A method detection limit study was performed to determine the method detection limit (MDL) for BTEX compounds (Benzene, Toluene, Ethylbenzene and Xylenes) in an aqueous matrix when analyzed with the FROG-5000 portable gas chromatograph.

First, a five-point calibration was performed for each BTEX compound on a FROG-5000 GC from 0.8µg/L to 20µg/L. All calibrations achieved a linear fit with R^2 values ranging between 0.99414 for Benzene to 0.99932 for Toluene.
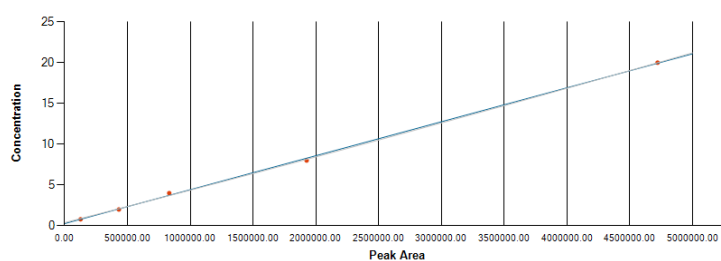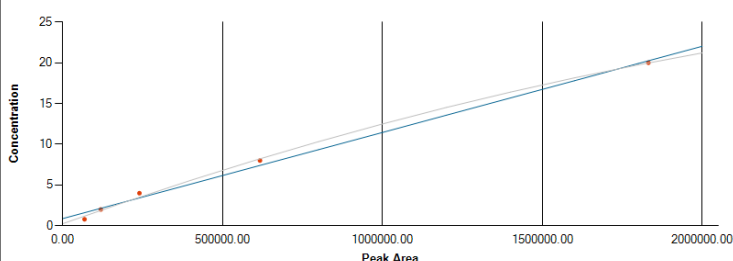
Calibration Curves for Benzene (left) and Toluene (right) used to perform the Method Detection Limit study

After the calibration was complete, the instrument was then blanked to ensure a clean baseline prior to any replicate injections taking place. Once a clean baseline was achieved, seven replicate injections of BTEX at 2µg/L were performed and analyzed. The results of each replicate are shown below:

| All units in µg/L (ppb)	Benzene	Toluene	Ethylbenzene	Para-/Meta-Xylene	Ortho-Xylene
Replicate 1	2.05	2.19	2.07	4.02	2.01
Replicate 2	2.06	2.09	1.98	3.87	1.94
Replicate 3	2.12	2.18	2.00	3.93	1.96
Replicate 4	2.12	2.18	2.09	4.11	2.05
Replicate 5	2.10	2.13	1.97	3.89	1.95
Replicate 6	2.16	2.19	2.04	4.02	2.03
Replicate 7	2.10	2.04	1.92	3.76	1.90

These results were then used to determine the standard deviation of the seven replicates for each compound, which is then used to determine the method detection limit. The method detection limit for a seven-replicate study is defined as the standard deviation of the seven replicates multiplied by the student t-value of 3.14:

All units in µg/L (ppb)	Benzene	Toluene	Ethylbenzene	Para-/Meta-Xylene	Ortho-Xylene
Standard Deviation	0.038	0.059	0.060	0.117	0.054
Method Detection Limit	**0.118**	**0.185**	**0.188**	**0.366**	**0.170**

Of course, the method detection limit only determines the concentration at which a positive detection can be relied upon with a high degree of certainty. It does not indicate the concentration at which reliable quantitation (or measurement) takes place. For that value, we calculated the Practical Quantitation Limit (PQL) for each of the compounds tested. We defined the PQL as the standard deviation of the seven replicates multiplied by 13:

All units in µg/L (ppb)	Benzene	Toluene	Ethylbenzene	Para-/Meta-Xylene	Ortho-Xylene
Standard Deviation	0.038	0.059	0.060	0.117	0.054
Method Detection Limit	0.118	0.185	0.188	0.366	0.170
Practical Quantitation Limit	**0.489**	**0.764**	**0.780**	**1.516**	**0.703**

The extremely low values for both the MDL and PQL when analyzing BTEX in an aqueous matrix speak to the good reproducibility and high sensitivity of the FROG-5000 Portable GC. In the hands of a skilled operator, the FROG-5000 can produce reliable, lab-quality results in the field, allowing the user to make real-time decisions based on real-time data, saving time and money in the process.

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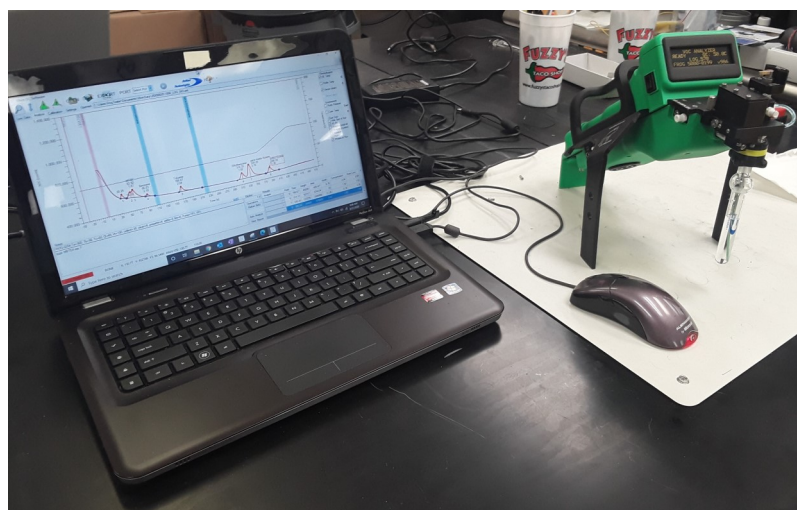
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