

# Technical Memorandum

November 23, 2023

<b>To</b>	CSX Transportation	<b>Tel</b>	
<b>Prepared By</b>	GHD	<b>Email</b>	
<b>Reviewed By</b>	GHD	<b>Ref. No.</b>	12628999
<b>Approved By</b>	CSX Transportation, GHD	<b>Distributed By</b>	GHD
<b>Subject</b>	Memo 1 – Summary of Real-Time Air Monitoring Results November 23, 2023, 01:00 to 05:00 Eastern Time Livingston, Kentucky – Train Derailment		

The purpose of this memorandum is to provide CSX Transportation (CSXT) with a summary of the real-time air monitoring activities, results, and observations from real-time air monitoring being performed at the location of a train derailment, and subsequent fire near the town of Livingston, Kentucky at Mile Post (MP) 138.8440 on the CSXT Cincinnati Corbin (CC) subdivision (Site). The derailment occurred on November 22, 2023, and involved approximately sixteen (16) mixed freight rail cars containing various commodities including multiple tank cars containing molten sulfur.

This memorandum summarizes the real-time air monitoring data collected between 01:00 and 05:00 Eastern Time (ET) on November 23, 2023 (monitoring period). GHD mobile industrial hygiene (IH) professionals manually recorded real-time air monitoring data using hand-held instruments throughout the work areas, Site perimeter, and nearby community.

Real-time air monitoring was used primarily as a screening tool to quickly indicate the presence of elevated airborne concentrations of Site-specific constituents of interest (COI) associated with molten sulfur, and a fire involving molten sulfur: flammability as a percentage of the lower explosive limit (%LEL), hydrogen sulfide, sulfur dioxide. In addition COIs related to the subsequent fire include: respirable particulate matter with a diameter of 2.5 microns or less (PM<sub>2.5</sub>) and total particulate matter with a diameter of 10 microns or less (PM<sub>10</sub>) and nitrogen dioxide. Oxygen was monitored in conjunction with flammability. Oxygen rich or deficient environments may shift the LEL or upper explosive limit (UEL) and cause erroneous readings for flammable gases.

Real-time air monitoring activities and strategies were performed in accordance with the Site-specific Air Monitoring Plan (AMP), developed by GHD, reviewed by a certified industrial hygienist (CIH), and provided to CSXT on November 22, 2023.

Evaluation of readings relative to established action levels were based on an approximate 1-minute average of concentrations measured by the air monitoring instruments. When readings of a COI were sustained at a concentration at, or above, the action level for the appropriate time period (generally one minute), they were considered an exceedance. Conversely, instantaneous readings that dispersed quickly and were not sustained for over one minute represent transient concentrations and are not representative of ambient conditions over a sustained duration.

GHD identified the following Site activities with potential exposures to the Site-specific COI during the monitoring period:

- Tank car inspection and assessment activities

- Active fire
- Ground disturbance activities

The manually collected real-time air monitoring data and tactics are summarized below.

### Real-Time Air Monitoring Data Evaluation and Summary of Results

Manually collected real-time air monitoring data was collected at breathing zone height (approximately 4.5 feet) using handheld instruments at the perimeter of the work areas, inside the work zones, and surrounding community. The purpose of the manually logged data was to characterize exposures in real-time during the various operations throughout the Site, as well as identify any potential fugitive emissions related to mitigation activities.

GHD used the following handheld instruments to measure airborne concentrations:

- **Honeywell MultiRAE instruments** equipped with a catalytic bead sensor specific for %LEL, and electrochemical sensors specific for SO<sub>2</sub>, H<sub>2</sub>S, and oxygen.
- **TSI DustTrak DRX (DustTrak)** aerosol monitors equipped with a light-scattering laser photometer to detect particulate matter

The data collected from these handheld devices was logged into an electronic handheld data collection device. Real-time air monitoring readings were collected at positions upwind, downwind, and within the breathing zone of workers during the monitoring period at the Site. GHD mobile teams logged over 74 real-time air monitoring readings during the monitoring period.

A summary of the manually logged data for the monitoring period is provided below in Table 1. Locations of the manually logged data is shown on Figure 1 (attached).

**Table 1** Manually Logged Real-Time Air Monitoring Data

COI	Action Level <sup>1</sup>	Reading Type	Result
Hydrogen Sulfide	≥0.5 ppm	Number of Readings	53
		Number of Readings Above Action Level	0
		Maximum Reading	<0.1 ppm
Sulfur Dioxide	≥0.2 ppm	Number of Readings	74
		Number of Readings Above Action Level	23
		Maximum Reading	9.5
Nitrogen Dioxide	≥0.2 LEL	Number of Readings	-
		Number of Readings Above Action Level	-
		Maximum Reading	-
Respirable Particulate Matter (as PM 2.5)	≥2.5 mg/m <sup>3</sup>	Number of Readings	26
		Number of Readings Above Action Level	0
		Maximum Reading	2.37
Respirable Particulate Matter (as PM 10)	≥5 mg/m <sup>3</sup>	Number of Readings	26
		Number of Readings Above Action Level	0
		Maximum Reading	4.83
%LEL	≥1% LEL	Number of Readings	78
		Number of Readings Above Action Level	0
		Maximum Reading	<1%
Oxygen	≤19.5 or ≥23.5%	Number of Readings	79
		Number of Readings Above Action Level	0
<b>Definitions:</b> COI – Constituent of interest AL – Action level LEL – Lower explosive limit ppm – Parts per million			

% – percent  
mg/m<sup>3</sup> – milligrams per cubic meter  
≥ – greater than or equal  
≤ – less than or equal  
PM 2.5 – Particulate matter 2.5 microns in diameter or less  
PM 10 – Particulate matter 10 microns in diameter or less

**Notes:**

1. The evaluation of airborne concentrations relative to the established action levels for the associated COI were based on the approximate one-minute average.

## **Real-Time Air Monitoring Data Evaluation and Summary of Results**

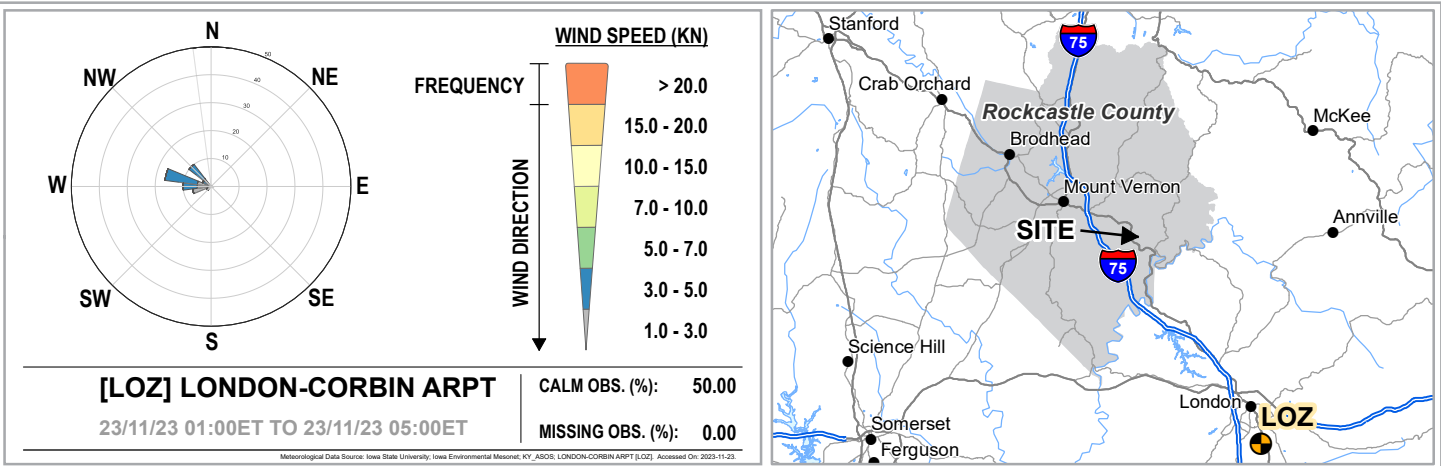
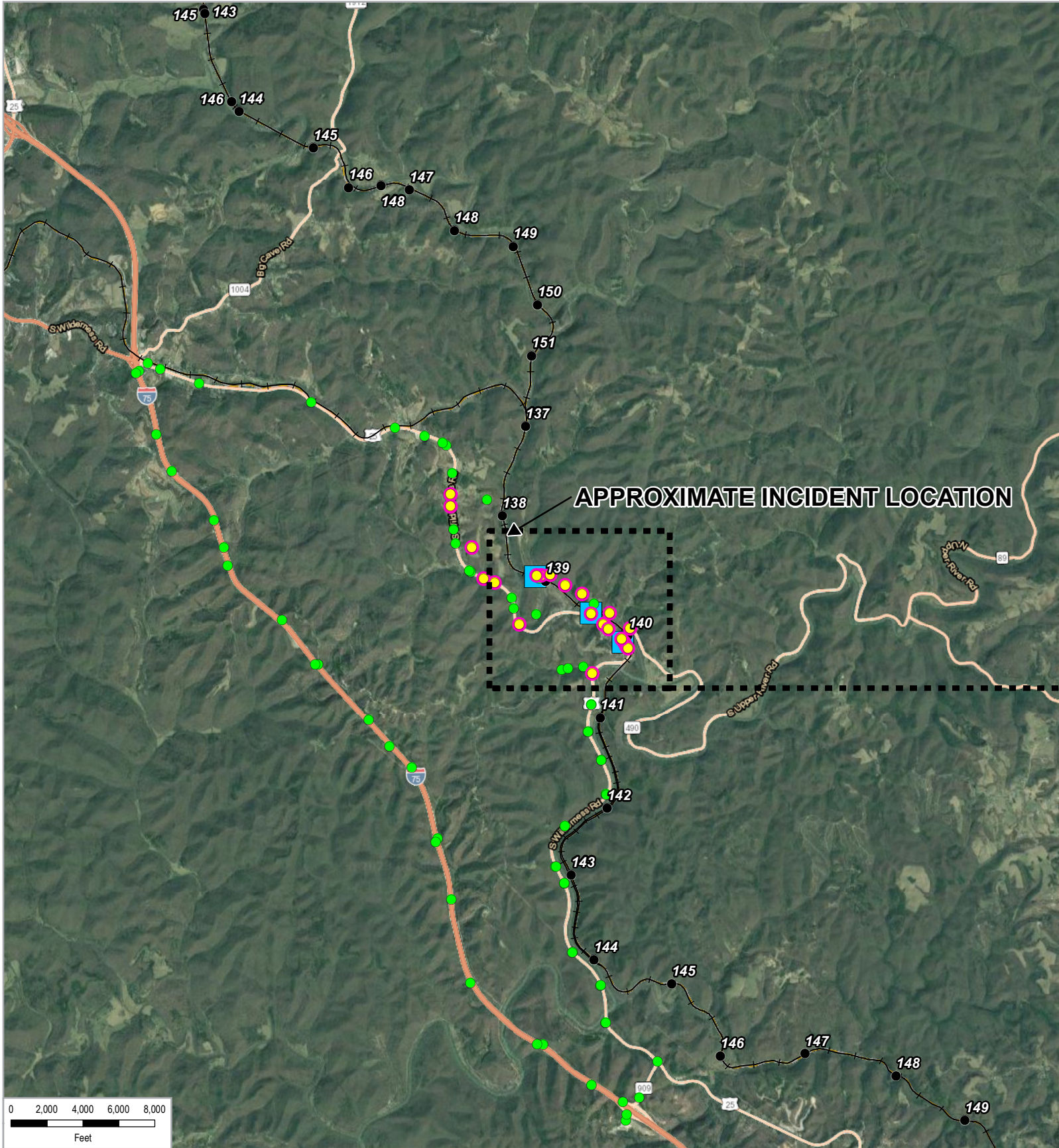
The **manually** real-time air monitoring data for the monitoring period indicated the following:

- **Hydrogen Sulfide (Action Level 0.5 ppm)**
  - No hydrogen sulfide readings were documented above the action level.
- **Sulfur Dioxide (Action Level of 0.2 ppm)**
  - The following readings were elevated above the action level:
    - Between 01:08 and 04:50 ET, twenty-three (23) readings were documented above the action level of 0.2 ppm at the Site and within the surrounding community. Readings ranged from 0.6 ppm to 9.5 ppm.
      - Mitigation measures implemented:
        - GHD recommended personnel in the work areas re-locate to a location upwind or don respiratory protection if remaining in the work areas.
        - Local fire and police departments issued an evacuation order within the surrounding community. The surrounding community were requested to evacuate at the time the elevated readings were documented.
- **Respirable Particulate Matter – as PM<sub>2.5</sub> (Action Level 2.5 mg/m<sup>3</sup>)**
  - No PM<sub>2.5</sub> readings were documented above the action level.
- **Respirable Particulate Matter – as PM<sub>10</sub> (Action Level 5 mg/m<sup>3</sup>)**
  - No PM<sub>10</sub> readings were documented above the action level.
- **%LEL (Action Level of 1% LEL)**
  - No %LEL readings were documented above the action level.
- **Oxygen (Normal Range 19.5-23.5%)**
  - No oxygen readings were documented outside the normal range.

## **Quality Assurance and Quality Control**

The information contained in this memorandum will be considered preliminary, as a final Quality Assurance / Quality Control (QA/QC) of the data has not been completed. At the completion of the project, a report will be prepared in which the data collected through real-time air monitoring will be compiled, summarized, and reported to CSXT. Data contained in the final report will have been through the final QA/QC process, will be reviewed by a GHD Certified Industrial Hygienist (CIH), and will be considered final.





- Legend**
- Real Time Air Monitoring Location (Above Action Level) (23)
  - Real Time Air Monitoring Location (Below Action Level) (78)
  - RAE Monitoring Location (3)
  - Weather Station (LOZ)
  - Mile Post
  - Track Centerline

- NOTES:**
- > AL = Above Action Level 2
  - Action Level for Hydrogen Sulfide is  $\geq 0.5$  ppm
  - Action Level for Sulfur Dioxide is  $\geq 0.2$  ppm
  - Action Level for Nitrogen Dioxide is  $\geq 0.2$  ppm
  - Action Level for LEL is  $\geq 1.0$  %
  - Action Level for PM<sub>2.5</sub> is  $\geq 2.5$  mg/m<sup>3</sup>
  - Action Level for PM<sub>10</sub> is  $\geq 5.0$  mg/m<sup>3</sup>
  - Action Level for Oxygen is  $\leq 19.5$  % or  $\geq 23.5$  %
  - AreaRAE readings are reported as 1-minute averages

Paper Size ANSI B

Map Projection: Lambert Conformal Conic  
Horizontal Datum: North American 1983  
Grid: NAD 1983 StatePlane Kentucky South FIPS 1602 Feet

CSXT FIRE  
CINCINNATI CORBIN SUB - MP 138.84  
LIVINGSTON, KENTUCKY  
2023/11/23 - 01:00 TO  
2023/11/23 - 04:59 (ET)  
**AIR MONITORING RESULTS SUMMARY**

Project No. 12628999  
Date Nov 23, 2023