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BP - Olympic Pipeline

Air Monitoring and Sampling Report

Conway, Washington

MP46 Gasoline Pipeline Spill

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EXECUTIVE SUMMARY

On December 10, 2023, CTEH was engaged by BP to provide toxicology and air monitoring support following a gasoline release from the Olympic Pipeline in Conway, Washington. CTEH implemented a comprehensive air monitoring program, using real-time instruments and analytical sampling equipment to assess air quality in both the community and work areas. The response was coordinated under Unified Command (UC), which was comprised of personnel from BP, as well as local, state, federal, and tribal representation.

Over the course of this response, over 34,000 real-time air monitoring readings were collected, focusing on gasoline-related volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, xylenes, and hexane (BTEX-H) as well as indicators of flammability. In the work area, air monitoring was conducted to ensure the safety of response personnel, with readings taken in proximity to workers and in areas of active remediation. Site-specific action levels were employed in both community and work area monitoring strategies.

While occasional detections of airborne compounds were recorded, all concentrations either remained below the established site-specific action levels or triggered communication of potential hazards to site management and response workers. These action levels, based on health-protective benchmarks, allowed CTEH personnel to identify and communicate potential risks in the community or work area before harmful conditions were posed. Continuous community air monitoring concluded on March 19, 2024, and work area monitoring continued until the final removal of response equipment on March 24, 2024.

In addition to real-time monitoring, CTEH personnel deployed 410 evacuated canisters across four fixed locations to collect 24-hour air samples. Analytical results indicated that the majority of detected compounds remained well below health-protective screening levels, with no exceedances expected to pose a risk to human health. For the few analytes with occasional screening level exceedances, average concentrations calculated over the entire sampling period remained below screening benchmarks, minimizing health concerns associated with these compounds. Continuous analytical air monitoring concluded on March 24, 2024.

In summary, the air monitoring and sampling data collected throughout the response indicated that airborne concentrations of gasoline-related compounds and other organic chemicals did not reach levels that would pose a hazard to the community or response personnel.

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1.0 DESCRIPTION OF THE INCIDENT AND RESPONSE

On December 10, 2023, CTEH responded to a request from BP p.l.c. (BP) to provide toxicology and air monitoring support following a gasoline release from the Olympic Pipeline in Conway, Washington. The release resulted in an overfilled concrete vault, which caused gasoline to spill onto the surrounding land, flow downgradient towards the Hill Ditch irrigation canal, eventually reaching Bulson Creek. CTEH conducted air monitoring according to regional response protocols and in coordination with the Unified Command (UC) overseeing the incident, which included representation from BP as well as local, state, federal, and tribal agencies.

CTEH personnel arrived on-site on December 11, 2023, at 0642 Pacific Standard Time (PST)[1], following the containment of the gasoline leak, and promptly initiated real-time air monitoring in the nearby community for gasoline constituents, as outlined in a preliminary Community Air Monitoring Plan (CAMP). At the same time, air monitoring support was provided for response personnel in designated work areas, based on a preliminary Sampling and Analysis Plan (SAP). These work areas included controlled-access points near the release site, as well as downstream locations where response activities were conducted. In addition to roaming real-time air monitoring in the community and work areas, CTEH personnel deployed radio-telemetering real-time air monitoring instruments at fixed-locations within and surrounding the release site to serve as sentinel equipment to direct roaming air monitoring personnel to collect follow-up readings with secondary instruments and communicate the proper actions to site personnel, as laid out in the CAMP and SAP.

Lastly, to assess for the presence of a broader list of gasoline-related chemical constituents beyond the score of real-time instruments, CTEH personnel deployed analytical air sampling equipment at several fixed locations within the nearby community on December 12, 2023.

CTEH conducted continuous community air monitoring until March 19, 2024, with handheld monitoring concluding at 23:03 PDT that day. In the work area, 24-hour monitoring continued until the removal of the last sheet piling on March 24, 2024, when handheld monitoring ceased at 07:14 PDT, and fixed-station monitors were decommissioned by 10:44 PDT. The final analytical air sample was collected on March 24, 2024. CTEH personnel then demobilized from the site. This report summarizes real-time air monitoring and analytical air sampling data collected from December 11, 2023, through March 24, 2024.

2.0 CHEMICALS OF INTEREST

Gasoline is a complex mixture of hydrocarbons primarily derived from the refining of crude oil. The chemical composition of gasoline depends on various factors including the source and type of crude oil,

[1] Unless otherwise noted, all times are reported in PST

as well as the refining process used. Key properties used to characterize gasoline include octane rating, volatility, density, and flammability. One of the most noteworthy properties of gasoline is its high flammability, making it a potent fuel but also posing a substantial risk of fire and explosion if not handled properly. The volatility of gasoline is a significant factor, particularly in terms of community or worker health risks, as it contains volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene, xylenes, and hexane (BTEX-H)

The chemicals of interest for this response were identified based on their potential human health impacts, as determined by the relative concentrations of volatile organic compounds emitted from gasoline and combustion products. This selection was guided by the Northwest Area Contingency Plan (NWACP) and relevant health-based worker exposure guidelines. CTEH personnel initially developed and implemented preliminary plans for air monitoring—one for the community (Community Air Monitoring Plan; CAMP) and another for the work area (Work Area Sampling and Analysis Plan; SAP)—to characterize the nature and extent of emissions associated with the release. These plans were subsequently reviewed, commented on, and ultimately approved by UC as the response progressed (**Attachment A**). The chemicals of interest included in these plans were total VOCs, benzene, ethylbenzene, toluene, xylene, hexane, and atmospheric flammability measured as a percentage of the lower explosive limit (%LEL). Monitoring and sampling for these chemicals was reduced or discontinued as product-specific data became available or when initial results indicated that they did not pose a health concern. Although not initially listed in the community or work area plans, carbon monoxide (CO) monitoring was conducted on an investigatory basis to rule out response vehicle exhaust as a potential source of offsite emissions. Additionally, discrete air samples were collected in several community locations to provide air quality data beyond the scope of real-time instruments and were analyzed for a wide range of specific VOCs using EPA Method TO-15.

Discrete air samples were also deployed on individual workers to assess exposure levels over the course of a work shift for comparison to occupational exposure values; however, the methods and results of this assessment will be detailed in a separate report.

2.1 Occupational and Community Exposure Standards and Guidelines

Results of real-time air monitoring and analytical air sampling were compared to CTEH site-specific action levels defined in the UC-approved CAMP and SAP and/or applicable health-based community and occupational exposure guidelines and standards.

In accordance with NWACP recommendations, inhalation exposure-based screening levels developed by the Agency for Toxic Substances and Disease Registry (ATSDR) were used to evaluate the results of 24-hour community air samples analyzed for VOCs via EPA Method TO-15. These air concentration benchmarks are considered protective of human health, including sensitive subpopulations. Given the duration of the incident and response activities, intermediate MRLs (covering exposures between 14-365 days) were applied. If an intermediate MRL was not available for a detected analyte, the chronic (lifetime) or acute (<14 days) MRLs were applied, in that order of preference (ATSDR, 2024).

In cases where no ATSDR inhalation MRLs were available for a detected compound, cleanup levels established by the Model Toxics Control Act (MTCA) in Washington State were used. Cleanup levels and Risk Calculation (CLARC) values, using the standard universal method (Method B), consider non-cancer effects and are derived based on a continuous 6-year exposure in a 16-kilogram child (Ecology, 2024).

Lastly, if no other guidance levels were available for detected analytes, measured air concentrations were compared to benchmark values based on USEPA Regional Screening Levels (RSLs), which are protective of daily human inhalation exposures over a 26-year period, including sensitive individuals (USEPA, 2024).

While these long-term screening values are protective, they are based on chronic exposure duration assumptions that are not directly comparable to the 24-hour samples collected during this relatively short-duration incident. As such, occasional exceedances of these benchmarks are not predictive of adverse health outcomes but are used as conservative indicators to guide further evaluation and response.

2.2 CTEH Site Specific Action Levels

CTEH personnel employed site-specific action levels for the monitoring activities outlined in the Unified Command (UC)-approved Community Air Monitoring Plan (CAMP) and Work Area Sampling and Analysis Plan (SAP).

The action levels for the community defined in the CAMP were developed in accordance with NWACP recommendations, while those for the work area defined in the SAP adhered to relevant occupational standards and guidelines. All plans were subject to review, input, and approval by UC. These action levels were employed to monitor potential offsite egress of incident-related contaminants and to prompt corrective actions to limit exposure. These values do not replace community or occupational exposure standards or guidelines but are intended to be a concentration limit that triggers a course of action to reduce or eliminate exposure to members of the public and incident responders.

Lastly, Site Assessment monitoring took place in areas that did not represent ambient air near the breathing zone level. This monitoring involved a variety of tasks intended to provide information to help delineate the nature and extent of the release. As a result, no action levels were employed for this monitoring plan.

2.3 Community Air Monitoring Action Levels

Air monitoring in accordance with the CAMP generally took place in locations easily accessible by individuals in those residential areas surrounding the incident area. The community was also be defined as those individuals who live downwind from the incident area who may be impacted via transport of contaminant(s), if any.

All site-specific action levels defined in the CAMP were established in accordance with NWACP guidelines, approved by UC, and shown in **Table 1** below. This included recommended use of 20 ppm for total VOCs, established as being 10% of the Protective Action Criteria (PAC) for gasoline. Also consistent with NWACP guidelines, the United States Environmental Protection Agency's Acute Exposure Guideline Level 1 (AEGL-1) served as the basis for most of the CTEH Site-Specific Community Action Levels. This represents an airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure. Notably, the concentration component of the CTEH site-specific action level is based on a conservative use of the AEGL-1 guideline value associated with a 60-minute exposure duration. However, the CTEH site-specific action level is set for a five-minute duration, which allowed for air monitoring teams to keep UC informed of elevated readings, enabling proactive measures such as notifying residents to shelter in place, initiating evacuations, or implementing engineering controls at the incident site to mitigate offsite egress of vapors before the AEGL-1 guideline is met or exceeded.

Due to the absence of an established AEGL-1 value for hexane, the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) was used as a surrogate benchmark for real-time air monitoring comparisons. Although the NIOSH REL is typically applied as a 10-hour time-weighted average (TWA) in occupational settings, using the TWA value as the concentration benchmark for a 5-minute duration detection in community areas provided a conservative criterion by which UC would be informed of potential offsite egress before a toxicological hazard was posed.

Lastly, given the potential physical hazards of flammability in a gasoline release, %LEL (percentage of the lower explosive limit) was monitored to remain apprised of the potential for offsite emissions of flammable vapors. A conservative action level was set at the instrument detection limit of 1%, ensuring prompt identification and management of any potential physical hazards.

Table 1. CTEH Site-Specific Community Actions Levels

Chemical	Action Level	Basis
Volatile Organic Compounds (VOCs)	20 ppm	(NWACP 2024, sec. 9418)
Benzene	52 ppm	AEGL-1 (60 minutes)
Ethyl benzene	33 ppm	AEGL-1 (60 minutes)
Hexane	50 ppm	NIOSH REL (10-Hr)*
Toluene	67 ppm	AEGL-1 (60 minutes)
Xylenes	130 ppm	AEGL-1 (60 minutes)
%LEL	1%	Detection

*Only AEGL-2 and -3 values exist for hexane.

2.4 Work Area Air Monitoring Action Levels

Air monitoring in accordance with the SAP generally occurred in the presence of workers performing or supporting response activities, with readings taken at a height consistent with the sampler's breathing zone and in proximity to workers without interfering with their response tasks. The CTEH Site-Specific Action Levels used in the work area are shown in **Table 2**. Although there are no specific health-based benchmarks for assessing concentrations of total VOCs or %LEL, the CTEH Site-Specific Action Levels for these analytes were conservatively set as protective triggers rather than direct indicators of health risk. The total VOC action level was designed to prompt further investigation into specific volatile compounds known to be associated with gasoline releases (BTEX-H), while the %LEL action level served as an early warning to notify site management of elevated flammability risks before the LEL for gasoline was reached[2].

All other site-specific action levels established for Worker Area Monitoring were set at values based on American Conference for Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs; ACGIH 2024). Similar to the protective approach used in the CAMP, the site-specific action levels laid out in the SAP are based on time-weighted benchmark values applied for much shorter durations than intended. Although ACGIH TLV-TWA reflect air concentrations that workers may be exposed to for a working lifetime without adverse effect, the CTEH Site-Specific Action Levels were established such that an exceedance would be noted if the TLV value was sustained for 5 minutes. This approach provided an additional layer

[2] Gasoline has a lower explosive limit (LEL) of 1.3% or 13,000 ppm (Honeywell, 2016).

of protection, allowing for prompt intervention to reduce exposure risks before longer-term exposure limits were exceeded.

Table 2. CTEH Site-Specific Work Area Action Levels

Chemical	Action Level	Basis
Volatile Organic Compounds (VOCs)	30 ppm	Detection of VOCs
Benzene	0.5 ppm	ACGIH TLV-TWA
Ethyl benzene	20 ppm	ACGIH TLV-TWA
Hexane	50 ppm	ACGIH TLV-TWA
Toluene	20 ppm	ACGIH TLV-TWA
Xylenes	130 ppm	ACGIH TLV-TWA
%LEL*	1.3-5%	Flammability
Carbon monoxide	25 ppm	ACGIH TLV-TWA

*Gasoline has a lower explosive limit (LEL) of 1.3% (13,000 ppm) in air; correction factors (CF) vary for LEL sensors and 10.6 eV PIDs and are sourced from RAE Systems by Honeywell TN-156 and TN-106A (and B), respectively (Honeywell, 2016, 2020).

3.0 METHODS

Based on the initial information available regarding the incident, a preliminary CAMP and SAP were developed to guide air monitoring and sampling efforts in the community and work area, respectively. These plans, included as **Appendix A**, outline the methodology and instrumentation used. As on-site conditions evolved, both the CAMP and SAP were modified to reflect the actual circumstances encountered. Updated work plans were provided to UC for review and approval.

3.1 Real-Time Air Monitoring

Real-time air monitoring refers to the use of direct-reading instruments that report instantaneous measurements of a substance, which can quickly indicate conditions that may have an impact on community or worker health.

An air monitoring strategy was developed in association with the CAMP and SAP to monitor potential exposures in the community and work area, respectively. The community was designated as the area immediately surrounding and beyond the work area, consisting primarily of residential properties and public-access roadways. The work area included the areas where active excavation operations were underway, designated as the "hot zone", as well as several equipment staging areas.

Additionally, a third monitoring plan outlined in the SAP, referred to as Site Assessment, was used primarily for operational awareness. This included collecting headspace readings above source samples, collection tanks, or other areas where volatile compounds or flammability indicators were present to identify potential hazard sources. These readings were not necessarily relevant to ambient atmospheric conditions and did not reflect potential exposures to the community or work area.

3.1.1 Handheld Real-Time Air Monitoring

Free-roaming handheld real-time air monitoring was conducted in a variety of areas based on levels of activity, proximity to the release, and site conditions. CTEH personnel utilized MultiRAE, UltraRAE, Gastec, and Dräger units to measure for gasoline-related chemical constituents or indicators of flammability.

3.1.2 Radio-Telemetering Real-Time Air Monitoring

Radio-telemetering RAE® Systems AreaRAE units were deployed at fixed locations to allow for continuous air monitoring at targeted locations within the community and work area. AreaRAE readings were received and monitored in a centralized location by CTEH personnel, enabling rapid recognition, communication, and response to changing conditions. Although not included in the CAMP or SAP, an oxygen sensor was used to continuously collect atmospheric oxygen level readings, which are important for interpreting %LEL. While there was no UC-approved action level set for oxygen, any deviations from the acceptable ambient concentration range of approximately 19.5% to 21.9% were noted. Elevated concentrations of any chemical of concern were verified using handheld real-time instrumentation, and CTEH field personnel assessed the impact on workers and, if applicable, the community.

3.2 AIR SAMPLING

Air sampling refers to the collection of discrete quantities of air using containers or chemical-specific media for further analysis in an off-site laboratory. Laboratory analysis of analytical air samples typically provides chemical-specific results at lower detection limits than real-time instrumentation. To supplement real-time instrumentation and provide additional air quality data, discrete air samples were collected using 1.4-liter evacuated canisters (referred to as “minicans"), which continuously collected air over a 24-hour period in designated areas of the community. A map of analytical sampling locations is provided in **Appendix B**. All analytical air samples were sent to Pace Analytical, a National Environmental Laboratory Accreditation Program (NELAP)-accredited laboratory, for chemical analysis of VOCs by USEPA method TO-15 with an additional request to report tentatively identified compounds (TICs).

Data validation was conducted by Environmental Standards, Inc. on analytical air sampling data provided by Pace Analytical. Data validation is a systematic process to review analytical results and laboratory quality control samples to evaluate data integrity and ensure that the data met established data quality objectives. Data was validated using two different levels of detail and granularity. Level II, a general validation of processes and data integrity was conducted on 20% of all samples collected. Level IV data validation was conducted on 10% of all samples collected. Level IV data validation is a comprehensive and granular evaluation of all aspects of the sampling, analysis, and reporting quality.

4.0 RESULTS

Real-time air monitoring and analytical air sampling activities were conducted to provide UC with information regarding the potential for exposure to chemicals of interest within the surrounding community as well as the general vicinity of the incidence site as outlined in the CAMP and SAP, respectively. During the response, preliminary air monitoring summary reports were provided daily and summarized the data collected in the community and work area across the preceding 24-hour period.

A cumulative summary of the monitoring and sampling results are summarized in the following tables, with Community Monitoring and Work Area Monitoring results presented in **Table 3** and **Table 4**, respectively; radio-telemetering real-time monitoring results in **Table 5**; and a summary of the results of analytical air sampling in **Table 6**. Maps of cumulative handheld real-time air monitoring location, radio-telemetering real-time air monitoring locations, and analytical air sampling locations are provided in **Appendix B**. Trend graphs of radio-telemetering real-time air monitoring results are provided in **Appendix C**. Laboratory results for analytical air samples are provided in **Appendix D**, and complete laboratory results are provided in **Appendix E**. Data validation reports are provided in **Appendix F**.

Table 3. Handheld Real-Time Community Air Monitoring Results

December 11, 2023, at 07:25 PST – March 19, 2024, at 23:03 PDT

Analyte	Instrument	Number of Readings	Number of Detections	Concentration Range*
VOCs	MultiRAE Pro	9,803	41	0.1 – 5.7 ppm
%LEL	MultiRAE	9,350	0	< 1 %
Benzene	UltraRAE	421	1	0.08 ppm
CO	MultiRAE	26	0	< 1 ppm

*If no detection was observed, the instrument detection limit preceded by "<" is provided.
ppm = parts per million

Table 4. Handheld Work Area Real-Time Air Monitoring Results

December 11, 2023, at 07:30 PST – March 24, 2024, at 07:14 PDT

Analyte	Instrument	Number of Readings	Number of Detections	Concentration Range
VOCs	MultiRAE Pro	6,793	1,537	0.1 – 1,426 ppm

%LEL	MultiRAE Pro	6,102	2	6 - 17 %
Benzene	UltraRAE	1,538	250	0.01 – 97.63 ppm
	Dräger X-PID	4	3	0.11 – 2.26 ppm
Toluene	Gastec 122L	6	3	5 - 10 ppm
	Dräger X-PID	4	4	0.33 – 7.92 ppm
Ethyl Benzene	Dräger X-PID	4	1	1.16 ppm
Xylene	Gastec 123	4	1	5 ppm
	Dräger X-PID	4	1	1.84 ppm
Hexane	Dräger X-PID	4	2	0.13 – 9.2 ppm
CO	MultiRAE Pro	350	1	6 ppm

ppm = parts per million

Table 5. Radio-Telemetering Real-Time Air Monitoring Results Summary

December 11, 2023 – March 24, 2024

AreaRAE Unit Date Range	Location	Analyte	Number of Readings	Number of Detections	Concentration Range
Unit 1 Dec 11 - Mar 24	NW corner of school field	%LEL	533,241	212	2 - 3 %
		O_2	144,126	144,126	20.4 - 21.9 %
		VOCs	532,812	5,303	0.1 - 9.5 ppm
Unit 2 Dec 12 - Mar 24	Roadside entrance to MP 46 block valve on chain link	%LEL	526,095	226	2 %
		O_2	148,565	148,565	19.6 - 21.4 %
		VOCs	525,806	41,163	0.1 - 10.3 ppm
Unit 3 Dec 12 - Mar 24	W of intersection of Hwy 534 and Conway Hill Rd	%LEL	508,532	44	2 %
		O_2	133,998	133,998	20.0 - 22.2 %
		VOCs	508,274	10,522	0.1 - 43.5 ppm
Unit 4 Dec 12 - Dec 18	N side of street guard rail by worker access to creek	%LEL	31,519	4	2 - 40 %
		O_2	31,519	31,519	18.5 - 21.5 %
		VOCs	31,522	17,622	0.1 - 460.3 ppm
Unit 5 Dec 12 – Jan 21	SW corner of Hill Ditch creek bridge	%LEL	156,212	34	2 - 69 %
		O_2	143,381	143,381	17.4 - 22.4 %
		VOCs	156,217	20,544	0.1 - 137.5 ppm
Unit 6 Dec 12 - Mar 24	50 yards N of incident site	%LEL	523,784	4	2 %
		O_2	147,950	147,950	20.1 - 21.4 %
		VOCs	523,728	6,619	0.1 - 32.0 ppm
Unit 7	Tree next to creek, on N	%LEL	512,031	0	< 1 %

Dec 14 - Mar 24	side of Hwy 534 bridge	O_2	6,463	6,463	20.5 - 21.5 %
		VOCs	511,772	42,354	0.1 - 315.8 ppm
Unit 8 Dec 17 - Jan 17	Approx. 7ft S of Marker 35 by Hill Ditch Creek	%LEL	106,004	1,928	2 - 40 %
		O_2	5,834	5,834	20.5 - 21.3 %
		VOCs	106,353	40,106	0.1 - 304.5 ppm
Unit 9 Dec 17 - Dec 18	Approx. 6ft S of Marker 35; tube analyzing air at ground level	%LEL	4,310	0	< 1 %
		VOCs	4,312	3,879	0.2 - 280.4 ppm
Unit 10 Dec 19 - Jan 17	Approx. 5ft E of Soil Marker 47 by Hill Ditch Creek	%LEL	101,008	647	2 %
		O_2	5,946	5,946	20.6 - 21.4 %
		VOCs	101,021	25,065	0.1 - 131.2 ppm
Unit 11 Dec 19 - Jan 20	Approx. 10ft S of Marker 27 by Hill Ditch Creek	%LEL	108,210	449	2 - 33 %
		O_2	6,644	6,644	20.2 - 21.8 %
		VOCs	108,219	22,834	0.1 - 120.7 ppm
Unit 12 Jan 20 - Jan 29	N corner of site, approx. 20 ft from Hill Ditch	%LEL	52,006	0	< 1 %
		VOCs	52,016	264	0.1 - 3.2 ppm
Unit 13 Jan 21 - Mar 24	E side of SR-534 bridge over Hill Ditch; S side of the road	%LEL	363,298	0	< 1 %
		VOCs	363,308	37	0.1 - 0.8 ppm
Unit 14 Jan 29 - Mar 24	Approx. 5 yards NW of northern most point of Division A1	%LEL	319,867	0	< 1 %
		VOCs	319,900	825	0.1 - 20.3 ppm
Unit 15 Jan 31 - Feb 3	A2 Gas Level Test Sump	%LEL	15,057	0	< 1 %
		VOCs	15,057	8,869	0.1 - 112.1 ppm

Graphical representations of AreaRAE data are provided by unit, analyte, and day in Appendix F.

Table 6. Analytical Air Sampling Results

December 12, 2023 – March 24, 2024

Analyte	Number of Samples	Number of Detections	Range of Detections (ppb)	Screening Value (µg/m3)	Detections Above Screening Value
1,1,2-Trichlorotrifluoroethane	410	37	0.0796 (J) - 0.0948 (J)	300.11 ppb [4]	0
1,2-Dichloropropane	410	1	0.363	2 ppb [1]	0
1,2,4-Trichlorobenzene	410	1	1.67	0.12 ppb [4]	1
1,2,4-Trimethylbenzene	410	72	0.0768 (J) - 4.22	5.49 ppb [4]	0
1,3-Butadiene	410	2	0.237 (J) - 0.846 (J)	0.41 ppb [4]	1
1,3,5-Trimethylbenzene	410	37	0.0781 (J) - 1.29	5.49 ppb [4]	0

1,4-Dichlorobenzene	410	1	0.0804 (J)	200 ppb [1]	0
2-Butanone (MEK)	410	176	0.124 (J) - 89.4	1000 ppb [3]	0
2-Propanol	410	270	0.318 (J) - 161 (E)	37.02 ppb [4]	6
2,2,4-Trimethylpentane	410	59	0.133 (J) - 1.87	NA	0
4-Ethyltoluene	410	36	0.0792 (J) - 1.45	NA	0
4-Methyl-2-pentanone (MIBK)	410	17	0.0788 (J) - 0.6 (J)	341.75 ppb [4]	0
Acetone	410	407	1.52 - 42.6	8000 ppb [3]	0
Acetonitrile	410	101	0.272 (J) - 444	16.08 ppb [4]	15
Acrylonitrile	410	42	0.356 (J) - 15.8	0.9 ppb [1]	39
Benzene	410	307	0.106 (J) - 2.18	6 ppb [1]	0
Butane	410	404	0.239 (B) - 24.6	NA	0
Carbon disulfide	410	34	0.105 (J) - 0.59	300 ppb [2]	0
Carbon tetrachloride	410	71	0.0737 (J) - 0.106 (J)	30 ppb [1]	0
Chlorobenzene	410	1	1.44	5.00 ppb [4]	0
Chloroethane	410	37	0.1 (J) - 0.839	15000 ppb [3]	0
Chloroform	410	4	0.0755 (J) - 0.237	50 ppb [1]	0
Chloromethane	410	407	0.384 - 4.1	300 ppb [1]	0
Cyclohexane	410	109	0.0753 - 2,540	784.37 ppb [4]	1
Dichlorodifluoromethane	410	403	0.208 (J3J4) - 0.937	9.30 ppb [4]	0
Ethanol	410	409	2.09 (J) - 410 (E)	NA	0
Ethylbenzene	410	77	0.0903 (J) - 6.04	2000 ppb [1]	0
Heptane	410	117	0.104 (J) - 12	43.92 ppb [4]	0
Isopropylbenzene	410	37	0.0839 (J) - 0.734	36.61 ppb [4]	0
m&p-Xylene	410	132	0.135 (J) - 20.5	600 ppb [1]	0
Methyl Butyl Ketone	410	1	0.198 (J)	3.42 ppb [4]	0
Methyl methacrylate	410	1	0.469	78.15 ppb [4]	0
Methylene Chloride	410	345	0.111 (J) - 30.9	300 ppb [1]	0
n-Decane	410	17	0.0921 (J) - 0.721	NA	0
n-Hexane	410	88	0.209 (J) - 15.8	600 ppb [2]	0
Naphthalene	410	3	0.388 (J) - 1.31	0.7 ppb [2]	1
Nonane	410	48	0.0517 (J) - 1.43	0.40 ppb [5]	10
o-Xylene	410	104	0.0828 (J) - 7.84	10.59 ppb [4]	0
Pentane	410	352	0.131 (J) - 107	155.88 ppb [4]	0
Propene	410	4	1.26 - 7.76	180.12 ppb [5]	0
Styrene	410	10	0.0883 (J) – 2	200 ppb [2]	0
Tetrachloroethylene	410	13	0.0858 (J) - 38.8	6 ppb [1]	1
Tetrahydrofuran	410	3	0.892 - 3.2	308.56 ppb [4]	0
Toluene	410	317	0.116 (J) – 39	1000 ppb [2]	0

trans-1,2-Dichloroethene	410	15	0.079 (J) - 1.89	3000 ppb [3]	0
Trichloroethylene	410	1	0.342	0.4 ppb [1]	0
Trichlorofluoromethane	410	374	0.157 (J) - 0.371	56.96 ppb [4]	0
Vinyl acetate	410	2	0.294 (J) - 0.899	700 ppb [1]	0

[1]ATSDR Intermediate (14-365 days) Inhalation MRL; [2]ATSDR Chronic (lifetime) Inhalation MRL; [3]ATSDR Acute (<14 days) Inhalation MRL [4]Washington State CLARC Method B – non cancer; [5]USEPA Residential air RSLs non-cancer

(J) = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

(B) = The analyte was found in the associated blank.

(E) = The analyte concentration exceeded the upper limit of the calibration range of the instrument established by the initial calibration.

ppb = parts per billion

NE = Not Established

5.0 DISCUSSION

CTEH personnel collected 34,413 handheld real-time air monitoring readings in accordance with the CAMP and SAP throughout the duration of recovery and remediation efforts in support of the Olympia Pipeline Gasoline Spill.

5.1 Handheld Real-Time Air Monitoring

5.1.1 Community Monitoring

The community was generally defined as locations concurrently occupied or easily accessible by individuals in residential or public-access areas surrounding the incident site. A total of 19,600 real-time air monitoring readings were documented by CTEH personnel in the community over the course of the incident. Of the four analytes monitored, there were 41 detections of total VOCs, and one detection of benzene. There were no observed indicators of flammability in the community. A request was submitted for CTEH to add carbon monoxide (CO) to the monitoring plan in the work area; although it was never formally added as constituent of interest in the CAMP, CO readings were still collected in the community, all of which were non-detect.

As seen in Table 4, VOC detections ranged from 0.1 to 5.7 ppm, all of which were below the site-specific action level concentration of 20 ppm. While these low-level VOC detections indicated minimal, if any, off-site egress of gasoline emissions, CTEH air monitoring personnel proactively conducted chemical-specific monitoring for benzene, as it is a critical indicator of potential inhalation hazards associated with gasoline releases. A single detection of benzene was documented at a concentration of 0.08 ppm, which was above the concentration component of a precautionary Action Level set at the instrument detection limit (0.01 ppm), but below the concentration component of the 60-minute AEGL-1 (52 ppm), the latter of which served as the trigger at or above which UC would be informed to assess the need for community shelter-in-place or evacuation.

This benzene detection occurred immediately downwind from the release site on December 11th at 15:46 at the intersection of Pioneer Highway and Conway Hill Road and sampler notes indicate a strong gasoline-like odor. No other detections of benzene were observed in the community for the duration of this response.

5.1.2 Work Area Monitoring

A total of 14,995 real-time air monitoring readings were documented in the work area, as summarized in Table 5. Of the eight analytes monitored, CTEH personnel recorded 1,537 detections of VOCs, 253 detections of benzene, one detection each of CO and ethylbenzene, two detections each of hexane, %LEL, and xylenes, and seven detections of toluene.

All detections of CO, ethylbenzene, hexane, toluene, and xylenes were below the CTEH Site-Specific action level associated with each respective analyte.

Of the 1,537 detections of VOCs, there were 205 at or above the CTEH Site-Specific Action Level of 30 ppm chosen for this analyte. As mentioned in section **2.4 Work Area Monitoring Action Levels** above, the basis for this Action Level does not reflect a health endpoint, but rather serves as a trigger for air monitoring personnel to investigate with chemical-specific readings for gasoline constituents or indicators of flammability.

Of the 253 detections of benzene, there were 39 at or above the CTEH Site-Specific Action Level of 0.5 ppm chosen for this analyte. Sampler notes associated with each benzene reading exceeding the concentration component of the site-specific action level of 0.5 ppm indicate that workers, if present, were notified to don respiratory protection if they were not already doing so, or egress to a cross- or upwind location. At times, work activities were halted while secondary instrumentation was used to confirm the elevated reading or engineering controls were put in place to reduce emissions. As noted above, a separate report, titled *Worker Exposure Report*, provides detailed information on potential personnel exposure, with a particular focus on benzene, associated with the response activities

There were two detections of %LEL above the CTEH Site-Specific Action Level documented during work area air monitoring. In both incidences these concentrations were observed at the manway opening of a frac tank containing gasoline-impacted wastewater that had been pumped from excavations and was awaiting treatment or removal from site for disposal. Personnel in the area at the time of these documented %LEL exceedances were wearing appropriate fire-retardant clothing and self-contained breathing apparatuses (SCBA). As a result of these exceedances, an exclusion zone was established around this frac tank and the lid remained closed, mitigating this flammability hazard.

5.2 Radio-Telemetering Real-Time Air Monitoring

CTEH personal deployed radio-telemetering RAE Systems AreaRAE units at various targeted locations near and surrounding the incident site to allow for continuous air monitoring and to serve as an early indication of potential need for follow-up monitoring and associated communication, if warranted. These instruments enabled quick communication to site management of any elevated concentrations that would require corrective actions to mitigate confirmed emissions. This included prompt recommendations for workers to use respiratory protection if not already doing so or notifying nearby personnel to egress to upwind locations.

Over the course of the AreaRAE deployment, oxygen readings remained consistent with normal ambient atmospheric conditions. It should be noted that not every chosen location reflected breathing zone air that would be encountered by workers; some instruments were strategically deployed to gain operational knowledge in areas where it would not be safe to stage air monitoring personnel. Total VOC detections sustained above the CTEH site-specific action level laid out in the SAP were evaluated using handheld real-time monitoring instruments to determine concentrations of other target analytes, and CTEH personnel took actions as needed to protect workers as described in the SAP.

5.3 Analytical Air Sampling

CTEH personnel deployed a total of 410 1.4-liter evacuated canisters regulated to continuously collect air over a 24-hour period in four designated areas surrounding the incident site. As previously mentioned above and summarized in **Table 6**, lab results of detected analytes were evaluated by comparison to health-protective screening levels in accordance with guidelines provided in the NWACP (*Northwest Area Contingency Plan*, 2024). Although these screening levels, often based on longer-duration exposures (e.g., Intermediate and Chronic MRLs, Washington State CLARC, or USEPA RSL values), are not directly relevant to any of the 24-hour samples collected during this relatively short-duration incident, they provide a conservative comparison for evaluating the detected compounds.

Continuous re-deployment of successive analytical canister at the four fixed-locations between December 12, 2023, and March 24, 2024, allowed for averaging of all 24-hour results per station, providing a more comprehensive indicator of air quality over a longer period – though still not fully equivalent to the exposure duration assumptions underlying most of the available health-based benchmark values. AS previously mentioned, it is important to note that these benchmarks are protective by design, meaning they incorporate safety factors and are set at concentrations where adverse effects are not expected. While exceedances should not be seen as predictive of adverse effects, concentrations below these benchmarks can confidently be ruled out as harmful. Given that the gasoline release was discrete and has been mitigated, air concentrations of the target analytes would be expected to decrease over time, further reducing any potential chronic health risks.

As shown in **Table 6** above, 48 compounds were identified with at least one detection during the sampling period. Of these, 39 analytes had estimated or measured air concentrations that remained below each compound's respective health-protective screening level. The sensitivity of this analysis is such that background airborne compounds, which may not be directly related to the incident, may be identified and measured. However, regardless of the source, all 24-hour air concentrations, measured or estimated, for each of these 39 compounds were found to be below each of their respective screening level and therefore not expected to impact human health.

There were nine analytes that had a measured or estimated concentration exceeding their respective screening level in at least one of the 24-hour samples. For ease of review**, Table 7** below reproduces these compounds alongside the screening level used. This table also includes additional detail including an average air concentration for each analyte, per analytical station. The average air concentrations were calculated using the estimated or measured concentrations for each 24-hour canister collected and analyzed during this response. For non-detections, the concentration was conservatively estimated by using one-half of the method detection limit (MDL), which represents the lowest concentrations that can be reliably detected under routine laboratory conditions.

Using one-half the MDL for non-detections approximates a presumed equal likelihood that a chemical may have been present just below the detection threshold or not at all, making it a reasonable method for estimating average exposure concentrations. This practice (called data censoring) can be useful in risk characterization practices, particularly when a particular compound has an MDL that is close to, or in excess off, the screening level. While this approach introduces some level of uncertainty, it is endorsed by the USEPA and effectively balances the potential effects of underestimating or overestimating an average concentration (USEPA, 2006).

Table 7. Exceedances in Analytical Air Sampling Results

December 12, 2023 – March 24, 2024

Analyte	Screening Value (ppb)	Analytical Station	Number of Detections	Avg* Concentration (ppb)	Avg Concentration Exceed Screening Value?
1,2,4-trichlorobenzene	0.12[4]	AS01	1	0.096	No
		AS02	0	0.074	No

		AS03	0	0.074	No
		AS04	0	0.074	No
1,3-butadiene	0.41[4]	AS01	1	0.058	No
		AS02	1	0.052	No
		AS03	0	0.052	No
		AS04	0	0.052	No
2-propanol	37.02[4]	AS01	63	3.988	No
		AS02	80	3.759	No
		AS03	60	4.456	No
		AS04	67	3.24	No
acetonitrile	16.08[4]	AS01	21	11.722	No
		AS02	36	9.9	No
		AS03	22	4.413	No
		AS04	22	2.243	No
acrylonitrile	0.9[1]	AS01	9	0.299	No
		AS02	14	0.601	No
		AS03	13	0.498	No
		AS04	6	0.297	No
cyclohexane	784.37[4]	AS01	33	0.082	No
		AS02	23	0.113	No
		AS03	29	0.091	No
		AS04	24	34.399	No

naphthalene	0.7[2]	AS01	2	0.196	No
		AS02	1	0.177	No
		AS03	0	0.175	No
		AS04	0	0.175	No
nonane	0.4[5]	AS01	13	0.021	No
		AS02	10	0.028	No
		AS03	15	0.025	No
		AS04	10	0.028	No
tetrachloroethylene	6[1]	AS01	2	0.625	No
		AS02	3	0.045	No
		AS03	3	0.048	No
		AS04	5	0.06	No

[1]ATSDR Intermediate (14-365 days) Inhalation MRL; [2]ATSDR Chronic (lifetime) Inhalation MRL; [3]ATSDR Acute (<14 days) Inhalation MRL [4]Washington State CLARC Method B – non cancer; [5]USEPA Residential air RSLs non-cancer

*Average concentrations were calculated using the estimated (J-flagged) or measured concentrations reported by the lab. Non-detections were accounted for by substituting ½ of the laboratory method detection limit (MDL) for each analyte.

As shown in **Table 7,** although there were occasional detections of certain compounds at measured or estimated concentrations greater than the screening value used, there were no instances where the average concentration was found to be in excess of the health-protective benchmark value. This is important when evaluating air sampling data using screening values that incorporate exposure assumptions with durations greater than the 24-hour period reflected by each sample. In every case, the average concentration across the entire sampling period remained below the health-protective screening level, indicating that the exposure conditions inherent to these benchmarks were not met. Therefore, while occasional exceedances were observed, the concentrations detected do not pose any risk of adverse health impacts based on the overall air quality data collected.

It is notable to point that that 1,2,4-trichlorobenzene was found to have an MDL (0.148 ppb) that exceeded the available screening level (0.12 ppb). While censoring non-detections of this analyte using one-half the MDL yields an average concentration that is below the screening level, this introduces some uncertainty that cannot entirely rule out the possibility that 1,2,4-trichlorobenzene was present above the health-based benchmark value. However, there are additional considerations in the risk characterization process and two such factors help to temper suck uncertainty in the context of this release. First, the sole detection of 1,2,4-trichlorobenzene occurred on February 20, 2024, which is more than two months following the December 10, 2023 incident date. This timing suggests that the detection of this analyte is not associated with the initial release of gasoline, as concentrations of incident-related compounds would typically be highest in the immediate aftermath of the event. Most importantly, this analyte is a chlorinated solvent, which is not typically found in gasoline and listed among the compounds identified by Washington Ecology as unrelated to petroleum releases (Ecology, 1997). Thus, the detection of 1,2,4-trichlorobenzene and the identification of an MDL that cannot resolve a potential screening level exceedance bear no impact on the overall interpretation of air sampling data.

The analytical air sampling results from December 12, 2024, through March 24, 2024, support that airborne concentrations of organic compounds, including those most relevant to gasoline spill as well as others that may not be incident-related, did not reach levels that would pose a health hazard.

6.0 CONCLUSION

The results of handheld and radio-telemetering real-time air monitoring indicated that, while intermittent detections of target analytes occasionally exceeded site-specific action levels, prompt communication to site management ensured that appropriate corrective actions were taken.

A review of air monitoring data in the work area shows that when sustained concentrations of target analytes approached or exceeded site-specific action levels, protective measures were implemented, including recommendations for respiratory protection or other mitigation strategies. A more comprehensive report on air monitoring and personal sampling data in the work area has been provided separately, supporting these conclusions.

Additionally, roaming handheld real-time air monitoring and analytical air sampling in the community did not reveal airborne concentrations of incident-related contaminants that would have posed a health concern to members of the surrounding community during the response.

7.0 REFERENCES

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Appendix A

Sampling and Analysis Plans

DOCUMENTATION – COVER SHEET

MP 46 Olympic Pipeline Spill Conway South of Allen Station

PRELIMINARY

Date: 12 December 2023

Document Control Name: Community Air Monitoring Plan (CAMP)

Prepared by: Robyn Whiteford

Preparer Role: Documentation Lead

Approvals

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Section Chief	Tony Hout	Tony Hout	12 Dec 23	1340
	Print Name above	*Sign Above*	*Date*	*Time*
Unit Leader				
	Print Name above	*Sign Above*	*Date*	*Time*

	Revision Record		
Change Date	Remove Insert Page Number(s)		Description of Change(s)
			This is revision 0. Describe subsequent revisions in this table.

PRELIMINARY

Mt Vernon, WA

Gasoline Release

COMMUNITY AIR MONITORING PLAN (CAMP)

Version 1.1

Prepared on behalf of BP

CONSIDER PRELIM UNTIL CAM ENDPOINT ESTABLISHED & UC APPROVED

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1.0 INTRODUCTION AND PURPOSE

This emergency response Community Air Monitoring Plan (CAMP) is intended to be used during response activities associated with a gasoline release that occurred in Mt. Vernon, Washington on December 10, 2023, where monitoring and/or sampling of atmospheric conditions to protect and inform nearby communities and the public may be required. Data gathered during the implementation of this plan will be used to assess the potential for community exposures, if any. All fieldwork and data collection will be conducted in accordance with this work plan and standard operating procedures (SOPs). The use of this monitoring plan will involve forethought and planning that should help direct the monitoring, sampling, and analytical work. It is meant to be used in emergency response events where monitoring and sampling teams (hereafter referred to as Field Teams) may not have the opportunity to write a more thorough monitoring and sampling plan.

Field Teams should always reference CTEH and/or Region 10/NWAC standard quality procedures, SOPs, and standard methods for sampling and analytical guidance when necessary. The development of this plan will improve the documentation, communication, planning, and overall quality associated with the monitoring/sampling and analysis by:

- Encouraging Field Teams to consider their goals and objectives before the generation of environmental data,
- Documenting predetermined information in a standardized format,
- Increasing the communication between sampling personnel and decision makers, and
- Detailing expectations and objectives before samples are collected.

2.0 OBJECTIVES

The objectives of this CAMP are to both identify and quantify the airborne contaminant(s), if any, and use these results as a baseline for Incident Command to determine if additional actions are needed to protect the health of the surrounding community. Specifically, the objectives of the CAMP are to characterize the contaminants and determine airborne concentrations of contaminants, if any, outside of the incident location. The Community may be designated as those locations easily accessible by individuals in those residential and commercial areas immediately surrounding the incident area at close or distant proximity. The Community may also be defined as those individuals who live downwind from the incident area who may be impacted via transport of contaminant(s), if any.

Air monitoring and sampling activities are assigned on a daily basis and will focus on the mixtures, chemicals, and indicators of flammability documented within this plan because they are among the most important and readily monitored hazards of released gasoline. Monitoring for these analytes may be conducted less frequently or even discontinued as product-specific information becomes available or as initial monitoring results indicate that these chemicals do not pose a health concern.

Community Air Monitoring (CAM) is typically divided into three phases: Initial Response and Assessment Phase, Sustained Community Assessment, and Demobilization Phase. The Initial Response and Assessment Phase occurs in the early hours of a response, generally within the first 24 hours after the incident is reported. It is composed of immediately deploying a Field Team to conduct an initial rapid assessment, or site characterization, and for planning future sustained systematic and/or ad hoc air quality assessments. Site Characterization may involve a variety of different monitoring tasks intended to provide information that may help to delineate the nature and extent of the release. Site Characterization air monitoring does not represent ambient air monitoring near breathing zone level. CTEH responders will be involved with this process as much as possible, depending on the proximity of the closest responder to the location of the incident. Phase 2, the Sustained Community Assessment, begins after approximately 24 hours post incident reporting and timing is dependent on event-specific conditions. This phase involves systematic field assessments as well as targeted, ad hoc assessments at locations that may be impacted by a release. The third phase, Demobilization, begins as CAM resources start to demobilize after airborne contaminant threats have been abated or are no longer a sustained concern. Air monitoring plans for Phase 1 and Phase 2 are described below.

The data that will be generated during each phase will be used to 1) compare with site-specific action levels or risk-based action levels to determine if any acute health hazard exists; 2) compare to an established background level or with collected background sample(s); 3) assist with determining the area of impact, if any, due to volatilization of chemical components; and 4) assist with an off-site acute exposure assessment, if needed.

Free-roaming handheld real-time air monitoring in the surrounding community will be conducted in a variety of areas based on levels of activity, proximity to the release, and site conditions (Figure 1). Considerations for monitoring locations will include information about contaminant properties, weather conditions and forecasts, the location of sensitive populations, and the potential dispersion of contaminants.

Community air monitoring locations will be selected based on proximity to the release location (**Figure 1**). Additional considerations for community air monitoring locations will be prioritized based on proximity to schools, assisted living facilities, prisons, hospitals, population density, daily weather conditions, trajectory of emissions, and reference to the vulnerable or sensitive populations, as applicable. The regions are subject to move as weather conditions change or in response to inquiries from the community or stakeholders. An example of roving air monitoring locations surrounding the release location is shown in **Figure 2.** Additionally, radio telemetering AreaRAE instruments continuously recording readings of %LEL, VOCs, and Oxygen (O2) deployed at fixed locations surrounding the release site (**Figure 3)** will serve as sentinel instruments to direct real-time air monitoring personnel to collect follow-up readings with secondary instruments and communicate the proper actions to site personnel. Updated maps will be created in the event that roving or fixed-station air monitoring locations require updating or changes. The Washington Environmental Health Disparities map for vulnerable populations is shown in **Figure 4**, as a reference guide to inform community air monitoring locations to account for sensitive populations.

Discrete air samples may be collected in Phase 2 and sent to an off-site laboratory for chemical analysis. Analytical air sampling locations will be determined based on the results of real-time air monitoring and shown in **Figure 5**. These analytical air sampling techniques may be used to provide air quality data beyond the scope of real-time instruments.

Figure 1. Incident site map.

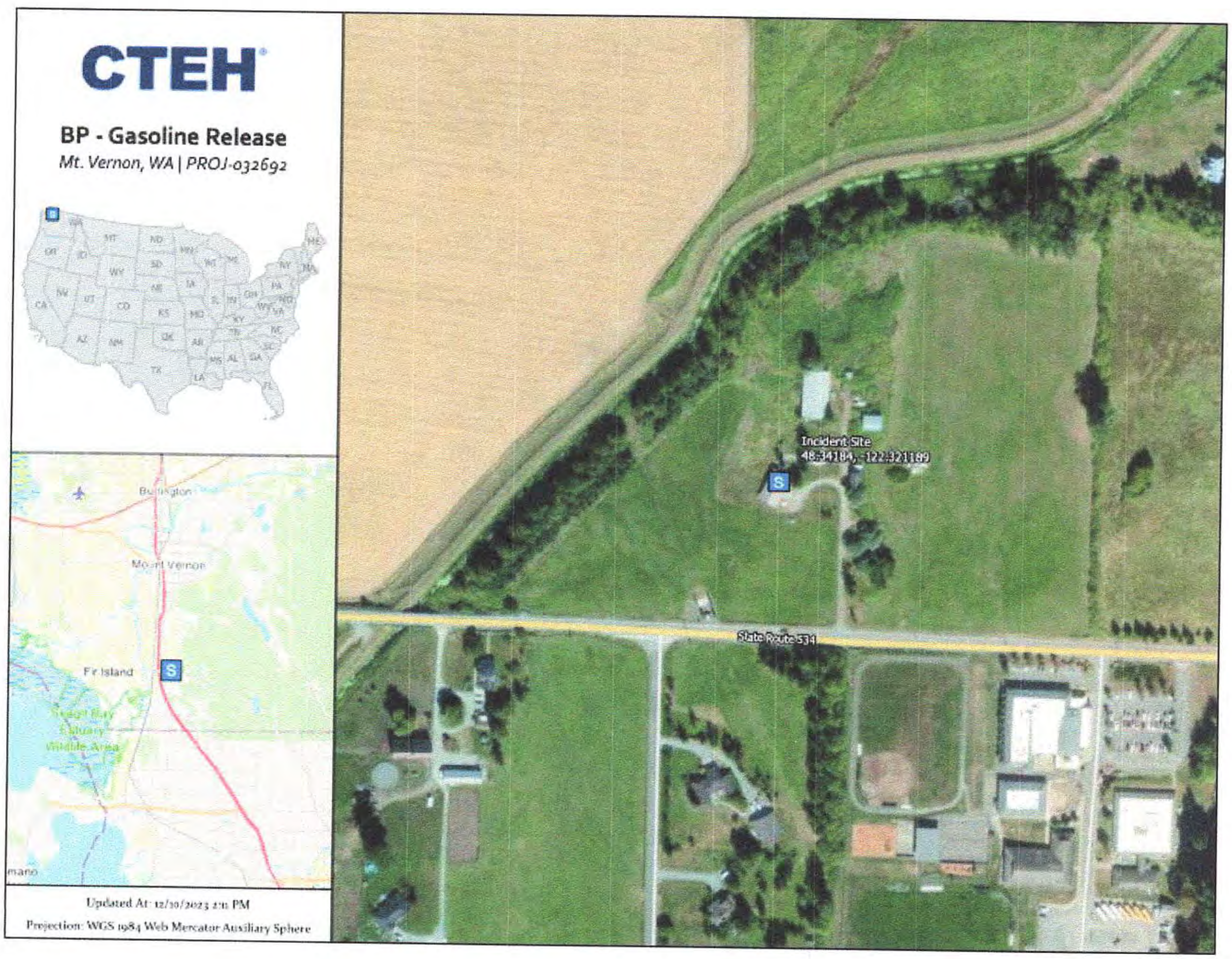


Figure 2. Map of Example Mobile Real-Time Air Monitoring Roving Locations (represented by green dots)

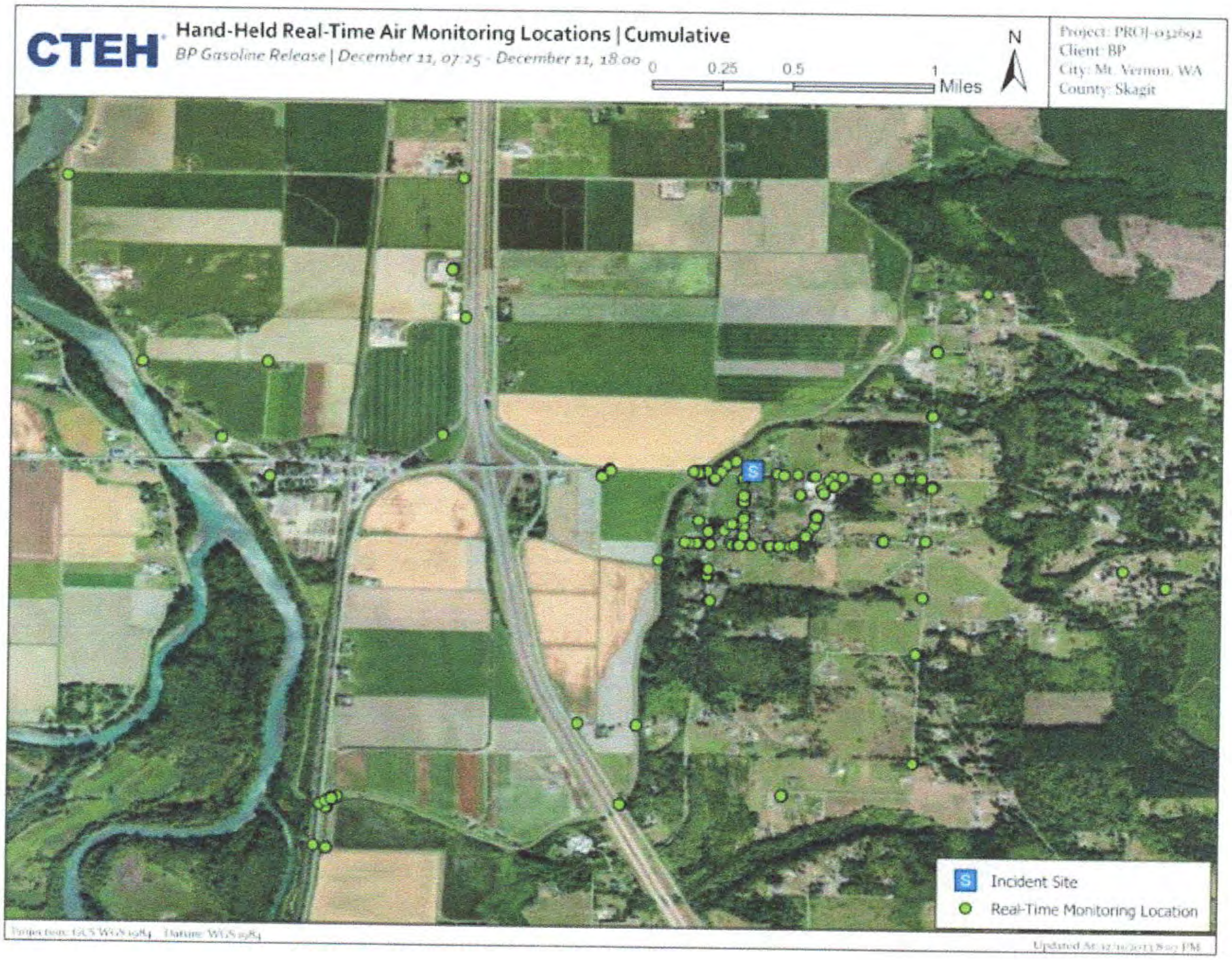


Figure 3. Map of Continuous Monitoring Radio-telemetering AreaRAE Instrument Locations

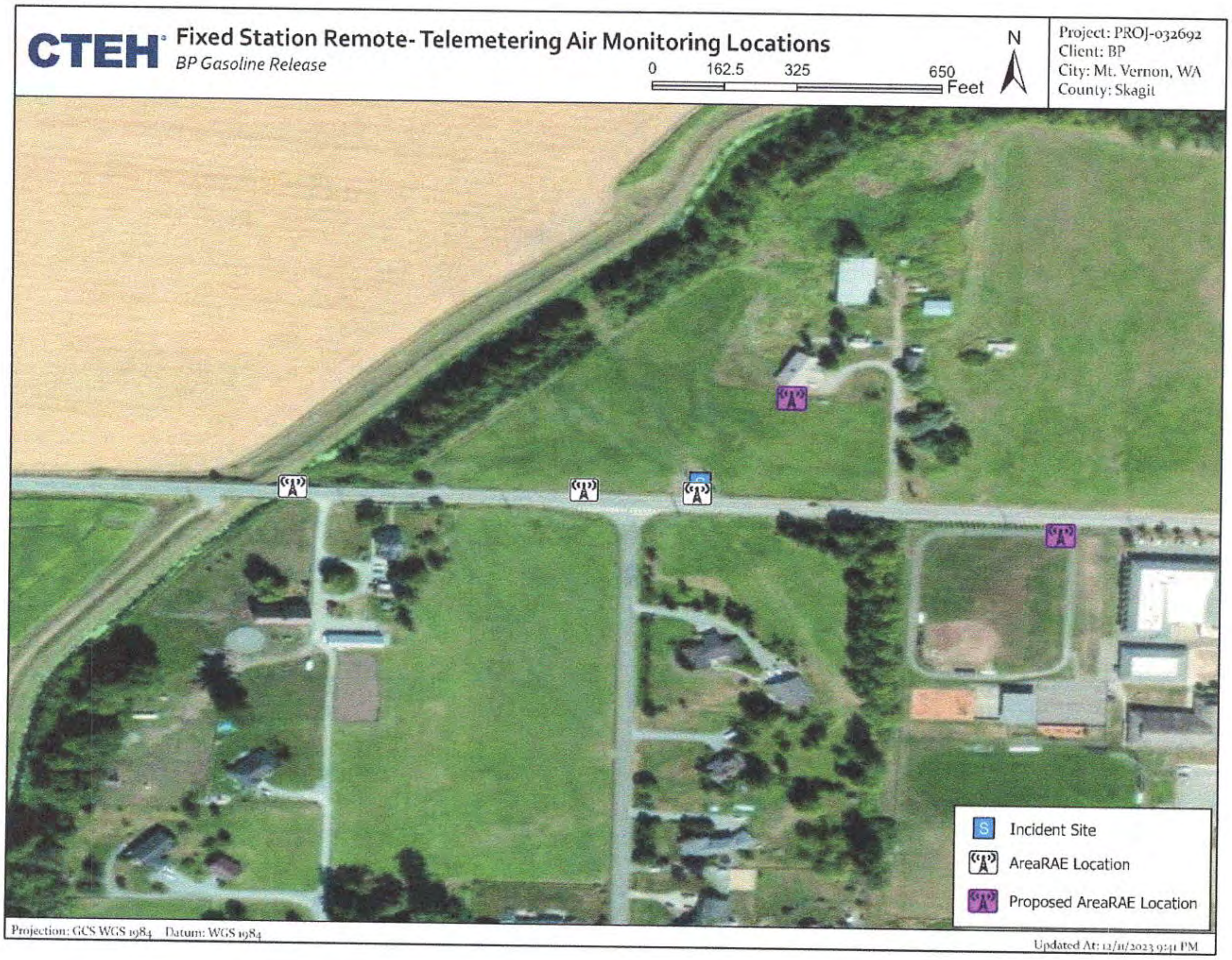
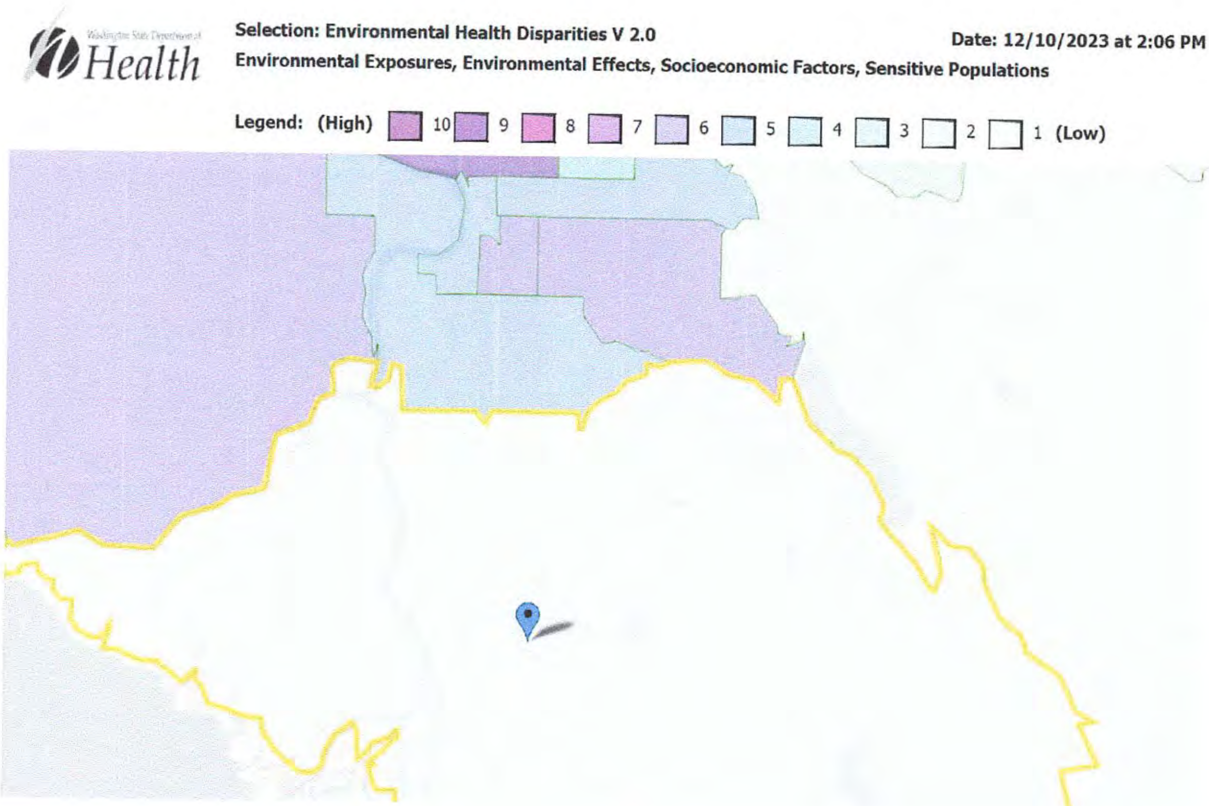


Figure 4. Washington Department of Health, Environmental Disparity Map.



SOURCE: HTTPS://FORTRESS.WA.GOV/DOH/WTNIBL/WTNIBL/MAP/EHD

Figure 5. Map of Analytical Air Volatile Organic Compound Sampling Stations

[To be added in Phase 2.]

3.0 CHEMICALS OF CONCERN AND COMMUNITY ACTION LEVELS

3.1 Gasoline

Gasoline is a complex mixture of hydrocarbons primarily derived from the refining of crude oil. The chemical composition of gasoline depends on various factors including the source and type of crude oil, as well as the refining process used. Key properties used to characterize gasoline include octane rating, volatility, density, and flammability. One of the most significant properties of gasoline is its high flammability, making it a potent fuel but also posing a significant risk of fire and explosion if not handled properly. The volatility of gasoline is a significant factor, particularly in terms of public health risks, as it contains volatile organic compounds (VOCs) like benzene, toluene, ethylbenzene, and xylene (BTEX).

3.2 Community Emergency Response Guideline Levels for Gasoline

The community emergency response guideline levels for released gasoline in accordance with NWACP guidelines and shown in Table 1 below. The United States Environmental Protection Agency's Acute Exposure Guideline Level 1 (AEGL-1) is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure. Protective Action Criteria (PAC) levels associated with mild and transient health effects (PAC-1) were used when no AEGL values have been established. The listed compounds will be monitored as directed by the CAM Team Leader under the direction of the Incident Command. Due to its carcinogenicity, benzene is typically the chemical constituent of gasoline that drives the risk for human exposure to gasoline volatiles. Thus, benzene detections above the 24-hr Environmental Exposure Guidance Level (NRC, 2008) of 3 ppm will result in notification to the Community Air Monitoring (CAM) Team Leader who will notify the Incident Command. Benzene detections above the 1-hr AEGL-1 of 52 ppm, sustained for five minutes, will result in notification to the CAM Team Leader who will notify the Incident Command to evaluate whether evacuations are prudent. The other listed compounds will be monitored as directed by the CAM Team Leader under the direction of the Incident Command Depending on response conditions, the chemicals listed in Table 1 may be updated and inclusion of additional analytes and guidelines levels not presently listed will prompt the creation and UC-approval of an updated CAM plan.

Table 1. Community Emergency Response Guideline Levels

Chemical	Guideline Level	Basis
Volatile Organic Compounds (VOCs)	20 ppm	NWACP Sec. 9418
Benzene	52 ppm	AEGL-1 (60 minutes)
Ethyl benzene	33 ppm	AEGL-1 (60 minutes)
Hexane	50 ppm	NIOSH REL (10-Hr)*
Toluene	67 ppm	AEGL-1 (60 minutes)
Xylenes	130 ppm	AEGL-1 (60 minutes)
%LEL	1%	Detection

*Only AEGL-2 and -3 values exist for hexane.

4.0 REAL-TIME AIR MONITORING METHODOLOGIES

Phase 1: Initial Response and Assessment Phase

Objective: Characterize the nature and extent of airborne impact, if any, from the spilled gasoline. Using basic instrumentation, obtain location-based monitoring results. Using basic instrumentation, obtain location-based monitoring results. Monitor downwind of an incident then move 360 degrees around the site, or into the Community in proximity to the incident. Identify and monitor at locations with sensitive populations downwind of the incident location. Rapidly communicate the results above site-specific action levels. Document the plume direction(s), if any. Monitoring frequency will be continuous throughout Phase I as feasible based on the personnel available for deployment to the Community. Site-specific action levels and instrument methodologies is provided in Table 2 on the following pages.

4.1 General Information on Procedures (Assessment Techniques) Used

Procedure	Description
Hand-held Air Monitoring Survey	CTEH Responders will utilize handheld instruments (e.g., MultiRAE Pro; ppbRAE, Gastec colorimetric detector tubes, etc.) to measure airborne chemical concentrations. Personnel will use these hand-held instruments primarily to measure for potential breathing zone exposures. Additionally, measurements can be made at grade level, as well as in elevated workspaces, as indicated by chemical properties or site conditions.
Calibration	All instrumentation will be calibrated according to manufacturer's recommendations or sample method requirements.

Table 2: Community Air Monitoring Methodologies and Action Levels

Objective: Report air levels before they reach those causing nuisance or health issues

Analyte	Action Level	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
Total VOCs	20 ppm 5 minutes	Report reading to CAM leader, ENVL, and Unified Command; Assess for the presence of BTEX compounds; report reading to PM/PTD	Potential egress of compounds from incident site	MultiRAE PID AreaRAE PID	0.1 ppm	Range: 0.1 – 5,000 ppm	NA
Benzene	Detection sustained for 5 min	Confirm reading with secondary instrument; Exit area or don air purifying respirator; Report reading to PM/PTD	Inform PM/PTD of potential off-site issues	UltraRAE PID	0.01 ppm	UltraRAE - Change SEP tube frequently	NA
				Gastec tube #121L	0.05 ppm	Range: 0.1 – 65 ppm Volume: Variable	Var.
	52 ppm 5 min	Report reading to CAM Team Leader, Safety and Unified Command; Confirm Reading; Assess need for community shelter-in-place or evacuation	1-h AEGL-1	UltraRAE PID	0.01 ppm	UltraRAE - Change SEP tube frequently	NA
				Gastec tube #121L	0.05 ppm	Range: 0.1 – 65 ppm Volume: Variable	Var.
	3 ppm 24-h	Report reading to CAM Team Leader, Safety	24-h EEGL	UltraRAE PID	0.01 ppm	UltraRAE - Change SEP tube frequently	NA
				Gastec tube #121L	0.05 ppm	Range: 0.1 – 65 ppm Volume: Variable	Var.
	0.2 ppm >24-h to 14-days	Report reading to CAM Team Leader	90-day CEGL	UltraRAE PID	0.01 ppm	UltraRAE - Change SEP tube frequently	NA
				Gastec tube #121L	0.05 ppm	Range: 0.1 – 65 ppm Volume: Variable	Var.

Analyte	Action Level	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
Ethyl benzene	33 ppm Sustained for 5 min	Report reading to CAM Team Leader, Safety and Unified Command	1-h AEGL-1	Gastec tube #122	1 ppm	Range: 11 – 330 ppm Volume: Variable	NA
Hexane	50 ppm Sustained for 5 min	Report reading to CAM Team Leader, Safety and Unified Command	NIOSH REL (10-Hr)	Gastec #102L	1 ppm	Range: 4 – 1,200 ppm Volume: Variable	Variable
Toluene	67 ppm Sustained for 5 min	Report reading to CAM Team Leader, ENVL, and Unified Command	1-h AEGL-1	Gastec tube #122L	0.5 ppm	Range: 1 - 100 ppm Volume: variable	Variable
Xylenes	130 ppm	Report reading to CAM Team Leader, ENVL, and Unified Command	1-h AEGL-1	Gastec tube #122L	1 ppm	Range: 5-625 ppm Volume: variable	Variable
%LEL	1% sustained for 5 min	Report reading to CAM Team Leader, ENVL, and Unified Command	LEL Detection (4% LEL corrected)	MultiRAE Sensor AreaRAE Sensor	1 %	Range: 1 – 100%	2.6
	3.8 % sustained for 5 min	Exit area; Report reading to CAM Team Leader, ENVL, and Unified Command	Elevated %LEL (10% LEL corrected)	MultiRAE Sensor AreaRAE Sensor	1 %	Range: 1 – 100%	2.6
%LEL (as total VOCs*)	130 ppm 5 min	Report reading to CAM Team Leader, ENVL, and Unified Command	1% LEL	MultiRAE PID AreaRAE PID	0.1 ppm	Measuring range: 1 – 5000 ppm	NA
	1,300 ppm 1 min	Exit area; Report reading to CAM Team Leader, ENVL, and Unified Command	10% LEL	MultiRAE PID AreaRAE PID	0.1 ppm	Measuring range: 1 – 5000 ppm	NA

*Gasoline has a lower explosive limit (LEL) of 1.3% (13,000 ppm) in air; correction factors (CF) vary for LEL sensors and 10.6 eV PIDs and are sourced from RAE Systems by Honeywell TN-156 and TN-106A (and B), respectively.
AEGL: Acute Exposure Guideline Levels (USEPA)
EEGL: Emergency Exposure Guidance Levels (NRC, 2008)
CEGL: Continuous Exposure Guidance Levels (NRC, 2008)

Phase 2: Sustained Community Assessment Phase

Objective: Identify and quantify the airborne contaminant(s). Use these results to inform Incident Command and enable them to make recommendations for community protection. At the beginning of each operational period or as needed, collect and assess critical information that may affect CAM activities, including weather forecast, applicable dispersion models or trajectories, contaminant weathering, incorporate any relevant or new information or shifts in objectives that may alter the CAMP. If air monitoring indicates levels are all below instrument detection limits during Phase I, the need for additional monitoring in Phase II may not be necessary. Analytical sampling locations that to be proposed during Phase II may be based on the detection of chemicals of potential concern, if any, during Phase I, wind direction, and odor complaints from the Community, if any. The methodologies and media to be considered for use in analytical sampling is provided in Table 3. Monitoring frequency will be continuous throughout Phase II as feasible based on the personnel available for deployment to the community.

The Action Levels and Analytes for real-time air monitoring during Phase 2 operations remain the same as above unless otherwise determined by Unified Command in consult with the CAM Team Leader or Technical Specialist and the ENVL with regards to the scientific nature of the analytes in question. Modification will be reviewed and approved by the proper channels and implemented in document changes.

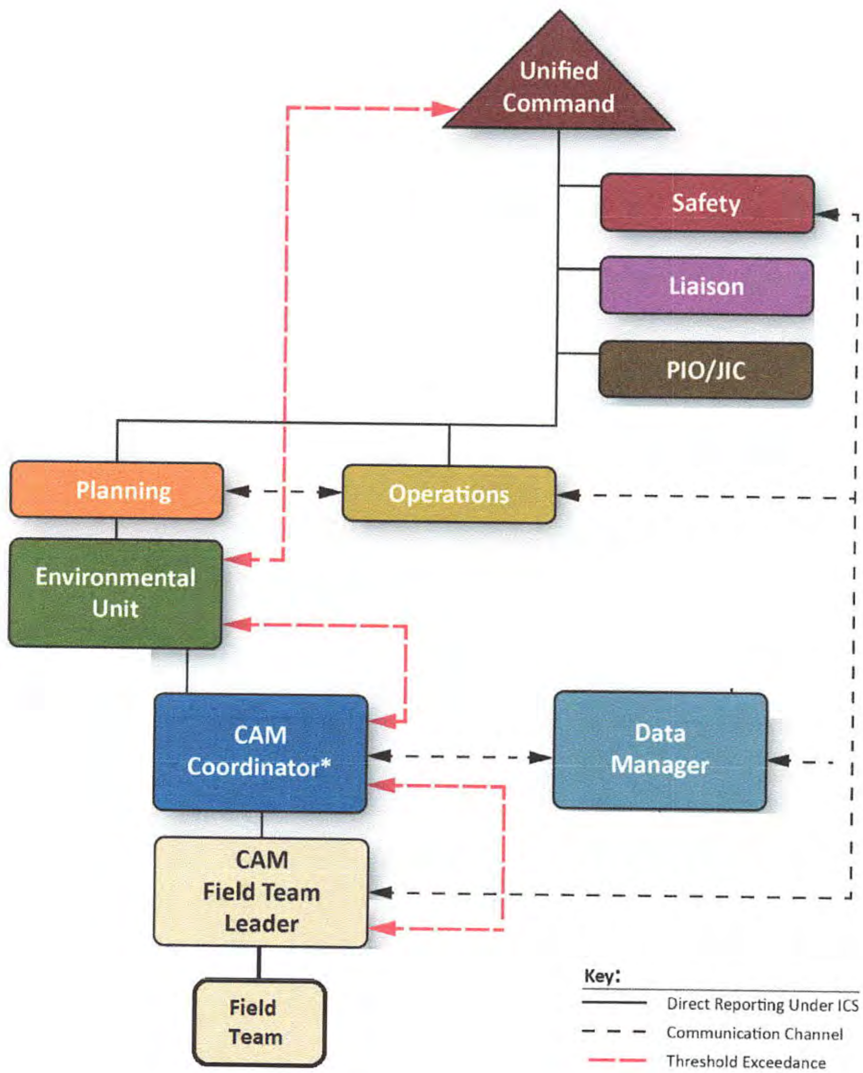
Table 3. Analytical Air Sampling Methods and Media

Analyte	Media/Can	Method	Notes
VOCs	Evacuated Canister/SUMMA	EPA TO-15	Indicators of hydrocarbon vapors

5.0 COMMUNITY AIR MONITORING COMMUNICATION

Guidance for community air monitoring communications is depicted in **Figure 6**. In brief, any air exceedance will be reported from the field to the CAM coordinator and the Environmental Unit Lead immediately, in order to inform the UC. Regular recurring field reports will be provided to the CAM coordinator in the EU every 24 hours, who will then review and disseminate. The results will be delivered to the representatives of Situation, JIC, Liaison, Operations, Safety, and Unified Command.

Figure 6. Organizational Chart for Reporting of Community Air Monitoring Data



Role	Name
Planning Section Chief	
Environmental Unit Leader	
Community Air Monitoring Leader	
Public Information Officer	
Liaison Representative	
Operations Section Chief	
Situation Unit Leader	

6.0 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Method	Procedure
Real-time Air Monitoring	• Real time instruments may be calibrated in excess of the manufacturer's recommendations, whenever indicated by site conditions or instrument readings, or at the start of every 12-hour shift. • Serial numbers for all analytical equipment used in field deployment will be recorded in the Air Monitoring Field Sheets • Lot numbers and expiration dates will be recorded with use of Gastec colorimetric tubes. • Meter readings for baseline samples will be evaluated on a daily basis to determine the percent drift, if any.
Analytical Air Sampling	• Chain of custody documents will be completed for each sample. • Serial numbers for all analytical equipment used in field deployment will be recorded in the Air Monitoring Field Sheets • Co-located sampling for analytical analysis may be conducted, if necessary, to assess accuracy and precision in the field. • Level IV data validation may be performed on the first sample group analyzed. • Level II data validation may be performed on 20% of all samples. • Level IV data validation may be performed on 10% of all samples.

7.0 GLOSSARY

Term	Definition
Sustained	Instrument reading above the action level continuously for the listed time period.
Breathing zone	The area within an approximate 10-inch radius of an individual's nose and mouth.

8.0 DATA MANAGEMENT

8.1 Data Quality Objectives

Air Monitoring will be conducted to determine if chemical concentrations are detectible in the community and below applicable community exposure guidelines. Exceedances of the community action levels will result in notification to the CAM Team Leader who will notify up the chain of command, as appropriate.

CTEH specific standard operating procedures (SOPs) will be utilized for consistent method continuity among field technicians collecting individual samples. Data sources and data management processes are described in Table 6.

Table 6. Data Sources and Data Management

Data Source	Required Information	Processing Instructions	Processing Frequency	Processing Responsibility	Storage Location	Final Output
Site Documents	Site Files, Health and Safety Plan, CAMP	File hard copies and electronic copies in indicated storage location	Beginning of project and as needed	CAM Team Leader	Digital: CTEH Projects Secure Server. Hard Copy: Project secure file	.pdf and other image formats
Field Sheets	Sample No., Date, Time, Sampler, Location, Field conditions	File hard copies and electronic copies in indicated storage location	Per sampler, location, equipment, and date	Sample Coordinator	Digital: CTEH Projects Secure Server Hard Copy: Project secure file	.pdf and other image formats
Real-Time Monitoring Data	Background concentrations, instrument data with time, date, and GPS location	Upload into Mobile Data Systems (MDS) software	At least every 10 data logs	Data Manager	CTEH Secure Server	.pdf and other image formats
Other Data Sources (as requested)						

9.0 SHORT COMMUNITY AIR MONITORING CHECKLIST

The following checklist outlines major points of establishing a CAM program during an emergency response, broken into operational phases. This section may be used as a tracking tool; each point is further detailed in the implementation checklists in later sections.

9.1 Initial Response and Assessment Phase (Days 1-2)

- ☐ Conduct/receive initial notification call with the other responding personnel.
- ☐ Receive objectives (or establish if none are available) of the CAMP using the objectives established by IC/UC as guidance.
- ☐ Mobilize readily available personnel and equipment.
- ☐ Prior to or during deployment, collect and assess information about contaminant properties, weather conditions and forecasts, the locations of HCAs (i.e., vulnerable and/or sensitive populations), and potential dispersion of contaminants. This information will help guide initial Field Team assessments.
- ☐ During the course of CAM activities, responders should continually assess the external variables that affect airborne contaminant behavior and data analysis.
- ☐ Determine the scope and scale of the area(s) to be monitored by initial CAM teams.
- ☐ As soon as practicable, deploy experienced rapid response air monitoring CAM Field Team(s) to collect baseline data for airborne contaminants.
- ☐ Establish communication and coordination with appropriate ICS group(s) and/or Air/Public health agencies.
- ☐ Identify initial CAM action levels for the contaminants of concern.
- ☐ Establish a process and schedule (i.e., hourly, daily, etc.) for reporting results and Action Level (or other threshold) exceedances.
- ☐ Determine the number of CAM Field Teams and appropriate level of Command Post staff.
- ☐ Submit Resource Request to Logistics for Field Team personnel and equipment.
- ☐ Establish general expectations, procedures, and accountability for CAM data management tasks.
- ☐ Establish a data management system.
- ☐ Develop a field assessment and reporting schedule as appropriate to provide key assessment information as needed by IC/UC, Safety, Liaison, Public Information Officer (PIO)/Join Information Center (JIC), or others.
- ☐ Identify incident specific health and safety considerations for CAM operations and communicate them to the Safety Officer.

- ☐ Establish endpoints for CAM activities
- ☐ Begin drafting a CAMP.

9.2 Sustained Community Assessment Phase (Day 3+)

- ☐ At the beginning of each operational period (or as needed), collect and assess critical information that may affect CAM activities.
- ☐ Determine which locations should be assessed and in what order.
- ☐ Ensure that all elements of the CAMP have been completed and or updated as needed.
- ☐ Prepare, deploy, and manage CAM Field Teams conducting monitoring assessments. This may be managed by the Field Team Leader or CAM Coordinator.
- ☐ Finalize or update the process for summarizing and communicating CAM field data.
- ☐ Ensure that assessment data from Field Teams is flowing into the command post and disseminated appropriately.

9.3 Demobilization Phase (To Be Determined)

- ☐ Ensure all expectations agreed upon initially have been met or communicated.
- ☐ Discuss continued CAM results with the Client Air Monitoring Lead.
- ☐ Establish a communication protocol with CAM group that notifies the Incident Command when monitoring has been completed within a given area.
- ☐ Establish endpoints for area monitoring clearance.
- ☐ Finalize monitoring efforts in all CAM locations based on endpoints.
- ☐ Coordinate personnel and equipment demobilization through the Demobilization Unit.
- ☐ Ensure that all of the CAM documents and data are collected and archived with the Documentation Unit.
- ☐ Identify, evaluate, and report all known gaps, delays, or interruptions of all data deliverables to strengthen future performances in the management and communication of CAM data.

Management of Change:			
	Name/Organization	Signature	Date Signed
Approved by:	Michael Reilly, PhD	[signature]	12/11/2023
Approved by:			
Approved by:			
Approved by:			

Mt Vernon, WA

Gasoline Release

COMMUNITY AIR MONITORING PLAN (CAMP)

Version 1.1

Prepared on behalf of BP

Prepared By:
CTEH, LLC
5120 Northshore Drive
Little Rock, AR 72118
501-801-8500
December 11, 2023

	Name/Organization	Signature	Date Signed
Prepared by:	Michael Reilly, PhD, CTEH		12/11/2023
Reviewed by:	Andrew Henault, BS, CTEH		12/11/2023
Approved by:			
Approved by:			
Approved by:			
Approved by:			
Approved by:			
Approved by:			

CAM Endpoints Addendum – March 08, 2024

The Environmental Unit is recommending community real-time air monitoring and analytical air sampling continue until airborne contaminant threats have been abated or no longer a sustained concern.

As conveyed in the December 2023, UC-approved CAM Plan generated in response to the Olympic Pipeline gasoline spill which occurred on December 10, 2023, volatile organic compounds (VOCs), particularly benzene, toluene, ethylbenzene, and xylenes (BTEX), as well as flammability measured as the percentage of the lower explosive limit (%LEL) are the primary contaminants of concern while bulk product recovery is ongoing during emergency soil and/or sediment removal activities.

As of March 7, 2024, roving real-time air monitoring personnel have collected more than 17,500 measurements in the community and have not detected any contaminants of concern at levels meeting or exceeding the compound-specific action levels laid out in the CAM Plan with the exception of a single low-level detection of benzene immediately downwind of the incident location on December 11, 2023.

Unified Command is directing the Environmental Unit to continue roving real-time air monitoring activities in the surrounding community until March 13, 2024, to ensure there is no longer a threat of total VOCs including BTEX compounds and flammability to the community. If readings for total VOCs, which would reflect BTEX compounds, and %LEL remain below the action level defined in the CAM Plan, the CAM team will begin to demobilize roving air monitoring equipment and personnel in the community. Air sampling and continuous fixed-station radio telemetering equipment will remain in the community and adhere to the action levels laid out in the CAM Plan.

Should ongoing response activities at the incident location lead to emergent threats of fugitive emissions of total VOCs including BTEX compounds and/or flammability, as informed by fixed location AreaRAE units in the community, the CAM team will remobilize roving personnel and equipment into the surrounding community and resume roving air monitoring activities per the CAM Plan. Specifically, in the event that air monitoring personnel in the work area at the incident location identify elevated concentrations (i.e., those exceeding the actions levels laid out in the Preliminary Air Sampling and Analysis Plan, December 2023), follow-up readings will be collected in downwind locations along the work area perimeter. Confirmation of sustained elevated detections of total VOCs, BTEX, and/or % LEL will prompt the CAM Lead to recommend a remobilization of roving air monitoring activities in accordance with the CAM Plan. Should this occur, the reinstated roving air monitoring activities will remain for a 24-hour period, remaining active until no contaminants of concern are detected above the action levels specified in the CAM Plan for a full 24 hours, at which point the roving resources will be demobilized.

If approved by Unified Command, the roving CAM endpoints defined in this General Message will be added as an addendum to the preliminary Community Air Monitoring Plan.

DOCUMENTATION – COVER SHEET

MP 46 Olympic Pipeline Spill Conway South of Allen Station

Date: 12 December 2023

Document Control Name: Air Sampling

Prepared by: Robyn Whiteford

Preparer Role: Documentation Lead

Approvals

Role	Print Name above	Sign Above	Date	Time
Responsible Party / Incident Commander	Terry Zimmerman	Terry Zimmerman	12 Dec 23	12:11 12/13 TZ
Federal On-Scene Coordinator	Monica Tonel	Monica Tonel	12/13/23	1245
Washington State On-Scene Coordinator	Madeline Fritzen	MF	12/12/23	1257 12/13 MF
Local On-Scene Coordinator	Julie DeLosada/Joan Cromley	Joan Cromley	12/12/23	12:04 12/13
Tribal Coordinator	Shaun Beasley Jeff Soleman		12.13.2023 12-12-23	 1208
Section Chief	Tony Hout	Tony Hout	12 Dec 23	1630
Unit Leader				

	Revision Record		
Change Date	Remove Insert Page Number(s)		Description of Change(s)
			This is revision 0. Describe subsequent revisions in this table.

THE SCIENCE OF READY℠

Gasoline Release

Mt. Vernon, WA

Preliminary Air Sampling and Analysis Plan (SAP)

Version 1.1

Prepared on behalf of BP

Prepared By:

CTEH, LLC

5120 Northshore Drive

Little Rock, AR 72118

501-801-8500

December 12, 2023

	Name/Organization	Signature	Date Signed
Prepared by:	Michael Reilly, PhD / CTEH, LLC	MReilly	12/12/2023
Reviewed by:	Andrew Henault, BS / CTEH		12/12/2023
Approved by:			
Approved by:			
Approved by:			

Air Monitoring and Sampling Strategy

CTEH® is focusing on the chemicals, and indicators of flammability chosen below because they are among the most important and readily monitored hazards of spilled or released gasoline. The possible hazards of gasoline vary with the environmental conditions associated with the spill. Monitoring and sampling for some chemicals or indicators of the presence of gasoline may be conducted less frequently or even discontinued as product-specific information becomes available or as initial monitoring and sampling results indicate that these chemicals and indicators do not pose a health concern.

The strategy is to utilize two broadly defined monitoring plans: **1)** Worker Activity Monitoring; **2)** Site Assessment. Worker Activity monitoring will generally take place in the presence of workers performing/supporting remediation operations. The readings will generally be taken at a height consistent with that of the samplers breathing zone and in proximity to workers without interfering or obstructing their remediation tasks. Unlike Worker Monitoring, Site Assessment does not necessarily represent ambient air monitoring near breathing zone level. Site Assessment may involve a variety of different monitoring tasks intended to provide information that may help to delineate the nature and extent of the release (e.g. fence line monitoring, worst case determination, container head space, ground level, etc.). Community air monitoring will be conducted under a separate Community Air Monitoring Plan

Free-roaming handheld real-time air monitoring may be conducted in a variety of areas based on levels of activity, proximity to the release, and site conditions. Radio-telemetering RAE Systems® AreaRAE/AreaRAE Plus units may be deployed in all monitoring plans to allow for continuous air monitoring in multiple areas. AreaRAE/AreaRAE Plus readings may be received and monitored in a centralized location by CTEH® personnel to allow for recognition, communication, and response to changing conditions.

Discrete air samples may be collected in all monitoring areas and sent to an off-site laboratory for chemical analysis. These analytical air sampling techniques may be used to provide air quality data beyond the scope of real-time instruments. When necessary, discrete air samples may be collected on individual workers (personal sampling) to provide exposure data over the course of a work shift for more direct comparison to occupational exposure values.

CTEH Site-Specific Action Levels

CTEH® site-specific action levels may be employed in all air monitoring plans to provide information for corrective action to limit potential exposures. These values do not replace occupational exposure standards or guidelines but are intended to represent a concentration limit that triggers a course of action to better address worker and public safety. Action level exceedances will be communicated to Site Management and the CTEH Project Technical Director by the CTEH Project Manager (PM). Work practice may be assessed and then altered if necessary. Site-Specific Action Levels are not utilized for Site Assessment monitoring.

Plan 1: Worker Monitoring

Objective: Report air levels before they reach those requiring respiratory protection

Analyte	Action Level	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
Total VOCs	30 ppm 5 min	Assess for the presence of BTEX-H compounds*; report reading to PM/PTD	To avoid over exposure to BTEX-H compounds	MultiRAE PID AreaRAE PID	0.1 ppm	Range: 1 – 5,000 ppm	NA
	300 ppm 5 min	Don respirator or evacuate area; Report reading to PM/PTD	ACGIH TLV-TWA	MultiRAE PID AreaRAE PID	0.1 ppm	Range: 1 – 5,000 ppm	NA
Benzene	0.5 ppm 5 min	Confirm reading with secondary instrument; Exit area or don air purifying respirator; Report reading to PM/PTD	ACGIH TLV-TWA	UltraRAE PID	0.01 ppm	UltraRAE - Change SEP tube frequently	NA
				Gastec tube #121L	0.05 ppm	Range: 0.1 – 65 ppm Volume: Variable	Var.
	2.5 ppm 1 min	Exit area or don air purifying respirator; Report reading to PM/PTD	ACGIH TLV-STEL	UltraRAE PID	0.01 ppm	UltraRAE - Change SEP tube frequently	NA
				Gastec tube #121L	0.05 ppm	Range: 0.1 – 65 ppm Volume: Variable	Var.
Ethylbenzene	20 ppm 5 min	Sample only as requested*; Report reading to PM/PTD	ACGIH TLV-TWA	Gastec tube #122	1 ppm	Range: 11 – 330 ppm Volume: Variable	NA
Toluene	20 ppm 5 min	Sample only as requested*; Report reading to PM/PTD	ACGIH TLV-TWA	Gastec tube #122L	0.5 ppm	Range: 1 – 100 ppm Volume: Var.	Var.
Xylene	20 ppm 5 min	Sample only as requested*; Report reading to PM/PTD	ACGIH TLV-TWA	Gastec #123, 123L	1 ppm	#123 Range: 5-625 ppm #123L Range: 2-200 ppm Volume: Variable	NA
Hexane	50 ppm 5 min	Sample only as requested*; Report reading to PM/PTD	ACGIH TLV-TWA	Gastec tube #102L	1 ppm	Range: 4 – 1,200 ppm Volume: Variable	Var.

*Instances where total VOCs are detected in the work area above the action level may prompt the CTEH Project Manager (PM) to request sampling personnel follow-up with chemical-specific readings for Benzene at the same location. If further investigation of total VOCs exceeding the action level yields no detectible concentrations of benzene, the CTEH PM may prompt field personnel to collect chemical-specific readings for ethylbenzene, toluene, xylenes, and hexane. This process will be facilitated through the Safety Officer for communication and alignment with Incident Command.

Flammability

Analyte	Action Level	Corrected Value	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
LEL*	1 % 5 min	2.6 %	Notify PM/PTD	LEL Detection	MultiRAE Sensor AreaRAE Sensor	2.6 %	Measuring range: 1 – 100%	2.6
	3.8 % 1 min	10 %	Exit area and Notify PM/PTD	Elevated LEL	MultiRAE Sensor AreaRAE Sensor	2.6 %	Measuring range: 1 – 100%	2.6
VOCs*	130 ppm 5 min	NA	Notify PM/PTD	1 % LEL	MultiRAE PID AreaRAE PID	0.1 ppm	Measuring range: 1 – 5000 ppm	1
	1,300 ppm 1 min	NA	Exit area and Notify PM/PTD	10 % LEL	MultiRAE PID AreaRAE PID	0.1 ppm	Measuring range: 1 – 5000 ppm	1

*Gasoline has a lower explosive limit (LEL) of 1.3% (13,000 ppm) in air; correction factors (CF) vary for LEL sensors and 10.6 eV PIDs and are sourced from RAE Systems by Honeywell TN-156 and TN-106A (and B), respectively.

Plan 2: Site Assessment

Objective: Characterize nature and extent of release

Analyte	Action Level	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
Total VOCs	NA	Report reading to PM	NA	MultiRAE PID AreaRAE PID	0.1 ppm	Measuring range: 1 – 5,000 ppm	NA
Benzene	NA	Report reading to PM	NA	UltraRAE PID	0.01 ppm	UltraRAE - Change SEP tube frequently	NA
				Gastec tube #121L	0.05 ppm	Range: 0.1 – 65 ppm Volume: Variable	Var.
Toluene	NA	Report reading to PM	NA	Gastec tube #122L	0.5 ppm	Range: 1 – 100 ppm Volume: Variable	Var.
Hexane	NA	Report reading to PM	NA	Gastec tube #102L	1 ppm	Range: 4 – 1,200 ppm Volume: Variable	Var.

Flammability

Analyte	Action Level	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
LEL*	NA	Report Reading to PM	NA	MultiRAE Sensor AreaRAE Sensor	2.6 %	Measuring range: 1 – 100%	2.6
VOCs*	NA	Report Reading to PM	NA	MultiRAE PID AreaRAE PID	0.1 ppm	Measuring range: 1 – 5000 ppm	1

*Gasoline has a lower explosive limit (LEL) of 1.3% (13,000 ppm) in air; correction factors (CF) vary for LEL sensors and 10.6 eV PIDs and are sourced from RAE Systems by Honeywell TN-156 and TN-106A (and B), respectively.

Analytical Methods

Analyte	Media/Can	Method	Notes
VOCs	MiniCans (1L)	EPA TO-15 with TICs	
Benzene	Charcoal tube	NIOSH 1501	
BTEX (+Hexane)	3M 3520 Badge or Assay 566	Modified NIOSH 1500/1501	

General Information on Procedures (Assessment Techniques) Used

Procedure	Description
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.
Real-Time Handheld Survey	CTEH staff members may utilize handheld instruments (e.g. MultiRAE Plus; ppbRAE, Gastec colorimetric detector tubes, etc.) to measure airborne chemical concentrations. CTEH will use these handheld instruments primarily to monitor the ambient air quality at breathing zone level. Additionally, measurements may be made at grade level, as well as in elevated workspaces, as indicated by chemical properties or site conditions. CTEH may also use these techniques to verify detections observed by the AreaRAE network.
Fixed Real-Time Monitoring locations	Multiple locations may be identified and monitored at the same location approximately once per hour using handheld instruments. This allows the use of statistical analysis more effectively than with a random approach.
Analytical sampling	Analytical sampling may be used to validate the fixed and handheld real-time monitoring data, or to provide data beyond the scope of the real-time instruments. Analytical samples may be collected as whole air samples in evacuated canisters or on specific collection media, and sent to an off-site laboratory for further chemical analysis.

Quality Assurance/Quality Control Procedures

Method	Procedure
Real-Time	Real-time instruments may be calibrated in excess of the manufacturer's recommendations. At a minimum whenever indicated by site conditions or instrument readings. Co-located sampling for analytical analysis may be conducted, if necessary, to assess accuracy and precision in the field. Lot numbers and expiration dates may be recorded with use of Gastec colorimetric tubes.
Analytical	Chain of custody documents may be completed for each sample. Level IV data validation may be performed on the first sample group analyzed. Level II data validation may be performed on 20% of all samples. Level IV data validation may be performed on 10% of all samples.
Reporting	Daily data summaries may be provided for informational purposes using data that have not undergone complete QA/QC. Comprehensive reports of real-time and/or analytical data may be generated following QA/QC and may be delivered 60 days following receipt of validated results, if applicable.

Glossary

Term	Definition
Sustained	Instrument reading above the action level continuously for the listed time period.
Excursion Limit	Whenever a reading exceeds an ACGIH® TLV by 5 times (if the chemical does not have a STEL- or Ceiling-based action level), exit the area and notify the PM
Breathing zone	The area within an approximate 10-inch radius of an individual's nose and mouth.
Ambient Air	That portion of the atmosphere (indoor or outdoor) to which workers and the general public have access.

Change from version 1.0 to 1.1

In the section titled: Plan 1: Worker Monitoring: Added a footnote describing the series of events preceding a request to collect chemical-specific readings for benzene, ethylbenzene, toluene, xylenes, and hexane compounds.

	Name/Organization	Signature	Date Signed
Prepared by:	Michael Reilly, PhD / CTEH, LLC	[signature]	12/12/2023
Review by:			
Approved by:			
Approved by:			
Approved by:			
Approved by:			

Change from version 1.1 to 1.2

In the section titled:

	Name/Organization	Signature	Date Signed
Prepared by:			
Review by:			
Approved by:			
Approved by:			
Approved by:			
Approved by:			

9 of 10

Plan 1: Worker Monitoring

Objective: Report air levels before they reach those requiring respiratory protection

Analyte	Action Level	Action to be Taken	Basis	Instrument	Detection Limit	Notes	Correction Factor
Total VOCs	30 ppm 5 min	Assess for the presence of BTEX-H compounds*; report reading to PM/PTD	To avoid over exposure to BTEX-H compounds	MultiRAE PID AreaRAE PID	0.1 ppm	Range: 1 – 5,000 ppm	NA
	300 ppm 5 min	Don respirator or evacuate area; Report reading to PM/PTD	ACGIH TLV-TWA	MultiRAE PID AreaRAE PID	0.1 ppm	Range: 1 – 5,000 ppm	NA
Benzene	0.5 ppm 5 min	Confirm reading with secondary instrument; Exit area or don air purifying respirator; Report reading to PM/PTD	ACGIH TLV-TWA	UltraRAE PID	0.01 ppm	UltraRAE - Change SEP tube frequently	NA
				Gastec tube #121L	0.05 ppm	Range: 0.1 – 65 ppm Volume: Variable	Var.
	2.5 ppm 1 min	Exit area or don air purifying respirator; Report reading to PM/PTD	ACGIH TLV-STEL	UltraRAE PID	0.01 ppm	UltraRAE - Change SEP tube frequently	NA
				Gastec tube #121L	0.05 ppm	Range: 0.1 – 65 ppm Volume: Variable	Var.
Ethylbenzene	20 ppm 5 min	Sample only as requested*; Report reading to PM/PTD	ACGIH TLV-TWA	Gastec tube #122	1 ppm	Range: 11 – 330 ppm Volume: Variable	NA
Toluene	20 ppm 5 min	Sample only as requested*; Report reading to PM/PTD	ACGIH TLV-TWA	Gastec tube #122L	0.5 ppm	Range: 1 – 100 ppm Volume: Var.	Var.
Xylene	20 ppm 5 min	Sample only as requested*; Report reading to PM/PTD	ACGIH TLV-TWA	Gastec #123, 123L	1 ppm	#123 Range: 5-625 ppm #123L Range: 2-200 ppm Volume: Variable	NA
Hexane	50 ppm 5 min	Sample only as requested*; Report reading to PM/PTD	ACGIH TLV-TWA	Gastec tube #102L	1 ppm	Range: 4 – 1,200 ppm Volume: Variable	Var.

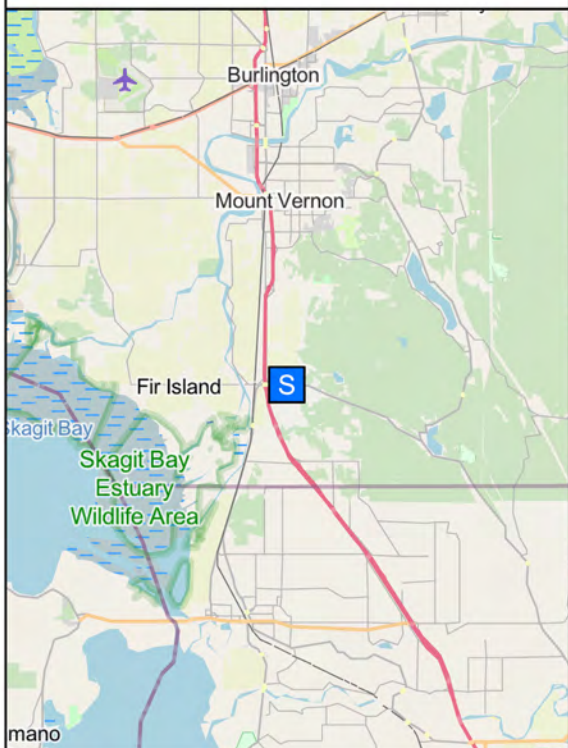
*Instances where total VOCs are detected in the work area above the action level may prompt the CTEH Project Manager (PM) to request sampling personnel follow-up with chemical-specific readings for Benzene at the same location. If further investigation of total VOCs exceeding the action level yields no detectible concentrations of benzene, the CTEH PM may prompt field personnel to collect chemical-specific readings for ethylbenzene, toluene, xylenes, and hexane. This process will be facilitated through the Safety Officer for communication and alignment with Incident Command.

Appendix B

Cumulative Maps of Manually Logged Real-Time Data Locations by Analyte

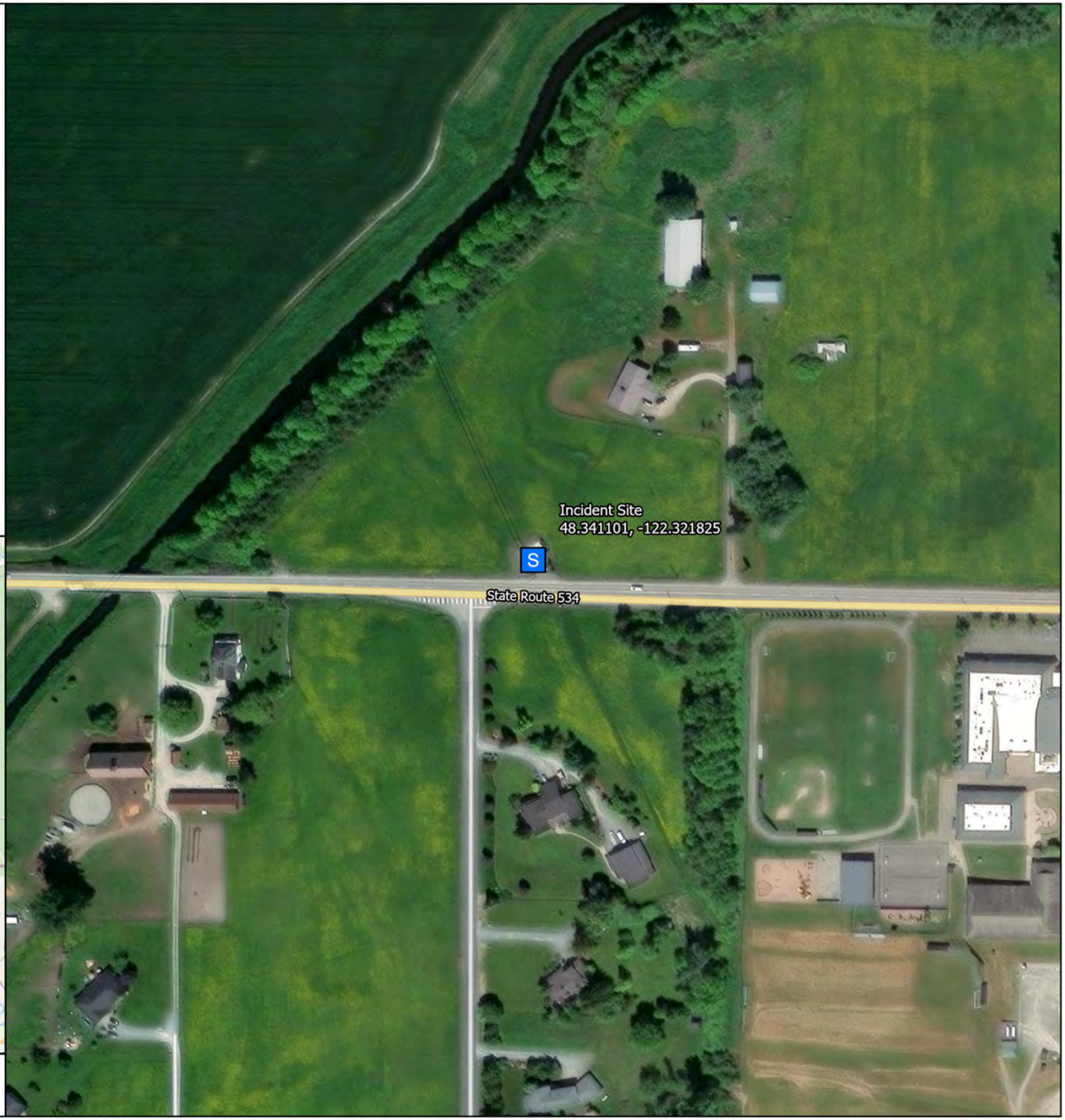
Olympic Pipeline Gasoline Spill

Conway, WA | PROJ-032692



Updated At: 9/16/2024 10:17 AM

Projection: NAD 1983 2011 UTM Zone 10N

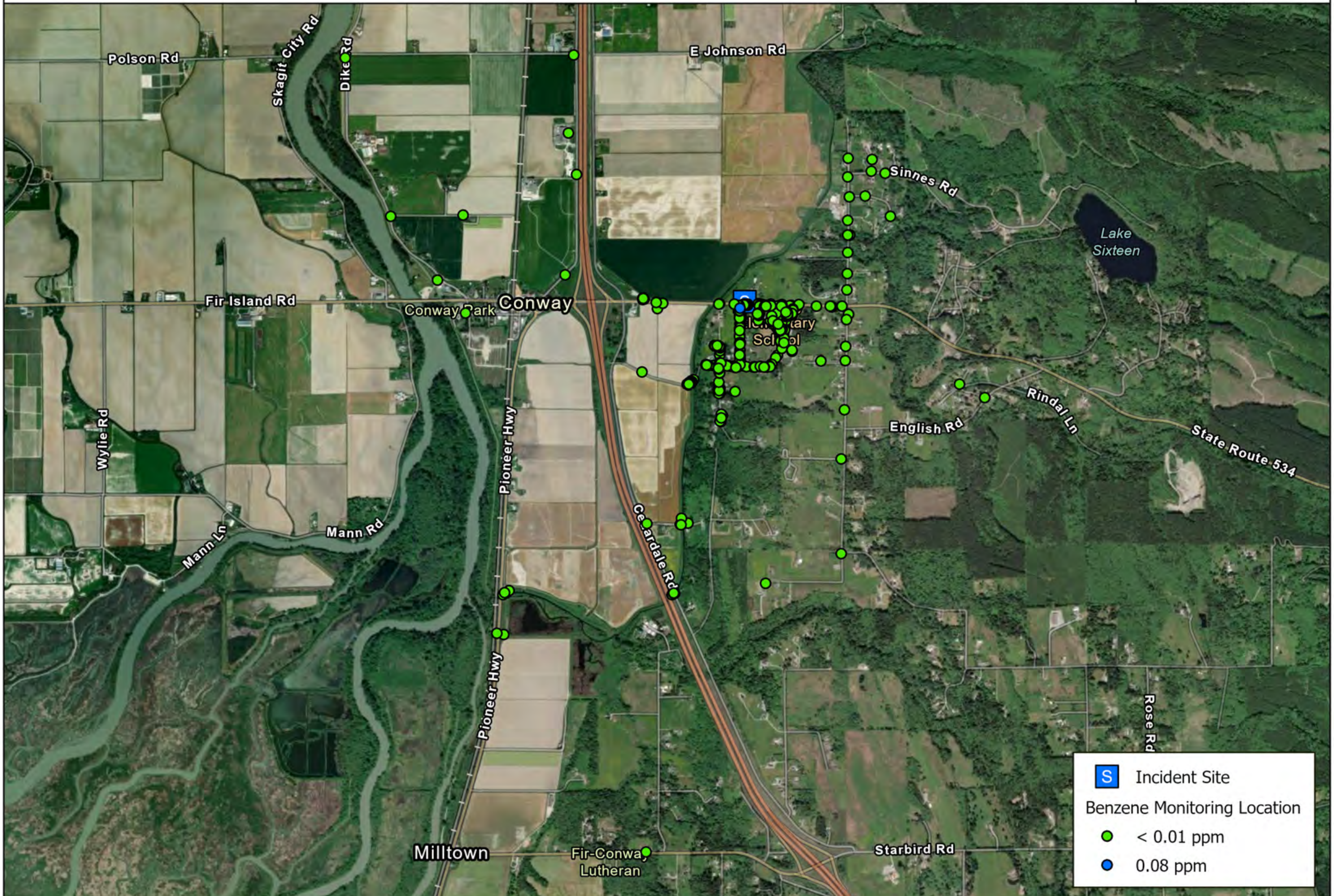


CTEH

Hand-Held Real-Time Air Monitoring Locations | Community Monitoring | Benzene

Olympic Pipeline Gasoline Spill | December 11, 2023 - March 19, 2024

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit



Projection: NAD 1983 2011 UTM Zone 10N Datum: NAD 1983 2011

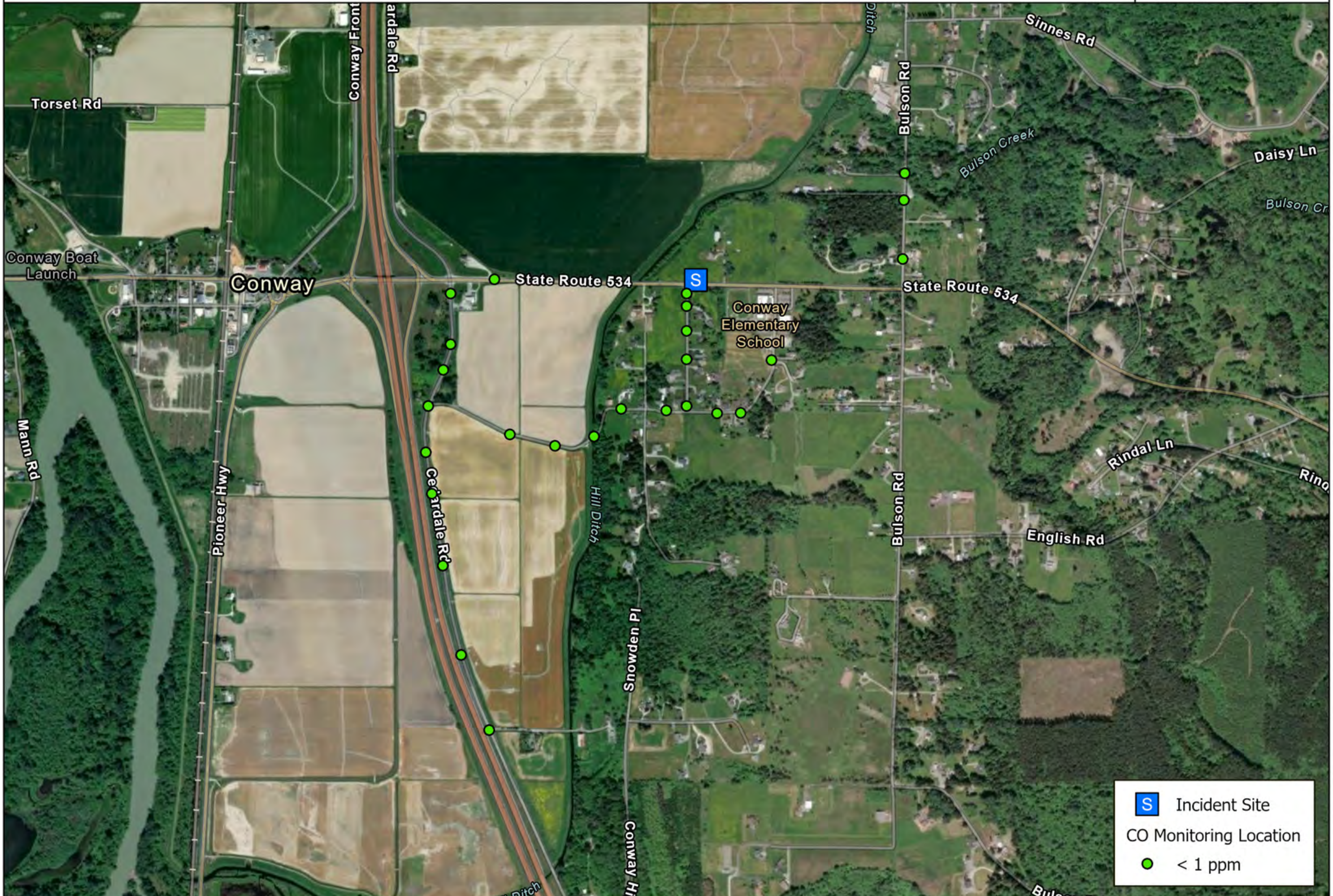
Updated At: 9/13/2024 5:57 PM

CTEH®

Hand-Held Real-Time Air Monitoring Locations | Community Monitoring | CO

Olympic Pipeline Gasoline Spill | January 11, 2024

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit



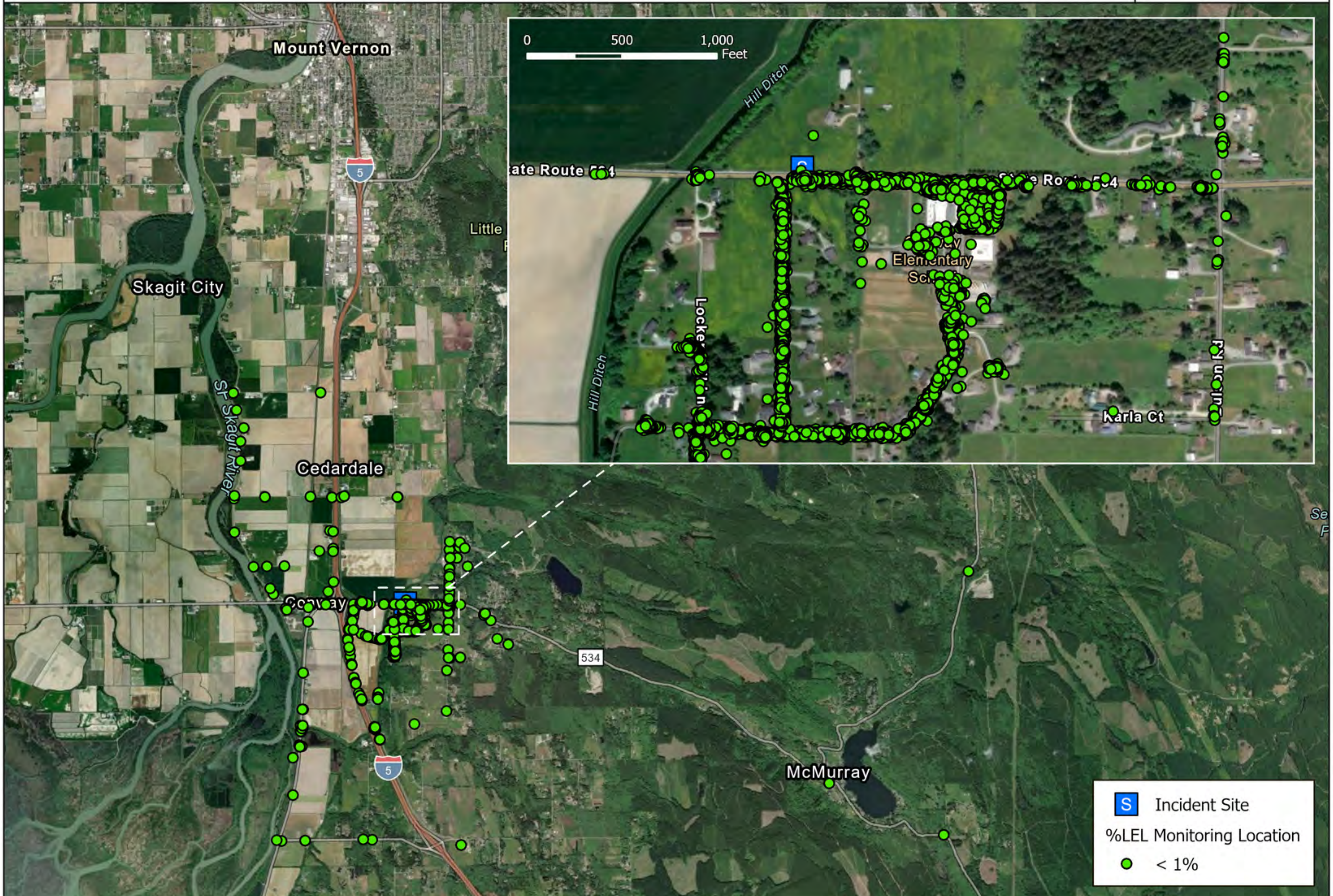
Projection: NAD 1983 2011 UTM Zone 10N Datum: NAD 1983 2011

Updated At: 9/13/2024 6:00 PM

Hand-Held Real-Time Air Monitoring Locations | Community Monitoring | %LEL

Olympic Pipeline Gasoline Spill | December 11, 2023 - March 19, 2024

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit



Projection: NAD 1983 2011 UTM Zone 10N Datum: NAD 1983 2011

Updated At: 9/13/2024 5:49 PM

CTEH

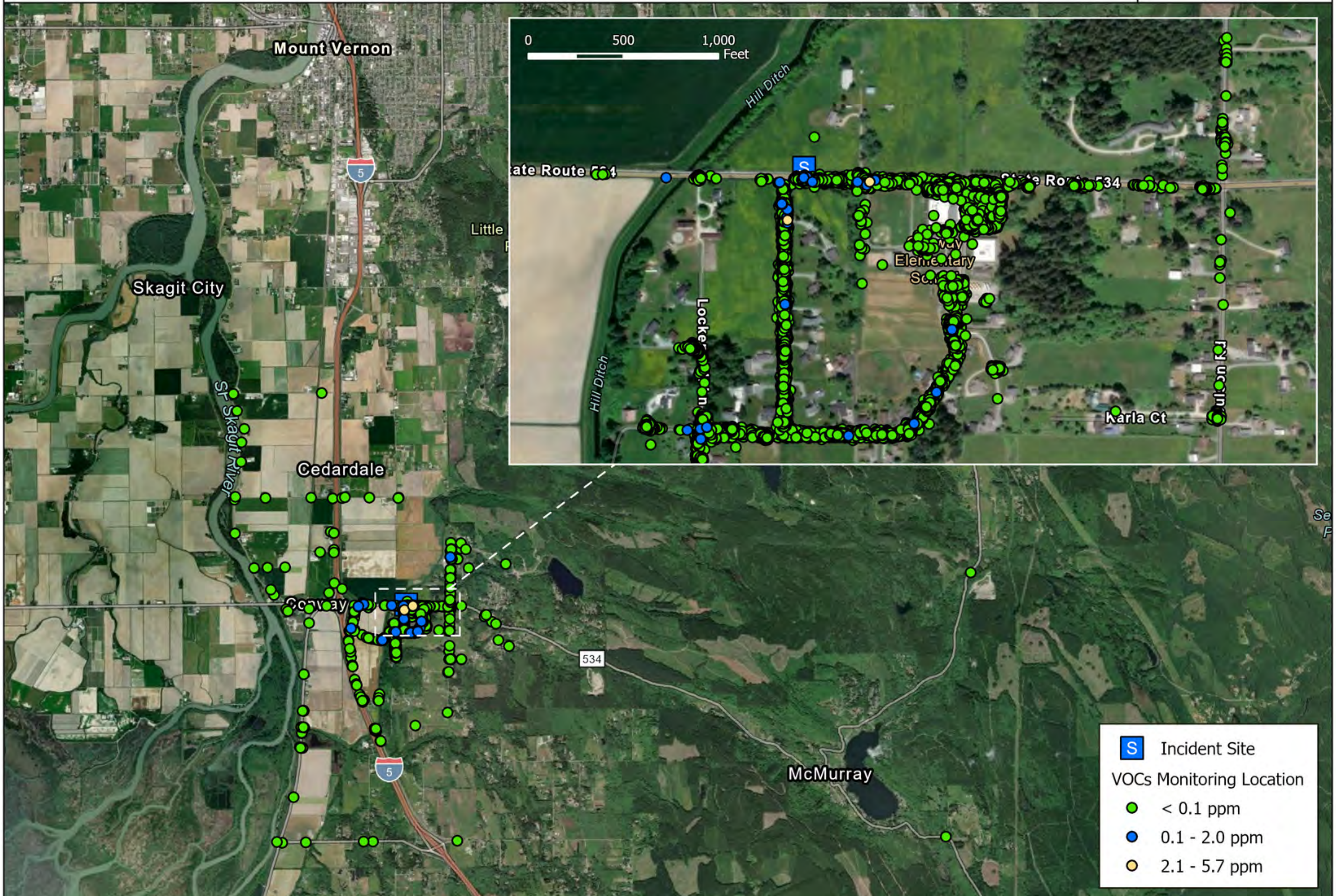
Hand-Held Real-Time Air Monitoring Locations | Community Monitoring | VOCs

Olympic Pipeline Gasoline Spill | December 11, 2023 - March 19, 2024

0 1 2 Miles

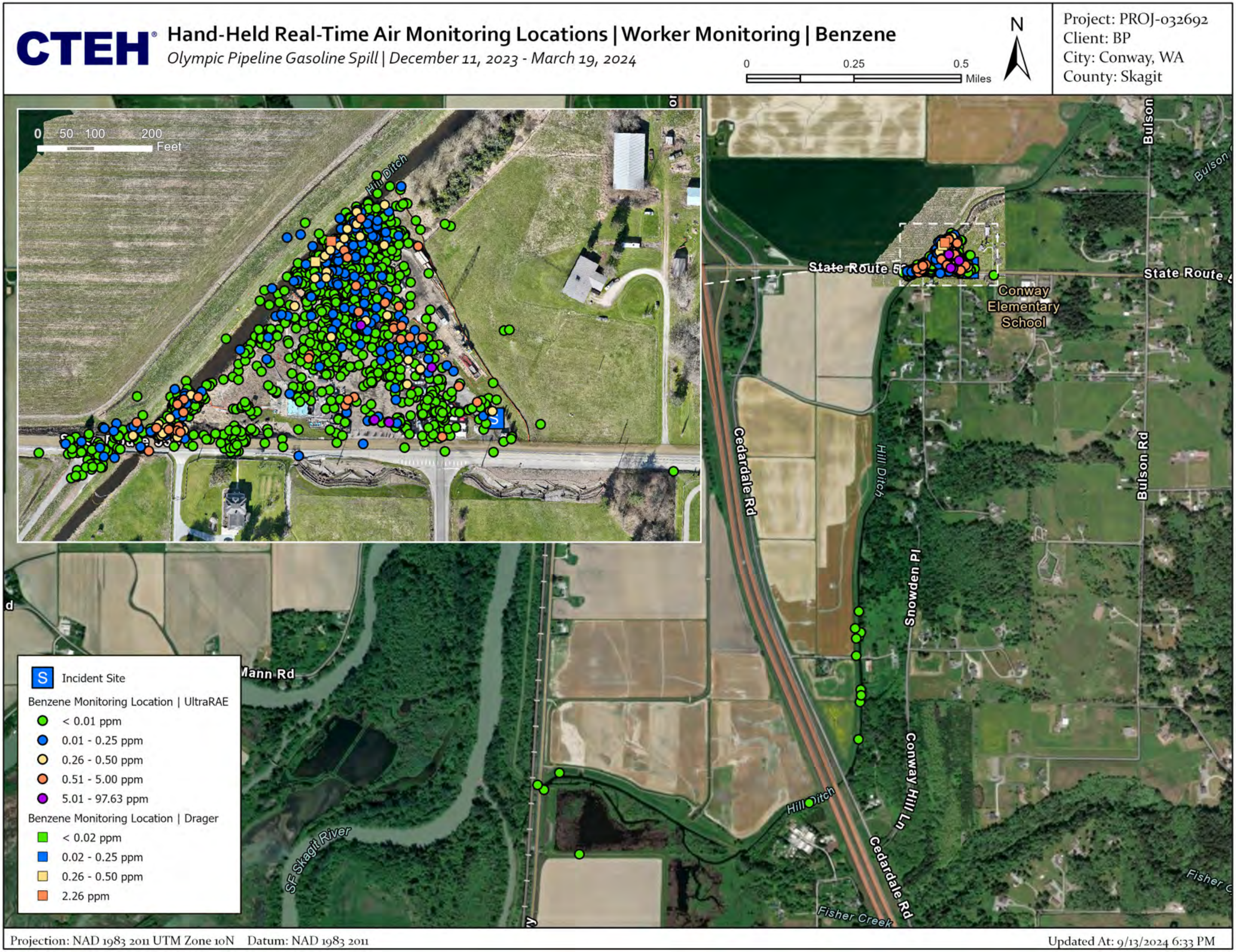
N

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit



Projection: NAD 1983 2011 UTM Zone 10N   Datum: NAD 1983 2011

Updated At: 9/13/2024 5:54 PM



CTEH
Hand-Held Real-Time Air Monitoring Locations | Worker Monitoring | Benzene
Olympic Pipeline Gasoline Spill | December 11, 2023 - March 19, 2024
0
0.25
0.5
Miles
N
Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit
0
50
100
200
Feet
Hill Ditch
State Route 5
Conway Elementary School
Bulson Rd
Cedardale Rd
Snowden Pl
Conway Hill Ln
Mann Rd
SF Skagit River
Fisher Creek
Incident Site
Benzene Monitoring Location | UltraRAE
< 0.01 ppm
0.01 - 0.25 ppm
0.26 - 0.50 ppm
0.51 - 5.00 ppm
5.01 - 97.63 ppm
Benzene Monitoring Location | Drager
< 0.02 ppm
0.02 - 0.25 ppm
0.26 - 0.50 ppm
2.26 ppm
Projection: NAD 1983 2011 UTM Zone 10N Datum: NAD 1983 2011
Updated At: 9/13/2024 6:33 PM

CTEH

Hand-Held Real-Time Air Monitoring Locations | Worker Monitoring | CO

Olympic Pipeline Gasoline Spill | January 1, 2024 - January 23, 2024

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit

Projection: NAD 1983 2011 UTM Zone 10N Datum: NAD 1983 2011

Updated At: 9/16/2024 9:39 AM

Hand-Held Real-Time Air Monitoring Locations | Worker Monitoring | Ethylbenzene

Olympic Pipeline Gasoline Spill | February 17, 2024

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit

Projection: NAD 1983 2011 UTM Zone 10N Datum: NAD 1983 2011

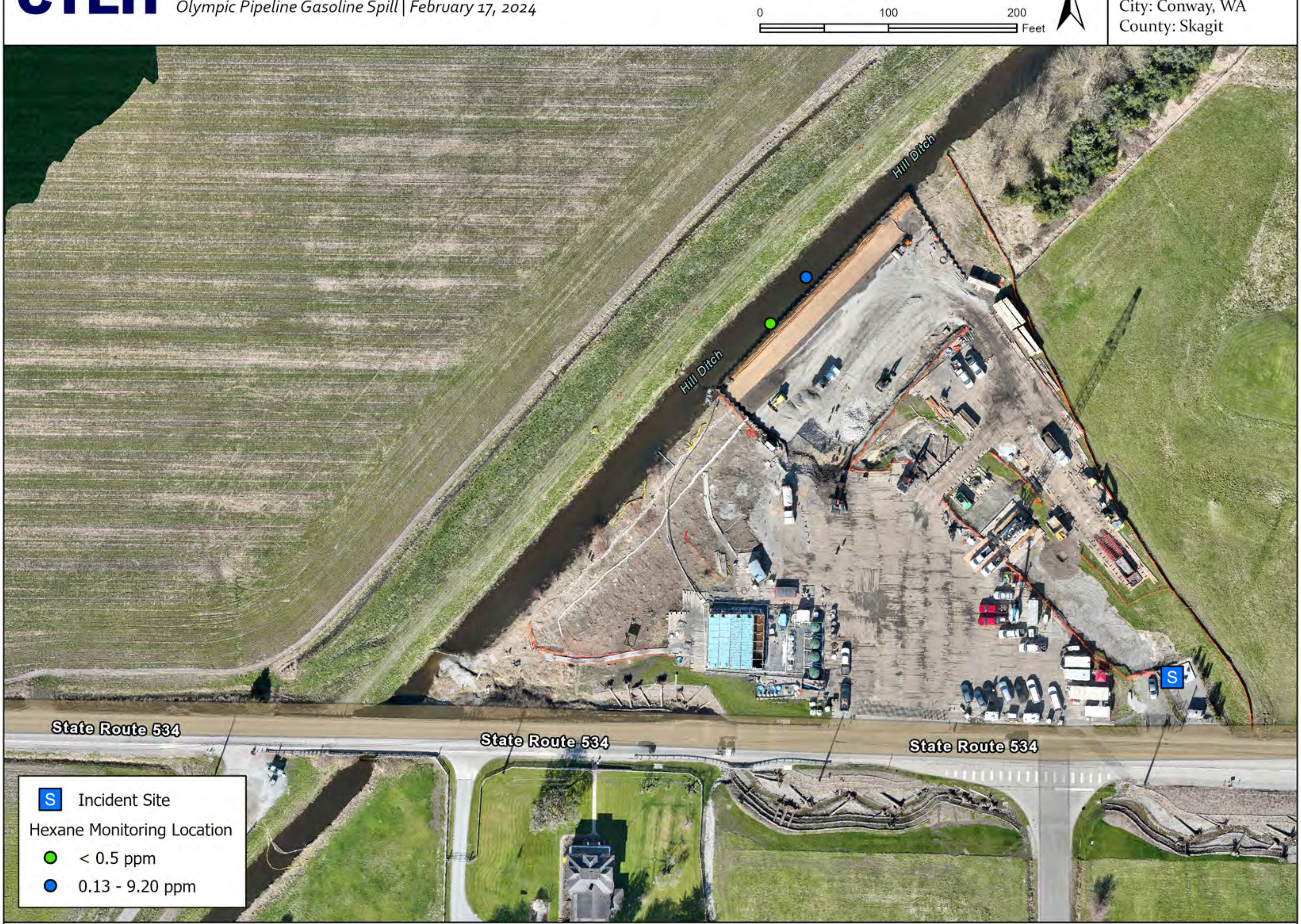
Updated At: 9/16/2024 9:42 AM

CTEH

Hand-Held Real-Time Air Monitoring Locations | Worker Monitoring | Hexane

Olympic Pipeline Gasoline Spill | February 17, 2024

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit



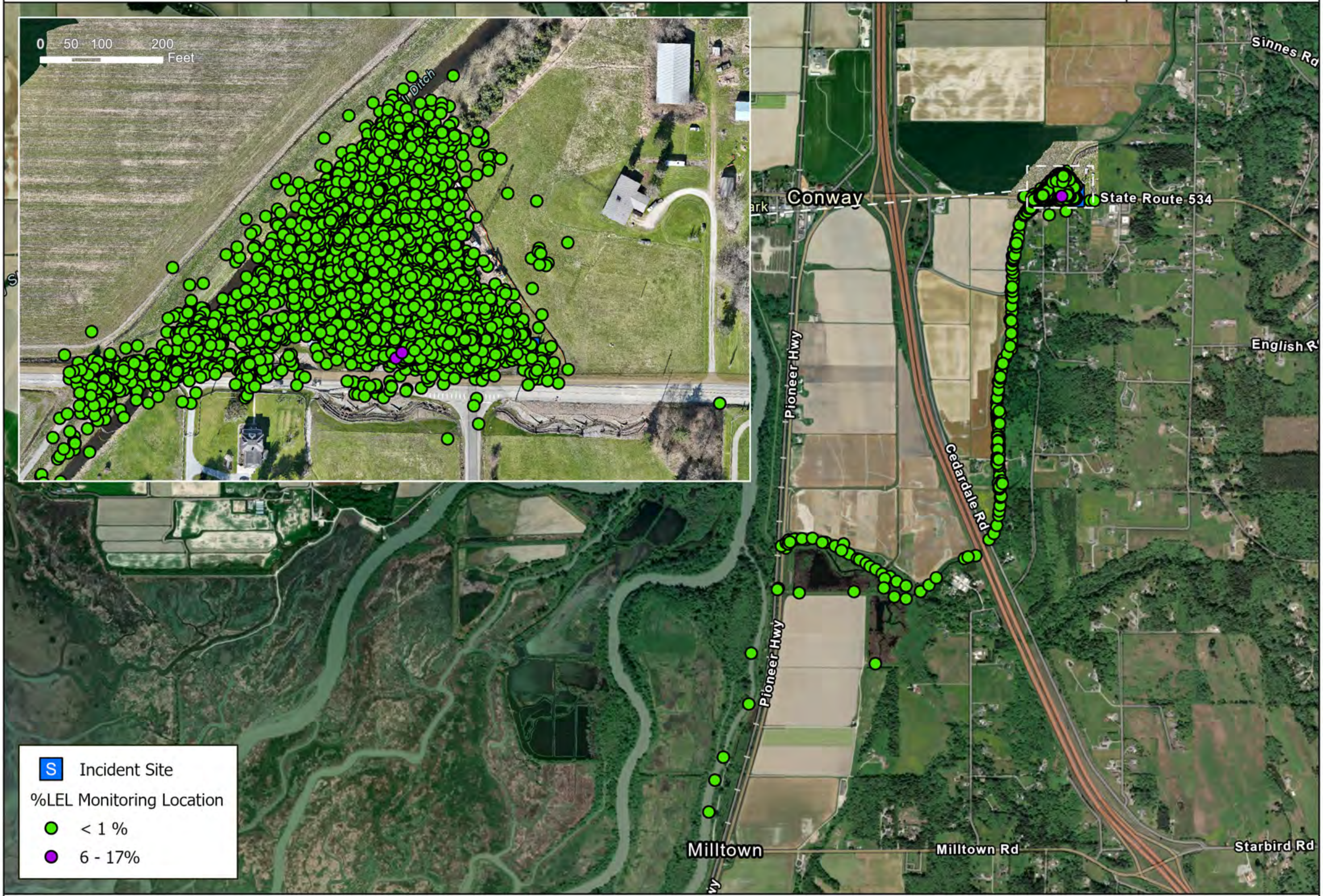
Projection: NAD 1983 2011 UTM Zone 10N   Datum: NAD 1983 2011

Updated At: 9/16/2024 9:44 AM

Hand-Held Real-Time Air Monitoring Locations | Worker Monitoring | %LEL

Olympic Pipeline Gasoline Spill | December 11, 2023 - March 24, 2024

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit



Projection: NAD 1983 2011 UTM Zone 10N Datum: NAD 1983 2011

Updated At: 9/16/2024 9:33 AM

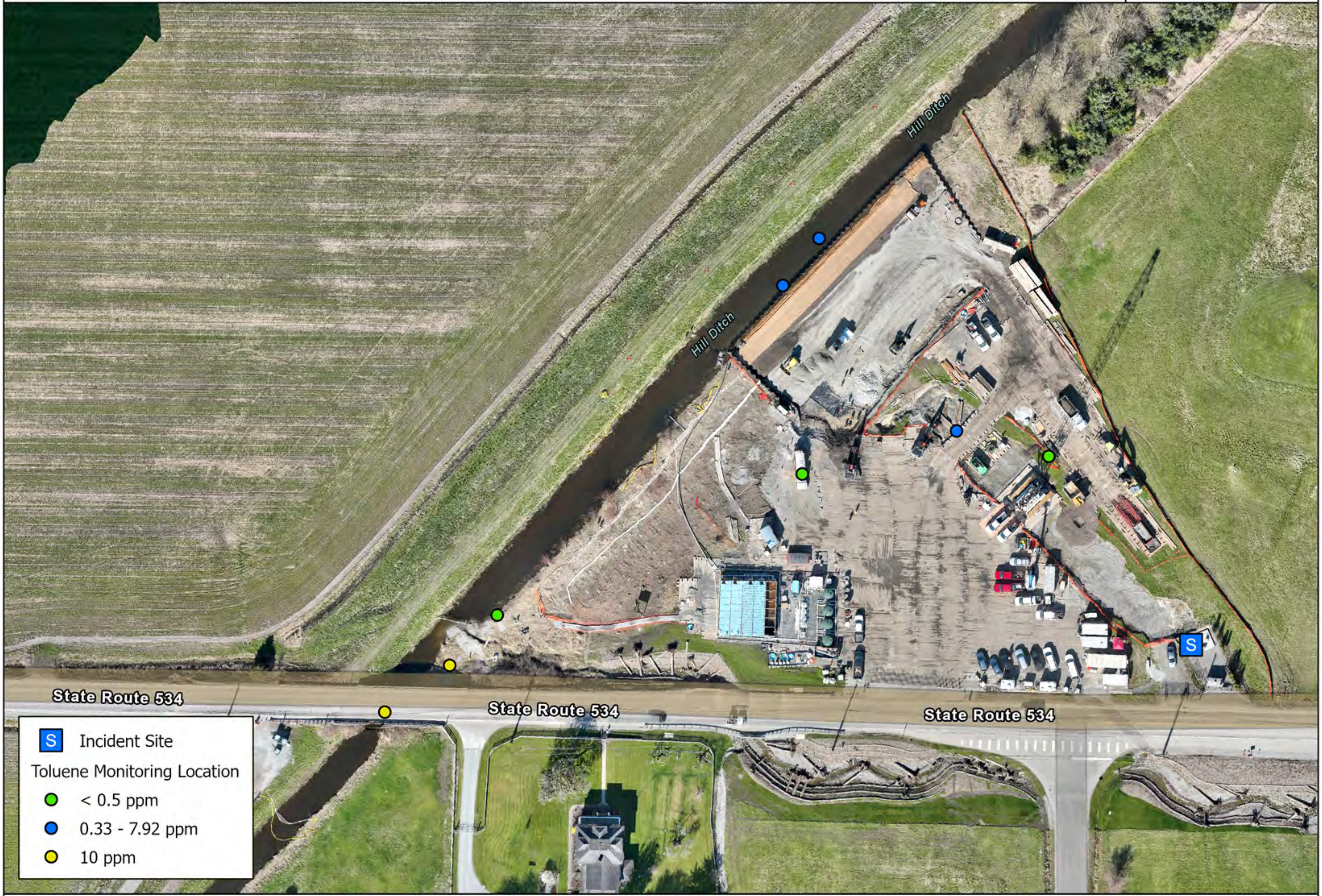
Hand-Held Real-Time Air Monitoring Locations | Worker Monitoring | Toluene

Olympic Pipeline Gasoline Spill | December 11, 2023 - February 17, 2024

0 100 200 Feet

N

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit



Projection: NAD 1983 2011 UTM Zone 10N Datum: NAD 1983 2011

Updated At: 9/16/2024 10:12 AM

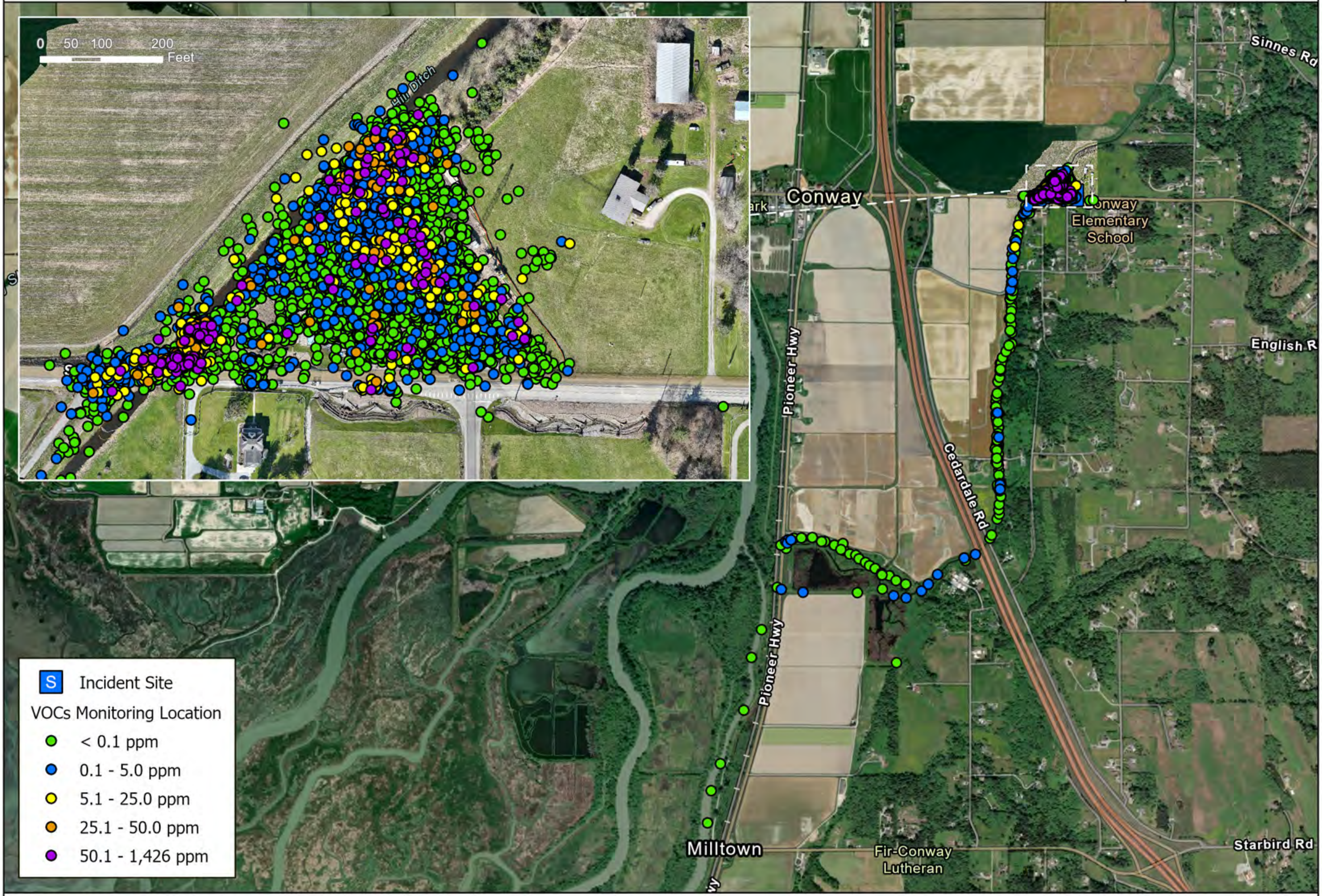
Hand-Held Real-Time Air Monitoring Locations | Worker Monitoring | VOCs

Olympic Pipeline Gasoline Spill | December 11, 2023 - March 24, 2024

0 0.5 1 Miles

N

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit



Projection: NAD 1983 2011 UTM Zone 10N Datum: NAD 1983 2011

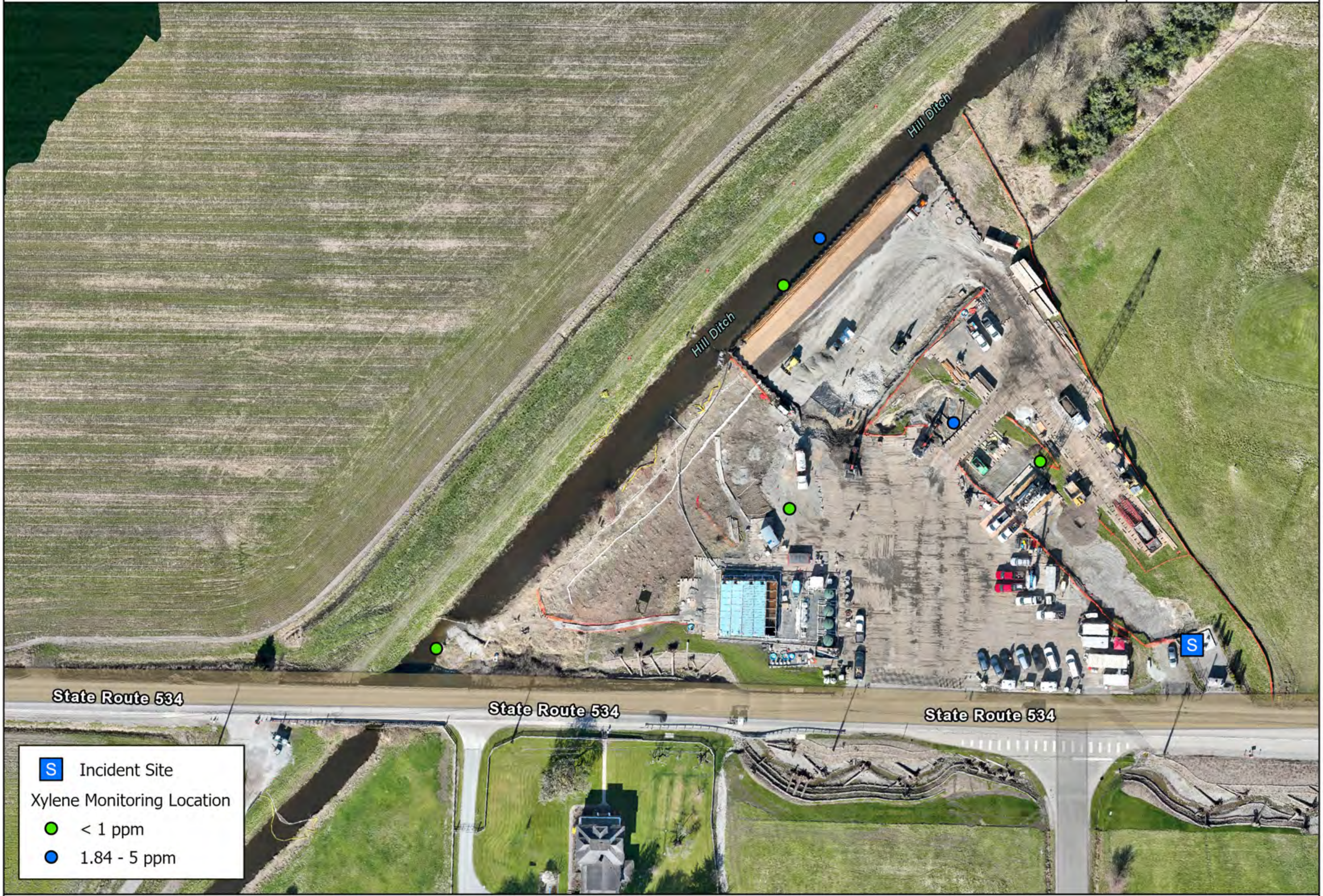
Updated At: 9/13/2024 6:42 PM

CTEH

Hand-Held Real-Time Air Monitoring Locations | Worker Monitoring | Xylene

Olympic Pipeline Gasoline Spill | December 18, 2023 - February 17, 2024

Project: PROJ-032692
Client: BP
City: Conway, WA
County: Skagit



Projection: NAD 1983 2011 UTM Zone 10N Datum: NAD 1983 2011

Updated At: 9/16/2024 10:08 AM