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Annual Report Fence line Monitoring Report for the Bazan Fence line Monitoring System 2023

Oil Refineries Ltd. | Carmel Olefins Ltd. | Gadiv Petrochemical Industries Ltd. | www.bazan.co.il
P.O Box 4, Haifa 3100001, Phone +972-4-8788111, Fax +972-4-8788000

February 16, 2024
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 2023. 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 2023 the year-to-date onstream efficiency for the systems was 97.19%.

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.
- UV1 had the highest annual average for benzene of 0.54 $\mu g/m^3$.
- The most daily average exceedances of the 3.9 $\mu g/m^3$ benzene alarm value was at UV2, UV4 and UV5 (1 day each)

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

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Report Details

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Date Submitted	3 March 2024
Client	Israel Ministry of Environment
Prepared by	Mark Baird Email: mwbaird@argos-sci.co.za Signed:
Review by	Amir Sagi Email: samir@bazan.co.il Signed:
Approval	Eliko Angel Email: aeliko@bazan.co.il Signed:
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 (UV1); Gadiv Eastern line 428 meters (UV2); Western Line (UV5) 311 m and Refinery Southwestern line (UV4) 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 2023, 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.

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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	<= 10 %	Between 10 % and 30 %	> 30 %
Precision	Relative Standard Deviation (RSD) < = 20 %		RSD > 20 %
MDL	N/A	N/A	N/A
Accuracy	<= 15 %		> 15 %
Linearity	R^2 >= 0.9		R^2 < 0.9
Robustness Temperature	<= 15 %		> 15 %
Robustness Signal Strength	<= 15 %		> 15 %
Robustness Sample Time	<= 15 %		> 15 %

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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	5.86%	Method acceptable
Precision	5.61%	Method acceptable
MDL	0.80 ppb	N/A
Accuracy	6.19%	Method acceptable
Linearity	R^2 = 0.9976	Method acceptable
Robustness Temperature	4.5%	Method acceptable
Robustness Signal Strength	6.0%	Method acceptable
Robustness Sample Time	7.45%	Method acceptable

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Section 3 - Summary of Field Data

As mentioned in Section 1, the air monitoring equipment operated continuously during 2023. 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 2023

Location	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	Annual (%)
UV_1	96.02	97.57	98.04	97.54	97.29
UV_2	98.84	98.07	95.43	97.14	97.37
UV_4	93.95	97.66	96.90	95.77	96.07
UV_5	98.82	96.75	97.69	98.78	98.01

A summary of the 2023 data is shown in Tables 3.2 and 3.3 below:

Table 3.2 – Annual Average Benzene Concentrations per Site for 2023

Location	Benzene ($\mu g/m^3$)	Uncertainty of MDL (%)*
UV_1	0.54	13.2
UV_2	0.47	14.9
UV_4	0.39	22.2
UV_5	0.41	11.3

*Uncertainty calculation adjusted based on NCR 02_29_24. Validation of methodology against 2022 Annual results in Section 5 - Annexes

Table 3.3 – Annual Average Toluene, Xylene and Ethyl Benzene Concentrations per Site for 2023

Location	Toluene ($\mu g/m^3$)	Xylene ($\mu g/m^3$)	Ethyl Benzene ($\mu g/m^3$)
UV_1	1.78	3.49	1.01
UV_2	2.31	2.50	8.46
UV_4	1.26	1.15	3.21
UV_5	0.72	1.49	7.32

The table below shows the number of daily average exceedances in 2023 of the following:

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

Table 3.3 – Number of Daily Average Exceedances Average Benzene Concentrations per Site for 2023

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

Figures 3.1 to 3.4 show the annual wind roses at each of the paths for 2023.

Figure 3.1 – Wind Speed and Wind Direction for UV1 for 2023

Figure 3.2 – Wind Speed and Wind Direction for UV2 for 2023

Figure 3.3 – Wind Speed and Wind Direction for UV4 for 2023

Figure 3.4 – Wind Speed and Wind Direction Data for UV5 for 2023

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.
- UV1 had the highest annual average for benzene of 0.54 $\mu g/m^3$.
- The most daily average exceedances of the 3.9 $\mu g/m^3$ benzene alarm value was at UV2, UV4 and UV5 (1 day each)

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Section 5 – Annexes

Bias results

Bias	0.575	
SDd	0.444	
t-test	3.664	< 2.571 means statistically insignificant
Relative Bias UV1	4.987	<=10%
Relative Bias UV2	5.861	<=10%
Relative Bias UV4	5.138	<=10%
Relative Bias UV5	3.805	<=10%
Average Relative Bias	4.948	<=10%

Date	File number	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)	Difference between spiked and unspiked samples
11/29/2023 1:26:59 PM	278367	Argosqa-11/29/2023 1:20:05 PM-278364	UV1	-0.71309	0	
11/29/2023 1:27:59 PM	278368	Argosqa-11/29/2023 1:20:05 PM-278364	UV1	0.42435	0	
11/29/2023 1:29:34 PM	278369	Argosqa-11/29/2023 1:20:05 PM-278364	UV1	11.50522	11.53	
11/29/2023 1:30:34 PM	278370	Argosqa-11/29/2023 1:20:05 PM-278364	UV1	11.7862	11.53	0.26008
11/29/2023 1:32:50 PM	278371	Argosqa-11/29/2023 1:20:05 PM-278364	UV1	-0.70884	0	
11/29/2023 1:34:50 PM	278373	Argosqa-11/29/2023 1:20:05 PM-278364	UV1	-0.71033	0	
11/29/2023 1:36:29 PM	278374	Argosqa-11/29/2023 1:20:05 PM-278364	UV1	11.56049	11.53	
11/29/2023 1:37:30 PM	278375	Argosqa-11/29/2023 1:20:05 PM-278364	UV1	11.13858	11.53	0.52912
11/29/2023 1:53:31 PM	278384	Argosqa-11/29/2023 1:20:05 PM-278364	UV2	-0.58513	0	
11/29/2023 1:54:31 PM	278385	Argosqa-11/29/2023 1:20:05 PM-278364	UV2	-0.43022	0	
11/29/2023 1:57:49 PM	278386	Argosqa-11/29/2023 1:20:05 PM-278364	UV2	8.8549	9.81	
11/29/2023 1:58:49 PM	278387	Argosqa-11/29/2023 1:20:05 PM-278364	UV2	11.21814	9.81	0.734195
11/29/2023 2:00:46 PM	278388	Argosqa-11/29/2023 1:20:05 PM-278364	UV2	-0.66417	0	
11/29/2023 2:01:47 PM	278389	Argosqa-11/29/2023 1:20:05 PM-278364	UV2	-0.23241	0	
11/29/2023 2:03:22 PM	278390	Argosqa-11/29/2023 1:20:05 PM-278364	UV2	11.53038	9.81	
11/29/2023 2:04:22 PM	278391	Argosqa-11/29/2023 1:20:05 PM-278364	UV2	8.6755	9.81	0.74123
11/29/2023 1:40:40 PM	278376	Argosqa-11/29/2023 1:20:05 PM-278364	UV4	-2.5318	0	
11/29/2023 1:41:40 PM	278377	Argosqa-11/29/2023 1:20:05 PM-278364	UV4	-2.23616	0	
11/29/2023 1:43:11 PM	278378	Argosqa-11/29/2023 1:20:05 PM-278364	UV4	9.56774	11.19	
11/29/2023 1:44:11 PM	278379	Argosqa-11/29/2023 1:20:05 PM-278364	UV4	9.18205	11.19	0.568875
11/29/2023 1:45:42 PM	278380	Argosqa-11/29/2023 1:20:05 PM-278364	UV4	-2.00541	0	
11/29/2023 1:46:42 PM	278381	Argosqa-11/29/2023 1:20:05 PM-278364	UV4	-0.73498	0	
11/29/2023 1:50:08 PM	278382	Argosqa-11/29/2023 1:20:05 PM-278364	UV4	9.8373	11.19	
11/29/2023 1:51:08 PM	278383	Argosqa-11/29/2023 1:20:05 PM-278364	UV4	9.86614	11.19	0.031915
12/15/2023 5:35:13 PM	558273	Argosqa-12/15/2023 5:33:49 PM-558272	UV5	-3.4235	0	
12/15/2023 5:35:43 PM	558274	Argosqa-12/15/2023 5:33:49 PM-558272	UV5	-0.49856	0	
12/15/2023 5:38:11 PM	558275	Argosqa-12/15/2023 5:33:49 PM-558272	UV5	15.08807	15.11	
12/15/2023 5:39:30 PM	558276	Argosqa-12/15/2023 5:33:49 PM-558272	UV5	14.17647	15.11	1.4833
9/15/2023 4:53:16 PM	532802	Argosqa-9/15/2023 4:51:14 PM-532801	UV5	-1.333	0	
8/17/2023 6:11:23 PM	524862	Argosqa-8/17/2023 6:10:27 PM-524861	UV5	0.28665	0	
9/15/2023 5:31:07 PM	532818	Argosqa-9/15/2023 4:51:14 PM-532801	UV5	14.87961	15.11	
8/17/2023 6:23:00 PM	524872	Argosqa-8/17/2023 6:10:27 PM-524861	UV5	14.79655	15.11	0.251255

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Precision results

	UV1	UV2	UV4	UV5	Total
Average	12.49	11.09	9.04	14.31	11.73
Stdev	0.3155	1.0671	0.3501	0.9202	0.6632
RSD (%)	2.53	9.62	3.87	6.43	5.61
No. of Samples	25	25	25	25	

Date	File number	Background File no.	System	Concentration (ppb)
11/29/2023 2:32:24 PM	278394	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.88492
11/29/2023 2:33:24 PM	278395	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	11.86839
11/29/2023 2:34:24 PM	278396	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.57044
11/29/2023 2:35:24 PM	278397	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.79052
11/29/2023 2:36:24 PM	278398	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.96733
11/29/2023 2:37:24 PM	278399	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.39673
11/29/2023 2:38:24 PM	278400	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.56411
11/29/2023 2:39:24 PM	278401	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.91415
11/29/2023 2:40:25 PM	278402	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.33337
11/29/2023 2:41:25 PM	278403	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	13.07177
11/29/2023 2:42:25 PM	278404	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.21677
11/29/2023 2:43:25 PM	278405	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.34672
11/29/2023 2:44:25 PM	278406	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.65404
11/29/2023 2:45:25 PM	278407	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.70255
11/29/2023 2:46:25 PM	278408	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	13.01602
11/29/2023 2:47:25 PM	278409	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.16435
11/29/2023 2:48:25 PM	278410	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.29151
11/29/2023 2:49:25 PM	278411	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.32776
11/29/2023 2:50:26 PM	278412	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.10334
11/29/2023 2:51:26 PM	278413	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.02148
11/29/2023 2:52:26 PM	278414	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.3453
11/29/2023 2:53:26 PM	278415	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.32825
11/29/2023 2:54:26 PM	278416	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.43594
11/29/2023 2:55:26 PM	278417	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.38848
11/29/2023 2:56:26 PM	278418	Argosqa-11/29/2023 2:29:54 PM-278392	UV1	12.6327

12/26/2023 11:11:15 AM	323770	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	12.21457
12/26/2023 11:12:16 AM	323771	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	10.99855
12/26/2023 11:13:16 AM	323772	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	9.29538
12/26/2023 11:14:16 AM	323773	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	10.49177
12/26/2023 11:15:17 AM	323774	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	10.27804
12/26/2023 11:16:18 AM	323775	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	12.35716
12/26/2023 11:17:19 AM	323776	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	12.32463
12/26/2023 11:18:20 AM	323777	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	11.41302
12/26/2023 11:19:21 AM	323778	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	11.21955
12/26/2023 11:20:22 AM	323779	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	10.69769
12/26/2023 11:21:23 AM	323780	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	12.33302
12/26/2023 11:22:24 AM	323781	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	10.04656
12/26/2023 11:23:25 AM	323782	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	9.02436
12/26/2023 11:24:26 AM	323783	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	11.10172
12/26/2023 11:25:27 AM	323784	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	12.58131
12/26/2023 11:26:28 AM	323785	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	12.3416
12/26/2023 11:27:29 AM	323786	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	11.54338
12/26/2023 11:28:30 AM	323787	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	10.76303
12/26/2023 11:29:31 AM	323788	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	9.19716
12/26/2023 11:30:32 AM	323789	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	11.02995
12/26/2023 11:31:33 AM	323790	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	11.00725
12/26/2023 11:32:34 AM	323791	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	12.30915
12/26/2023 11:33:35 AM	323792	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	12.01722
12/26/2023 11:34:36 AM	323793	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	9.89893
12/26/2023 11:35:37 AM	323794	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	10.85897

12/26/2023 11:18:50 AM	383985	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.9834
12/26/2023 11:21:50 AM	383986	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.56903
12/26/2023 11:22:50 AM	383987	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.41643
12/26/2023 11:23:51 AM	383988	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.9141
12/26/2023 11:24:51 AM	383989	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.4762
12/26/2023 11:25:51 AM	383990	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.99745
12/26/2023 11:26:51 AM	383991	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.50476
12/26/2023 11:27:52 AM	383992	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.76658
12/26/2023 11:28:53 AM	383993	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.432
12/26/2023 11:29:53 AM	383994	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.87426
12/26/2023 11:30:53 AM	383995	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.15609
12/26/2023 11:31:53 AM	383996	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.7156
12/26/2023 11:32:54 AM	383997	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.52068
12/26/2023 11:33:54 AM	383998	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.8236
12/26/2023 11:34:55 AM	383999	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.01893
12/26/2023 11:35:55 AM	384000	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.66083
12/26/2023 11:36:55 AM	384001	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.92493
12/26/2023 11:37:55 AM	384002	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.25794
12/26/2023 11:38:56 AM	384003	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.92383
12/26/2023 11:39:56 AM	384004	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.56422
12/26/2023 11:40:56 AM	384005	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.64701
12/26/2023 11:41:57 AM	384006	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	8.9174
12/26/2023 11:42:57 AM	384007	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.10253
12/26/2023 11:43:57 AM	384008	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.21398
12/26/2023 11:44:57 AM	384009	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.64132

11/29/2023 1:19:10 PM	553695	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	13.78435
11/29/2023 1:19:40 PM	553696	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	13.98357
11/29/2023 1:20:11 PM	553697	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	14.22873
11/29/2023 1:20:41 PM	553698	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	13.85767
11/29/2023 1:21:11 PM	553699	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	15.01926
11/29/2023 1:21:41 PM	553700	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	12.11502
11/29/2023 1:22:11 PM	553701	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	15.11077
11/29/2023 1:22:41 PM	553702	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	14.46679
11/29/2023 1:23:11 PM	553703	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	15.39464
11/29/2023 1:23:41 PM	553704	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	15.27649
11/29/2023 1:24:11 PM	553705	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	14.34137
11/29/2023 1:24:42 PM	553706	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	15.1134
11/29/2023 1:25:12 PM	553707	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	14.36592
11/29/2023 1:25:42 PM	553708	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	13.10756
11/29/2023 1:26:12 PM	553709	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	15.15354
11/29/2023 1:26:42 PM	553710	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	13.99466
11/29/2023 1:27:12 PM	553711	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	15.57953
11/29/2023 1:27:42 PM	553712	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	13.55145
11/29/2023 1:28:12 PM	553713	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	14.64003
11/29/2023 1:28:43 PM	553714	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	14.42527
11/29/2023 1:29:13 PM	553715	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	13.58748
11/29/2023 1:29:43 PM	553716	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	15.97709
11/29/2023 1:30:13 PM	553717	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	14.28844
11/29/2023 1:30:43 PM	553718	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	12.7008
11/29/2023 1:31:13 PM	553719	Argosqa-11/29/2023 1:14:00 PM-553692	UV5	13.58733

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MDL results

Q1

Location	January MDL (ppb)	February MDL (ppb)	March MDL (ppb)
UV_1	0.28	0.60	0.46
UV_2	0.25	0.46	0.53
UV_4	0.54	0.78	0.54
UV_5	0.21	0.65	0.50

Q2

Location	April MDL (ppb)	May MDL (ppb)	June MDL (ppb)
UV_1	0.81	0.69	0.51
UV_2	0.48	0.23	0.44
UV_4	0.91	0.87	0.41
UV_5	0.38	0.21	0.26

Q3

Location	July MDL (ppb)	August MDL (ppb)	September MDL (ppb)
UV_1	0.46	0.64	0.29
UV_2	0.57	0.62	0.49
UV_4	0.36	0.35	0.28
UV_5	0.49	0.32	0.83

Q4

Location	October MDL (ppb)	November MDL (ppb)	December MDL (ppb)
UV_1	0.53	0.58	0.48
UV_2	0.66	0.57	0.56
UV_4	0.47	0.61	0.26
UV_5	0.68	0.46	0.42

Accuracy results

Date	File number	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)	Collection time (min)		UV1
11/29/2023 3:10:13 PM	278422	Argosqa-11/29/2023	UV1	11.86022	11.53	0.5	Average Conc of Ref Gas (ppb)	11.53
11/29/2023 3:15:02 PM	278425	Argosqa-11/29/2023	UV1	12.98753	11.53	0.5	Average Conc of Measurements (ppb)	12.24
11/29/2023 3:18:57 PM	278427	Argosqa-11/29/2023	UV1	12.18532	11.53	0.5	Accuracy (%)	6.14
11/29/2023 3:31:14 PM	278429	Argosqa-11/29/2023	UV1	11.91689	11.53	5		
								UV2
11/29/2023 3:10:13 PM	323797	Argosqa-12/26/2023	UV2	10.48212	9.81	1	Average Conc of Ref Gas (ppb)	9.81
11/29/2023 3:15:02 PM	323799	Argosqa-12/26/2023	UV2	9.88773	9.81	1	Average Conc of Measurements (ppb)	10.19
11/29/2023 3:18:57 PM	323801	Argosqa-12/26/2023	UV2	9.21679	9.81	1	Accuracy (%)	3.92
11/29/2023 3:31:14 PM	323804	Argosqa-12/26/2023	UV2	11.19142	9.81	1		
								UV4
12/26/2023 11:47:01 AM	384011	Argosqa-12/26/2023	UV4	9.49838	11.19	1	Average Conc of Ref Gas (ppb)	11.19
12/26/2023 11:47:31 AM	384012	Argosqa-12/26/2023	UV4	10.44466	11.19	1	Average Conc of Measurements (ppb)	9.80
12/26/2023 11:52:51 AM	384013	Argosqa-12/26/2023	UV4	9.44306	11.19	1	Accuracy (%)	12.41
12/26/2023 11:58:15 AM	384015	Argosqa-12/26/2023	UV4	9.82083	11.19	1		
								UV5
11/29/2023 1:51:49 PM	553730	Argosqa-11/29/2023	UV5	14.83731	15.11	0.5	Average Conc of Ref Gas (ppb)	15.11
11/29/2023 1:54:42 PM	553732	Argosqa-11/29/2023	UV5	16.16812	15.11	0.5	Average Conc of Measurements (ppb)	14.76
11/29/2023 1:57:30 PM	553734	Argosqa-11/29/2023	UV5	14.42841	15.11	0.5	Accuracy (%)	2.32
11/29/2023 2:01:48 PM	553736	Argosqa-11/29/2023	UV5	13.60583	15.11	0.5		

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Linearity results

Date	File numbe	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)
12/24/2023 12:23:50 PM	285487	Argosqa-12/24/2023 12:21:38 PM-285486	UV1	13.15	11.53
12/24/2023 12:32:28 PM	285496	Argosqa-12/24/2023 12:21:38 PM-285486	UV1	40.06822	37.72
12/24/2023 12:28:25 PM	285490	Argosqa-12/24/2023 12:21:38 PM-285486	UV1	120.69464	105.4
12/13/2023 4:16:49 PM	320093	Argosqa-12/13/2023 3:59:29 PM-320078	UV2	9.16	9.81
12/13/2023 4:05:49 PM	320083	Argosqa-12/13/2023 3:59:29 PM-320078	UV2	81.88135	76.4
12/13/2023 4:12:09 PM	320089	Argosqa-12/13/2023 3:59:29 PM-320078	UV2	261.09	243.4
12/15/2023 5:03:32 PM	380956	Argosqa-12/15/2023 4:59:06 PM-380953	UV4	11.16621	11.19
12/13/2023 10:16:26 AI	380308	Argosqa-12/13/2023 9:20:44 AM-380296	UV4	35.71	39.78
12/13/2023 10:27:22 AI	380313	Argosqa-12/13/2023 9:20:44 AM-380296	UV4	154.75	126.8
11/29/2023 3:50:35 PM	553775	Argosqa-11/29/2023 3:26:14 PM-553766	UV5	14.89	15.11
12/24/2023 12:07:39 PI	560733	Argosqa-12/24/2023 11:27:50 AM-56072	UV5	118.21779	105
12/24/2023 11:29:31 AI	560725	Argosqa-12/24/2023 11:27:50 AM-56072	UV5	455.07479	335

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Robustness Temperature

	UV1	UV2	UV4	UV5	Total
Average Abs	12.2	9.3	10.4	15.0	11.7
STDDEV	0.8	0.3	0.7	0.3	0.5
RSD (%)	6.2	2.7	7.0	2.1	4.5
Min Temp	21.7	20.1	18.4	22.1	
Max Temp	31.9	31.7	32.5	30.3	

Date	System	Concentration (ppb)	Temperature °C
8/28/2023 11:54:25 AM	UV1	11.56827	29.3
9/28/2023 3:50:57 PM	UV1	13.03531	28.9
10/30/2023 4:52:50 PM	UV1	11.57999	31.9
11/15/2023 4:20:06 PM	UV1	11.75981	22.8
11/29/2023 1:29:34 PM	UV1	12.99949	21.7
9/28/2023 9:17:25 AM	UV2	9.1595	24.7
10/6/2023 5:46:27 PM	UV2	9.62003	27.6
10/30/2023 4:14:14 PM	UV2	9.03051	31.7
11/7/2023 10:13:02 AM	UV2	9.50104	26.3
12/13/2023 4:16:49 PM	UV2	9.16995	20.1
9/6/2023 12:05:22 PM	UV4	10.77437	32.5
10/10/2023 12:11:08 AM	UV4	9.26417	27.1
10/29/2023 4:19:42 PM	UV4	10.17036	29.1
11/17/2023 5:11:13 PM	UV4	10.77482	22.2
12/15/2023 5:08:58 PM	UV4	11.11271	18.4
9/15/2023 5:31:07 PM	UV5	14.87961	29.2
8/17/2023 6:23:00 PM	UV5	14.79655	29
10/29/2023 5:19:02 PM	UV5	14.7423	30.3
11/15/2023 5:03:58 PM	UV5	15.42572	22.1

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Robustness Signal Strength

	UV1	UV2	UV4	UV5	Total
Average (ppb)	12.5	10.0	8.6	15.1	11.6
Stddev	0.4751	0.7493	0.7958	0.5266	0.6
RSD (%)	3.8	7.5	9.2	3.5	6.0
Min Signal	9000.0	9285.4	8870.1	4412.0	
Max Signal	44000.0	70438.7	37322.9	88594.0	
Number of Sample Points	12	15	12	8	

Sample Date	Site Name	File Number	Path Length	Signal Strength	Benzene
11/29/2023 4:30:19 PM	UV1	278447	867	44000	13.39794
11/29/2023 4:30:49 PM	UV1	278448	867	44000	11.97305
11/29/2023 4:31:19 PM	UV1	278449	867	44000	12.89422
11/29/2023 4:32:17 PM	UV1	278450	867	35000	12.76811
11/29/2023 4:32:47 PM	UV1	278451	867	35000	12.74257
11/29/2023 4:33:16 PM	UV1	278452	867	35000	11.9913
11/29/2023 4:34:03 PM	UV1	278453	867	22000	11.8057
11/29/2023 4:34:33 PM	UV1	278454	867	22000	12.71812
11/29/2023 4:35:03 PM	UV1	278455	867	22000	12.67043
11/29/2023 4:35:52 PM	UV1	278456	867	9000	11.99287
11/29/2023 4:36:23 PM	UV1	278457	867	9000	12.33561
11/29/2023 4:36:53 PM	UV1	278458	867	9000	12.61066
12/30/2023 12:24:34 PM	UV2	324930	428	70438.73333	9.72577
12/30/2023 12:25:04 PM	UV2	324931	428	69475.93333	10.23186
12/30/2023 12:25:34 PM	UV2	324932	428	67903.43333	10.53617
12/30/2023 12:26:25 PM	UV2	324933	428	45158.97619	10.62068
12/30/2023 12:26:55 PM	UV2	324934	428	45974.57143	9.80765
12/30/2023 12:27:24 PM	UV2	324935	428	47248.45238	9.62851
12/30/2023 12:28:19 PM	UV2	324936	428	25768.66667	10.32692
12/30/2023 12:28:49 PM	UV2	324937	428	24915	9.16285
12/30/2023 12:29:19 PM	UV2	324938	428	25425.38667	9.33909
12/30/2023 12:30:05 PM	UV2	324939	428	12484.86	11.06019
12/30/2023 12:30:35 PM	UV2	324940	428	12285.74667	11.28564
12/30/2023 12:31:05 PM	UV2	324941	428	12628.56667	8.75954
12/30/2023 12:31:55 PM	UV2	324942	428	9695.875	10.44993
12/30/2023 12:32:25 PM	UV2	324943	428	9285.35	8.95103
12/30/2023 12:32:56 PM	UV2	324944	428	9325.365	9.83674

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12/30/2023 3:22:32 PM	UV4	385197	822	36574.23333	9.84884
12/30/2023 3:23:02 PM	UV4	385198	822	36991.53333	7.7107
12/30/2023 3:23:33 PM	UV4	385199	822	37322.9	7.81211
12/30/2023 3:24:31 PM	UV4	385200	822	27716.09524	8.76421
12/30/2023 3:25:00 PM	UV4	385201	822	26892.30952	8.31562
12/30/2023 3:25:30 PM	UV4	385202	822	25477.88095	8.3807
12/30/2023 3:26:19 PM	UV4	385203	822	18032.9	9.91949
12/30/2023 3:26:49 PM	UV4	385204	822	18136	8.12854
12/30/2023 3:27:19 PM	UV4	385205	822	18148.56667	8.32419
12/30/2023 3:28:20 PM	UV4	385206	822	8962.783333	9.34995
12/30/2023 3:28:51 PM	UV4	385207	822	9033.966667	9.35673
12/30/2023 3:29:21 PM	UV4	385208	822	8870.1	7.7732

11/29/2023 2:27:21 PM	UV5	553743	311	88594	14.95047
11/29/2023 2:28:09 PM	UV5	553744	311	75313.68571	14.8791
11/29/2023 2:28:54 PM	UV5	553745	311	53003.22	14.17249
11/29/2023 2:29:41 PM	UV5	553746	311	39735.98485	14.91823
11/29/2023 2:30:25 PM	UV5	553747	311	26491.73	15.62702
11/29/2023 2:31:11 PM	UV5	553748	311	13221.145	15.44849
11/29/2023 2:32:01 PM	UV5	553749	311	8835.336667	15.23147
11/29/2023 2:32:45 PM	UV5	553750	311	4411.986667	15.85499

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Robustness Sample Time

Date	File number	Background File no.	System	Concentration (ppb)	Expected Conc (ppb)	Collection time (min)		UV1
11/29/2023 3:55:42 PM	278432	Argosqa-11/29/2023 3:54:09 PM-278430	UV1	11.8744	11.53	0.5	Average Conc of Ref Gas (ppb)	11.53
11/29/2023 3:58:31 PM	278434	Argosqa-11/29/2023 3:57:14 PM-278433	UV1	12.37795	11.53	1	Average Conc of Measurements (ppb)	12.39
11/29/2023 3:59:31 PM	278435	Argosqa-11/29/2023 3:57:14 PM-278433	UV1	12.5027	11.53	1	Accuracy (%)	7.42
11/29/2023 4:03:29 PM	278439	Argosqa-11/29/2023 4:02:43 PM-278438	UV1	12.73308	11.53	5		
11/29/2023 4:03:59 PM	278440	Argosqa-11/29/2023 4:02:43 PM-278438	UV1	12.72707	11.53	0.5		
11/29/2023 4:14:57 PM	278442	Argosqa-11/29/2023 4:09:31 PM-278441	UV1	12.38062	11.53	0.5		
11/29/2023 4:19:57 PM	278443	Argosqa-11/29/2023 4:09:31 PM-278441	UV1	11.90659	11.53	5		
11/29/2023 4:22:47 PM	278445	Argosqa-11/29/2023 4:21:28 PM-278444	UV1	12.64455	11.53	5		
11/29/2023 4:23:47 PM	278446	Argosqa-11/29/2023 4:21:28 PM-278444	UV1	12.32132	11.53	1		
								UV2
12/26/2023 11:53:31 AM	323805	Argosqa-12/26/2023 11:50:30 AM-323803	UV2	10.35857	9.81	0.5	Average Conc of Ref Gas (ppb)	9.81
12/26/2023 11:54:01 AM	323806	Argosqa-12/26/2023 11:50:30 AM-323803	UV2	10.3445	9.81	0.5	Average Conc of Measurements (ppb)	10.23
12/26/2023 11:34:36 AM	323793	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	9.89893	9.81	1	Accuracy (%)	4.30
12/26/2023 11:35:37 AM	323794	Argosqa-12/26/2023 11:09:37 AM-323769	UV2	10.85897	9.81	1		
12/26/2023 11:59:29 AM	323807	Argosqa-12/26/2023 11:50:30 AM-323803	UV2	9.7	9.81	5		
								UV4
12/26/2023 11:47:31 AM	384012	Argosqa-12/26/2023 11:50:30 AM-323803	UV4	10.44466	11.19	0.5	Average Conc of Ref Gas (ppb)	11.19
12/26/2023 11:52:51 AM	384013	Argosqa-12/26/2023 11:50:30 AM-323803	UV4	9.44306	11.19	0.5	Average Conc of Measurements (ppb)	9.74
12/26/2023 11:44:57 AM	323793	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.64132	11.19	1	Accuracy (%)	12.98
12/26/2023 11:45:58 AM	323794	Argosqa-12/26/2023 11:17:07 AM-383984	UV4	9.33739	11.19	1		
12/26/2023 11:59:29 AM	323807	Argosqa-12/26/2023 11:50:30 AM-323803	UV4	9.82083	11.19	5		
								UV5
11/29/2023 2:14:36 PM	553738	Argosqa-11/29/2023 2:00:21 PM-553735	UV5	14.18129	15.11	0.5	Average Conc of Ref Gas (ppb)	15.11
11/29/2023 2:15:06 PM	553739	Argosqa-11/29/2023 2:00:21 PM-553735	UV5	15.32653	15.11	0.5	Average Conc of Measurements (ppb)	14.34
11/29/2023 2:16:22 PM	553740	Argosqa-11/29/2023 2:00:21 PM-553735	UV5	14.12089	15.11	1	Accuracy (%)	5.10
11/29/2023 2:17:22 PM	553741	Argosqa-11/29/2023 2:00:21 PM-553735	UV5	13.85602	15.11	1		
11/29/2023 2:24:11 PM	553742	Argosqa-11/29/2023 2:00:21 PM-553735	UV5	14.20895	15.11	5		

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Uncertainty Validation on 2022 Annual results based on NCR 02_29_24

NCR_02_29_24 Comparison of Uncertainty Of Measurement Between EN-14662 and ISO Guide 14956

Site	UV1	UV2	UV4	UV5
EN14662 Uncertainty (%)	6.27	10.38	6.74	2.37
ISO 14956 (%)	19.8	19.9	21.5	19.2
Target (%)	< 25	< 25	< 25	< 25

Validated 24 hours average Fenceline results

Attached files:

1. Bazan_Site_#1_24H_validated_20230101_to_20240101
2. Bazan_Site_#2_24H_validated_20230101_to_20240101
3. Bazan_Site_#4_24H_validated_20230101_to_20240101
4. Bazan_Site_#5_24H_validated_20230101_to_20240101