CTEH CENTER FOR TOXICOLOGY AND ENVIRONMENTAL HEALTH, LLC

Colonial CR-251 Event

Helena, AL

Air Sampling and Analysis Plan

Version 1.1

Prepared On Behalf Of:

Colonial Pipeline

Prepared By:

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CTEH CENTER FOR TOXICOLOGY AND ENVIRONMENTAL HEALTH, LLC

Version 1.1			
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Project:	CR-251 Event
Location:	Pelham, AL
Client:	Colonial Pipeline
Version History:	V 1.1

Introduction and Purpose

The Center for Toxicology and Environmental Health CTEH® was contracted by Colonial Pipeline, LP (Colonial) to conduct real-time air monitoring and analytical air sampling at a gasoline pipeline release and fire in Helena, AL. Based on an absence of air monitoring data, CTEH will be conducting initial air monitoring to determine if workers performing certain job tasks may be exposed to gasoline-related hydrocarbons, including benzene, at levels approaching their applicable occupational exposure guidelines (OELs) as outlined in this Plan.

The objective of the Sampling and Analysis Plan is to provide guidance for the action levels for airborne constituents of gasoline and its combustion by-products for response and remediation workers working in the area of the release site and the nearby community.

CTEH® Site-Specific Action Levels

The following chemicals were determined to have the greatest potential for human health impacts based on the relative levels in air of volatile organics emitted from gasoline and its likely combustion by-products, together with published information regarding health-based worker exposure and community health guidelines. Site specific action levels are to be employed in all monitoring locations (i.e. pipeline repair site and in nearby residential areas) to provide information for corrective action to limit chemical exposure. These levels are intended to be a concentration limit that triggers a course of action to better address worker and community member safety before regulatory or guideline exposure limits are reached. Real-time air monitoring for all analytes will be conducted on a 24-hour continuous basis with discrete readings recorded periodically. In addition, real-time air monitoring for site characterization may be conducted upon request. Readings collected for site characterization may be recorded directly above pooled product, or other areas not representative of the breathing zone. Based on the data collected, real-time air monitoring for some analytes may be reduced or discontinued. CTEH® will also collect analytical air samples at residential or commercial locations upwind and downwind of response operations. Details of this analytical sampling are provided in the pages below.

Plan/Assignment: **WORK AREA (Including sites where workers are performing response-related activities, such as fire suppression, excavation, and pipeline repair)**

Objective: Report air levels before they reach those requiring respiratory protection or other precautionary actions. More information regarding worker exposure sampling is provided in **Appendix A**.

Analyte	Action Level	Basis	Action to be Taken
Total VOCs	30 ppm	1/10 ACGIH® TLV-TWA for gasoline - Reading sustained for 15 minutes	Report reading to Site Management. Conduct specific monitoring for benzene.
	300 ppm	ACGIH® TLV-TWA – for gasoline Reading sustained for 15 minutes	Don respirator or evacuate area; report reading to Site Management.
Benzene	0.5 ppm	ACGIH® TLV-TWA - Reading sustained for 15 minutes	Don Air purifying respirator or evacuate area; report reading to Site Management.
	2.5 ppm	ACGIH® STEL Reading sustained for 5 minutes	Don Air purifying respirator or evacuate area; report reading to Site Management.
Gasoline	30 ppm	ACGIH® TLV-TWA - Reading sustained for 15 minutes	Don Air purifying respirator or evacuate area; report reading to Site Management.
Toluene	20 ppm	ACGIH® TLV-TWA - Reading sustained for 15 minutes	Don Air purifying respirator or evacuate area; report reading to Site Management.
Xylene	100 ppm	ACGIH® TLV-TWA - Reading sustained for 15 minutes	Don Air purifying respirator or evacuate area; report reading to Site Management.
Hexane	50 ppm	ACGIH® TLV-TWA (n-hexane) - Reading sustained for 15 minutes	Don Air purifying respirator or evacuate area; report reading to Site Management.
Naphthalene	10 ppm	ACGIH® TLV-TWA - Reading sustained for 15 minutes	Don Air purifying respirator or evacuate area; report reading to Site Management.

Combustion Products							
Analyte	Instrument Reading	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
Particulate Matter ($PM_{2.5}$ or PM_{10})	351 µg/m³ sustained for 5 min	Report reading to PM	Wildfire Smoke Guidelines for 1-hr avg. upper-bound breakpoint for unhealthy AQI	SidePak AM510	0.001 mg/m³	PM2.5 impactor – 50% cut-off at 2.5 micron PM10 impactor – 50% cut-off at 10 micron	NA
PM	200 µg/m³ for 8 hrs	Report reading to PM	Wildfire Smoke Guidelines for 8-hr avg. upper-bound breakpoint for unhealthy AQI	SidePak AM510	0.001 mg/m³	See above	NA
Carbon monoxide	25 ppm	Report reading to PM	ACGIH® TLV – Reading sustained for 5 minutes	MR Sensor	1 ppm	Range: 0 – 500 ppm	NA
				Gastec tube #1LC	0.5 ppm	Range: 1 – 30 ppm Volume: 100	1
Sulfur dioxide	0.25 ppm	Exit area - Report reading to PM	ACGIH® STEL – Reading sustained for 5 minutes	MR Sensor	0.1 ppm	Range: 0 – 20 ppm	NA
				Gastec tube #5Lb	0.05 ppm	Range: 0.05 – 10 ppm Volume: Var.	Var.
Nitrogen dioxide	0.2 ppm	Report reading to PM	ACGIH® TLV – Reading sustained for 5 minutes	MultiRAE PID	1 ppm	Measuring range: 1 – 5,000	16
				MR Sensor	0.1 ppm	Range: 0 – 20 ppm	NA
				Gastec tube #9L	0.1 ppm	Range: 0.5 – 125 ppm Volume: Var.	Var.
Formaldehyde	0.3 ppm	Sample only as requested, Exit area - Report to PM	ACGIH® Ceiling – confirmed with secondary instrument	Gastec tube #91L	0.05 ppm	Range: 0.1 – 40 ppm Volume: Var.	Var.

Plan/Assignment: **COMMUNITY (Residential Areas near the Excavation & Pipeline Repair Sites)**

Objective: Report levels that minimize nuisance odor in the community and evaluate

Analyte	Action Level	Basis	Action to be Taken
Total VOCs	0.2 ppm	Reading Sustained for 15 minutes. Gasoline Odor Threshold; Colonial Air Monitoring Protocol	Report reading to Site Management. Assess the presence of benzene.
	100 ppm	Reading sustained for 30 minutes*. ½ Gasoline-specific Emergency Response Planning Guidelines (ERPG)-1** value	Report reading to Site Management.
Gasoline	0.2 ppm	Reading Sustained for 15 minutes. Gasoline Odor Threshold; Colonial Air Monitoring Protocol	Report reading to Site Management. Assess the presence of benzene.
Benzene	0.05 ppm	Reading Sustained for 15 minutes. Gasoline Odor Threshold; Colonial Air Monitoring Protocol	Report reading to PM and Site Management.
Toluene	2.5 ppm	Reading Sustained for 15 minutes; Colonial Air Monitoring Protocol	Report reading to PM and Site Management.
Xylene	0.5 ppm	Reading Sustained for 15 minutes; CTEH instrument detection limit	Report reading to PM and Site Management.
Hexane	50 ppm	Reading Sustained for 15 minutes; Colonial Air Monitoring Protocol	Report reading to PM and Site Management.
Naphthalene	10 ppm	Reading Sustained for 15 minutes; Colonial Air Monitoring Protocol	Report reading to PM and Site Management.

*If VOCs are detected at or above 100 ppm in the community, air monitoring personnel will remain at the site of detection and collect multiple readings throughout a 30 minute period.

**ERPG-1: The maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor. ERPGs are developed by the Emergency Response Planning Committee of the American Industrial Hygiene Association (AIHA).

Combustion Products							
Analyte	Instrument Reading	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
Particulate Matter ($PM_{2.5}$ or PM_{10})	138 µg/m³ Sustained for 5 minutes	Report reading to PM	Wildfire Smoke Guidelines for 1 to 3-hr avg. upper-bound breakpoint for unhealthy for sensitive groups AQI	SidePak AM510	0.001 mg/m³	PM2.5 impactor – 50% cut-off at 2.5 micron PM10 impactor – 50% cut-off at 10 micron	NA
PM	79 µg/m³ for 8 hrs	Report reading to PM	Wildfire Smoke Guidelines for 8-hr avg. upper-bound breakpoint for unhealthy for sensitive groups AQI	SidePak AM510	0.001 mg/m³	See above	NA
Carbon monoxide	12 ppm	Report reading to PM	Inform PM/PTD of potential off-site issues	MR Sensor	1 ppm	Range: 0 – 500 ppm	NA
				Gastec tube #1LC	0.5 ppm	Range: 1 – 30 ppm Volume: 100	1
Sulfur dioxide	Detection	Report reading to PM	Inform PM/PTD of potential off-site issues	MR Sensor	0.1 ppm	Range: 0 – 20 ppm	NA
	0.3 ppm	Report reading to PM and Site Management	Emergency Response Planning Guidelines (ERPG)-1*	Gastec tube #5Lb	0.05 ppm	Range: 0.05 – 10 ppm Volume: Var.	Var.
Nitrogen dioxide	Detection	Report reading to PM	Inform PM/PTD of potential off-site issues	MultiRAE PID	1 ppm	Measuring range: 1 – 5,000	16
	1.0 ppm	Report reading to PM and Site Management	Emergency Response Planning Guidelines (ERPG)-1*	MR Sensor	0.1 ppm	Range: 0 – 20 ppm	NA
				Gastec tube #9L	0.1 ppm	Range: 0.5 – 125 ppm Volume: Var.	Var.
Formaldehyde	Detection	Sample only as requested, Report reading to PM	Inform PM/PTD of potential off-site issues	Gastec tube #91L	0.05 ppm	Range: 0.1 – 40 ppm Volume: Var.	Var.
	1.0 ppm	Report reading to PM and Site Management	Emergency Response Planning Guidelines (ERPG)-1*				

* The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to one hour without experiencing other than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.

Plan/Assignment: **SITE CHARACTERIZATION**

Objective: Report air levels before they reach those precautionary actions.

Analyte	Action Level	Basis	Action to be Taken
Total VOCs	NA	NA	Report reading to Site Management.
Benzene	NA	NA	Report reading to Site Management.
Toluene	NA	NA	Report reading to Site Management.
Xylene	NA	NA	Report reading to Site Management.
Hexane	NA	NA	Report reading to Site Management.
Naphthalene	NA	NA	Report reading to Site Management

Site characterization readings are not indicative of worker exposures (i.e., not taken at breathing level, no work activity, directly above product, etc.). As such, no occupational action levels are established for site characterization. All site characterization readings are noted and reported to site management.

Plan: **All – FLAMMABILITY**

Objective: Report areas where flammability is most likely.

Analyte	Instrument Reading	Corrected Value	Correction Factor	Basis	Action to be Taken
LEL	3 %	10 %	2.6 for gasoline LEL	10% LEL	Egress and Notify Site Management
VOCs	1,444 ppm	1,300 ppm	0.9 for gasoline PID	10% LEL	Egress and Notify Site Management

Methods

Real-Time Monitoring Methods					
Chemical	Instrument	Detection Limit*	Tube#/Lamp	Notes	Correction Factor
Gasoline (as VOC)	MultiRAE/ AreaRAE	0.09 ppm	PID 10.6 eV lamp	Measuring Range: 0.1 – 4,500 ppm	0.9
Gasoline	Colorimetric	5 ppm	Gastec tube #101L	Measuring Range: 30 – 1,000 ppm	NA
Benzene	UltraRAE	0.05 ppm	PID 9.8 eV lamp	Change SEP tube frequently (Ben. Cal Gas)	NA
	MultiRAE/ AreaRAE	0.05 ppm	PID 10.6 eV lamp	Measuring Range: 0.1 – 2,350 ppm	0.47
	Colorimetric	0.05 ppm	Gastec tube #121L	Range: 0.1 to 65 ppm	Var.
Toluene	MultiRAE/ AreaRAE	0.05 ppm	PID 10.6 eV lamp	Measuring Range: 0.1 – 2,250 ppm	0.45
	Colorimetric	0.5 ppm	Gastec tube #122L	Range: 1 to 100 ppm	Var.
Xylene	MultiRAE/ AreaRAE	0.5 ppm	PID 10.6 eV lamp	Measuring Range: 0.1 – 5,000 ppm	0.44
	Colorimetric	1 ppm	Gastec tube #123L	Measuring Range: 2 – 200 ppm	Var.
Hexane	MultiRAE/ AreaRAE	0.5 ppm	PID 10.6 eV lamp	Measuring Range: 0.1 – 5,000 ppm	4.3
	Colorimetric	1 ppm	Gastec tube #102L	Range: 4 to 1200 ppm	Var.
LEL	MultiRAE/ AreaRAE	2.6 %	Sensor	Measuring range: 1 – 100%	2.6
Naphthalene	Colorimetric	0.5 ppm	Gastec tube #60	Range: 0.5 – 14 ppm	1

*For electronic instruments, the detection limit is listed as the resolution adjusted by the correction factor.

Analytical Methods			
Analyte	Media/Can	Method	Notes
VOCs	1 L Minican	TO-15 + TICS	Minicans will be regulated for an 8 or 24 hour sampling period.
BTEX (+Hexane)	3M® 3520	NIOSH 1501	Passive sampling badges will be utilized for personnel sampling, if needed.
BTEX (+ Hexane)	226-01	NIOSH 1501	Charcoal Tubes to be used for STEL Sampling, if needed
Gasoline	3M® 3520	NIOSH 1550	Passive sampling badges will be utilized for personnel sampling, if needed.
PAHs (18 PNAH Profile - Galson)	37PTFE 2.0/Treated Amberlite XAD-2	Method 5506	

General Information on Procedures (Assessment Techniques) Used

Procedure	Description
Handheld Survey	CTEH® staff members will utilize handheld instruments (e.g. MultiRAE Plus/Pro; UltraRAE, Gastec colorimetric detector tubes, etc.) to measure airborne chemical concentrations. CTEH® will use these hand-held instruments primarily to measure the air within breathing zone. Additionally, measurements may be made at grade level, as well as in elevated workspaces, as indicated by chemical properties or site conditions. When readings are collected outside of the breathing zone, they may be classified as Site Characterization or will be noted in the reading comments. Real-time air monitoring readings may be collected at indoor commercial and residential buildings, if requested (e.g. prior to reopening).
Analytical Sampling	Analytical sampling will be used to validate the handheld data monitoring data, or to provide data beyond the scope of the real-time instruments. Analytical samples will be collected on specific collection media and sent to an off-site laboratory for further chemical analysis. If deemed necessary by the results of real-time air monitoring, CTEH® will conduct personal exposure sampling on response personnel involved in excavation, pipeline repair, or product recovery operations.
Guardian Network	A Guardian network may be established with AreaRAEs equipped with electrochemical sensors at locations around the work zone perimeter. The AreaRAEs will be telemetering instantaneous data at 15-second intervals to a computer console. MultiRAE Pros may also be used in the network. The data will be visible in real-time at the computer console and will be monitored 24 hours per day by CTEH personnel.

Quality Assurance/Quality Control Procedures

Method	Procedure
Real-time	• Real time instruments will be calibrated once per day which exceeds the manufacturer's recommendations. ○ At a minimum whenever indicated by site conditions or instrument readings. • Lot numbers and expiration dates will be recorded with use of Gastec colorimetric tubes.
Analytical	• Chain of custody documents will be completed and documented for each sample. • Level II data verification may be performed on all samples. • Level IV data validation may be performed on 10% of total samples. • Sample Nomenclature may contain: ○ Badge Serial Number (Badge Sampling)

Data Management	• Real-Time Monitoring data will be collected through the Mobile Data Studio Software, and QA/QC'ed by air monitoring personnel for accuracy and consistency.
	  ○ Real-time Data may Include:
	  ▪ GPS Coordinates
	  ▪ Location Description
	  ▪ Comments
	  ▪ Reading of equipment
	  ▪ Serial Number of equipment
	  ▪ Unique Environmental Conditions (i.e. humidity, dust, etc.)
	• Data will be databased using Microsoft Access Software and will be provided using the EPA SCRIBE software.
	• QA/QC'ed data and final report will be made after the demobilization of CTEH® from site.

Change from version 1.0 to 1.1
• *Added additional Community combustion product action levels for nitrogen dioxide, sulfur dioxide, and formaldehyde, based on AIHA ERPG-1 values.*

	Name/Organization	Signature	Date Signed
Revised by:	Michael H. Lumpkin, PhD, DABT / CTEH	Michael H. Lumpkin	11/01/2016
Reviewed by:			