**Letter Health Consultation**

Fire at Clean Harbors Reclamation Facility

1 Hill Avenue, Braintree, Norfolk County, Massachusetts

**Prepared by the Massachusetts Department of Public Health**

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**Health Consultation: A Note of Explanation**

A Massachusetts Department of Health (MDPH) health consultation is a verbal or written response from MDPH to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. To prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material. In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members.

This letter concludes the health consultation process for the Fire at Clean Harbors Reclamation Facility, unless additional information is obtained by MDPH which, in the Agency’s opinion, indicates a need to revise or append the conclusions previously issued.

This health consultation was made possible by a Cooperative Agreement [program # TS-23-0001] from the Agency for Toxic Substances and Disease Registry (ATSDR). Its contents are solely the responsibility of the Massachusetts Department of Public Health and do not necessarily represent the official views of the ATSDR, or the U.S. Department of Health and Human Services.

# Introduction

## 1.1 Summary

The Massachusetts Department of Public Health, Bureau of Climate and Environment Health (MDPH/BCEH) was asked by the Town of Braintree (Braintree Town Council or BTC) to evaluate the health risks associated with a fire that occurred at the Clean Harbors Reclamation Facility in Braintree, Massachusetts on February 16, 2023. The environmental hazards associated with this incident include those generated by the fire or fire suppression, including the release of contaminated debris and combustion by-products to the air and the nearby Fore River. As the location of the incident was unlikely to result in harmful levels of contaminants in drinking water, residential soil, or surface water, the quantitative evaluation described in this consultation focuses on breathing fire-related airborne contaminants. Other non-inhalation pathways (e.g., ingestion or dermal exposure) were evaluated qualitatively. Based on our evaluation, sensitive people may have experienced short-term respiratory effects, such as irritation, and may have had an increased risk of cardiovascular effects associated with breathing contaminants from the fire. We do not expect that this brief (acute) exposure would result in any long-term health impacts, and we do not expect that the fire has resulted in opportunities for continued (chronic) exposure to residual contamination.

## 1.2 Background

Clean Harbors Reclamation Facility is the largest hazardous waste treatment, storage, and transfer facility in New England, and is licensed by the Massachusetts Department of Environmental Protection (MassDEP). It stores and processes a broad range of hazardous materials in various forms (CH, 2023). Clean Harbors is located along the Fore River Basin, which houses several industrial properties including: the Calpine Fore River Energy Center, the Braintree Electric Light Department, Twin Rivers Technology, New England Fertilizer Company, Massachusetts Water Resources Authority intermediate pump station, Citgo, and Sprague Energy (MDPH/MassDEP/MAPC, 2019).

On the evening of February 16, 2023, at approximately 10 PM, smoke and a possible fire was reported in the loading dock area of the Clean Harbors Reclamation Facility on 1 Hill Ave (BTC, 2023). The Braintree Fire Department (BFD) was dispatched to this area and reported that four of the nine trailers in the vicinity of the loading dock were fully involved in an on-site fire. The BFD controlled the fire, and the remaining five trailers were not involved.

According to a Department of Fire Services (DFS) Hazardous Materials Emergency Response Division Team (HazMat) incident report provided by MassDEP, the fire burned for 4 hours and 37 minutes (DFS, 2023). The BFD did not use firefighting foam and applied water only to the burning trailers. Approximately 330,000 gallons of firefighting water was captured in fracture tanks[[1]](#footnote-2) to be shipped off-site for processing and proper disposal. In addition to the BFD, representatives from Clean Harbors, DFS State HazMat Team, Massachusetts State Police Fire Investigators, MassDEP, the Coast Guard, Brewster Ambulance, and emergency response personnel from Quincy, Weymouth, Randolph, and Holbrook participated in the response to the fire (BTC, 2023). Because the fire constituted a potential release of oil and hazardous material, Clean Harbors notified MassDEP of the potential release in accordance with the Massachusetts Contingency Plan (MCP) and retained a Licensed Site Professional (LSP) to oversee response actions.

According to the Immediate Response Action Completion (IRAC) report completed by the Tetra Tech LSP, on behalf of Clean Harbors, the winds were light and variable on the night of the fire (TTI, 2023). Using the meteorological data from MassDEP’s air monitoring station on Monatiquot Street in Weymouth, the LSP opined that smoke from the Clean Harbors fire was likely disbursed in multiple directions from the facility location (TTI, 2023).

According to the HAZMat Fire incident report, there were approximately 75 55-gallon drums of highly flammable liquids and solids in the trailer where the fire originated (DFS, 2023). These materials included carcinogenic and toxic chemicals. According to the IRAC report, approximately 18,786 pounds of combusted material were emitted into the air during the fire (TTI, 2023).

MDPH and MassDEP have collaborated with the Braintree Town Council, Mayor’s Office, and Health Department to support the town and its residents in understanding the potential health effects related to the fire. The purpose of this health consultation is to respond to requests from the Town of Braintree to address health-related concerns communicated by Braintree residents.

The MDPH/BCEH Environmental Toxicology Program, under a cooperative agreement with the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), routinely works with federal, state, and municipal officials to understand the presence and nature of health hazards in Massachusetts communities.[[2]](#footnote-3) Consistent with this role, MDPH/BCEH has reviewed environmental data provided by MassDEP, and the TetraTech LSP working under contract to Clean Harbors to evaluate the potential for health effects from exposure to fire-related contaminants. This letter health consultation has been prepared in cooperation and coordination with MassDEP and the Town of Braintree.

# Approach

MDPH/BCEH identified potential pathways of exposure to determine whether fire-related contaminants in air, soil, or water in the vicinity of the Clean Harbors Facility have the potential to cause adverse health effects for residents in the surrounding neighborhoods. Evaluating exposure pathways involves examining specific ways in which people might contact site-related contamination. Human exposure pathways are identified by examining environmental and human factors that might cause a person to be exposed to contaminants. A person can only be potentially harmed by contamination when there is both a source of contamination and an exposure pathway to that contaminant, such as ingesting, inhaling, or touching a chemical. If there is no pathway of exposure, there is no potential for harm.

The ATSDR Public Health Guidance Manual considers five elements when conducting a pathway evaluation: a contaminant source, environmental fate and transport, an exposure point, an exposure route, and a potentially exposed population (ATSDR, 2023a). When all five elements are present, the exposure pathway is considered “complete.” The identification of a complete exposure pathway does not mean that the exposure will result in harmful health effects. The likelihood of health effects depends on specific exposure conditions such as the exposure duration, the nature or toxicity of the contaminant, the magnitude or concentration of the contamination, and frequency or how often someone is exposed. Therefore, even if exposure has occurred, human health might not be affected.

To determine whether adverse health effects are possible, MDPH/BCEH compares contaminant concentrations to health-based screening values (SVs). SVs are concentrations in environmental media, such as soil, water, or air, that account for both toxicity and potential exposure. SVs represent a concentration that is expected to be safe for all individuals, including potentially sensitive or vulnerable individuals. Scientists that assess human health use a variety of health-based screening values that have been scientifically peer-reviewed or derived using scientifically peer-reviewed values and published by authoritative organizations, such as Federal and State Agencies. ATSDR develops SVs[[3]](#footnote-4) for a specified exposure period: exposures that are 14 days or less (acute), exposures that are from 15 to 364 days (intermediate), or those that last more than a year or longer (chronic). MDPH/BCEH prioritizes ATSDR SVs, which are typically the most health protective. If ATSDR SVs are not available, MDPH/BCEH considers US Environmental Protection Agency (EPA), World Health Organization (WHO), and state agency SVs and selects the most conservative (i.e., lowest or most health-protective) guideline.

If contaminant concentrations are less than SVs, adverse health effects are not likely to occur, and no further evaluation is required. If contaminant concentrations are greater than SVs, MDPH/BCEH conducts additional evaluation, considering site-specific factors such as how often or for how long individuals were exposed to the contaminant.

In addition to comparing contaminant concentrations to SVs, MDPH/BCEH also evaluates contaminants with no available screening values as well as other factors, such as community concerns, that warrant closer examination.

For this health consultation, MDPH/BCEH compared air monitoring and sampling data to SVs established by ATSDR, EPA, WHO, or states. Table 1 defines SVs used for this health consultation. MDPH/BCEH also considered potential exposure of resident’s soil in their yards, and to surface water in the Fore River.

For this health consultation, MDPH/BCEH considered the specific risks for sensitive people. With respect to inhalation exposure, sensitive people include those with existing respiratory or cardiovascular illness that could be exacerbated by exposure to airborne contaminants like particulate matter. People at certain life stages are also more likely to experience health effects following exposure to particulate matter, including pregnant people, young children, and people older than 65 years of age (ATSDR, 2022a). People of lower socioeconomic status are also more likely to be sensitive because of the cumulative impacts from poor environmental conditions, pre-existing health conditions, and social factors such as access to quality healthcare (ATSDR, 2022a, ATSDR, 2023b). This letter health consultation collectively refers to these categories as “sensitive” individuals or populations throughout this document.

MDPH/BCEH also considered the statewide Environmental Justice (EJ) Policy in this consultation.[[4]](#footnote-5) As outlined in the EJ Policy (EEA, 2021), communities should be screened to evaluate demographic characteristics, as well as existing health burden and the underlying vulnerability of the population to environmental contamination. The statewide EJ Policy identifies four environmentally related health indicators for understanding a community’s vulnerability to environmental exposures. The health criteria include heart attack hospitalization, childhood lead poisoning, low birth weight, and childhood asthma emergency department visits. (EEA, 2021). This information was collected to inform and prioritize any proposed actions, recognizing that people of color face higher exposure to air pollution and greater harm from these exposures that should be prioritized (ALA, 2023). For this health consultation, MDPH/BCEH considered strategies outlined in the EJ Policy and used the recommended data sources (e.g., household income, race/ethnicity, English language proficiency, hospitalization rates for myocardial infarction, childhood blood lead, low birth weight, and childhood asthma emergency department visits) to characterize the EJ populations surrounding the Clean Harbors site.

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| **Table 1. Screening Value Definitions** | | | |
| **Name** | **Abbreviation** | **Description** | **Reference** |
| **ATSDR Screening Values** | | | |
| Cancer Risk Evaluation Guideline | CREG | ATSDR SV based on carcinogenic effects. | ATSDR, 2022b |
| Environmental Media Evaluation Guide | EMEG | ATSDR SV based on non-carcinogenic effects, equivalent to ATSDR minimal risk levels (MRL). | ATSDR, 2022b |
| Reference Dose Media Evaluation Guides | RMEG | ATSDR SV based on non-carcinogenic effects, equivalent to EPA reference concentration (RfC). | ATSDR, 2022b |
| **Non-ATSDR Screening Values** | | | |
| Air Quality Guideline | AQG | WHO SV based on air contaminant concentrations designed to protect individuals, including sensitive populations, from experiencing adverse health effects. | WHO, 2021 |
| National Ambient Air Quality Standard | NAAQS | EPA standards established under the Clean Air Act, for six common air contaminants. NAAQS are designed to protect human health and include an adequate margin of safety. | US EPA, 2016 |
| Reference Exposure Level | REL | SV established by the California Environmental Protection Agency/Office of Environmental Health Hazard Assessment, as a concentration at which noncancer health effects are not anticipated, including for sensitive individuals. | CalEPA, 2008 |
| Reference Concentration | RfC | Concentration at which individuals, including sensitive individuals, can be exposed to on a daily basis that is not likely to cause adverse health effects. | MassDEP, 1995 |
| Regional Screening Levels | RSLs | EPA SV based on pollutant concentrations developed to protect the general population and sensitive individuals from experiencing adverse health effects from a lifetime of exposure. | US EPA, 2015c |

# Environmental data

To conduct our evaluation, MDPH/BCEH reviewed 1) field monitoring data collected in the immediate aftermath of the fire, 2) routine air quality data from MassDEP’s air monitoring station and air sensors, and 3) on-site samples of soil and surface water collected at the Clean Harbors facility after the fire. These data and their application in this assessment are described below.

In addition to the onsite soil data, MDPH/BCEH also reviewed the air screening modeling report prepared by GHD, on behalf of Tetra Tech. The purpose of this modeling was to estimate the concentrations of fire-related contaminants in the air and in soil from the deposition of soot on residential properties (GHD, 2023). The modeling approach in the report suggests that the levels of fire-related contaminants in the air and soil would not lead to an increased health risk. As the model uses simplified assumptions consistent with a screening assessment, the data are not of sufficient quality to be applied to a health consultation that relies on measured levels of contamination. This conclusion was supported by discussions with air modeling experts at MassDEP. As such, the model results are not further discussed in this consultation for evaluating the potential exposure and health effects related to the Clean Harbors fire.

## 3.1. Initial Field Monitoring Data

Shortly after the fire started, MassDEP and the responding HazMat team used hand-held instruments (photoionization detectors and 4-gas meters) to measure air concentrations of total volatile organic chemicals, oxygen, carbon monoxide, hydrogen sulfide, and methane in the immediate vicinity of the Clean Harbors facility (MassDEP, 2023a).

Data collected using hand-held instruments are useful for evaluating air quality for first responders. For example, these instruments help identify the level of personal protective equipment that should be used and if initial conditions represent an immediately dangerous condition for individuals responding to the fire. However, because the data are not chemical specific, the results are not used quantitatively to inform an assessment of long-term health risks consistent with the scope of this health consultation.

## 3.2 Routine Air Quality Data

MassDEP operates a network of air quality monitoring stations in communities across Massachusetts, to collect information about ambient air quality and to determine whether air quality complies with the National Ambient Air Quality Standards for carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide (MassDEP, 2022). At several monitors in the Boston metropolitan area the monitoring stations also measure toxic air pollutants, such as benzene and formaldehyde. These toxic air pollutants are part of a class of chemicals called volatile organic chemicals (VOCs).

MassDEP’s air quality monitoring network includes a monitoring station in Weymouth, located on Monatiquot Street. The Weymouth monitoring station collects information for nitrogen dioxide, ozone, and particulate matter, as well as toxic air pollutants. In addition to the Weymouth air monitoring station, there are also eight PurpleAir sensors near the Clean Harbors facility, which measure particulate matter. The PurpleAir sensors include one operated by MassDEP, at the same location as the Weymouth monitoring station, and seven community operated PurpleAir sensors. Figure 1 shows the location of the Weymouth monitoring station and the PurpleAir sensors.

The Weymouth air monitoring station and eight PurpleAir sensors routinely measure air quality in the Fore River Basin area surrounding the Clean Harbors Facility. Particulate matter, ozone, and nitrogen dioxide (NO2) are monitored continuously at the MassDEP monitoring station. The PurpleAir sensors also continuously monitor particulate matter. MassDEP collects 24-hour air canister samples at the Weymouth monitoring station every six days, starting at midnight on the day of collection, for evaluation of 63 VOCs.

MassDEP provided air quality summary data for particulate matter,reported at 10-minute, 1-hour, and 24-hour averaging times; and ozone and NO2 reported at 1-hour averaging times, for data collected on 2/15/23 through 2/18/23 from the Weymouth station and the PurpleAir sensors (MassDEP, 2023a). Particulate matter data for one of the eight PurpleAir sensors, at the Glenrose location, were not available for the time of the fire; data were not available until 12 PM on 2/17/23. MassDEP also provided VOC data collected from the Weymouth station on 2/5/23, 2/11/23, and 2/17/23 (MassDEP, 2023a).

**Figure 1: Air Monitoring Station and Air Sensor Locations**

Map

Description automatically generated

## 3.3 Onsite Soil and Surface Water Data

Following the fire, Clean Harbors and Tetra Tech collected soil and surface water samples at the Clean Harbors facility. Although MDPH/BCEH did not evaluate these data quantitatively to assess health effects, MDPH/BCEH reviewed the data to consider potential exposure to fire-related contaminants in soil on residential yards and in the Fore River.

### 3.3.1 Soil Data

Clean Harbors and Tetra Tech collected soil samples at the Clean Harbors facility at three areas where there was accessible soil, including the truck loading/unloading area, the lunch building area, and the berm area on the northeast side of the property, close to the border with the CITGO property. Soil samples were analyzed for the standard suite of chemicals found at hazardous waste sites, including volatile organic chemicals, semi-volatile organic chemicals, petroleum hydrocarbons, and metals (TTI, 2023).

Soil samples collected in the loading/unloading area and the lunch building area were collected after contaminated soil was removed, and thus do not provide information about potential impacts to soil from the fire. Samples in the berm area were collected both before and after contaminated soil was removed and can thus be used to inform estimates of on-site soil contamination from the fire. Soil samples collected by Tetra Tech prior to removal of contaminated soil include samples with visible evidence of soot from the fire, and samples collected without evidence of fire-related impacts.

### 3.3.2 Surface Water Data

Neither Clean Harbors nor Tetra Tech collected samples of surface water from the Fore River. However, at approximately 4 PM on 2/17/23, Clean Harbors collected a sample of firefighting water that had pooled on the Clean Harbors property. This water sample was analyzed for the same suite of chemicals that were analyzed in soil (TTI, 2023). Although concentrations of contaminants in the firefighting water are not representative of what individuals could be exposed to in the Fore River, evaluating these data can help understand potential impacts from firefighting water that may have been released to the Fore River.

# Evaluation of Exposure TO CONTAMINANTS IN AIR

To evaluate the potential for health effects resulting from breathing fire-related contaminants, MDPH/BCEH considered air quality data provided by MassDEP.

## 4.1 Particulate MatterData

Particulate matter is a mixture of solid particles and liquid droplets, which can be made up of hundreds of different chemicals. Particulate matter also consists of different sizes, ranging from ultrafine to course (US EPA, 2022a). The particulate matter measured at the Weymouth air monitor and the PurpleAir sensors is PM2.5, whichis defined as “fine” particulate matter.[[5]](#footnote-6) PM2.5 is readily inhaled, can enter the lungs and the bloodstream, and can pose a risk to human health (US EPA, 2018d).

For assessing the potential for harmful levels of exposure, ATSDR recommends using the WHO Air Quality Guideline (AQG) of 15 micrograms per cubic meter (μg/m3) to evaluate PM2.5 exposure averaged over a 24-hour period because it is the most health-protective screening value available (ATSDR, 2022a). We also compared PM2.5 environmental data to the EPA 24-hour PM2.5 National Ambient Air Quality Standard (NAAQS) of 35 μg/m3. Based on this evaluation there was one exceedance of the AQG and there were no exceedances of the NAAQS (see Table 2).

MDPH/BCEH used the noon-to-noon period for the 24-hour average. This value represents the maximum average for most stations, as compared to other 24-hour periods during the time of the fire. The MassDEP PurpleAir sensor measured a PM2.5 24-hour average that slightly exceeds the WHO AQG[[6]](#footnote-7) and the Idlewell PurpleAir sensor measured a level equal to the WHO AQG.

In addition to considering exposure to a 24-hour average level of PM2.5, we also considered exposure to a 1-hour maximum level of PM2.5. As there are no 1-hour criteria (such as WHO AQGs or EPA NAAQS) for evaluating exposure that occurs for a duration of less than 24 hours, we compared the hourly exposure data to the 24-hour standard, which is a health-protective approach (ATSDR 2022a). It is important to note that exposure to 1-hour PM2.5 levels that are greater than the 24-hour standard does not necessarily mean that adverse health effects would occur.

Table 2 presents the 24-hour averages, the AQS guideline and NAAQS, and the maximum 1-hour average concentrations, for the seven PurpleAir sensors, and MassDEP’s monitor. As shown in Table 2, six of the PurpleAir sensors measured 1-hour average PM2.5 levels greater than the 24-hour AQG and NAAQS.

As shown in Figure 2, *maximum hourly* PM2.5 concentrations occurred shortly after the fire started, between 11 PM on 2/16/23 and 1 AM on 2/17/23, and were greater than the 24-hour WHO AQG at all PurpleAir sensors (except the Skyline sensor) and at DEP’s monitoring station (DEP T640). *Hourly* PM2.5 concentrations remained above the WHO AQG at the Baxter, Claremont, King’s Cove, Idlewell, Evans, and MassDEP PurpleAir sensors, until 12:00 PM on 2/17/23.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 2. PM2.5 Screening Evaluation** | | | | | | | | | | |
|  | | **PurpleAir Sensors\*\*** | | | | | | | | **Monitoring Station** |
|  | **Baxter** | **Claremont** | | **King’s Cove** | **Skyline** | **Idlewell** | **Evans** | **DEP** | **DEP T640** |
| **24 hr Average Concentration\*** | | 12 | 13 | 13 | | 8 | **15** | 12 | **16** | 11 |
| **WHO AQG (24-hour)** | | 15 | | | | | | | | |
| **EPA NAAQS (24-hour)** | | 35 | | | | | | | | |
| **Max. (1-hour) Concentration** | | **22** | **22** | **21** | | 15 | **45** | **21** | **40** | **28** |
| **Units: µg/m3**  \*Calculated using 10-minute interval data from 2/16 noon to 2/17 noon, rounded to the nearest whole number.  \*\*Glenrose PurpleAir sensor data were not available during the time of the fire. | | | | | | | | | | |

**Figure 2: Comparison of PM2.5 Data Collected During the Fire.**



*Note: The data that are plotted are averaged over 1-hour intervals and are shown relative to the WHO Air Quality Guideline (AQG) that is protective of an average exposure over 24 hours (red dashed line). The shaded region of the plot indicates the 4- hour period of the fire.*

As exposure to PM2.5 levels increase above the AQG, the potential to cause acute health effects in sensitive individuals also increases, even for exposures of less than 24 hours (ATSDR, 2022a). Sensitive individuals, such as individuals with cardiovascular or respiratory illnesses, older adults, children, and people of lower socioeconomic status, may have had a slightly increased risk of exacerbation of respiratory and cardiovascular illnesses and/or increased risk of respiratory symptoms from short-term exposure to PM2.5 between 11 PM on 2/16 to 12 PM on 2/17. MDPH/BCEH expects that these exacerbations would be transient (i.e., during the time of elevated exposure), and would resolve once pollutant levels were no longer elevated. Based on our understanding of the scientific literature for particulate matter, this type of brief (acute) exposure is not expected to cause long-term health effects, including for sensitive subgroups. Individuals who were indoors during the fire, with their windows closed, likely would have been exposed to lower PM2.5 concentrations than those measured at the sensor locations, which would have reduced their likelihood of experiencing short-term health effects associated with the fire. People without any underlying sensitivities to PM are not likely to have been exposed to harmful levels of PM released from the fire.

## 4.2 VOC Data

VOCs can be released into the air and remain airborne in events such as fires. VOCs occur naturally from vegetation and forest fires and from human sources such as fossil fuel combustion, manufacturing, and commercial and household products (US EPA, 2018c). Some VOCs have been linked to various health effects (US EPA, 2019a).

To assess VOC exposure from the fire, MDPH/BCEH compared VOC air sampling data collected at the Weymouth air monitoring station on 2/17/23 to acute Environmental Media Evaluation Guide/Minimal Risk Level (EMEG/MRL) established by ATSDR. Because acute SVs were not available for all VOCs analyzed, VOC concentrations were compared to chronic SVs in the absence of acute SVs. For chronic exposure, ATSDR Cancer Risk Evaluation Guides (CREG), Chronic EMEG/MRLs, or Reference Dose Media Evaluation Guide/Reference Concentrations (RMEG/RfC) were used for comparison. In the absence of ATSDR SVs, MDPH/BCEH compared VOC concentrations to EPA Regional Screening Levels (RSLs), if available, or to MassDEP Reference Concentrations (RfCs). Use of chronic SVs to evaluate acute exposures provides an extra level of assurance that exposures below the SV would not result in harm.

Table 3 presents the results of VOC air sampling data, the respective SV, whether the SV was exceeded. Also shown in Table 3 is the Margin of Exposure (MOE). The MOE is a quantitative comparison of the SV relative to the VOC concentration that is the ratio of the SV to the VOC concentration. The greater the ratio (or margin), the less likely there is for potential human health effects associated with exposure to the VOC. Of the 63 VOCs, 34 were detected at the Weymouth monitoring station on 2/17/23. Of these, 27 had SVs available for comparison. For these 27 VOCs, concentrations measured at the MassDEP monitoring station were all less than their respective SVs, with MOEs ranging from 9 to more than 1.5 million. This analysis suggests that it is unlikely that individuals were exposed to harmful levels of contamination from breathing VOCs during and immediately after the fire.

| **Table 3. VOC Screening Evaluation** | | | | | | | | | |
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| **Chemical Name** | **DEP**  **Monitoring Station  (ppb)** | | **VOC Screening Values (SVs)** | | | | | | |
| **Value**  **(ppb)** | **Description** | **Duration** | **Is SV Exceeded?** | **Margin of Exposure** | |
| **Detected Chemicals with Screening Values** | | | | | | | | | |
| 1,2,4-trimethylbenzene | 0.023 |  | 12.8 | EPA RSL2 | Chronic | No | 558 | |
| 1,2-dichloroethane | 0.015 |  | 300 | ATSDR EMEG | Acute | No | 20125 | |
| 1,3-butadiene | 0.014 |  | 0.95 | EPA RSL2 | Chronic | No | 67 | |
| acetaldehyde1 | 0.56 |  | 5.2 | EPA RSL2 | Chronic | No | 9 | |
| acetone1 | 1.76 |  | 8,000 | ATSDR EMEG | Acute | No | 4545 | |
| acetonitrile | 0.145 |  | 37.6 | EPA RSL2 | Chronic | No | 259 | |
| acrolein | 0.092 |  | 3 | ATSDR EMEG | Acute | No | 32 | |
| benzene | 0.152 |  | 9 | ATSDR EMEG | Acute | No | 59 | |
| carbon tetrachloride | 0.085 |  | 30 | ATSDR EMEG | Intermediate | No | 352 | |
| chloroethane | 0.009 |  | 15,000 | ATSDR EMEG | Acute | No | 1662098 | |
| chloroform | 0.033 |  | 100 | ATSDR EMEG | Acute | No | 3055 | |
| chloromethane | 0.626 |  | 500 | ATSDR EMEG | Acute | No | 798 | |
| cyclohexane | 0.057 |  | 1,700 | ATSDR RMEG | Chronic | No | 29808 | |
| dichloromethane | 0.338 |  | 600 | ATSDR EMEG | Acute | No | 1776 | |
| ethylbenzene | 0.032 |  | 5,000 | ATSDR EMEG | Acute | No | 155423 | |
| ethylene oxide | 0.066 |  | 400 | ATSDR EMEG | Acute | No | 6089 | |
| formaldehyde1 | 1.32 |  | 40 | ATSDR EMEG | Acute | No | 30 | |
| heptane | 0.054 |  | 90 | EPA RSL2 | Chronic | No | 1674 | |
| hexane | 0.321 |  | 200 | ATSDR RMEG | Chronic | No | 622 | |
| m&p-xylenes | 0.097 |  | 2000 | ATSDR EMEG | Acute | No | 20651 | |
| methyl ethyl ketone | 0.299 |  | 1,000 | ATSDR EMEG | Acute | No | 3344 | |
| o-xylene | 0.034 |  | 2000 | ATSDR EMEG | Acute | No | 59501 | |
| octane | 0.036 |  | 142 | MassDEP RfC2,3 | Chronic | No | 3950 | |
| pentane | 0.457 |  | 240 | EPA RSL2 | Chronic | No | 525 | |
| styrene | 0.010 |  | 5,000 | ATSDR EMEG | Acute | No | 486555 | |
| tetrachloroethylene | 0.014 |  | 6 | ATSDR EMEG | Acute | No | 440 | |
| toluene | 0.191 |  | 2,000 | ATSDR EMEG | Acute | No | 10471 | |
| **Detected Chemicals without Screening Values** | | | | | | | | | |
| butane | 3.468 |  |  |  |  |  |  | |
| 1-butene | 7.594 |  |  |  |  |  |  | |
| 2,2,4-trimethylpentane | 0.110 |  |  |  |  |  |  | |
| alpha-pinene | 0.016 |  |  |  |  |  |  | |
| bromofluorobenzene | 105.2 |  |  |  |  |  |  | |
| Freon-12 | 0.504 |  |  |  |  |  |  | |
| trichlorofluoromethane | 0.213 |  |  |  |  |  |  | |
| **Chemicals Below Method Detection Limits or Method Reporting Limits** | | | | | | | | | |
| 1,1-dichloroethane | 0.001 | <MDL | 0.44 | EPA RSL2 | Chronic | No | 305 | |
| 1,1-dichloroethene | 0.000 | <MDL | 1 | ATSDR EMEG | Chronic | No |  | |
| 1,1,1-trichloroethane | 0.002 | <MDL | 1,000 | ATSDR EMEG | Acute | No | 585179 | |
| 1,1,1,2-tetrachloroethane | 0.000 | <MDL | 0.02 | ATSDR CREG | Chronic | No |  | |
| 1,1,2-trichloroethane | 0.000 | <MDL | 30 | ATSDR EMEG | Acute | No | 92822 | |
| 1,1,2,2-tetrachloroethane | 0.000 | <MDL | 0.0070 | EPA RSL2 | Chronic | No |  | |
| 1,2-dibromoethane | 0.000 | <MDL | 0.00022 | ATSDR CREG | Chronic | No |  | |
| 1,2-dichloropropane | 0.002 | <MDL | 20 | ATSDR EMEG | Acute | No | 8862 | |
| 1,2,4-trichlorobenzene | 0.000 | <MDL | 0.28 | EPA RSL2 | Chronic |  |  | |
| 1,3,5-trimethylbenzene | 0.008 | <MDL | 12.8 | EPA RSL2 | Chronic | No | 5728339 | |
| acrylonitrile | 0.000 | <MDL | 100 | ATSDR EMEG | Acute | No |  | |
| bromoform | 0.003 | <MDL | 0.88 | ATSDR CREG | Chronic | No | 308 | |
| bromomethane | 0.009 | <MDL | 1 | ATSDR EMEG | Chronic | No | 107 | |
| chlorobenzene | 0.001 | <MDL | 11.6 | EPA RSL2 | Chronic | No | 8722 | |
| methyl isobutyl ketone | 0.004 | <MDL | 730 | ATSDR RMEG | Chronic | No | 187630 | |
| methyl-t-butyl ether | 0.000 | <MDL | 2,000 | ATSDR EMEG | Acute | No | 1629 | |
| naphthalene | 0.007 | <MDL | 0.7 | ATSDR EMEG | Chronic | No | 101 | |
| o-dichlorobenzene | 0.000 | <MDL | 34.2 | EPA RSL2 | Chronic |  |  | |
| p-dichlorobenzene | 0.003 | <MDL | 2,000 | ATSDR EMEG | Acute | No | 778210 | |
| propionaldehyde1 | <MRL | <MRL | 3.5 | EPA RSL2 | Chronic |  |  | |
| trans-1,2-dichloroethene | 0.002 | <MDL | 200 | ATSDR EMEG | Acute | No | 94268 | |
| trichloroethylene | 0.007 | <MDL | 0.4 | EPA RSL2 | Chronic | No | 59 | |
| vinyl chloride | 0.002 | <MDL | 500 | ATSDR EMEG | Acute | No | 225683 | |
| benzaldehyde1 | <MRL | <MRL |  |  |  |  |  | |
| cis-1,3-dichloropropene | 0.000 | <MDL |  |  |  |  |  | |
| m-dichlorobenzene | 0.000 | <MDL |  |  |  |  |  | |
| n-butylbenzene | 0.002 | <MDL |  |  |  |  |  | |
| p-isopropyltoluene | 0.005 | <MDL |  |  |  |  |  | |
| trans-1,3-dichloropropene | 0.000 | <MDL |  |  |  |  |  | |
| **Notes:** |  |  |  |  |  |  |  | |
| VOCs analyzed by Rhode Island State Health Laboratories by VOCs by GCFID and GCMS (i.e., modified EPA Method TO-15) | | | | | | | | | |
| 1. VOC carbonyl compounds analyzed at MassDEP Division of Environmental Laboratory Sciences by modified EPA Method TO-11A | | | | | | | | | |
| 2. Converted from µg/m3 to ppb [ppb=(concentration in µg/m3 x 24.4)/contaminant molecular weight in grams/mole]. | | | | | | | | | |
| 3. Based on toxicity of hexane | | | | | | | | | |
| NA = Not Available |  |  |  |  |  |  |  | |
| <MRL = Less than the method reporting limit as reported by MassDEP. | | | | | | | | | |
| <MDL = less than Method Detection Limit as Reported by RI State Health Laboratories | | | | | | | |  | |
|  | | |  |  |  |  |  | |
| CREG = ATSDR Cancer Risk Evaluation Guides | | |  |  |  |  |  | |
| EMEG = ATSDR Environmental Media Evaluation Guides | | | | | | | | | |
| RMEG = Reference Dose Environmental Media Evaluation Guides | | | | | | | | | |
| NC = No comparison |  |  |  |  |  |  |  | |
| EPA RSL = EPA Regional Screening values for Chemical Contaminants at Superfund Sites, non-cancer chronic (THQ=1)  MOE = A ratio of the screening value to the VOC concentration. | | | | | | | | | |

Seven VOCs detected at the Weymouth monitoring station on 2/17/23 did not have screening values and therefore could not be evaluated quantitatively relative to a SV. Table 4 shows concentrations of these VOCs measured on 2/5/23, 2/11/23 and 2/17/23. For Freon-12, bromofluorobenzene, and trichloromethane, concentrations observed during and after the fire were comparable to concentrations observed before the fire. As such, these VOCs are likely not related to the fire. Concentrations of 1-butene, 2,2,4-trimethylpentane, alpha-pinene, and butane, observed during and immediately after the fire were greater than concentrations observed before the fire. As such, these VOCs may have been released during the fire.

|  |  |  |  |
| --- | --- | --- | --- |
| **Table 4 - Detected VOCs Without SVs** | | | |
|  | **2/5/2023** | **2/11/2023** | **2/17/2023** |
| **VOC** | **ppb** | **ppb** | **ppb** |
| 1-butene | 3.024 | 3.247 | 7.594 |
| 2,2,4-trimethylpentane | 0.073 | 0.050 | 0.110 |
| alpha-pinene | 0.007\* | 0.007\* | 0.016 |
| butane | 2.720 | 1.047 | 3.468 |
| Freon-12 | 0.516 | 0.487 | 0.504 |
| bromofluorobenzene | 106.4 | 113.4 | 105.2 |
| trichlorofluoromethane | 0.216 | 0.206 | 0.213 |
| \* Value less than Method Detection Limit | | | |

For 2,2,4-trimethylpentane, alpha-pinene, and butane VOCs, effects following acute exposure include confusion, dizziness, headache, nausea, vomiting, and irritation of the nose, throat, and lung (NJ Health, 2008. 2017; NIOSH, 2014). These effects are reversible once individuals are no longer exposed to the VOC. Moreover, concentrations of 2,2,4-trimethylpentane, alpha-pinene, and butane measured during the fire are much less than concentrations allowed in the workplace for continuous exposure during an 8-hour workday: the allowable workplace concentrations are 300,000 ppb, 20,000 ppb, and 800,000 ppb, respectively. We recognize that allowable workplace concentrations are not intended to protect the general population or sensitive individuals. However, given that the allowable workplace concentrations are more than 200,000 times greater than levels measured at MassDEP’s air monitoring station, it is not likely that individuals would have been harmed from exposure to these VOCs during the fire.

We did not identify allowable workplace concentrations or other allowable concentrations for 1-butene. A review of 1-butene toxicity by the Organization for Economic Cooperation and Development concluded that 1-butene is not highly toxic. In various studies in laboratory animals, adverse health effects were observed only at concentrations greater than 5,000,000 ppb (OECD, 2004), which is more than 1 million times greater than the level measured at the air monitoring station. Although humans could be more sensitive than animals to 1-butene, differences in sensitivity between animals and humans is typically about 10-fold, or less. Therefore, as with 2,2,4-trimethylpentane, alpha-pinene, and butane, it is not likely that individuals would have been harmed from exposure to 1-butene during the fire.

## 4.3 Ozone and NO2 Data

Ozone is a colorless gas that occurs naturally in the stratosphere. Ozone can also form at ground level when VOCs and nitrogen oxides react in sunlight (US EPA, 2018b). Breathing ozone can be harmful to human health, especially for sensitive populations such as children, people with asthma, and older adults (US EPA, 2015b). NO2 is a gas that primarily forms from the combustion of carbon-rich materials such as fossil fuel. Breathing NO2 can cause respiratory health effects, especially for sensitive populations such as individuals with asthma (US EPA, 2018a).

Ozone and NO2 concentrations were compared to the most conservative SVs among EPA’s NAAQS, California’s Office of Environmental Health Hazard Assessment (OEHHA) Acute Reference Exposure Level, or WHO’s AQG. One, eight, or twenty-four hour average concentrations of ozone and NO2 were calculated appropriately, for comparison with the selected health-based SV. There are no ATSDR SVs for ozone or NO2.

As shown in Table 5, the maximum 1-hour concentrations of ozone (50.6 ppb) and NO2 (26.0 ppb) at the MassDEP monitoring station are both less than their respective SVs of 91.7 ppb (CA OEHHA) and 100 ppb (NAAQS). The ozone 8-hour maximum (39.1 ppb) is below its SVs of 50.9 ppb (WHO AQG). The maximum 24-hour concentration for NO2 (7.0 ppb) is below the 24-hour WHO AQG. Health effects would not be expected from acute inhalation exposure to levels of ozone or NO2 detected by the DEP T640 monitor during and after the fire. It should be noted that NO2 and ozone levels prior to the fire were greater than levels measured during and after the fire, indicating that the fire did not contribute to a notable increase in NO2 and ozone levels.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table 5: Ozone and NO2 Screening Evaluation** | | | |  |
| **Contaminant** | **Averaging Time** | **Value (ppb)** | **Screening Value (ppb)** | **Description of Screening Value** |
| **Ozone (O3)** | **Maximum – 1 hour1** | **50.6** | 91.7 | CA OEHHA REL (1 hour)4 |
| **Maximum - 8 hour2** | **39.1** | 50.9 | WHO AQG (8 hour) 3,4 |
| **Nitrogen Dioxide (NO2)** | **Maximum- 1 hour1** | **26.0** | 100 | EPA NAAQS (1 hour)6 |
| **Maximum - 24 hour3** | **7.0** | 13 | WHO AQG (24 hour)4,5 |
| **Notes:** |  |  |  |  |
| Data collected at the MassDEP Air Monitoring Station, DEPT640, 2/16/23 - 2/18/23 | | | | |
| 1. O3 1 hour maximum occurred at 3 AM on 2/18; NO2 1 hour maximum occurred at 12 AM on 2/17  2. For 8-hour period of 3 AM to 11 AM on 2/18 | | | | |
| 3. For 24-hour period of 10 PM on 2/16 to 10 PM on 2/17 | | | | |
| 4. converted from µg/m3 to ppb [ppb = (concentration in µg/m3 x 24.4)/contaminant molecular weight in grams/mole].  molecular weights: ozone = 48 grams/mole, nitrogen dioxide = 46.0055 grams/mole | | | | |
| 5. WHO AQG of 50.9 ppb for Ozone is lower than the NAAQS value of 70 ppb for the same averaging time (8 hours) | | | | |
| 6. NAAQS of 100 ppb for nitrogen dioxide is lower than the CA OEHHA REL of 250 ppb for the same averaging time (1 hour) | | | | |

## 4.4 Data limitations

The available air data for this health consultation have limitations, including the accuracy of the PurpleAir sensors, and the lack of peak VOC concentrations.

According to the EPA and the Air Quality Sensor Performance Evaluation Center, PurpleAir sensors have moderate to good accuracy while monitoring stations such as MassDEP’s T640 monitor, which is a laboratory-grade air monitor, has greater precision and accuracy than PurpleAir sensors (AQSPEC, 2023). PurpleAir sensor data are most valuable for assessing changes in air quality by comparing environmental data to other PurpleAir sensors. However, these sensors’ exact values for pollutants are not considered to be as accurate and precise as stationary monitors (US EPA, 2022b) and generally overestimate PM2.5 concentrations (Barkjohn et al., 2022). This was observed in the data from the MassDEP station, where there is both a PurpleAir sensor and the laboratory grade monitor. For all PM2.5 data collected at the same time at the MassDEP location, the PurpleAir sensor data were greater than the data from the MassDEP’s stationary monitor. Given this limitation, the data collected from the PurpleAir sensors described in this health consultation most likely overestimated PM2.5 levels, and correspondingly the potential risks for experiencing health effects from inhalation of PM2.5 related to the fire.

Another data limitation is that the 24-hour average VOC concentrations measured at MassDEP’s stationary monitor might not have captured peak VOC concentrations potentially related to the Clean Harbors Fire. As shown in Table 3, SVs were at least nine times greater than the 24-hour average VOC concentrations, as indicated by the Margin of Exposure (which is a ratio of the SV divided by the VOC concentration). Thus, even if peak VOC concentrations were 9 times greater than the 24-hour average concentrations, they would still be less than or equal to health-protective SVs.

# EVALUATION OF EXPOSURE TO SOIL AND WATER

There are no environmental data for soil in residential yards, or for surface water in the Fore River, in the aftermath of the fire. As such MPDH/BCEH did not quantitatively evaluate exposure to soil or surface water. However, data for soil and surface water collected at the Clean Harbors facility provides information to evaluate qualitatively potential exposure to fire-related contaminants in residential soil and the Fore River.

## 5.1 Soil

To assess potential impacts of the fire on residential soil, MDPH/BCEH reviewed results for soil samples collected on 3/29/23 by Tetra Tech, along the northeast side of the Clean Harbors facility, near the border with the CITGO property. This sampling includes: four surface soil samples collected from areas with visible evidence of soot; four soil samples collected from the underlying soil after soot-impacted soil was removed; and two surface soil samples collected from an area where there was no visible evidence of the fire (TTI, 2023).

Importantly, except for certain petroleum-based chemicals, polychlorinated biphenyl compounds (PCBs) and dioxins/furans, concentrations of contaminants in surface soil visibly impacted by soot were less than MassDEP’s criteria for determining when soil represents a potential health hazard in residential yards. [[7]](#footnote-8) Both PCBs and dioxins/furans were also observed in the underlying soil at concentrations comparable to the surface soil. Hence, these contaminants may have been present in the soil prior to the fire. The petroleum-based chemicals may have originated from the trailers, and then washed over in the firefighting water to where the soil samples were collected. For soil not visibly impacted by the fire, lead was the only contaminant with a concentration greater than MassDEP’s soil criteria. As with the PCBs and dioxins/furans, lead was also observed in the underlying soil at concentrations comparable to the surface soil, suggesting lead may have been present in the soil prior to the fire.

For some contaminants, primarily solvents, concentrations in surface soil visibly impacted by soot from the fire were greater than concentrations in the underlying soil after the soot-impacted soil was removed. As with the petroleum-based chemicals, these contaminants may have similarly washed over in the firefighting water from the trailers. In contrast, contaminant concentrations in surface soil not visibly impacted by the fire were generally comparable to concentrations in underlying soil.

The soil samples suggest that emissions from the fire did not result in contamination that would be a health concern. If the fire impacted residential soils in a similar manner, it is unlikely that the incident resulted in any residential contamination of concern.

## 5.2 Water

### 5.2.1 Fore River Surface Water

According to the IRAC report, approximately 330,000 gallons of water were used to extinguish the fire (TTI, 2023). The firefighting water was collected into storage tanks, partially treated on-site, and stored for eventual off-site disposition (TTI, 2023). Most runoff water was collected, but some firefighting water might have migrated onto the adjacent Citgo property. According to the IRAC report, the firefighting water was contained at both the Citgo property and the Clean Harbors facility. The IRAC report also describes a cloudy, white substance that was observed on 2/17/23 near the Hayward Creek outfall to the Fore River (TTI, 2023). It could not be determined if the cloudy, white substance was related to the fire because surface water samples were not immediately collected when the substance was observed, and the discharge was no longer visible by 2/19/23. For these reasons, it is not possible to evaluate the white substance with respect to exposure and potential health implications.

Although surface water samples were not collected from the Fore River, Clean Harbors measured contaminant concentrations in firefighting water that had collected on the Clean Harbors property.

Twenty-nine chemicals were measured, and concentrations of 11 chemicals were greater than MassDEP’s standard for screening groundwater that is used as a source of drinking water.[[8]](#footnote-9) These standards assume individuals ingest 1-2 liters of water/day[[9]](#footnote-10), for 365 days/year (MassDEP, 2017). Considering that 1) the amount of water ingested while engaging in recreational activities along the Fore River is expected to be much less than 1-2 liters; 2) exposure would likely occur less often than 365 days/year; and 3) any firefighting water potentially released to the Fore River would be diluted and eventually flushed out of the river; it is not likely that the Clean Harbors fire resulted in contaminant concentrations in the Fore River that would be a health concern.

### 5.2.2 Drinking Water

The Town of Braintree receives their drinking water from the Great Pond Reservoir System (BWS, 2022) that is approximately 4.5 miles from the location of the fire at the Clean Harbors facility (Google Maps, 2023). At this distance, it is possible that some emissions from the fire may have reached the Great Pond Reservoir System. Because turbidity[[10]](#footnote-11) of public water systems is monitored daily (MassDEP, 2019), significant increases in particulate matter related to emissions from the fire would have been detected. As such, customers would have been notified if there were health concerns related to turbidity.

### 5.2.3 Groundwater

The Clean Harbors site is unlikely to impact any groundwater. For example, the site falls under groundwater category GW-3: it is not located within a productive aquifer, Zone 2[[11]](#footnote-12), interim wellhead protection area, or other groundwater drinking resource areas. Moreover, as determined by soil investigations discussed in the IRAC report, contaminated firefighting water did not penetrate soil to a depth where it would impact groundwater (TTI, 2023).

# Discussion

There is robust evidence indicating that people of color and low-income people have a greater risk of potential exposure to PM2.5, and a greater potential to suffer from adverse health effects from the exposure (US EPA, 2019b, 2022c). MDPH/BCEH relied on the Massachusetts specific data to identify people that may be disproportionately burdened by poor air quality (MEPHT, 2023).

The Clean Harbors facility is in an industrial area of Braintree with residential communities to the south and west of the facility. Weymouth is across the Fore River to the northeast, and southeast and Quincy is located to the north of the facility. Demographic data for Braintree, Quincy, and Weymouth are described in Table 6.

|  |  |  |  |
| --- | --- | --- | --- |
| **Table 6: Demographic Data for Braintree, Quincy and Weymouth1** | | | |
|  | **Braintree** | **Quincy** | **Weymouth** |
| Total Population | 35,747 | 92,254 | 53,749 |
| White | 81% | 61% | 84% |
| Black or African American | 3% | 5% | 6% |
| Asian | 14% | 30% | 7% |
| Other | 3% | 3% | 3% |
| Hispanic or Latino (of Any Race) | 2% | 3% | 4% |
| Populations 65 Years and Older | 17% | 17% | 18% |
| Populations 19 Years or Younger | 24% | 16% | 20% |
| Population with No High School Degree | 6% | 12% | 6% |
| Households with Income Base Less than $60,000 | 31% | 30% | 34% |
| Population Speaking English Not Well or Not at All | 4% | 12% | 3% |

1Data from Massachusetts Environmental Public Health Tracking (MEPHT, 2023).

An overview of the baseline health conditions for these communities was summarized in a 2019 Health Impact Assessment (HIA) for a Proposed Natural Gas Compressor Station in the Fore River Basin area of Weymouth, MA, across the river to the northeast of the Clean Harbors site. Findings of this report indicate elevated rates of hospitalizations for chronic obstructive pulmonary disease (COPD), cardiac conditions (heart attack hospitalizations), and certain types of cancer for Braintree, Quincy, and Weymouth when compared to Massachusetts state averages. Weymouth also had elevated rates of pediatric asthma and asthma hospitalizations. (MDPH/MassDEP/MAPC 2019).

A review of currently available data for communities near the Clean Harbors site shows Braintree, Quincy, and Weymouth each with neighborhoods[[12]](#footnote-13) meeting one or more of the EJ policy criteria for income, English isolation, and community of color. This equates to 37% of the Braintree population, 82% of the Quincy population, and 32% of the Weymouth population being defined as living in EJ neighborhoods. The MDPH Community Profiles show that 4%, 12%, and 3% of the population in Braintree, Quincy, and Weymouth (respectively) do not speak English well or not at all, and most of the population in these municipalities are proficient in English (MEPHT 2023b).

When evaluating EJ data more closely within these municipalities, most neighborhoods (US Census block groups) near the site speak predominantly English, consistent with what is seen at the community level. However, there are three neighborhoods within two miles of the site that meet English isolation EJ criteria. The Braintree neighborhood where the Clean Harbors site is located, meets two EJ criteria, community of color and English Isolation, with 25% of the residents not fluent in English. Two other neighborhoods further north and northwest of the site in Quincy, meet three EJ criteria, for communities of color, income, and English isolation (29% and 33%, respectively).

In addition to EJ criteria, MDPH/BCEH further evaluated these municipalities to understand the community’s general health vulnerability to environmental exposures. Braintree and Quincy do not meet any of the vulnerable health EJ criteria for heart attack hospitalization, childhood lead exposure, low birth weight, or childhood asthma emergency department visits, while Weymouth meets the vulnerable health EJ criterion for heart attack[[13]](#footnote-14). Heart attack hospitalization is a criterion used to identify vulnerable health EJ populations because exposure to air pollution can increase the risk for heart attack and other forms of heart disease (MEPHT, 2023).

This EJ Evaluation, along with the findings of the HIA, characterize the vulnerability of the communities surrounding the Fore River area. Sensitive people from these vulnerable communities are at increased risk of adverse health effects from exposure to air pollutants and other types of environmental contamination, such as, an increased likelihood of experiencing PM2.5 related health effects from short-term exposures because of the fire.

Information from this EJ evaluation can be used to inform outreach strategies for future planning and response to environmental concerns. Language barriers may prevent residents from accessing information quickly. Future efforts should be mindful to communicate in multiple languages to meet the needs of the community.

# Conclusions

Given that 24-hour and 1-hour average PM2.5 concentrations exceeded the WHO AQG, sensitive groups such as individuals with cardiovascular or respiratory illnesses, children (under 18 years of age), older adults (over 65 years old), or those of lower socioeconomic status, may have experienced respiratory symptoms and an exacerbation of respiratory and cardiovascular illnesses. MDPH/BCEH expects that this exacerbation would be temporarily experienced during elevated exposure to PM2.5 but would subside once pollutant levels were no longer elevated. Individuals who were indoors during the fire, with their windows closed, likely would have been exposed to lower pollutantconcentrations, which would have reduced their likelihood of experiencing short-term health effects associated with PM2.5.

Breathing PM2.5, VOCs, NO2 and ozone at the levels detected in outdoor air near the Clean Harbors facility during the time of the fire are not expected to result in long-term harm to people’s health. Sensitive populations may have had a slightly increased risk of exacerbation of respiratory and cardiovascular illnesses during the acute exposure (<24 hours) to elevated levels of PM2.5.

Based on data for soil collected at the Clean Harbors facility, it is not expected that the emissions from the fire would have resulted in soil concentrations in residential yards that would be a health concern. Based on surface water data collected at the Clean Harbors facility, it is not expected that the fire would have resulted in contaminant concentrations in the Fore River that would be a health concern for individuals engaged in recreational activities.

# Recommendations

The data we reviewed indicates that there are no on-going health concerns related to emissions from the Clean Harbors Fire. No further public health actions are required to reduce or avoid exposure. Residents in the communities surrounding the Clean Harbors Facility do not need to take additional precautions in everyday activities.

For future incidents where residents may be exposed to environmental contaminants, the town of Braintree should ensure outreach activities meet the language needs of the community.

Individuals with additional information or questions regarding this health consultation should contact the MDPH/BCEH, Environmental Toxicology Program, at 617-624-5757.

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1. Fracture tanks, commonly referred to as “frac tanks”, are used for containing and often treating hazardous waste before it is sent to an external facility for final processing and disposal (US EPA, 2005). [↑](#footnote-ref-2)
2. This health consultation was made possible by a cooperative agreement [program # TS-23-0001] from the Agency for Toxic Substances and Disease Registry (ATSDR). Its contents are solely the responsibility of the Massachusetts Department of Public Health and do not necessarily represent the official views of the ATSDR, or the U.S. Department of Health and Human Services. [↑](#footnote-ref-3)
3. ATSDR refers to their screening values as comparison values, or CVs. [↑](#footnote-ref-4)
4. Massachusetts Executive Office of Energy and Environmental Affairs (EEA) has established a statewide Environmental Justice (EJ) Policy to address the disproportionate burden experienced by individuals of color and lower-income people (EEA 2021). In Massachusetts, EJ populations are defined as neighborhoods (U.S. Census block groups) that meet one or more criteria based on household income, race/ethnicity, and/or English language proficiency. [↑](#footnote-ref-5)
5. PM2.5 refers to particulate matter with an aerodynamic diameter of 2.5 micrometers or smaller (ATSDR, 2022a). Aerodynamic diameter refers to the diameter of a unit density sphere, which behaves aerodynamically as the particle in question, which may have an irregular, non-spherical shape (GreenFacts, 2022). [↑](#footnote-ref-6)
6. Note that the more accurate MassDEP regulatory PM2.5 monitor (DEP T640) at the same location measured a PM2.5 24-hour average less than the WHO AQG. [↑](#footnote-ref-7)
7. Soil concentrations were compared to the Massachusetts Contingency Plan S-1 Soil/GW-3 standards, which apply to residential soils, and consider potential for migration of contaminants to surface water (MassDEP, 2020). [↑](#footnote-ref-8)
8. These are referred to as GW-1 standards, under the Massachusetts Contingency Plan (MassDEP, 2020). [↑](#footnote-ref-9)
9. The standards assume individuals ages 1-8 years ingest 1 liter of water per day; individuals 8 years and older ingest 2 liters of water per day (MassDEP, 2017) [↑](#footnote-ref-10)
10. Turbidity refers to cloudy water, caused by particles in the water (MPCA, 2008). [↑](#footnote-ref-11)
11. Zone 2 is the hydrological layer below ground that is saturated with water. The top of this layer is referred to as the water table (MassDEP, 2023b). [↑](#footnote-ref-12)
12. Defined as U.S. census block groups. [↑](#footnote-ref-13)
13. The 5-year average age-adjusted rates of hospitalizations for myocardial infarction (heart attack) in Weymouth is equal to or greater than 110% of the state rate. [↑](#footnote-ref-14)