



## Annual Report Fence line Monitoring Report for the Bazan Fence line Monitoring System - 2021



February 22, 2022  
Bazan Group  
Haifa, Israel

**Subject:** Annual Report for Open-Path UV Air Monitoring

This report summarizes the data collected by the four open-path UV air monitoring systems that were installed at the Bazan refinery during the time period of January to December 2021. During this time, the four systems continuously collected and quantified the concentration of Benzene, Toluene, Ethyl Benzene and Xylene (BTEX) gas in the ambient air. Information from the analyzers was reported along with meteorological data to a secured website, and alarm notifications were generated in the event target gases were detected above preset levels. Summary information is included for each beam path. The following report presents the summary results of the measurements.

**Operational Performance Events**

As of the end of 2021 the year-to-date onstream efficiency for the systems was 96.95%.

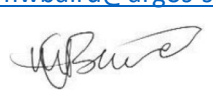
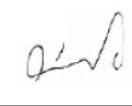

**Summary Findings**

From the results in Section 3 above the following were noted:

- The sample paths detected compounds at different times. This was expected as the paths (due to their orientation) were affected by sources from the refinery under different weather conditions.
- UV2 had the highest annual average for benzene of  $0.61 \mu\text{g}/\text{m}^3$ .
- The most daily average exceedances of the  $3.9 \mu\text{g}/\text{m}^3$  benzene alarm value was at UV2 (7 days each)

Please do not hesitate to contact me if you have questions or need additional information regarding the report.

## Report Details

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Status	Signed
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## Section 1 – Introduction

The purpose of the Argos open-path UV air monitoring project at the Bazan Refinery in Haifa, Israel is to measure Benzene, Toluene, Ethylbenzene and Xylene (BTEX) gases on a real-time basis and to present this information via a secured website. The system also send alerts for detection levels defined by Israeli authorities. The fence-line monitoring equipment is installed along four portions of the fence line at the Bazan refinery, these locations are shown in Figure 1.1. The beam paths covered are referenced as: Refinery Northeastern line 867 meters (UV\_1); Gadiv Eastern line 428 meters (UV\_2); Western Line (UV\_5) 311 m and Refinery Southwestern line (UV\_4) 822 meters.

**Figure 1.1 - Location Map Showing Fence Lines Covered by Argos Open-path UV Air Monitoring Systems**



Each site is equipped with a meteorological station measuring the following parameters:

- Wind speed
- Wind direction
- Temperature
- Relative humidity

The purpose of meteorological station is to help locate pollution source direction only on the Fenceline system height.

The annual summary of the measurements performed by the system for 2021 are presented in the sections that follow. The measurements for Benzene were performed using an in-house validated method FLM-QLT-MET-001 Determination of BTEX by UV DOAS based on TO-16 and EPA 301 methods.

## Section 2 - Quality Assurance Quality Control Checks

The method for analysis of benzene was validated against the requirements of US EPA Method 301. These requirements are shown in Table 2.1 below.

**Table 2.1 – Validation Parameters for UV Systems**

Parameter	Method Acceptable	Site specific Method Acceptable	Unacceptable
Relative Bias	$\leq 10 \%$	Between 10 % and 30 %	$> 30 \%$
Precision	Relative Standard Deviation (RSD) $\leq 20 \%$		RSD $> 20 \%$
MDL	N/A	N/A	N/A
Accuracy	$\leq 15 \%$		$> 15 \%$
Linearity	$R^2 \geq 0.9$		$R^2 < 0.9$
Robustness Temperature	$\leq 15 \%$		$> 15 \%$
Robustness Signal Strength	$\leq 15 \%$		$> 15 \%$
Robustness Sample Time	$\leq 15 \%$		$> 15 \%$

Table 2.2 shows the overall results of the validation checks as a summary of all the systems.

**Table 2.2 – Results of Validation for all UV Systems**

Parameter	Value	Status
Relative Bias	1.614%	Method acceptable
Precision	RSD = 0.53%	Method acceptable
MDL	0.81 ppb	N/A
Accuracy	1.70%	Method acceptable
Linearity	$R^2 = 0.99995 \approx 1$	Method acceptable
Robustness Temperature	RSD = 4.5%	Method acceptable
Robustness Signal Strength	RSD = 1.8%	Method acceptable
Robustness Sample Time	7.32%	Method acceptable

## Section 3 - Summary of Field Data

As mentioned in Section 1, the air monitoring equipment operated continuously during 2021. The following figures and tables summarize the data collected during this time period for BTEX gases. Each system collected data at five-minute averages. Table 3.1 lists the time periods that valid data was collected at each location.

**Table 3.1 – Summary of Onstream Efficiency for 2021**

Location	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	Annual (%)
UV_1	98.24	96.89	98.50	98.93	98.14
UV_2	92.33	97.99	96.91	98.08	96.33
UV_4	94.87	96.78	98.26	96.62	96.63
UV_5	98.18	98.24	99.47	99.17	98.77

A summary of the 2021 data is shown in Tables 3.2 and 3.3 below:

**Table 3.2 – Annual Average Benzene Concentrations per Site for 2021**

Location	Benzene ( $\mu\text{g}/\text{m}^3$ )	Uncertainty of Measurement (%)
UV_1	0.54	4.90
UV_2	0.61	4.94
UV_4	0.57	17.14
UV_5	0.46	1.25

**Table 3.3 – Annual Average Toluene, Xylene and Ethyl Benzene Concentrations per Site for 2021**

Location	Toluene ( $\mu\text{g}/\text{m}^3$ )	Xylene ( $\mu\text{g}/\text{m}^3$ )	Ethyl Benzene ( $\mu\text{g}/\text{m}^3$ )
UV_1	0.40	1.66	0.13
UV_2	1.32	1.41	0.17
UV_4	0.49	0.61	0.13
UV_5	0.64	1.56	0.99

The table below shows the number of daily average exceedances in 2021 of the following:

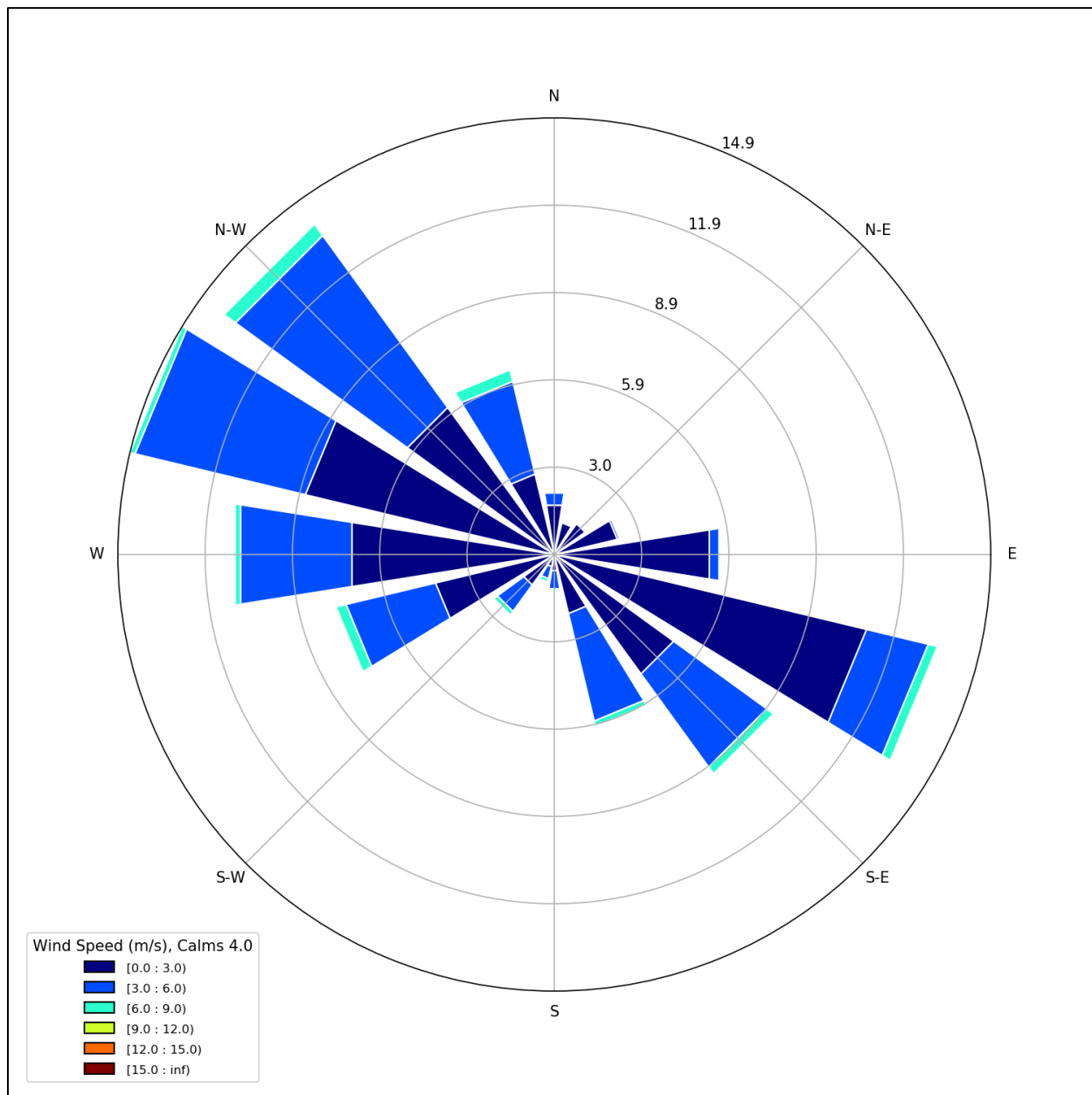
- Benzene: 3.9 microgram/m<sup>3</sup> daily average. (24 hr alarm)
- Toluene: 3,770 microgram/m<sup>3</sup> daily average.
- Total Xylenes: 4,800 microgram/m<sup>3</sup> daily average (Almog value).

**Table 3.3 – Number of Daily Average Exceedances Average Benzene Concentrations per Site for 2021**

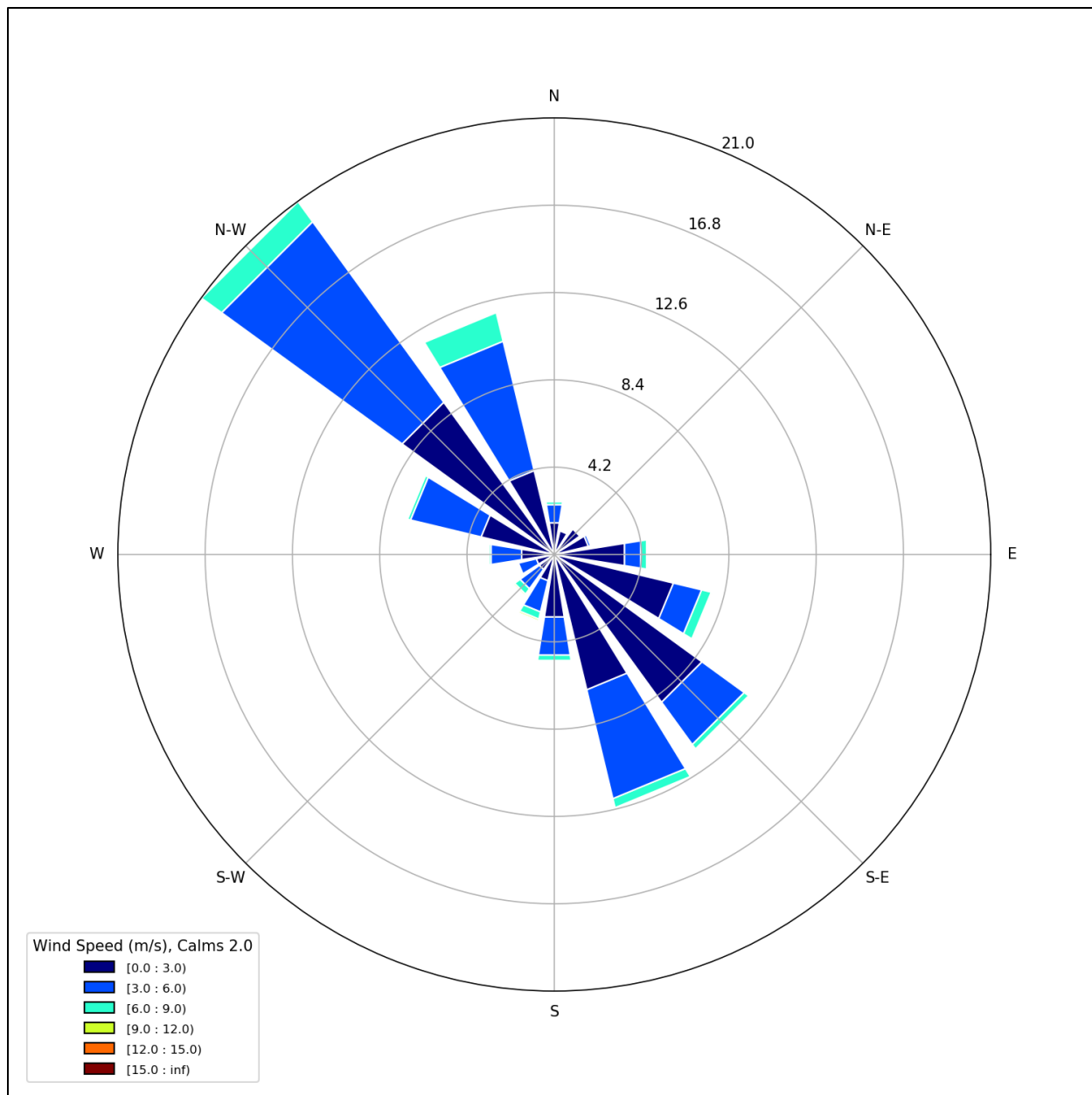
Location	Benzene (Days)	Toluene (Days)	Xylene (Days)
UV_1	1	0	0
UV_2	7	0	0
UV_4	0	0	0
UV_5	1	0	0

Figures 3.1 to 3.4 show the annual wind roses at each of the paths for 2021.

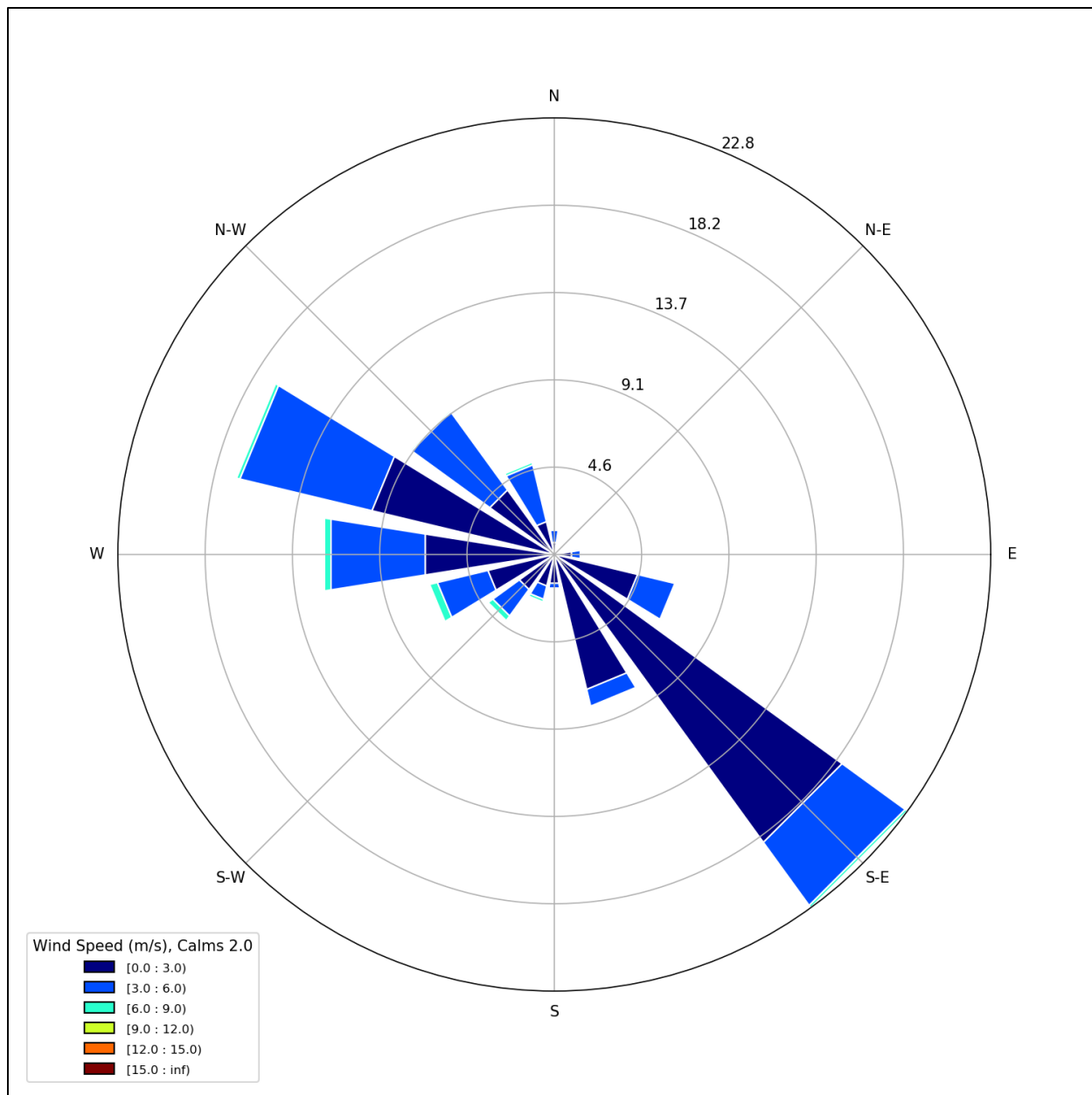
**Figure 3.1 – Wind Speed and Wind Direction for UV1 for 2021**



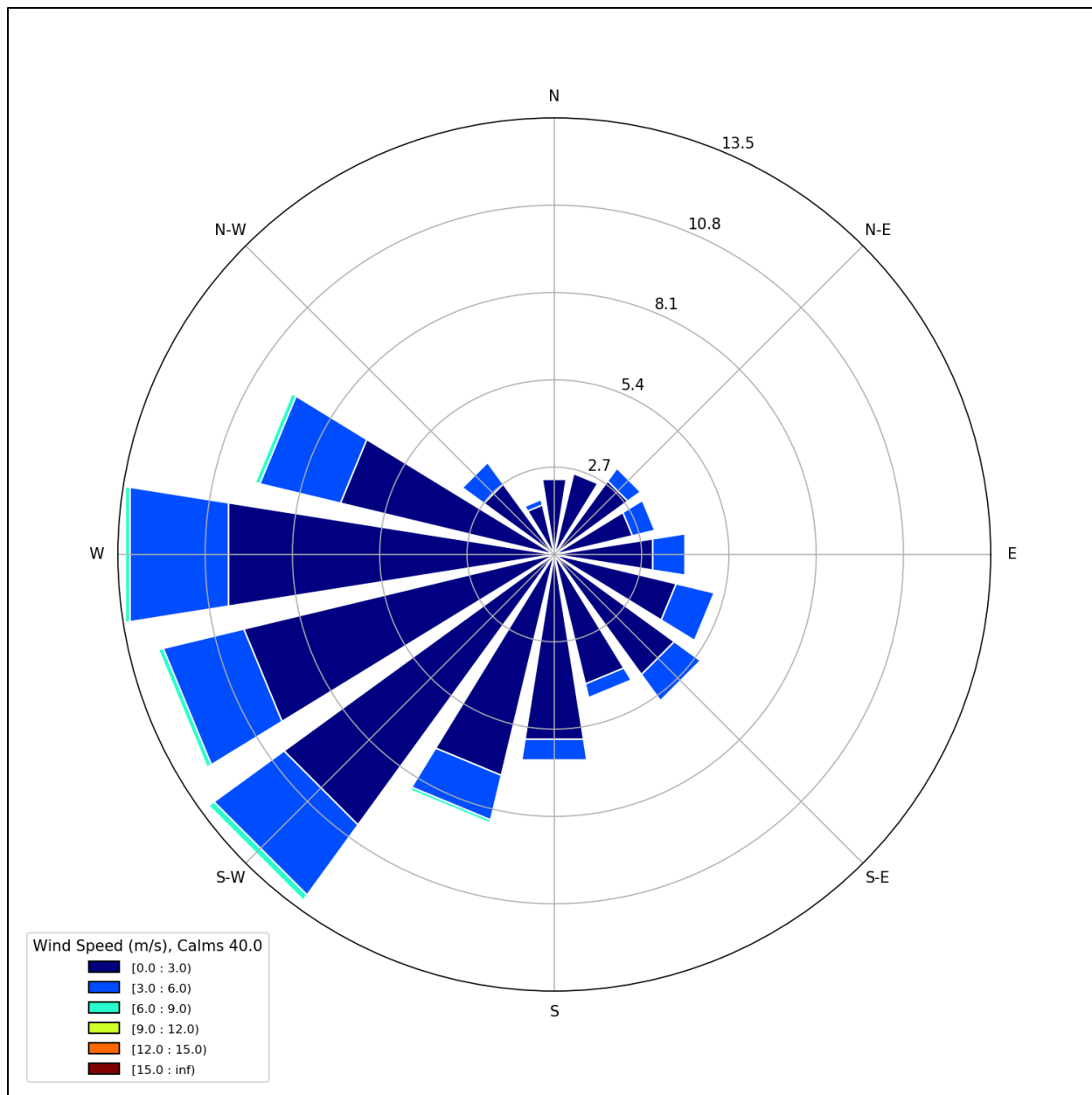
**Figure 3.2 – Wind Speed and Wind Direction for UV2 for 2021**



**Figure 3.3 – Wind Speed and Wind Direction for UV4 for 2021**



**Figure 3.4 – Wind Speed and Wind Direction Data for UV5 for 2021**



#### Section 4 – Summary notes

From the results in Section 3 above the following were noted:

- The sample paths detected compounds at different times. This was expected as the paths (due to their orientation) were affected by sources from the refinery under different weather conditions.
- UV2 had the highest annual average for benzene of  $0.61 \mu\text{g}/\text{m}^3$ .
- The most daily average exceedances of the  $3.9 \mu\text{g}/\text{m}^3$  benzene alarm value was at UV2 (7 days each)

## Section 5 – Annexes

### Bias results

Bias	2.510	
SDd	25.379	
t-test	0.280	< 2.571 means statistically insignificant
Relative Bias UV1	1.988	<=10%
Relative Bias UV2	1.352	<=10%
Relative Bias UV4	2.297	<=10%
Relative Bias UV5	0.817	<=10%
Average Relative Bias	1.614	<=10%

Date	File number	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)	Difference between spiked and unspiked samples
11/30/2021 3:34:43 PM	361524	361523	UV1	-0.03894	0	
11/30/2021 3:35:14 PM	361525	361523	UV1	-0.61906	0	
11/30/2021 3:47:04 PM	361532	361523	UV1	136.1918	126.29	
11/30/2021 3:47:35 PM	361533	361523	UV1	135.19147	126.29	9.73
12/14/2021 1:44:46 PM	365530	365529	UV1	0.85512	0	
12/14/2021 1:45:17 PM	365531	365529	UV1	1.14483	0	
12/14/2021 2:02:15 PM	365538	365529	UV1	134.51242	126.29	
12/14/2021 2:02:46 PM	365539	365529	UV1	135.03045	126.29	7.49
10/18/2021 6:11:28 PM	87328	87327	UV2	0.07109	0	
10/18/2021 6:11:58 PM	87329	87327	UV2	-0.66589	0	
10/18/2021 6:21:11 PM	87336	87327	UV2	157.74296	185.61	
10/18/2021 6:21:41 PM	87337	87327	UV2	157.32806	185.61	-27.78

Date	File number	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)	Difference between spiked and unspiked samples
11/23/2021 11:06:12 AM	97559	97558	UV2	0.28942	0	
11/23/2021 11:06:43 AM	97560	97558	UV2	0.21085	0	
11/23/2021 11:16:00 AM	97566	97558	UV2	168.04461	185.61	
11/23/2021 11:16:30 AM	97567	97558	UV2	168.47806	185.61	-17.60
12/14/2021 3:28:41 PM	174057	174056	UV4	-0.0779	0	
12/14/2021 3:29:12 PM	174058	174056	UV4	-0.65809	0	
12/14/2021 3:39:58 PM	174064	174056	UV4	89.87163	109.27	
12/14/2021 3:40:29 PM	174065	174056	UV4	91.00382	109.27	-18.46
12/29/2021 11:18:22 AM	178171	178170	UV4	-0.05606	0	
12/29/2021 11:18:53 AM	178172	178170	UV4	-0.10338	0	
12/29/2021 11:32:43 AM	178179	178170	UV4	105.79321	109.27	
12/29/2021 11:33:14 AM	178180	178170	UV4	105.89607	109.27	-3.34
11/30/2021 2:38:32 PM	347840	347839	UV5	-0.03062	0	
11/30/2021 2:39:02 PM	347841	347839	UV5	-0.67967	0	
11/30/2021 2:53:17 PM	347848	347839	UV5	324.31723	307.09	
11/30/2021 2:53:47 PM	347849	347839	UV5	326.93658	307.09	18.89
12/14/2021 4:07:06 PM	351884	351883	UV5	0.25261	0	
12/14/2021 4:07:37 PM	351885	351883	UV5	-0.65484	0	



Date	File number	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)	Difference between spiked and unspiked samples
12/14/2021 4:30:30 PM	351892	351883	UV5	358.45154	307.09	
12/14/2021 4:31:01 PM	351893	351883	UV5	357.66276	307.09	51.16

### Precision results

	UV1	UV2	UV4	UV5	Total
Average	134.66	168.18	126.78	406.93	209.14
Stdev	0.32	1.39	1.07	0.80	0.90
RSD (%)	0.24	0.82	0.85	0.20	0.53
No. of Samples	25	25	25	25	

Date	File number	Background File no.	System	Concentration (ppb)
11/23/2021 3:33:23 PM	359478	359476	UV1	134.53
11/23/2021 3:33:54 PM	359479	359476	UV1	134.93
11/23/2021 3:34:24 PM	359480	359476	UV1	134.64
11/23/2021 3:34:54 PM	359481	359476	UV1	134.93
11/23/2021 3:35:25 PM	359482	359476	UV1	134.60
11/23/2021 3:35:55 PM	359483	359476	UV1	134.37
11/23/2021 3:36:26 PM	359484	359476	UV1	134.81
11/23/2021 3:36:56 PM	359485	359476	UV1	134.92
11/23/2021 3:37:26 PM	359486	359476	UV1	134.60
11/23/2021 3:37:57 PM	359487	359476	UV1	134.61
11/23/2021 3:38:27 PM	359488	359476	UV1	134.80
11/23/2021 3:38:58 PM	359489	359476	UV1	134.36
11/23/2021 3:39:28 PM	359490	359476	UV1	134.65
11/23/2021 3:39:58 PM	359491	359476	UV1	135.48
11/23/2021 3:40:29 PM	359492	359476	UV1	134.64
11/23/2021 3:40:59 PM	359493	359476	UV1	134.77
11/23/2021 3:41:30 PM	359494	359476	UV1	134.86
11/23/2021 3:42:00 PM	359495	359476	UV1	135.16
11/23/2021 3:42:30 PM	359496	359476	UV1	134.90
11/23/2021 3:43:01 PM	359497	359476	UV1	134.49
11/23/2021 3:43:31 PM	359498	359476	UV1	134.37
11/23/2021 3:44:02 PM	359499	359476	UV1	133.76
11/23/2021 3:44:32 PM	359500	359476	UV1	134.35
11/23/2021 3:45:02 PM	359501	359476	UV1	134.46
11/23/2021 3:45:33 PM	359502	359476	UV1	134.42
11/28/2021 3:14:50 PM	99047	99046	UV2	166.45
11/28/2021 3:15:21 PM	99048	99046	UV2	165.94
11/28/2021 3:15:51 PM	99049	99046	UV2	166.11
11/28/2021 3:16:22 PM	99050	99046	UV2	165.46

Date	File number	Background File no.	System	Concentration (ppb)
11/28/2021 3:16:52 PM	99051	99046	UV2	166.18
11/28/2021 3:17:23 PM	99052	99046	UV2	167.51
11/28/2021 3:17:53 PM	99053	99046	UV2	167.10
11/28/2021 3:18:24 PM	99054	99046	UV2	166.85
11/28/2021 3:18:54 PM	99055	99046	UV2	168.13
11/28/2021 3:19:25 PM	99056	99046	UV2	167.85
11/28/2021 3:19:55 PM	99057	99046	UV2	167.78
11/28/2021 3:20:26 PM	99058	99046	UV2	168.69
11/28/2021 3:20:56 PM	99059	99046	UV2	168.31
11/28/2021 3:21:27 PM	99060	99046	UV2	168.97
11/28/2021 3:21:57 PM	99061	99046	UV2	169.07
11/28/2021 3:22:28 PM	99062	99046	UV2	169.42
11/28/2021 3:22:58 PM	99063	99046	UV2	168.73
11/28/2021 3:23:29 PM	99064	99046	UV2	169.00
11/28/2021 3:23:59 PM	99065	99046	UV2	168.98
11/28/2021 3:24:30 PM	99066	99046	UV2	169.36
11/28/2021 3:25:00 PM	99067	99046	UV2	169.31
11/28/2021 3:25:31 PM	99068	99046	UV2	169.42
11/28/2021 3:26:01 PM	99069	99046	UV2	169.98
11/28/2021 3:26:32 PM	99070	99046	UV2	170.05
11/28/2021 3:27:02 PM	99071	99046	UV2	169.89
2/17/2022 12:08:19 PM	192381	192380	UV4	125.96
2/17/2022 12:08:50 PM	192382	192380	UV4	126.34
2/17/2022 12:09:21 PM	192383	192380	UV4	128.13
2/17/2022 12:09:52 PM	192384	192380	UV4	126.97
2/17/2022 12:10:23 PM	192385	192380	UV4	126.11
2/17/2022 12:10:54 PM	192386	192380	UV4	127.02
2/17/2022 12:11:25 PM	192387	192380	UV4	128.71
2/17/2022 12:11:56 PM	192388	192380	UV4	129.41
2/17/2022 12:12:27 PM	192389	192380	UV4	125.18
2/17/2022 12:12:59 PM	192390	192380	UV4	128.33
2/17/2022 12:13:29 PM	192391	192380	UV4	127.21
2/17/2022 12:14:00 PM	192392	192380	UV4	127.20
2/17/2022 12:14:31 PM	192393	192380	UV4	127.79
2/17/2022 12:15:02 PM	192394	192380	UV4	127.02
2/17/2022 12:15:33 PM	192395	192380	UV4	125.38
2/17/2022 12:16:04 PM	192396	192380	UV4	126.62

Date	File number	Background File no.	System	Concentration (ppb)
2/17/2022 12:16:35 PM	192397	192380	UV4	127.06
2/17/2022 12:17:06 PM	192398	192380	UV4	126.44
2/17/2022 12:17:37 PM	192399	192380	UV4	126.20
2/17/2022 12:18:08 PM	192400	192380	UV4	125.50
2/17/2022 12:18:39 PM	192401	192380	UV4	125.91
2/17/2022 12:19:10 PM	192402	192380	UV4	125.54
2/17/2022 12:19:41 PM	192403	192380	UV4	127.09
2/17/2022 12:20:12 PM	192404	192380	UV4	126.51
2/17/2022 12:20:43 PM	192405	192380	UV4	125.86
2/7/2022 7:15:08 PM	367672	367646	UV5	406.79
2/7/2022 7:15:38 PM	367673	367646	UV5	406.64
2/7/2022 7:16:08 PM	367674	367646	UV5	407.26
2/7/2022 7:16:39 PM	367675	367646	UV5	405.65
2/7/2022 7:17:09 PM	367676	367646	UV5	405.99
2/7/2022 7:17:39 PM	367677	367646	UV5	406.42
2/7/2022 7:18:10 PM	367678	367646	UV5	407.99
2/7/2022 7:18:40 PM	367679	367646	UV5	405.83
2/7/2022 7:19:10 PM	367680	367646	UV5	405.53
2/7/2022 7:19:41 PM	367681	367646	UV5	406.55
2/7/2022 7:20:11 PM	367682	367646	UV5	407.74
2/7/2022 7:20:41 PM	367683	367646	UV5	407.55
2/7/2022 7:21:11 PM	367684	367646	UV5	407.29
2/7/2022 7:21:42 PM	367685	367646	UV5	406.46
2/7/2022 7:22:12 PM	367686	367646	UV5	405.90
2/7/2022 7:22:42 PM	367687	367646	UV5	407.01
2/7/2022 7:23:13 PM	367688	367646	UV5	406.65
2/7/2022 7:23:43 PM	367689	367646	UV5	406.41
2/7/2022 7:24:13 PM	367690	367646	UV5	407.56
2/7/2022 7:24:44 PM	367691	367646	UV5	407.32
2/7/2022 7:25:14 PM	367692	367646	UV5	408.53
2/7/2022 7:25:44 PM	367693	367646	UV5	407.26
2/7/2022 7:26:15 PM	367694	367646	UV5	406.94
2/7/2022 7:26:45 PM	367695	367646	UV5	407.94
2/7/2022 7:27:15 PM	367696	367646	UV5	407.94

## MDL results

### Q1

Location	January MDL (ppb)	February MDL (ppb)	March MDL (ppb)
UV_1	0.41	0.44	0.71
UV_2	0.77	0.16	0.50
UV_4	0.98	0.86	1.28
UV_5	0.84	0.60	0.57

### Q2

Location	April MDL (ppb)	May MDL (ppb)	June MDL (ppb)
UV_1	0.26	0.75	0.59
UV_2	0.27	0.23	0.27
UV_4	1.18	1.66	1.88
UV_5	0.83	0.70	0.85

### Q3

Location	July MDL (ppb)	August MDL (ppb)	September MDL (ppb)
UV_1	0.69	0.79	1.09
UV_2	0.72	1.09	0.32
UV_4	3.01	0.91	1.09
UV_5	0.47	0.77	1.05

### Q4

Location	October MDL (ppb)	November MDL (ppb)	December MDL (ppb)
UV_1	0.38	0.25	0.68
UV_2	0.69	0.30	0.45
UV_4	3.80	0.71	0.32
UV_5	0.46	0.63	0.74

### Accuracy results

	All Systems
Average Conc of Ref Gas (ppb)	68.41
Average Conc of Measurements (ppb)	69.57
Accuracy (%)	1.70
Average Conc of Ref Gas (ppb)	68.41

Date	File number	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)	Collection time (min)
10/25/2021	351111	351100	UV1	125.55	126.29	5
10/25/2021	351111	351098	UV1	138.03	126.29	5
11/22/2021	359160	359150	UV1	135.02	126.29	5
11/22/2021	359160	359148	UV1	135.10	126.29	5
11/30/2021	361534	361525	UV1	135.88	126.29	5
11/30/2021	361534	361524	UV1	135.30	126.29	5
12/14/2021	365541	365532	UV1	134.95	126.29	5
12/14/2021	365541	365531	UV1	134.38	126.29	5
10/25/2021	351114	351100	UV1	11.72	10.53	5
10/25/2021	351114	351098	UV1	13.27	10.53	5
11/22/2021	359161	359150	UV1	13.87	12.46	5
11/22/2021	359161	359148	UV1	13.96	12.46	5
11/30/2021	361535	361525	UV1	17.75	15.80	5
11/30/2021	361535	361524	UV1	17.17	15.80	5
12/14/2021	365542	365532	UV1	15.07	13.71	5
12/14/2021	365542	365531	UV1	14.50	13.71	5
10/25/2021	351113	351100	UV1	5.99	5.38	5
10/25/2021	351113	351098	UV1	7.00	5.38	5
11/22/2021	359162	359150	UV1	7.10	6.45	5
11/22/2021	359162	359148	UV1	7.18	6.45	5
11/30/2021	361536	361525	UV1	7.51	6.63	5
11/30/2021	361536	361524	UV1	6.93	6.63	5
12/14/2021	365543	365532	UV1	7.19	6.54	5
12/14/2021	365543	365531	UV1	6.62	6.54	5
10/26/2021	89507	89499	UV2	161.57	185.61	5
10/26/2021	89507	89498	UV2	161.69	185.61	5

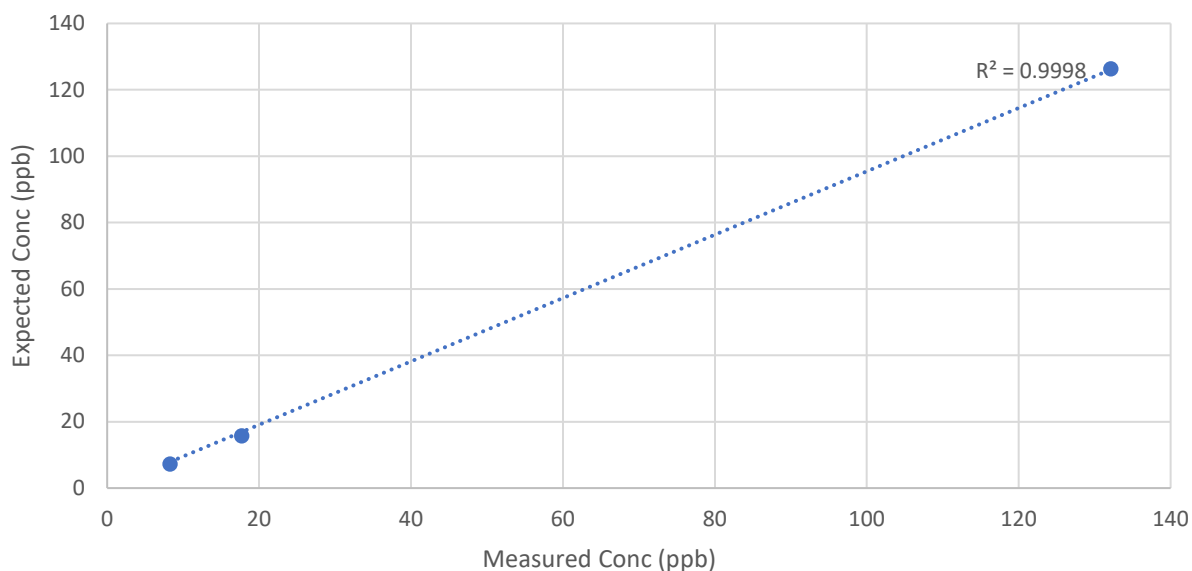
11/23/2021	97569	97560	UV2	167.73	185.61	5
11/23/2021	97569	97558	UV2	167.94	185.61	5
12/14/2021	103672	103662	UV2	175.60	185.61	5
12/14/2021	103672	103660	UV2	175.30	185.61	5
12/26/2021	107124	107117	UV2	159.19	185.61	5
12/26/2021	107124	107115	UV2	159.57	185.61	5
10/26/2021	89508	89499	UV2	19.83	20.78	5
10/26/2021	89508	89498	UV2	19.95	20.78	5
11/23/2021	97570	97560	UV2	17.19	16.64	5
11/23/2021	97570	97558	UV2	17.41	16.64	5
12/14/2021	103673	103662	UV2	26.54	26.87	5
12/14/2021	103673	103660	UV2	26.25	26.87	5
12/26/2021	107125	107117	UV2	20.11	20.60	5
12/26/2021	107125	107115	UV2	20.50	20.60	5
10/26/2021	89509	89499	UV2	9.29	9.64	5
10/26/2021	89509	89498	UV2	9.41	9.64	5
11/23/2021	97571	97560	UV2	8.14	7.95	5
11/23/2021	97571	97558	UV2	8.35	7.95	5
12/14/2021	103674	103662	UV2	12.81	13.11	5
12/14/2021	103674	103660	UV2	12.51	13.11	5
12/27/2021	107309	107307	UV2	8.95	9.33	5
12/27/2021	107309	107306	UV2	8.46	9.33	5
11/22/2021	167875	167865	UV4	96.45	109.27	5
11/22/2021	167875	167863	UV4	95.94	109.27	5
11/30/2021	170164	170155	UV4	103.88	109.27	5
11/30/2021	170164	170154	UV4	86.62	109.27	5
12/14/2021	174067	174058	UV4	90.19	109.27	5
12/14/2021	174067	174057	UV4	89.61	109.27	5
12/29/2021	178181	178172	UV4	105.75	109.27	5
12/29/2021	178181	178171	UV4	105.70	109.27	5
11/22/2021	167876	167865	UV4	13.30	12.48	5
11/22/2021	167876	167863	UV4	12.79	12.48	5
11/30/2021	170165	170155	UV4	10.36	9.98	5
11/30/2021	170165	170154	UV4	9.76	9.98	5
12/14/2021	174068	174058	UV4	11.54	12.53	5
12/14/2021	174068	174057	UV4	10.96	12.53	5
12/29/2021	178182	178172	UV4	12.82	13.35	5
12/29/2021	178182	178171	UV4	12.77	13.35	5

11/22/2021	167877	167865	UV4	7.44	6.48	5
11/22/2021	167877	167863	UV4	6.94	6.48	5
11/30/2021	170166	170155	UV4	3.96	3.73	5
11/30/2021	170166	170154	UV4	4.13	3.73	5
12/14/2021	174069	174058	UV4	5.45	4.78	5
12/14/2021	174069	174057	UV4	4.87	4.78	5
12/29/2021	178183	178172	UV4	6.49	6.70	5
12/29/2021	178183	178171	UV4	6.44	6.70	5
10/26/2021	337697	337690	UV5	348.41	307.09	5
10/26/2021	337697	337689	UV5	342.15	307.09	5
11/22/2021	345531	345521	UV5	336.51	307.09	5
11/22/2021	345531	345519	UV5	336.50	307.09	5
11/30/2021	347851	347841	UV5	328.22	307.09	5
11/30/2021	347851	347840	UV5	327.57	307.09	5
12/14/2021	351894	351885	UV5	359.05	307.09	5
12/14/2021	351894	351883	UV5	358.39	307.09	5
10/26/2021	337698	337690	UV5	20.77	21.10	5
10/26/2021	337698	337689	UV5	21.50	21.10	5
11/22/2021	345532	345521	UV5	17.86	16.16	5
11/22/2021	345532	345519	UV5	17.85	16.16	5
11/30/2021	347852	347841	UV5	17.02	16.30	5
11/30/2021	347852	347840	UV5	16.37	16.30	5
12/14/2021	351895	351885	UV5	15.32	13.44	5
12/14/2021	351895	351883	UV5	14.67	13.44	5
10/26/2021	337700	337690	UV5	9.10	9.91	5
10/26/2021	337700	337689	UV5	9.94	9.91	5
11/22/2021	345533	345521	UV5	8.14	7.08	5
11/22/2021	345533	345519	UV5	8.14	7.08	5
11/30/2021	347853	347841	UV5	7.60	6.69	5
11/30/2021	347853	347840	UV5	6.95	6.69	5
12/14/2021	351896	351885	UV5	7.83	7.45	5
12/14/2021	351896	351883	UV5	7.17	7.45	5

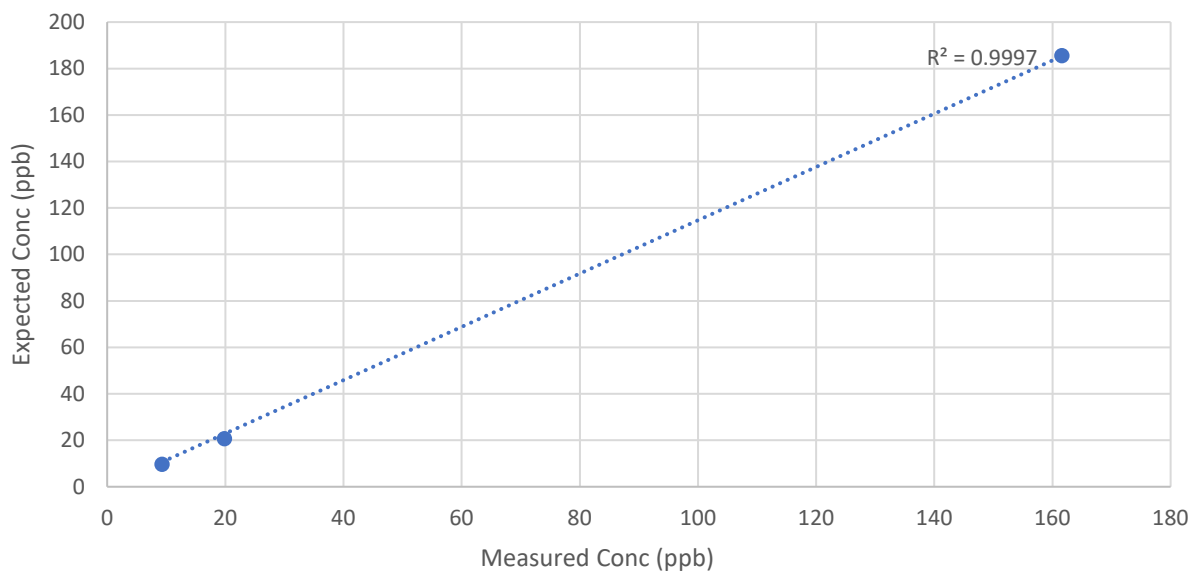
### Linearity results

Date	File number	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)
9/26/2021 12:49:54 PM	342769	342758	UV1	132.1	126.3
9/26/2021 1:13:35 PM	342770	342758	UV1	17.7	15.7
9/26/2021 1:25:29 PM	342771	342758	UV1	8.3	7.2
10/26/2021 8:48:27 AM	89507	89499	UV2	161.6	185.6
10/26/2021 8:55:01 AM	89508	89499	UV2	19.8	20.8
10/26/2021 9:02:28 AM	89509	89499	UV2	9.3	9.6
12/29/2021 11:39:14 AM	178181	178172	UV4	105.8	109.3
12/29/2021 11:44:15 AM	178182	178172	UV4	12.8	13.4
12/29/2021 11:50:03 AM	178183	178172	UV4	6.5	6.7
11/22/2021 2:01:13 PM	345531	345521	UV5	336.5	307.1
11/22/2021 2:06:14 PM	345532	345521	UV5	17.9	16.2
11/22/2021 2:11:14 PM	345533	345521	UV5	8.1	7.1

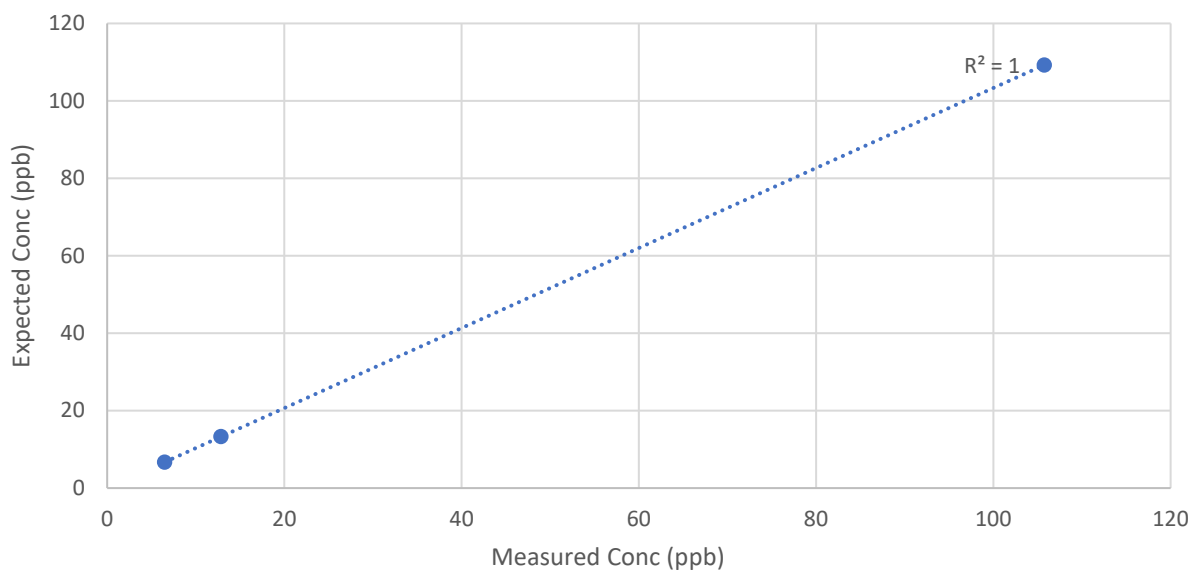
Benzene Linearity Check Bazan UV1



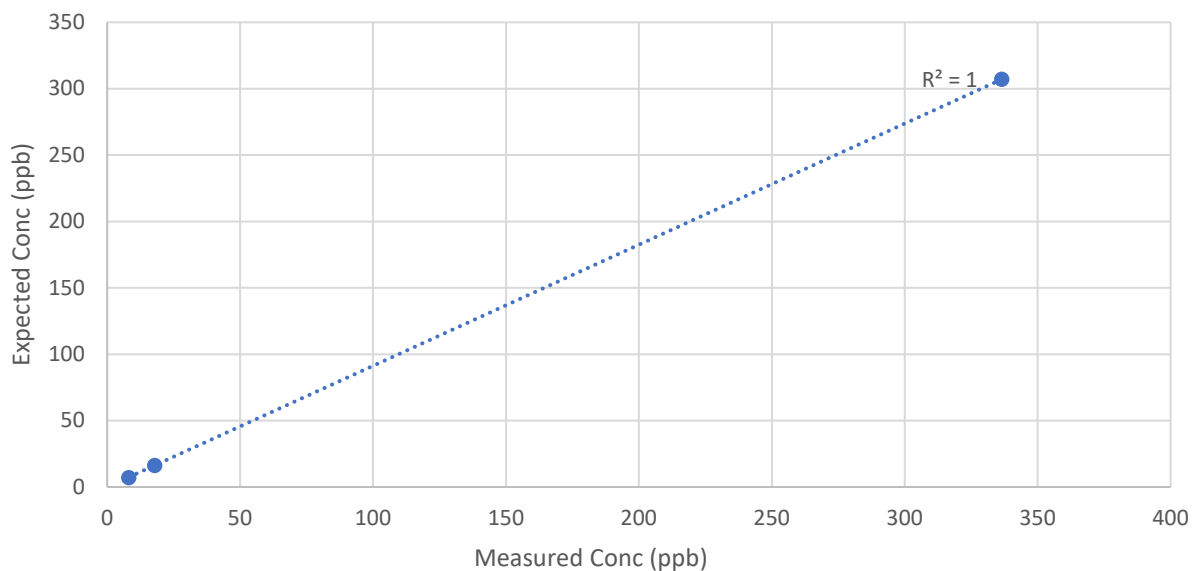
Benzene Linearity Check Bazan UV2



Benzene Linearity Check Bazan UV4



Benzene Linearity Check Bazan UV5





### Robustness Temperature

	UV1	UV2	UV4	UV5	Total
Average Abs	132.4	167.1	104.6	344.0	187.0
STDDEV	2.7	7.3	8.9	10.9	7.4
RSD (%)	2.0	4.4	8.5	3.2	4.5
Min Temp	21.1	23.9	21.1	19.4	
Max Temp	30.0	30.4	25.8	27.4	

Date	System	Concentration (ppb)	Temperature (°C)
11/22/2021 12:55:05 PM	UV1	135.0	21.1
7/30/2021 6:21:31 PM	UV1	133.9	30
10/18/2021 5:11:37 PM	UV1	131.8	25
8/25/2021 1:51:09 PM	UV1	128.8	30
8/30/2021 12:06:02 PM	UV2	168.9	30.4
9/14/2021 3:33:59 PM	UV2	175.4	30
9/27/2021 8:18:15 AM	UV2	172.0	24.1
10/18/2021 6:27:16 PM	UV2	157.7	23.9
10/26/2021 8:48:27 AM	UV2	161.6	24.6
9/30/2021 9:47:57 AM	UV4	105.8	25.8
10/25/2021 9:49:23 AM	UV4	110.8	21.1
11/11/2021 10:16:34 AM	UV4	110.0	23.8
12/14/2021 3:40:29 PM	UV4	91.7	21.4
9/14/2021 7:48:22 PM	UV5	329.1	27.4
9/24/2021 8:02:15 PM	UV5	338.5	25.5
10/18/2021 6:51:40 PM	UV5	352.3	24.2
10/26/2021 8:50:16 AM	UV5	348.5	19.4
11/22/2021 1:53:53 PM	UV5	337.2	22.2
12/14/2021 4:31:01 PM	UV5	358.3	20.7

### Robustness Sample Time

	All Systems
Average Conc of Ref Gas (ppb)	182.07
Average Conc of Measurements (ppb)	195.40
Accuracy (%)	7.32
Average Conc of Ref Gas (ppb)	182.07

Date	File number	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)	Collection time (min)
11/24/2021 3:10:46 PM	359784	359782	UV1	132.24	126.29	0.5
11/24/2021 3:11:16 PM	359785	359782	UV1	132.16	126.29	0.5
11/24/2021 3:11:47 PM	359786	359782	UV1	132.35	126.29	0.5
11/24/2021 3:14:38 PM	359788	359787	UV1	133.37	126.29	1
11/24/2021 3:15:38 PM	359789	359787	UV1	133.16	126.29	1
11/24/2021 3:16:39 PM	359790	359787	UV1	133.43	126.29	1
11/24/2021 3:27:26 PM	359792	359791	UV1	133.90	126.29	5
11/24/2021 3:32:26 PM	359793	359791	UV1	134.01	126.29	5
11/24/2021 3:37:26 PM	359794	359791	UV1	134.63	126.29	5
11/29/2021 3:37:43 PM	99391	99390	UV2	171.48	185.61	0.5
11/29/2021 3:38:14 PM	99392	99390	UV2	170.56	185.61	0.5
11/29/2021 3:38:44 PM	99393	99390	UV2	170.18	185.61	0.5
11/29/2021 3:40:10 PM	99394	99390	UV2	170.59	185.61	1
11/29/2021 3:41:11 PM	99395	99390	UV2	171.75	185.61	1

Date	File number	Background File no.	Syst-em	Concentra-tion (ppb)	Expected Conc (ppb)	Collection time (min)
11/29/2021 3:42:11 PM	99396	99390	UV2	171.77	185.61	1
11/29/2021 3:47:44 PM	99397	99390	UV2	171.73	185.61	5
11/29/2021 3:52:44 PM	99398	99390	UV2	172.01	185.61	5
11/29/2021 3:57:45 PM	99399	99390	UV2	172.67	185.61	5
12/14/2021 3:39:58 PM	174064	174058	UV4	90.53	109.27	0.5
12/14/2021 3:40:29 PM	174065	174058	UV4	91.66	109.27	0.5
12/14/2021 3:41:00 PM	174066	174058	UV4	89.88	109.27	0.5
2/17/2022 12:26:46 PM	192410	192409	UV4	125.59	109.27	1
2/17/2022 12:27:47 PM	192411	192409	UV4	125.48	109.27	1
2/17/2022 12:28:48 PM	192412	192409	UV4	125.25	109.27	1
2/17/2022 12:34:09 PM	192413	192409	UV4	126.61	109.27	5
2/17/2022 12:39:10 PM	192414	192409	UV4	127.61	109.27	5
2/17/2022 12:44:11 PM	192415	192409	UV4	129.11	109.27	5
11/30/2021 2:53:17 PM	347848	347841	UV5	325.00	307.09	0.5
11/30/2021 2:53:47 PM	347849	347841	UV5	327.62	307.09	0.5
11/30/2021 2:54:17 PM	347850	347841	UV5	327.10	307.09	0.5
2/9/2022 1:19:14 PM	368199	368198	UV5	381.63	307.09	1
2/9/2022 1:20:14 PM	368200	368198	UV5	382.53	307.09	1
2/9/2022 1:21:15 PM	368201	368198	UV5	381.14	307.09	1



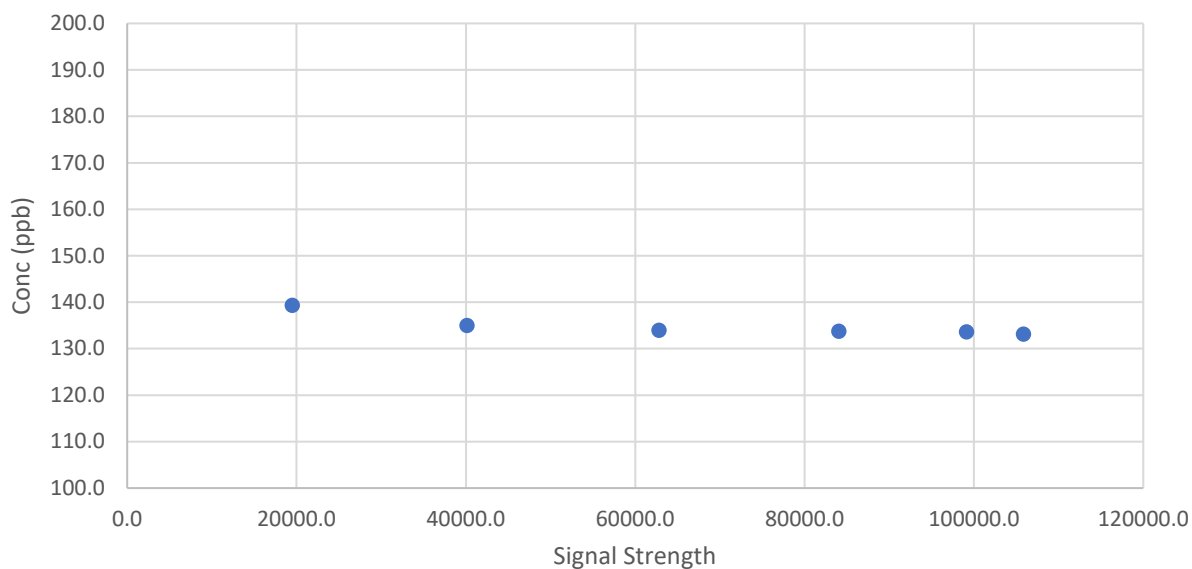
Date	File number	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)	Collection time (min)
2/9/2022 1:26:33 PM	368202	368198	UV5	379.81	307.09	5
2/9/2022 1:31:33 PM	368203	368198	UV5	378.01	307.09	5
2/9/2022 1:36:33 PM	368204	368198	UV5	377.79	307.09	5

### Robustness Signal Strength

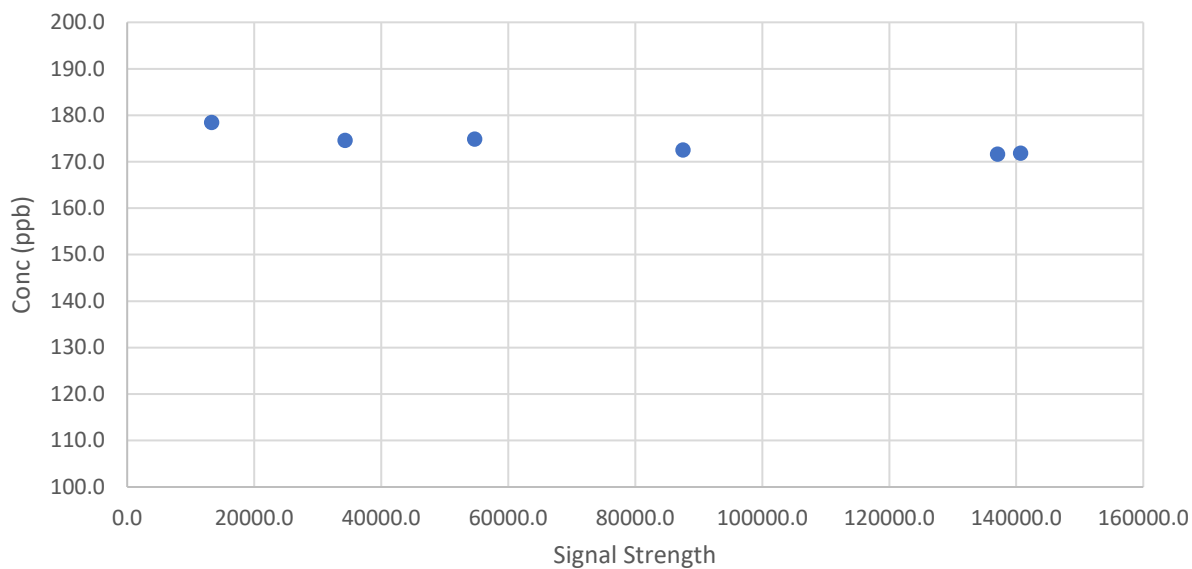
	UV1	UV2	UV4	UV5	Total
Average (ppb)	134.8	174.0	130.9	373.6	203.3
Stddev	2.3	2.6	4.7	1.9	2.9
RSD (%)	1.7	1.5	3.6	0.5	1.8
Min Signal	19488.4	13293.9	11783.1	42675.4	
Max Signal	105845.3	140675.1	44686.9	112782.7	
Number of Sample Points	6	6	6	6	

Sample Date	Site Name	File Number	Path Length	Signal Strength	Benzene (ppb)
11/25/2021 1:41:39 PM	UV1	360058	867	105845.3	133.1
11/25/2021 1:42:34 PM	UV1	360059	867	99112.9	133.6
11/25/2021 1:43:31 PM	UV1	360060	867	84062.3	133.8
11/25/2021 1:44:20 PM	UV1	360061	867	62808.8	133.9
11/25/2021 1:45:12 PM	UV1	360062	867	40118.4	135.0
11/25/2021 1:46:05 PM	UV1	360063	867	19488.4	139.3
11/28/2021 4:40:31 PM	UV2	99094	428	140675.1	171.9
11/28/2021 4:41:02 PM	UV2	99095	428	137046.8	171.7
11/28/2021 4:44:00 PM	UV2	99099	428	87545.6	172.5
11/28/2021 4:45:55 PM	UV2	99102	428	54694.8	174.9
11/28/2021 4:47:56 PM	UV2	99105	428	34290.8	174.6
11/28/2021 4:49:56 PM	UV2	99108	428	13293.9	178.4
2/17/2022 12:48:38 PM	UV4	192416	822	44686.9	126.5
2/17/2022 12:27:47 PM	UV4	192411	822	38957.9	125.5
2/17/2022 12:51:46 PM	UV4	192419	822	30593.1	130.4
2/17/2022 12:53:47 PM	UV4	192422	822	22967.5	130.4
2/17/2022 12:55:58 PM	UV4	192425	822	15679.5	134.8
2/17/2022 1:00:09 PM	UV4	192432	822	11783.1	137.8
2/21/2022 2:00:30 PM	UV5	371618	311	112782.7	370.3
2/21/2022 2:01:55 PM	UV5	371619	311	90983.0	372.7
2/21/2022 2:03:04 PM	UV5	371620	311	77474.4	373.7
2/21/2022 2:03:58 PM	UV5	371621	311	64609.1	374.5
2/21/2022 2:05:23 PM	UV5	371622	311	53959.1	375.2
2/21/2022 2:06:13 PM	UV5	371623	311	42675.4	375.3

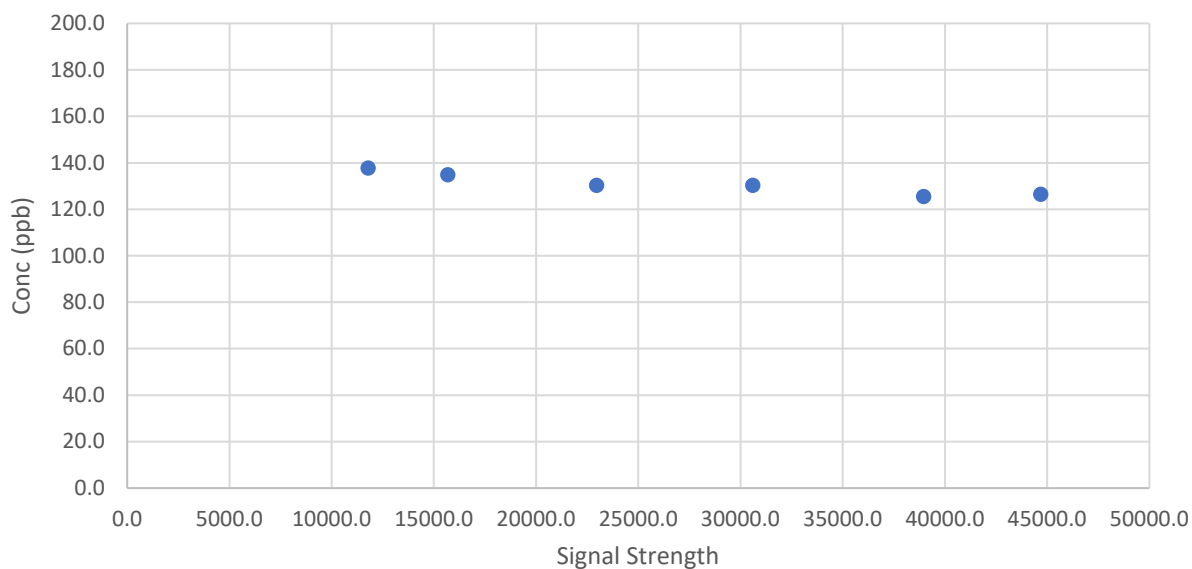
Signal Strength Robustness Check Bazan UV1



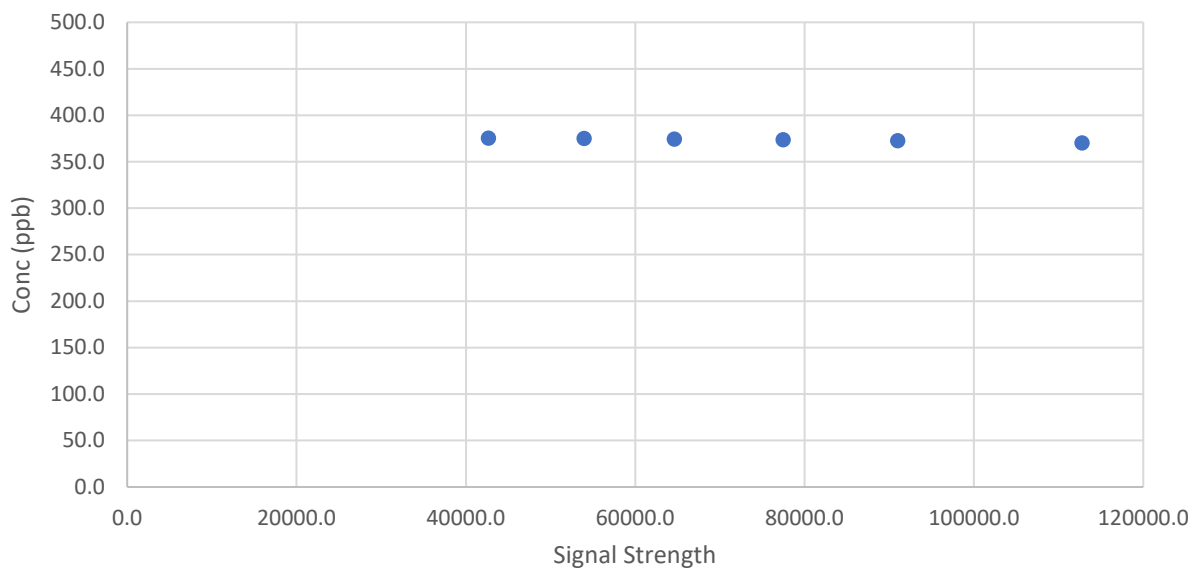
Signal Strength Robustness Check Bazan UV2



Signal Strength Robustness Check Bazan UV4



Signal Strength Robustness Check Bazan UV5



### **Validated 24 hours average Fenceline results**

Attached files:

1. Bazan\_Site\_#1\_24H\_validated\_20210101\_to\_20211231.csv
2. Bazan\_Site\_#2\_24H\_validated\_20210101\_to\_20211231.csv
3. Bazan\_Site\_#4\_24H\_validated\_20210101\_to\_20211231.csv
4. Bazan\_Site\_#5\_24H\_validated\_20210101\_to\_20211231.csv