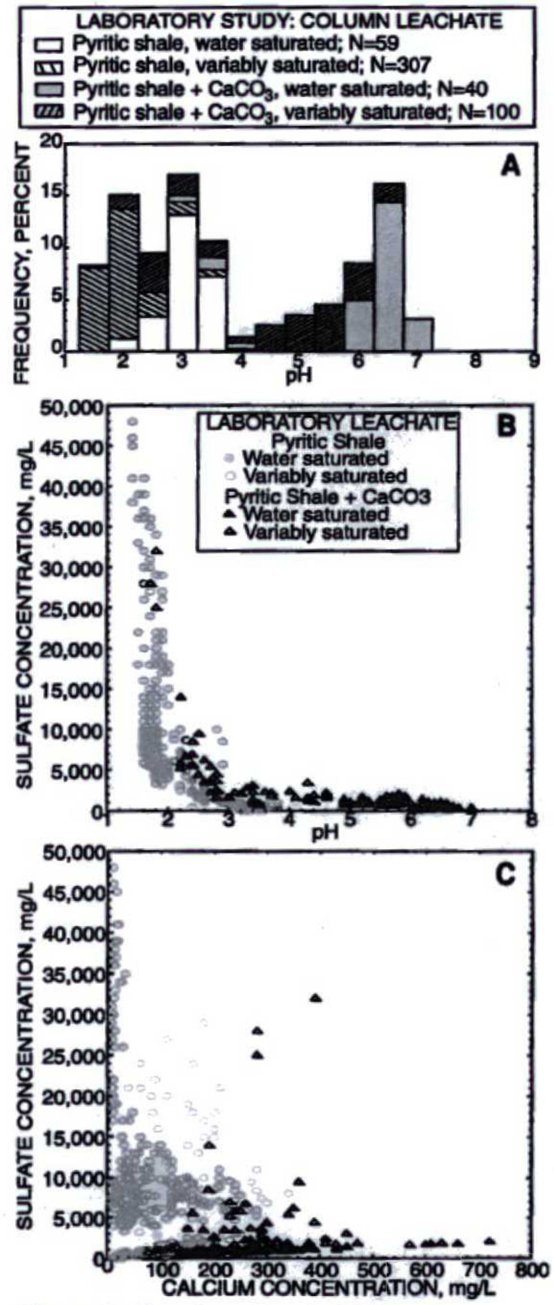


Figure 5. Chemistry data for 606 leachate samples from pyritic shale. Data for each of four leaching scenarios, collected biweekly over 3 to 9 months (source: Cravotta, 1996). *A,* Frequency distribution of pH; data for each treatment weighted to represent 25% of the total. *B,* Relation between sulfate concentration and pH. *C,* Relation between sulfate concentration and calcium concentration.

Geochemical Simulations

Geochemical simulations evaluated the effects on pH, Eh, and sulfate concentrations from pyrite oxidation over a range of conditions characteristic of the field conditions at coal mines. Although a wide range of conditions was considered, this paper evaluates only the most important variables affecting pH. A typical simulation involved 100 or more incremental steps with small additions of pyrite to 1 L solution. After each of these steps, the pH, Eh, and dissolved species were calculated. The pH was plotted as a function of the total concentration of sulfate species in solution (SO_4^{2-}, HSO_4^-, $FeHSO_4^{2+}$, etc.) which indicates the amount of pyrite oxidized (192 g SO_4 per 120 g FeS_2) if sulfate minerals do not precipitate.

Firstly, the oxidation of pyrite, in the absence of calcite, is considered for different P_{CO_2} and P_{O_2} (fig. 6A). Except for depressing the pH of initially pure water, varying P_{CO_2} from $10^{-3.5}$ to 10^{-1} atm has little effect on the pH after pyrite oxidation has begun. In contrast, limiting the availability of oxygen has a significant effect on the pH as simulated for an "open system" (air equilibrium, P_{O_2}=0.2 atm, for complete oxidation of S and Fe in FeS_2 by reactions 1 and 2) or a "closed system" (3.5 mol O_2 per mol FeS_2 for oxidation of only S by reaction 1). Starting with pure water in equilibrium with ambient P_{CO_2}, pH declines from 5.5 to 4 with the oxidation of only a small quantity of pyrite (0.012 $g \cdot L^{-1}$ FeS_2 produces pH~4 and 20 $mg \cdot L^{-1}$ SO_4^{2-}); continued pyrite oxidation decreases pH to about 3 at the point where total SO_4 concentration is 100 $mg \cdot L^{-1}$. As SO_4 concentration increases from 100 to 1,200 $mg \cdot L^{-1}$ the pH declines asymptotically approaching 2. For an open system, where oxygen is unlimited, the oxidation of pyritic S and Fe^{2+} and the precipitation of amorphous $Fe(OH)_3$ (reactions 1 and 2) results in pH about 0.3 units *greater than* that for the closed system where oxygen is limited to only the stoichiometric amount needed to produce SO_4^{2-} (reaction 1). The pH decreases about 0.5 units if a phase such as goethite (FeOOH) precipitates instead of higher solubility amorphous $Fe(OH)_3$, resulting in pH under air equilibrium that is *less than* that under oxygen limited conditions (fig. 6A). The narrow range of pH results mainly from the logarithmic scale for pH, plus buffering by ionic complexation $Fe(OH)^{2+}/Fe^{3+}$ and SO_4^{2-}/HSO_4^- (reactions 6 and 7) and dissolution of previously formed iron minerals. The simulations illustrate that for a specific SO_4 concentration, a lower pH cannot be achieved simply from pyrite oxidation; however, most mine water samples have greater pH at a given SO_4 concentration because of neutralization reactions with other minerals that increase pH and add other solutes.

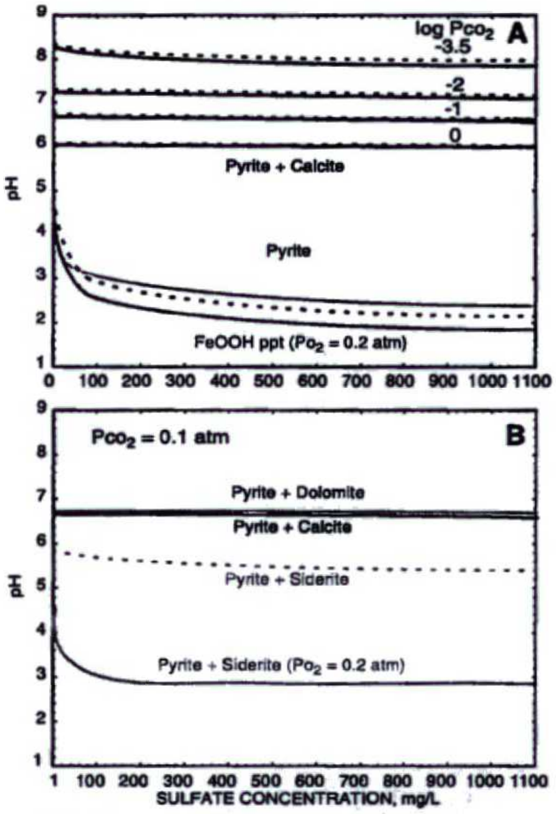


FIGURE 6. Simulated pH and sulfate concentration resulting from pyrite oxidation under different conditions (dashed line O_2 limited; solid line P_{O_2}= 0.2 atm). Simulations conducted using PHREEQC (Parkhurst, 1995); temperature = 10°C, P_{CO_2} = 0.1 atm, and amorphous $Fe(OH)_3$ allowed to precipitate, unless specified. *A*, Effects of P_{O_2} and P_{CO_2} and equilibrium with calcite. *B*, Equilibrium with various carbonate minerals.

Secondly, the oxidation of pyrite in equilibrium with various carbonate minerals including calcite, dolomite, or siderite ($FeCO_3$) is considered (figs. 6A and 6B). For example, if calcite equilibrium is maintained, the pH remains relatively constant at a particular P_{CO_2} despite the oxidation of pyrite (fig. 6A); however, the pH can range widely as a function of P_{CO_2} from a relatively constant pH value of 6 ($Pco_2 = 1$ atm) to pH values of 8.0 to 8.4 ($Pco_2 = 10^{-3.5}$ atm). For calcite equilibrium at $Pco_2 = 0.1$ atm, pH is 6.6±0.1 over the entire range of SO_4^{2-}. Little difference results if equilibrium with dolomite (pKsp = 16.5) is maintained instead of with calcite (pKsp = 8.5) (fig. 6B); for $Pco_2 = 0.1$ atm, these calcareous minerals buffer pH at about 6.6. However, if siderite (pKsp = 10.5) is the available carbonate mineral, the pH generally will be much lower at equilibrium. For a closed system, where oxygen is limited to only the stoichiometric amount needed to produce SO_4^{2-}, siderite buffers pH at about 5.5, because H^+ is consumed by the reaction:

$$FeCO_3 + 2\,H^+ \leftrightarrow Fe^{2+} + H_2O + CO_2(aq). \qquad (8)$$

However, if oxygen is available to oxidize Fe^{2+}, siderite has little buffering effect, because all Fe is oxidized by the reaction:

$$FeCO_3 + 0.25\,O_2 + 1.5\,H_2O \rightarrow Fe(OH)_3 + CO_2(aq) \qquad (9)$$

An increase in the dissolved CO_2 by reaction 9 will produce a corresponding decrease in the ratio of $HCO_3^-/H_2CO_3^*$ and hence decrease the pH (per reaction 5).

DISCUSSION AND CONCLUSIONS

The bimodal distribution of pH for coal-mine drainage, with modes at pH 2.5 to 4 (acidic) and pH 6 to 7 (near neutral), is a regional phenomenon controlled by the mineralogy and hydrology of the mines. Although iron disulfide (pyrite) and calcareous minerals (calcite and dolomite) comprise only a few percent, or less, of the coal-bearing rock, these acid-forming and acid-neutralizing minerals are highly reactive and are mainly responsible for the bimodal pH distribution. The acidic mode, classified as AMD, is produced by the oxidation of pyrite in the absence of carbonate buffering. The field and laboratory studies indicate that, where calcite and dolomite are absent, extensive pyrite oxidation can result under variably saturated conditions, producing severe AMD (pH < 3 and SO_4 > 2,000 mg·L^{-1}); these conditions can be found at some well-drained underground mines and surface mines (e.g. bituminous mines, fig. 3). The studies also indicate that, where calcareous minerals are absent or deficient, the oxidation of only small amounts of pyrite under stagnant water-saturated conditions can produce AMD (pH < 4 and SO_4 > 200 mg·L^{-1}); these conditions commonly are found at flooded underground mines (e.g. anthracite mines, fig. 3). In contrast, where calcareous minerals are abundant, the pH can be buffered to be near neutral. Some near-neutral water contains high concentrations of SO_4 (median > 200 mg·L^{-1}), suggesting an origin as AMD that had been neutralized by reactions with calcareous minerals after, or downflow from the location of, pyrite oxidation.

The geochemical simulations confirm the interpretations of the field and laboratory data. The simulations clearly illustrate the effect of pyrite oxidation on lowering pH and of calcite and dolomite dissolution on increasing pH. Specific conclusions from the simulations are as follows:

- The near-neutral pH mode results from the dissolution of calcite and dolomite and by resultant carbonate buffering ($HCO_3^-/H_2CO_3^*$; $HCO_3^-/CaCO_3$; $HCO_3^-/CaMg(CO_3)_2$). As long as carbonate equilibrium is maintained or approximated, near-neutral pH can be maintained despite continued amounts of pyrite oxidation.
- In the absence of carbonate buffering, only a small amount of pyrite oxidation produces dilute AMD (0.012 g·L^{-1} FeS_2 produces pH~4 and 20 mg·L^{-1} SO_4^{2-}). However, because of the logarithmic scale for pH and ion speciation, unit decreases in pH require greater than 1 order of magnitude increases in the amount of pyrite oxidation.
- Buffering in the acidic mode is due to ion speciation (SO_4^{2-}/HSO_4^-; $Fe(OH)^{2+}/Fe^{3+}$) and to precipitation and dissolution of $Fe(OH)_3$.
- The least frequent pH range of pH 4.5 - 5.5 indicates a poorly buffered condition and could result from limited reactions with calcareous minerals (undersaturated) or limited availability of O_2 resulting in the incomplete oxidation of Fe^{2+} from pyrite or siderite.

The results of this evaluation have several implications. Firstly, the bimodal distribution for pH and the tendency for calcareous minerals to buffer pH in the near-neutral range support the approach of using "acid-base" accounting, where only pyritic and calcareous minerals are evaluated, as a basis for predicting post-mining water quality (e.g. Brady and others, 1994). Generally, "net alkaline" mine water has pH ≥ 6 (Rose and Cravotta, 1998), and near-neutral pH is desirable to limit the mobility of iron and associated metals (Stumm and Morgan, 1996). The calcareous minerals not only neutralize acid, but their dissolution tends to slow or inhibit pyrite oxidation. Furthermore, although siderite may temporarily buffer pH in the near-neutral range, the presence of siderite should be considered as a negative factor with regard to the prediction of mine-drainage quality, because once the iron precipitates any benefits of siderite as a neutralizing agent will be negated (Skousen and others, 1997).

Secondly, the laboratory experiments indicate that addition of calcite can increase pH and reduce the transport of iron and other metals; however, equilibrium with calcite, hence buffering by the carbonate minerals, is not achieved except under conditions of water saturation. On the other hand, pyrite oxidation tends to be diminished under continuously saturated conditions, in which oxygen availability is limited, compared to variably saturated hydrologic conditions, in which oxygen availability is enhanced. Thus, for those mines where the importation and addition of alkaline materials is needed to achieve a net-neutral acid-base account, the placement of alkaline and pyritic materials in continuously wet zones would be prudent. In practice, however, a permanently wet zone in spoil generally will not be realized immediately and may be difficult to sustain (Cravotta and others, 1994).

Thirdly, recent field and laboratory work indicates iron hydroxysulfate minerals, which tend to be yellowish colored, form dominantly under acidic conditions whereas relatively pure iron hydroxide, which tends to be reddish colored, tends to form dominantly under near-neutral conditions (e.g. Bigham and others, 1996a, 1996b). Because these minerals have different coloration and related spectral properties, new approaches to characterizing mine drainage by use of remote sensing may have merit. For example, preliminary testing of aerial and ground-based spectral reflectance techniques has demonstrated the potential for differentiating between acidic and near-neutral drainages (Robbins and others, 1996). These techniques may be useful for locating and characterizing water quality where access is restricted.

REFERENCES CITED

Ball, J.W., and Nordstrom, D.K., 1991, User's manual for WATEQ4F with revised data base: U.S. Geological Survey Open-File Report 91-183, 189 p.

Bigham, J.M., Schwertmann, U., and Pfab, G., 1996a, Influence of pH on mineral speciation in a bioreactor simulating acid mine drainage: Applied Geochemistry, v. 11, p. 845-849.

Bigham, J.M., Schwertmann, U., Traina, S.J., Winland, R.L., and Wolf, M., 1996b, Schwertmannite and the chemical modeling of iron in acid sulfate waters: Geochimica et Cosmochimica Acta, v. 60, p. 2111-2121.

Blowes, D.W., and Ptacek, C.J., 1994, Acid-neutralization mechanisms in inactive mine tailings, in Jambor, J.L., and Blowes, D.W., eds., Environmental geochemistry of sulfide mine-wastes: Mineralogical Association of Canada, Short Course Handbook, vol. 22, p. 271-292.

Boyer, J., and Sarnoski, B., 1995, 1995 progress report--statement of mutual intent strategic plan for the restoration and protection of streams and watersheds polluted by acid mine drainage from abandoned coal mines: Philadelphia, Pa., U.S. Environmental Protection Agency, 33 p., appendix (http://www.epa.gov/reg3giss/libraryp.htm).

Brady, K.B.C., Hornberger, R.J., and Fleeger, G., 1998, Influence of geology on post-mining water quality-Northern Appalachian Basin, in Brady, K.B.C., Smith, M.W., and Schueck, J.H., eds., Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania: Harrisburg, Pennsylvania Department of Environmental Protection, 5600-BK-DEP2256, p. 8.1-8.92.

———, Perry, E.F., Beam, R.L., Bisko, D.C., Gardner, M.D., and Tarantino, J.M., 1994, Evaluation of acid-base accounting to predict the quality of drainage at surface coal mines in Pennsylvania, U.S.A.: U.S. Bureau of Mines Special Publication SP 06A, p. 138-147.

———, Rose, A.W., Cravotta, C.A., III, and Hellier, W.W., 1997, Bimodal distribution of pH in coal-mine drainage (abs.): Geological Society of America, GSA Abstracts with Programs, v. 29, no. 1, p. 32.

———, Rose, A.W., Hawkins, J.W., and DiMatteo, M.R., 1996, Shallow ground water flow in unmined regions of the northern Appalachian Plateau--Part 2. Geochemical characteristics, in Proceedings 13th Annual Meeting American Society for Surface Mining and Reclamation: Princeton, W.Va., American Society for Surface Mining and Reclamation, p. 52-62.

Cravotta, C.A., III, 1994, Secondary iron-sulfate minerals as sources of sulfate and acidity: The geochemical evolution of acidic ground water at a reclaimed surface coal mine in Pennsylvania, in Alpers, C.N., and Blowes, D.W., eds., Environmental geochemistry of sulfide oxidation: Washington, D.C., American Chemical Society Symposium Series 550, p. 345-364.

———1996, Municipal sludge use in coal-mine reclamation and potential effects on the formation of acidic mine drainage: University Park, Pa., Pennsylvania State University, unpublished Ph.D. thesis, 200 p.

———1998, Effect of sewage sludge on formation of acidic ground water at a reclaimed coal mine: Ground Water, v. 36, no 1, p. 9-19.

———, Dugas, D.L., Brady, K.B.C., and Kovalchuk, T.E., 1994, Effects of selective handling of pyritic, acid-forming materials on the chemistry of pore gas and ground water at a reclaimed surface coal mine in Clarion County, PA, USA: U.S. Bureau of Mines Special Publication SP 06A, p. 365-374.

diPretoro, R., 1986, Premining prediction of acid drainage potential for surface coal mines in northern West Virginia: Morgantown, W.Va., West Virginia University, unpublished M.S. thesis, 217 p.

Dugas, D.L., Cravotta, C.A. III, and Saad, D.A., 1993, Water-quality data for two surface coal mines reclaimed with alkaline waste or urban sewage sludge, Clarion County, Pennsylvania, May 1983 through November 1989: U.S. Geological Survey Open-File Report 93-115, 153 p.

Growitz, D.J., Reed, L.A., and Beard, M.M., 1985, Reconnaissance of mine drainage in the coal fields of eastern Pennsylvania: U.S. Geological Survey Water Resources Investigations Report 83-4274, 54 p.

Hellier, W.W., 1994, Best professional judgment analysis for the treatment of post-mining discharges from surface mining activities: Harrisburg, Pa., Pennsylvania Department of Environmental Resources, unpublished report, 160 p.

Helsel, D.R., and Hirsch, R.M., 1992, Statistical methods in water resources: New York, Elsevier Publishers, Inc., Studies in Environmental Science no. 49, 522 p.

Hornberger, R.J., 1985, Delineation of acid mine drainage potential of coal-bearing strata of the Pottsville and Allegheny Groups in western Pennsylvania: University Park, Pa., Pennsylvania State University, unpublished M.S. thesis, 558 p.

———, Smith, M.W., Friedrich, A.E., and Lovell, H.L., 1990, Acid mine drainage from active and abandoned coal mines in Pennsylvania, in Majumdar, S.K., Miller, E.W., and Parizek, R.R., eds., Water resources in Pennsylvania--Availability, quality, and management: Easton, Pa., The Pennsylvania Academy of Science, p. 432-451.

Klapper, H., and Schultze, M., 1995, Geologically acidified mining lakes--living conditions and possibilities of restoration: Int. Revue ges. Hydrobiol., v. 80, p. 639-653.

Ladwig, K.J., Erickson, P.M., Kleinmann, R.L.P., and Posluszny, E.T., 1984, Stratification in water quality in inundated anthracite mines, eastern Pennsylvania: U.S. Bureau of Mines Report of Investigations RI 8837, 35 p.

LeRigina, J.A., 1988, The mine drainage tunnels of the Eastern Middle Anthracite Field, in Inners, J.D., ed., Bedrock and glacial geology of the North Branch Susquehanna lowland and Eastern Middle Anthracite Field: Harrisburg, Pa., 53rd Annual Field Conference for Pennsylvania Geologists.

McKibben, M.A., and Barnes, H.L., 1986, Oxidation of pyrite in low temperature acidic solutions--Rate laws and surface textures: Geochimica et Cosmochimica Acta, v. 50, p. 1509-1520.

Moses, C.O., and Herman, J.S., 1991, Pyrite oxidation at circumneutral pH: Geochimica et Cosmochimica Acta, v. 55, p. 471-482.

Nordstrom, D.K., 1977, Thermochemical redox equilibria of Zobell's solution: Geochimica et Cosmochimica Acta, v. 41, p. 1835-1841.

———, and Alpers, C.N., 1999, Geochemistry of acid mine waters, in Plumlee, G.S., and Logsdon, M.J., eds., The Environmental Geochemistry of Mineral Deposits--Part A. Processes, methods, and health issues: Reviews in Economic Geology, v. 6, 27 p.

Parkhurst, D.L., 1995, PHREEQC--A computer model for geochemical calculations: U.S. Geological Survey Water-Resources Investigations Report 95-4227, 143 p.

Pennsylvania Department of Environmental Protection, 1998, "Working" draft Pennsylvania's nonpoint source (NPS) management program: Harrisburg, Pa., Pennsylvania Department of Environmental Protection, 3940-BK-DEP2275, p. 14-23.

Pennsylvania Geological Survey, 1964, Distribution of Pennsylvania coals: Pennsylvania Geological Survey, Fourth Series, Map # 11.

Plummer, L.N., Parkhurst, D.L., and Wigley, M.L., 1979, Critical review of the kinetics of calcite dissolution and precipitation, in Jenne, E.A., ed., Chemical modeling in aqueous systems--Speciation, sorption, solubility, and kinetics: American Chemical Society Symposium Series 93, p. 537-573.

Robbins, E.I., Anderson, J.E., Cravotta, C.A., III, Koury, D.J., Podwysocki, M.H., Stanton, M.R., and Growitz, D.J., 1996, Development and preliminary testing of microbial and spectral reflectance techniques to distinguish neutral from acidic drainages, in Chiang, S.-H., ed., Proceedings 13th Annual International Pittsburgh Coal Conference, v. 2, p. 768-775.

Rose, A.W., and Cravotta, C.A., III, 1998, Geochemistry of coal-mine drainage, in Brady, K.B.C., Smith, M.W., and Schueck, J.H., eds., Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania: Harrisburg, Pa., Pennsylvania Department of Environmental Protection, 5600-BK-DEP2256, p. 1.1-1.22.

Skousen, J., Renton, J., Brown, H., Evans, P., Leavitt, B., Brady, K., Cohen, L., and Ziemkiewicz, P., 1997, Neutralization potential of overburden samples containing siderite: Journal of Environmental Quality, v. 26, p. 673-681.

Stumm, Werner, and Morgan, J.J., 1996, Aquatic chemistry--chemical equilibria and rates in natural waters (3rd): New York, Wiley-Interscience, 1022 p.

Wood, C.R., 1996, Water quality of large discharges from mines in the anthracite region of eastern Pennsylvania: U.S. Geological Survey Water-Resources Investigations Report 95-4243, 69 p.

Wood, W.W., 1976, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents: U.S. Geological Survey Techniques of Water-Resources Investigations, book 1, chap. D2, 24 p.

AUTHOR INFORMATION

Charles A. Cravotta, III, U.S. Geological Survey, Lemoyne, Pennsylvania (cravotta@usgs.gov).

Keith B.C. Brady, Pennsylvania Department of Environmental Protection, Harrisburg, Pennsylvania (brady.keith@dep.state.pa.us).

Arthur W. Rose and Joseph B. Douds, Pennsylvania State University, University Park, Pennsylvania (rose@ems.psu.edu).

IEI Industrial Ecosystems Inc.

DATE 2/13/15

Industrial Ecosytems Inc
Soil Reclamation Center

Soil (Solids) Multiple Loads - Material Tracking Sheet

COMPANY NAME: CCI.

COMPANY REP. Ryan Kelly

ORIGIN OF MATERIAL(LOCATION): Barter Dome 24" Pipeline

PHONE #

TYPE OF MATERIAL: Soil

H2S GAS ☐ NON DETECT ☐ DETECT

____ Chlorides ____ PH

TESTED

TRUCKING COMPANY: Triple F

Paint Filter Test: ☒ Passed ☐ Failed

	Date	Time In	Transported by	Truck#	Yards	Virgin Soil Out	Driver's Name (Print)	Driver's Signature	Time Out
1	2/13	10:16	Hart man	87	18		Roger	[illegible]	10:44
2		10:49	TripleF	31	18		Jeff	[illegible]	10:59
3		10:50	" "	5	18		Troy	[illegible]	11:07
4		10:51	" "	32	18		Sandy	[illegible]	11:41
5		10:53	" "	33	18		Jeremy	[illegible]	11:23
6		1:33	Hartman	87	18		Roger	[illegible]	1:43
7		2:26	FFF	33	18		Jeremy	[illegible]	2:40
8		2:26	TripleF	31	18		Jeff	[illegible]	2:42
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									

138 cy

IEI Industrial Ecosystems Inc.

Industrial Ecosytems Inc
Soil Reclamation Center

DATE 2/12/15

Soil (Solids) Multiple Loads - Material Tracking Sheet

COMPANY NAME: CCI

COMPANY REP. Ryan Kelly

ORIGIN OF MATERIAL(LOCATION): Barker Dome 24' Pipeline

PHONE #

TYPE OF MATERIAL: Soil

H2S GAS ☒ NON DETECT ☐ DETECT

<128 Chlorides 7.0 PH

TRUCKING COMPANY: Triple F

Paint Filter Test: ☒ Passed ☐ Failed

	Date	Time In	Transported by	Truck#	Yards	Virgin Soil Out	Driver's Name (Print)	Driver's Signature	Time Out
1	2/12	11:10	Triple F	31	18	—	Jeff	[signature]	11:27
2		11:10	Triple F	3	18	—	Tim	[signature]	11:27
3		11:10	Triple F	33	18	—	Jeremy	[signature]	11:33
4		11:29	Triple F	71	10	—	Fidel	[signature]	11:43
5		1:00pm	Hartman	H7	18	—	Roger L (Hartman)	[signature]	1:13
6		2:26	Triple F	31	18	—	Jeff	[signature]	2:36
7		2:27	" "	3	10	—	Tim	[signature]	2:38
8		2:42	" "	33	10	—	Jeremy	[signature]	2:57
9		3:22	" "	71	10	—	Fidel	[signature]	3:40
10		4:21	Hartman	H7	18	—	Roger	[signature]	4:45
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									

140 cy