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30 November 2000

Mr. Lonnie Monaco
Northern Division, Naval Facilities
Engineering Command
10 Industrial Highway, Mail Stop 82
Lester, Pennsylvania 19113-2090

RE: Summary of the September 2000 Aqueous Diffusion Sampling Pilot Study, Eastern Plume, Naval Air Station, Brunswick, Maine
Contract N62472-92-D-1296, Contract Task Order No. 0047
EA Project No. 29600.47

Dear Mr. Monaco:

EA Engineering, Science, and Technology is pleased to provide 2 copies of this summary of analytical results for the September 2000 aqueous diffusion sampling pilot study conducted at the Eastern Plume, Naval Air Station, Brunswick, Maine. Previous pilot studies using aqueous diffusion samplers completed during Monitoring Events 15 (September 1999) and 16 (September 2000) indicated that aqueous diffusion samplers were useful in collecting representative ground-water samples (EA 1999[1] and EA 2000[2]). Therefore, a third diffusion sampler pilot study was completed in September 2000 to assess the specific sampling intervals that should be monitored using aqueous diffusion samplers.

The objective of this pilot study was to assess whether passive diffusion samplers can be used to collect representative ground-water samples from monitoring wells that are comparable to those collected using low-flow sampling techniques currently used in the Eastern Plume. This objective was assessed by placing aqueous diffusion samples in the screened interval of the 10 monitoring wells used during the April 2000 pilot study at three separate intervals. Samples were then collected and analyzed to quantify the degree of vertical stratification of volatile organic compound (VOC) concentrations in the screened interval of each monitoring well. The locations of monitoring wells included in this pilot study are shown on Figure 1.

This letter summarizes the construction technique and sampling methodologies for the aqueous diffusion samplers and the aqueous diffusion sampling pilot study results, conclusions, and recommendations.

1. EA Engineering, Science, and Technology. 1999. Letter Report Summary of the Aqueous Diffusion Sampling Pilot Study Conducted at the Eastern Plume, Naval Air Station, Brunswick, Maine. 3 December.
2. EA Engineering, Science, and Technology. 2000. Final Long-Term Monitoring Plan. Sites 1 and 3 and Eastern Plume, Naval Air Station, Brunswick, Maine. Prepared for Department of the Navy Northern Division, Naval Facilities Engineering Command. February.

AQUEOUS DIFFUSION CONSTRUCTION AND SAMPLING METHODS

The aqueous diffusion samplers were constructed by sealing de-ionized water in a 2-in. diameter × 1-mil thick polyethylene tubing. Each diffusion sampler was approximately 2 ft in length. The samplers were weighted with stainless steel bolts enclosed in 4-mil polyethylene tubing attached to the bottom of the sampler, and a line was attached for sampler placement and retrieval. The aqueous diffusion sampler is constructed of disposable components that do not require decontamination.

On 29-30 August and 1 September 2000, the samplers were placed in the 10 monitoring wells following removal of the dedicated submersible pump. The diffusion samplers were installed at three intervals in each well as follows: shallow (1-3 ft below top of well screen), mid-point (4-6 ft below top of well screen), and deep (7-9 ft below top of well screen). Figure 2 shows the typical placement of the diffusion samplers. The diffusion samplers were allowed to equilibrate for approximately 21 days. Following equilibration, the diffusion samplers were retrieved on 21 September 2000. The planned sampling intervals were collected with one exception: the mid-depth sampler at MW-319 was damaged, and no sample could be collected from this interval. Aqueous samples were sent to Katahdin Analytical Services, Inc. of Westbrook, Maine, for VOC analysis by U.S. Environmental Protection Agency (EPA) Method 8260B.

A field equipment blank was constructed by placing a diffusion sampler in a sealed laboratory sample bottle filled with de-ionized water to assess whether materials used for construction may off-gas VOCs. The sample blank was also allowed to equilibrate in Building 50 for approximately 21 days prior to being sent to the laboratory for analysis. Duplicate aqueous diffusion samples were collected from each of the three different intervals in monitoring well MW-332, and an additional duplicate sample was collected from monitoring well MW-311. The equipment blank and duplicate samples were also analyzed for VOCs by EPA Method 8260B.

AQUEOUS DIFFUSION SAMPLER PILOT STUDY RESULTS

A detailed summary of the analytical results for samples collected using the aqueous diffusion samplers is provided in Attachment A. This attachment summarizes only those analytes detected in at least one of the samples and the chemicals of concern listed in the Final Long-Term Monitoring Plan for Sites 1 and 3 and Eastern Plume (EA 2000). Attachment B provides graphs for each of the 10 monitoring wells included in this pilot study, and compares total VOC results for aqueous diffusion samplers collected during Monitoring Events 15 (September 1999), 16 (April 2000), and 17 (September 2000). Attachment C provides graphs summarizing analytical results for these monitoring points over the same period. The laboratory Form I summary tables are included in the Monitoring Event 15, 16, and 17 reports for Sites 1 and 3 and the Eastern Plume.

Table 1 provides a general overview of the results of the September 2000 aqueous diffusion sampler pilot study.

The following qualitative observations can be made based on this pilot study:

- At two sampling locations (MW-105A and MW-224), ground-water samples collected from both diffusion sampler pilot studies reported trace concentrations of VOCs (3 μg/L or less of total VOCs). This is consistent with previous long-term monitoring results at these perimeter monitoring wells.

- At three locations (MW-205, MW-306, and MW-NASB-212), the diffusion sampler interval with the highest total VOCs was similar in both the April 2000 and September 2000 monitoring event pilot studies. Vertical stratification of VOCs with depth appears to be consistent based on data from Monitoring Events 16 and 17.

- Data from one location (MW-229A) the analytical results for the three depth intervals reported only slight differences in total VOC concentrations during both Monitoring Events 16 and 17 results. Based on these data, vertical stratification of VOCs does not appear to be a significant factor at this monitoring well.

- At one location (MW-311), significant vertical stratification of VOCs has been noted in previous sampling. However, the deep sampling interval noted a significant reduction in total VOC concentrations between Monitoring Events 16 and 17 (736 μg/L in Monitoring Event 16 compared to 391 μg/L in Monitoring Event 17). This reduction in deep interval total VOC concentrations is likely due to the operation of extraction well EW-2A, which is screened across the deep sand interval and has been reducing VOC concentrations at MW-311 since installation in June 1998.

- At three locations (MW-319, MW-331 and MW-332), no definite trend can be identified for vertical stratification of VOCs. At these locations, the interval with the highest total VOC concentration was not consistent between Monitoring Events 16 and 17. Based on these data, vertical stratification of VOCs does not appear to be a significant factor at these monitoring wells.

- The results for the diffusion sampler duplicate samples (MW-332 and MW-311) suggest the diffusion sampling method has good reproducibility.

CONCLUSIONS

Based on the results of the diffusion sampler pilot study, the following conclusions can be made:

- In general, good reproducibility was noted between Monitoring Events 16 and 17 for aqueous diffusion samplers. This includes monitoring wells with historically high concentrations of total VOCs (i.e., interior plume wells), and wells that historically note lower concentrations (i.e., perimeter wells).

- The sampling intervals within each well screen showed a similar pattern of VOC results between Monitoring Events 16 and 17. One exception was noted at MW-311, where deep interval concentrations decreased during Monitoring Event 17. This decrease is likely attributable to the operation of the nearby extraction well EW-2A.

- Duplicate sample results indicate samples collected by diffusion samplers have good reproducibility. Similar results were noted in previous pilot studies.

RECOMMENDATIONS

Based on these results, EA makes the following recommendations for the Navy's consideration:

- Based on a comparison of historical data collected using low-flow sampling methods and the result of the aqueous diffusion sampler pilot studies collected during Monitoring Events 15, 16, and 17, one sampling interval can be monitored at each of these 10 sampling points to

accurately track changes in VOC concentrations.

- During Monitoring Event 18 (April 2001), collect one ground-water sample using aqueous diffusion samplers installed at each of the 10 monitoring wells included in the pilot study. The recommended sampling interval for each well is summarized on Table 1. It is recommended that two samplers be positioned at each interval so a sample can be collected if one sampler is damaged.

- Expand the use of aqueous diffusion samplers to the remaining monitoring wells in the Eastern Plume and Site 9. Complete a pilot study for wells at these sites that are currently sampled for VOCs. The recommended design of the study should be similar to the one used for the second aqueous diffusion sampler pilot study (i.e., three diffusion samplers installed in each well and collection of low-flow sample for comparison).

- Revise the Long-Term Monitoring Plan for Sites 1 and 3 and the Eastern Plume to include use of aqueous diffusion samplers at these 10 monitoring wells rather than use of low-flow samples.

We look forward to discussing these issues with the Navy and the Naval Air Station Brunswick Restoration Advisory Board. It has been our pleasure providing the Northern Division with this summary. If there are any questions, please do not hesitate to contact either of the undersigned.

Sincerely,

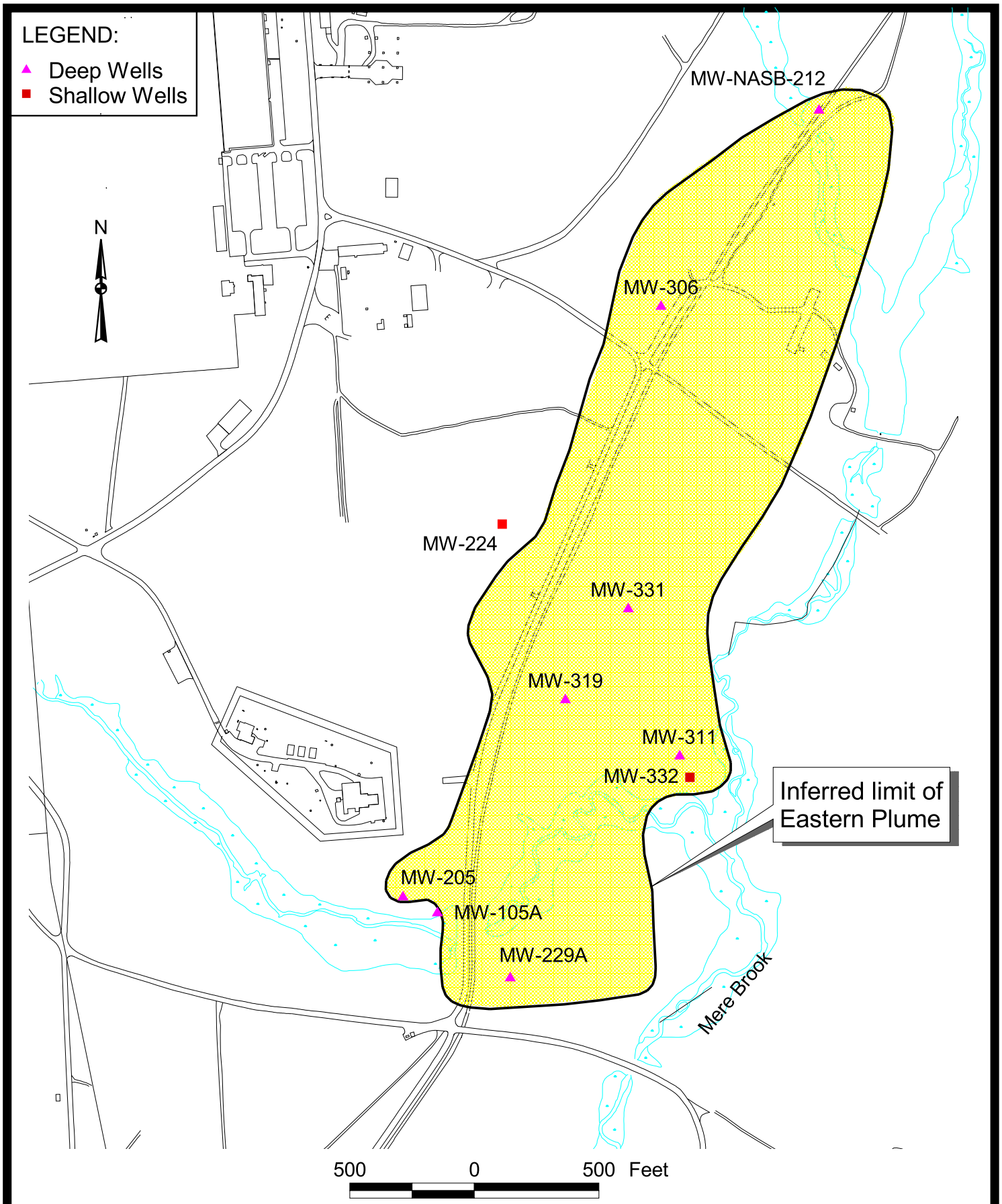
Alexander Easterday

Alexander C. Easterday, P.G.
Project Manager

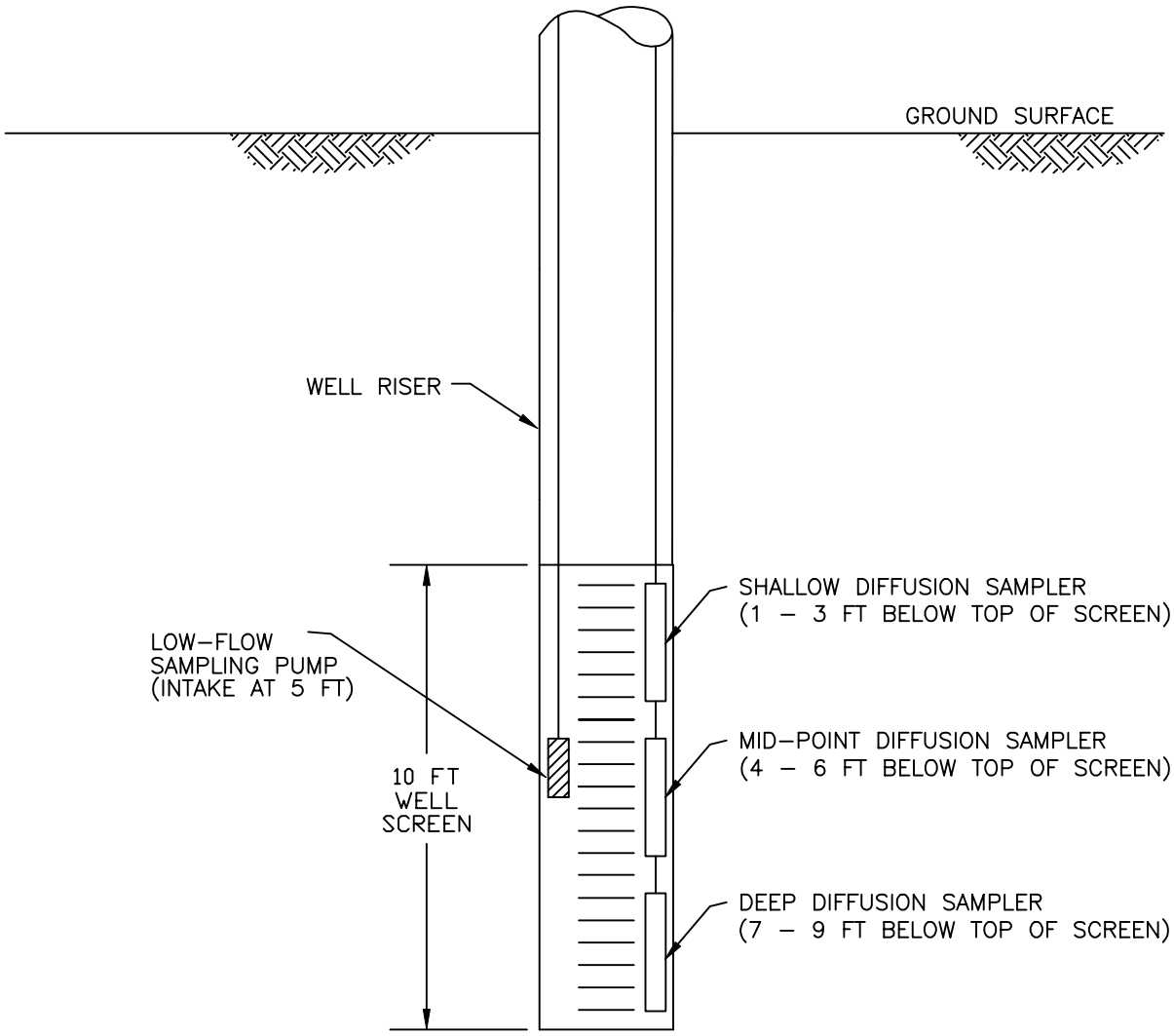
Peter L. Nimmer, P.G.
Project Geologist

ACE/mkp
Attachments

cc: T. Williams, NAS (1 copy)
C. Sait, MEDEP (2 copies)
M. Barry, EPA (2 copies)
M. Fohner, Northern Division (1 copy)
C. Lepage, Lepage Environmental Services (1 copy)
J. Shultz, EA (1 copy)
G. Calderone, EA (1 copy)
S. Chase, EA (1 copy)
Administrative Record (2 copies)



EA ENGINEERING, SCIENCE, AND TECHNOLOGY	EASTERN PLUME NAVAL AIR STATION, BRUNSWICK, MAINE				FIGURE 1 LOCATION OF MONITORING WELLS INCLUDED IN THE EASTERN PLUME DIFFUSION SAMPLING PILOT STUDY		
PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT No	FILE No
PLN	BT	BT	PLN	AS SHOWN	14 JUNE 2000	29600.47	I:\NASB_GIS \NAVY.APR



NOTE: NOT TO SCALE.

DWG. FILE No. F:\FEDERAL\DOD\NAVY\2960047\CAD\DIFFUSION SAMPLE\FIG2.DWG

EA ENGINEERING, SCIENCE, AND TECHNOLOGY			NAVAL AIR STATION BRUNSWICK, MAINE		FIGURE 2 TYPICAL PLACEMENT OF DIFFUSION SAMPLERS IN MONITORING WELL		
PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT NO	FILE No.
PLN	PLN	BT	PLN	N.T.S.	6/14/2000	29600.47	FIG2

TABLE 1 SUMMARY OF AQUEOUS DIFFUSION PILOT STUDY
SEPTEMBER 2000

Monitoring Well (Well Depth)	Monitoring Event 17 Ground-Water Total VOC Concentration[a]	Well Type	Summary of Monitoring Event 17 Diffusion Sampler Study Results	Diffusion Sampler Interval with Higher Total VOCs in Monitoring Event 17	Diffusion Sampler Intervals Recommended for Sampling during Monitoring Event 18
MW-105A (Deep)	Low	Perimeter	Low VOC reported in samples (less than 1 µg/L).	Mid-point	Mid-point
MW-205 (Deep)	High	Interior Plume	Slightly increasing VOC with depth.	Deep	Deep
MW-224 (Shallow)	Low	Perimeter	Low VOC reported in samples (less than 3 µg/L).	Mid-point and deep	Mid-point
MW-229A (Deep)	Moderate	Perimeter	Mid-point slightly higher than deep sample; similar VOC results at all three intervals.	Mid-point	Mid-point
MW-306 (Deep)	Moderate	Perimeter	Increasing VOC with depth.	Deep	Deep
MW-311 (Deep)	High	Interior Plume	Mid-point sample shows highest total VOC. Reduced deep VOC results due to effects of EW-2A.	Mid-point	Deep
MW-319 (Deep)	Moderate	Interior Plume	Increasing VOC with depth.	Deep	Deep
MW-331 (Deep)	High	Interior Plume	No clear VOC stratification trend, midpoint has highest historical total VOC concentration in ME17	Mid-point	Mid-point
MW-332 (Shallow)	Moderate	Interior Plume	Increasing VOC with depth. Mid-point detected highest historical total VOC in ME16.	Deep	Mid-point
MW-NASB-212 (Deep)	Moderate	Perimeter	Sampling intervals have similar total VOC results	Shallow	Shallow

(a) High concentration – greater than 400 µg/L, moderate contamination from 400 µg/L to 5 µg/L, and low contamination – less than 5 µg/L.

NOTE: VOC = Volatile organic compound.

Attachment A

Summary of Analytical Results Using Aqueous Diffusion Samplers

ATTACHMENT A: SUMMARY OF ANALYTICAL RESULTS FOR AQUEOUS DIFFUSION SAMPLES

MW-105A

			Event 15	Event 16				Event 17		
			Low-flow Sample	Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**								
Total VOC	---	---	(<1U)	0.7	5	3.8	5.5	0.5	0.9	0.5
1,1,1-Trichloroethane	200	200	(<1U)	0.7	(<1U)	(<1U)	1	0.5	0.9	0.5
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethene	7	7	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethane	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, Total	70	70	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Acetone	---	---	(<5U)	(<5U)	3	3	4	(<5U)	(<5U)	(<5U)
Benzene	5	5	(<1U)	(<1U)	2	0.8	(<1U)	(<1U)	(<1U)	(<1U)
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	(<1U)	0.6	0.6	0.5	0.7	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Trichloroethene	5	5	(<1U)	(<1U)	(<1U)	(<1U)	0.5	(<1U)	(<1U)	(<1U)

MW-205

			Event 15		Event 16				Event 17		
			Low-flow Sample	Mid-depth Diffusion Sample	Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**									
Total VOC	---	---	415.5	566.3	433.4	596.4	639.1	700.1	407.9	450.2	503.6
1,1,1-Trichloroethane	200	200	**230**	**310**	**210D**	**290D**	**340D**	**330D**	160	200	**250D**
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	(<1U)	0.7	0.8	0.8	0.5	0.7	(<1U)
1,1-Dichloroethane	70	---	0.5	0.7	0.9	1	1	2	0.8	0.9	1
1,1-Dichloroethene	7	7	**18**	**26**	**18**	**25**	**29**	**30**	**26**	**35**	**32**
1,2-Dichloroethane	5	5	(<1U)	0.6	0.5	0.7	0.8	0.8	0.6	0.6	0.6
1,2-Dichloroethene, Total	70	70	14	21	14	19	22	22	19	26	22
Acetone	---	---	(<5U)	(<5U)	(<5U)	(<5U)	(<5U)	(<5U)	(<5U)	3	(<5U)
Benzene	5	5	(<1U)	(<1U)	4	**8**	5	**6**	5	(<1U)	1
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)	(<1U)	0.5	0.5	(<1U)	0.5	(<1U)
Methylene Chloride	---	5	0.9	1	2	2	2	2	1	2	2
Tetrachloroethene	3	5	**13**	**18**	**16**	**22**	**30**	**28**	**16**	**24**	**17**
Trichloroethene	5	5	**140**	**190**	**170**	**230D**	**210D**	**280D**	**180**	**160D**	**180D**

D = Sample result from a secondary dilution factor.

MW-224

			Event 15	Event 16				Event 17		
			Low-flow Sample	Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**								
Total VOC	---	---	1.1	1.5	(<1U)	4.6	4.6	(<1U)	3	3
1,1,1-Trichloroethane	200	200	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethene	7	7	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethane	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, Total	70	70	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Acetone	---	---	(<5U)	(<5U)	(<5U)	4	4	(<5U)	3	3
Benzene	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	(<1U)	0.6	0.8	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	0.6	1	(<1U)	0.6	0.6	(<1U)	(<1U)	(<1U)
Trichloroethene	5	5	0.5	0.5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)

MW-224 (Duplicate)

			Event 16
			Low-flow Sample
Compound	**MEG**	**MCL**	
Total VOC	---	---	1.5
1,1,1-Trichloroethane	200	200	(<1U)
1,1,2-Trichloroethane	3	5	(<1U)
1,1-Dichloroethane	70	---	(<1U)
1,1-Dichloroethene	7	7	(<1U)
1,2-Dichloroethane	5	5	(<1U)
1,2-Dichloroethene, Total	70	70	(<1U)
Acetone	---	---	(<5U)
Benzene	5	5	(<1U)
Bromodichloromethane	---	---	(<1U)
Chloroethane	---	---	(<2U)
Chloroform	---	100	(<1U)
Methylene Chloride	---	5	0.6
Tetrachloroethene	3	5	1
Trichloroethene	5	5	0.5

MW-229A

			Event 15	Event 16				Event 17		
			Low-flow Sample	Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**								
Total VOC	---	---	95	106	74	82	84	84	101	92
1,1,1-Trichloroethane	200	200	43	48	27	34	36	36	42	47
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethene	7	7	3	2	2	2	3	4	4	5
1,2-Dichloroethane	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, Total	70	70	7	6	7	7	7	6	7	5
Acetone	---	---	(<5U)	(<5U)	4	3	(<5U)	(<5U)	(<5U)	(<5U)
Benzene	5	5	(<1U)	(<1U)	3	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	(<1U)	1	0.5	0.6	0.7	(<1U)	(<1U)	0.7
Tetrachloroethene	3	5	**4**	**6**	**4**	**4**	**4**	**4**	**5**	3
Trichloroethene	5	5	**38**	**44**	**27**	**32**	**34**	**34**	**43**	**32**

MW-229A (Duplicate)

			Event 15	Event 16		
			Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**				
Total VOC	---	---	95	72	87	89
1,1,1-Trichloroethane	200	200	42	27	36	36
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethene	7	7	3	2	3	3
1,2-Dichloroethane	5	5	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, Total	70	70	7	6	7	7
Acetone	---	---	(<5U)	4	3	3
Benzene	5	5	(<1U)	2	(<1U)	(<1U)
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	(<1U)	0.6	0.7	0.6
Tetrachloroethene	3	5	**5**	**4**	**5**	**5**
Trichloroethene	5	5	**38**	**27**	**33**	**35**

MW-306

			Event 15	Event 16				Event 17		
			Low-flow Sample	Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**								
Total VOC	---	---	22.8	261.6	50.9	81	363	122	223	275
1,1,1-Trichloroethane	200	200	12	120	19	34	180	60	110	130
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	1	17	2	3	23	6	12	14
1,1-Dichloroethene	7	7	0.8	6	0.9	2	**10**	5	**9**	**11**
1,2-Dichloroethane	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, Total	70	70	2	50	4	8	**71**	23	41	53
Acetone	---	---	(<5U)	(<5U)	(<5U)	(<5U)	(<5U)	(<5U)	3	4
Benzene	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Bromodichloromethane	---	---	1	1	(<1U)	(<1U)	1	1	1	1
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	12	7	(<1U)	(<1U)	8	10	10	9
Methylene Chloride	---	5	(<1U)	0.6	(<1U)	(<1U)	1	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	(<1U)	0.6	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Trichloroethene	5	5	**6**	**60**	**25**	**34**	**70**	**27**	**47**	**62**

MW-311

			Event 15		Event 16				Event 17		
			Low-flow Sample	Mid-depth Diffusion Sample	Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**									
Total VOC	---	---	1645.9	949.7	744.8	395.3	482.5	736.6	399	453	391
1,1,1-Trichloroethane	200	200	**950**	**390**	**420D**	24	31	**430D**	98	130	170
1,1,2-Trichloroethane	3	5	2	0.8	0.8	0.6	0.6	0.6	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	46	51	19	65	**82**	14	36	38	18
1,1-Dichloroethene	7	7	**180**	**150**	**66**	**100**	**120**	**63**	**77**	**85**	**48**
1,2-Dichloroethane	5	5	4	3	2	4	5	1	2	2	1
1,2-Dichloroethene, Total	70	70	8	5	7	2	3	14	6	6	14
Acetone	---	---	(<5U)	(<5U)	(<5U)	4	4	3	4	5	3
Benzene	5	5	0.9	0.9	(<1U)	0.7	0.9	1	(<1U)	(<1U)	(<1U)
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	0.7	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	2	3	2	5	**7B**	1	2	2	1
Tetrachloroethene	3	5	**15**	**9**	**20**	**5**	**6**	**20**	**6**	**7**	**17**
Trichloroethene	5	5	**440**	**340**	**210D**	**190D**	**230D**	**190D**	**170**	**180**	**120**

MW-311 (Duplicate)

			Event 15	Event 16		Event 17
			Mid-depth Diffusion Sample	Low-flow Sample	Mid-depth Diffusion Sample	Shallow Diffusion Sample
Compound	**MEG**	**MCL**				
Total VOC	---	---	930.6	748.7	507.5	390
1,1,1-Trichloroethane	200	200	**380**	**420D**	35	100
1,1,2-Trichloroethane	3	5	0.8	0.7	0.6	(<1U)
1,1-Dichloroethane	70	---	52	22	**83**	36
1,1-Dichloroethene	7	7	**150**	**70**	**130**	**76**
1,2-Dichloroethane	5	5	3	2	5	2
1,2-Dichloroethene, Total	70	70	5	9	3	6
Acetone	---	---	(<5U)	(<5U)	3	4
Benzene	5	5	0.8	(<1U)	0.9	(<1U)
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	3	2	**6B**	1
Tetrachloroethene	3	5	**9**	**15**	**7**	**6**
Trichloroethene	5	5	**330**	**210D**	**240D**	**160**

MW-319

			Event 15		Event 16				Event 17	
			Low-flow Sample	Mid-depth Diffusion Sample	Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Shallow Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**								
Total VOC	---	---	64	75	95	120	94	90	15.5	77
1,1,1-Trichloroethane	200	200	4	4	2	6	2	1	(<1U)	3
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethene	7	7	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethane	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, Total	70	70	8	11	7	11	5	6	(<1U)	8
Acetone	---	---	(<5U)	(<5U)	(<5U)	(<5U)	4	(<5U)	(<5U)	(<5U)
Benzene	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	**15**	(<1U)
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	(<1U)	(<1U)	(<1U)	0.7	(<1U)	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	**30**	**30**	**70**	**80**	**70**	**71**	0.5	**39**
Trichloroethene	5	5	**22**	**30**	**16**	**23**	**17**	**12**	(<1U)	**27**

MW-331

			Event 15		Event 16				Event 17		
			Low-flow Sample	Mid-depth Diffusion Sample	Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**									
Total VOC	---	---	413.9	390.8	657.6	715.9	609.4	523.3	696.6	801.7	543
1,1,1-Trichloroethane	200	200	**270**	**260**	**380D**	**440D**	**390D**	**320D**	**360D**	**450D**	**310D**
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	0.6	(<1U)	0.5	0.5	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	12	10	23	19	26	24	25	25	25
1,1-Dichloroethene	7	7	**29**	**30**	**46**	**39**	**51**	**47**	**38**	**41**	**47**
1,2-Dichloroethane	5	5	0.9	0.8	2	0.9	1	1	0.6	0.7	1
1,2-Dichloroethene, Total	70	70	4	4	15	43	13	13	**95**	**97**	34
Acetone	---	---	(<5U)	(<5U)	(<5U)	3	(<5U)	2	5	5	5
Benzene	5	5	(<1U)	(<1U)	2	4	0.9	0.8	**13**	**12**	2
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	1	(<2U)	2	1	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	1	1	3	2	3	3	1	1	3
Tetrachloroethene	3	5	**4**	**4**	**8**	**7**	**5**	**4**	**5**	**6**	**4**
Trichloroethene	5	5	**94**	**82**	**180**	**160**	**120**	**110**	**160**	**170**	**120**

MW-332

			Event 15		Event 16				Event 17		
			Low-flow Sample	Mid-depth Diffusion Sample	Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**									
Total VOC	---	---	130	48.2	261.6	139.8	299.7	261.6	23.5	51	65.6
1,1,1-Trichloroethane	200	200	94	34	180	94	200	180	16	35	44
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	2	0.6	5	3	6	5	0.5	1	2
1,1-Dichloroethene	7	7	5	3	**15**	**9**	**19**	**15**	2	5	6
1,2-Dichloroethane	5	5	(<1U)	(<1U)	0.6	(<1U)	0.7	0.6	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, Total	70	70	(<1U)	(<1U)	2	1	3	2	(<1U)	(<1U)	0.6
Acetone	---	---	(<5U)	(<5U)	(<5U)	3	3	3	(<5U)	(<5U)	(<5U)
Benzene	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	0.7	(<1U)	0.7	0.6	0.7	0.7	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	1	0.6	2	0.8	3	2	(<1U)	(<1U)	(<1U)
Trichloroethene	5	5	**28**	**10**	**57**	**29**	**65**	**54**	5	**10**	**13**

MW-332 (Duplicate)

			Event 17		
			Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**			
Total VOC	---	---	23.5	47.6	63.7
1,1,1-Trichloroethane	200	200	16	32	42
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	0.5	1	2
1,1-Dichloroethene	7	7	2	4	5
1,2-Dichloroethane	5	5	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, Total	70	70	(<1U)	0.6	0.7
Acetone	---	---	(<5U)	(<5U)	(<5U)
Benzene	5	5	(<1U)	(<1U)	(<1U)
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	(<1U)	(<1U)	(<1U)
Trichloroethene	5	5	5	**10**	**14**

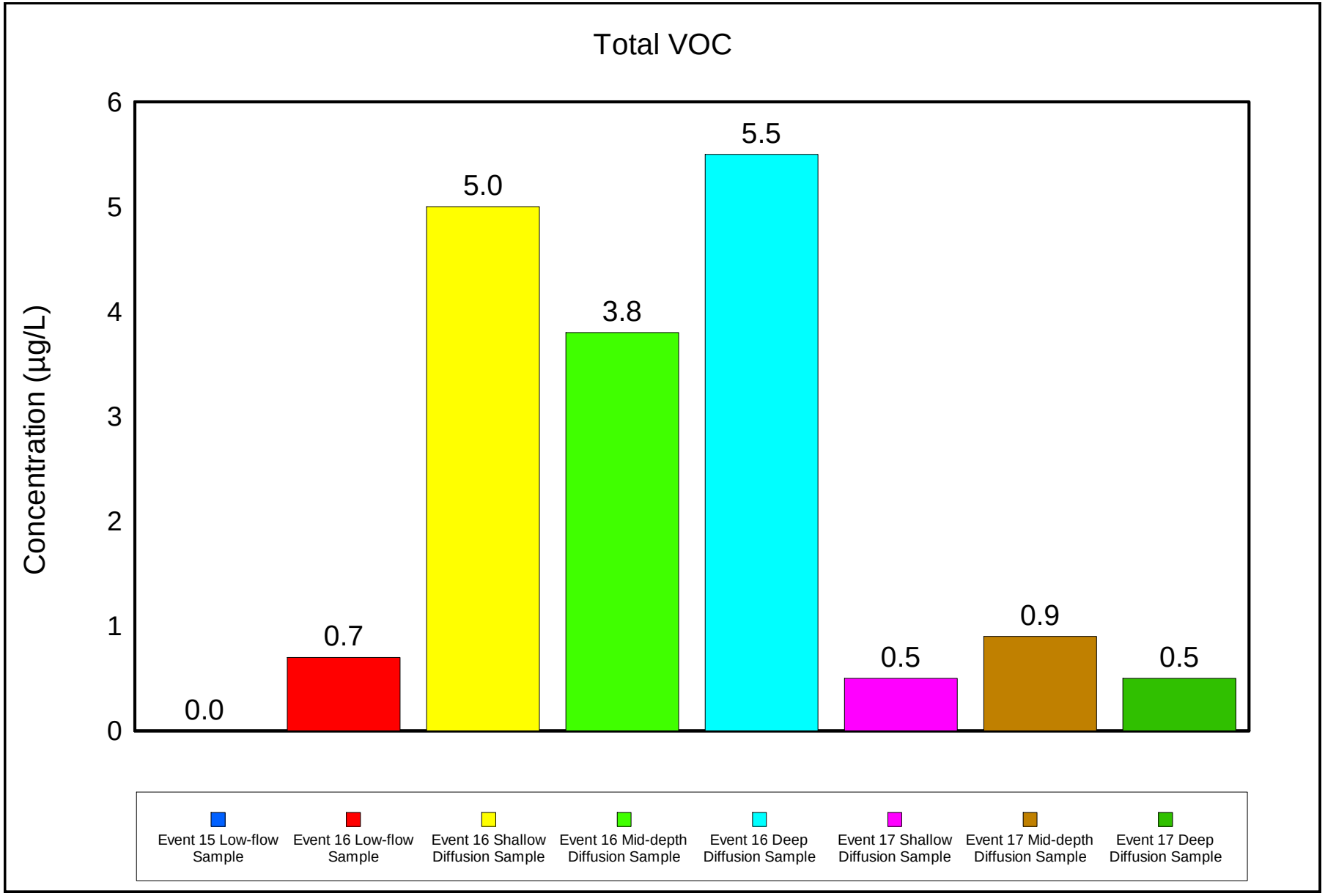
MW-NASB-212

			Event 15		Event 16				Event 17		
			Low-flow Sample	Mid-depth Diffusion Sample	Low-flow Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound	**MEG**	**MCL**									
Total VOC	---	---	20.9	2.6	20.7	22	21.7	13	18	16.7	16.7
1,1,1-Trichloroethane	200	200	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1,2-Trichloroethane	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,1-Dichloroethene	7	7	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethane	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, Total	70	70	2	2	2	1	2	1	2	2	2
Acetone	---	---	(<5U)	(<5U)	(<5U)	4	3	4	4	(<5U)	(<5U)
Benzene	5	5	(<1U)	(<1U)	(<1U)	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Bromodichloromethane	---	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Chloroethane	---	---	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Chloroform	---	100	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Methylene Chloride	---	5	(<1U)	(<1U)	(<1U)	0.7	0.6	(<1U)	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	0.9	0.6	0.7	(<1U)	0.7	(<1U)	(<1U)	0.7	0.7
Trichloroethene	5	5	**18**	**12B**	**18**	**12**	**16**	**8**	**12**	**14**	**14**

Attachment B

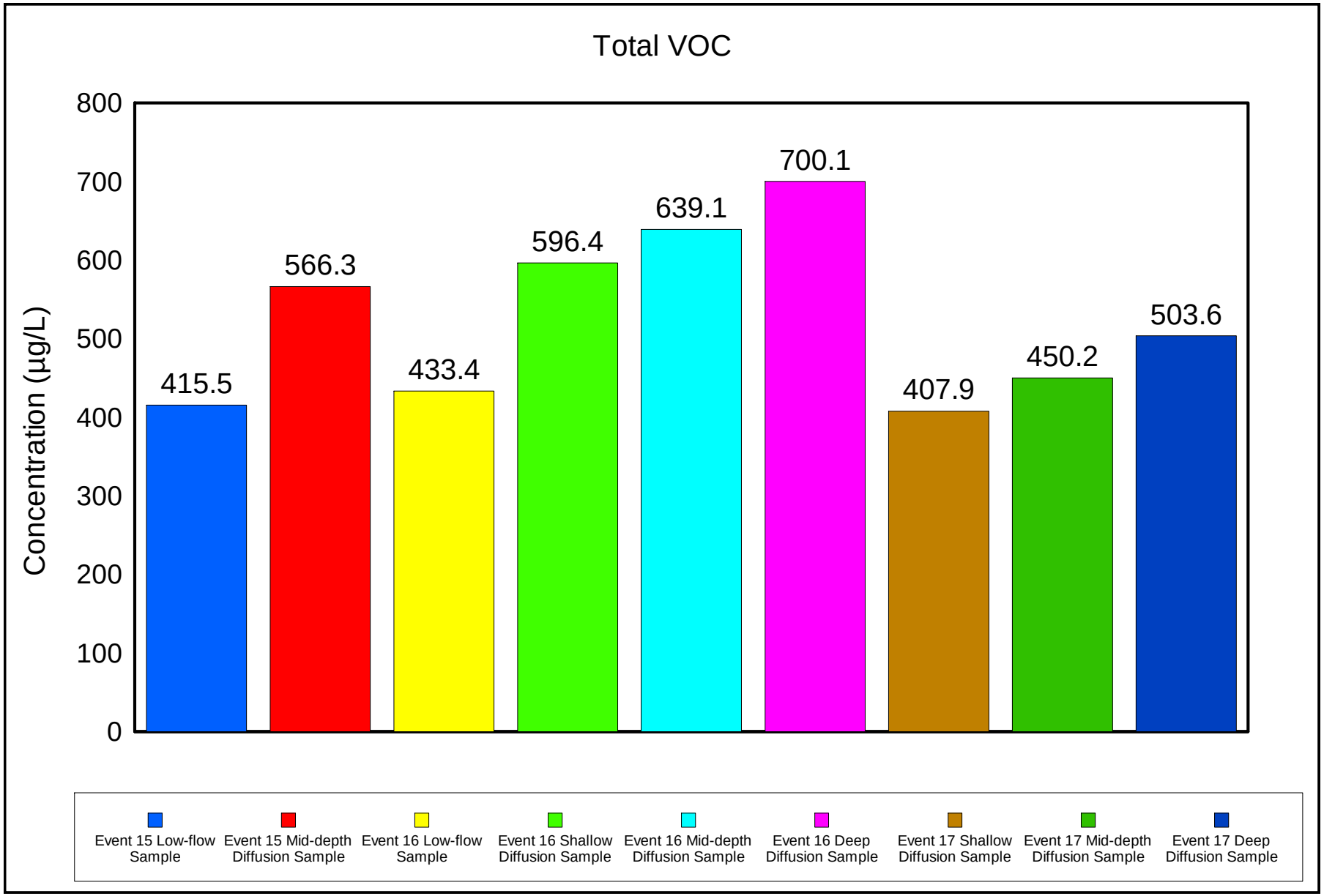
Graphs Summarizing Total Volatile Organic Compound Results for Monitoring Events 15, 16, and 17

MW-105A



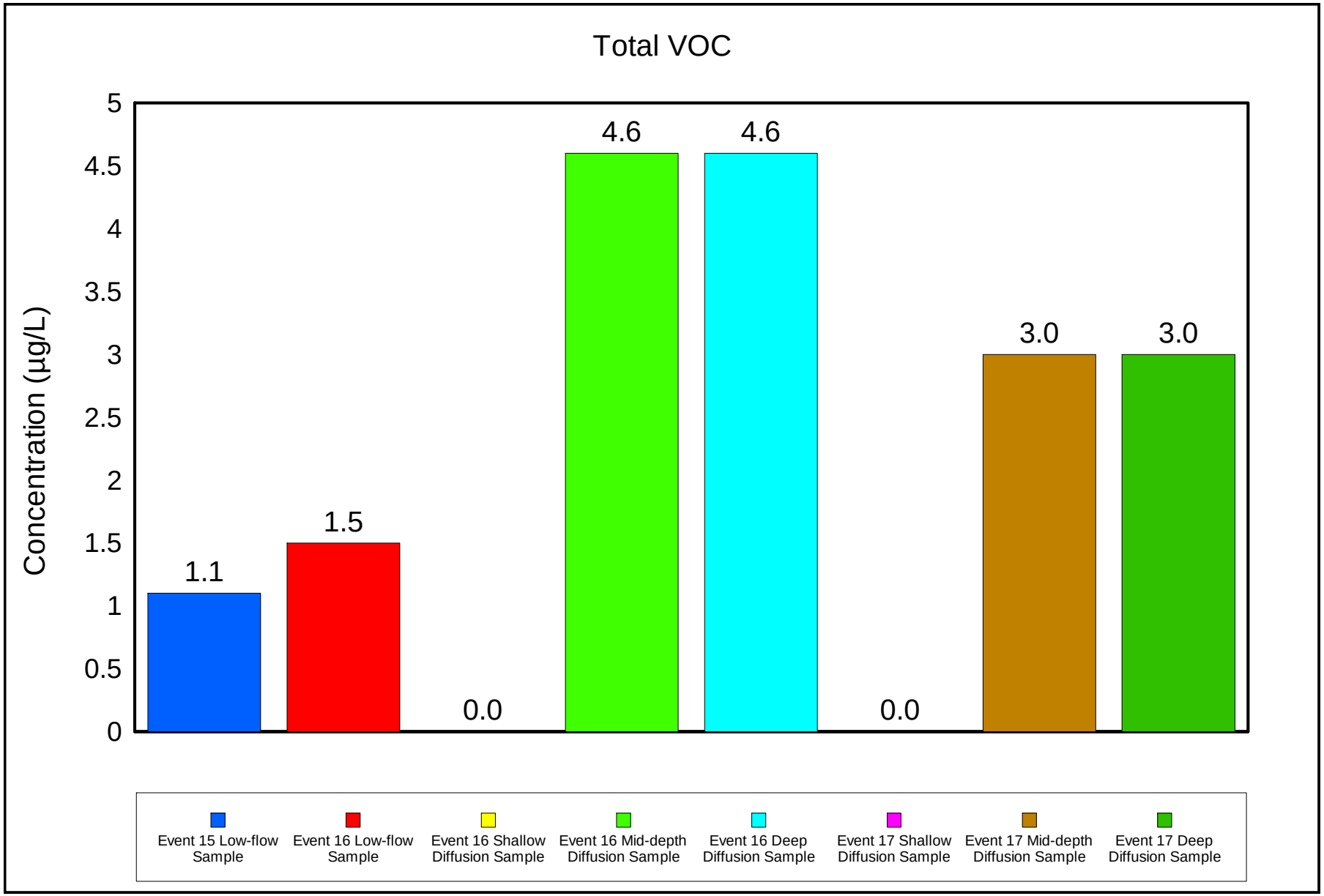
A value of zero was used for non-detects and B qualified results when calculating Total VOC.

MW-205



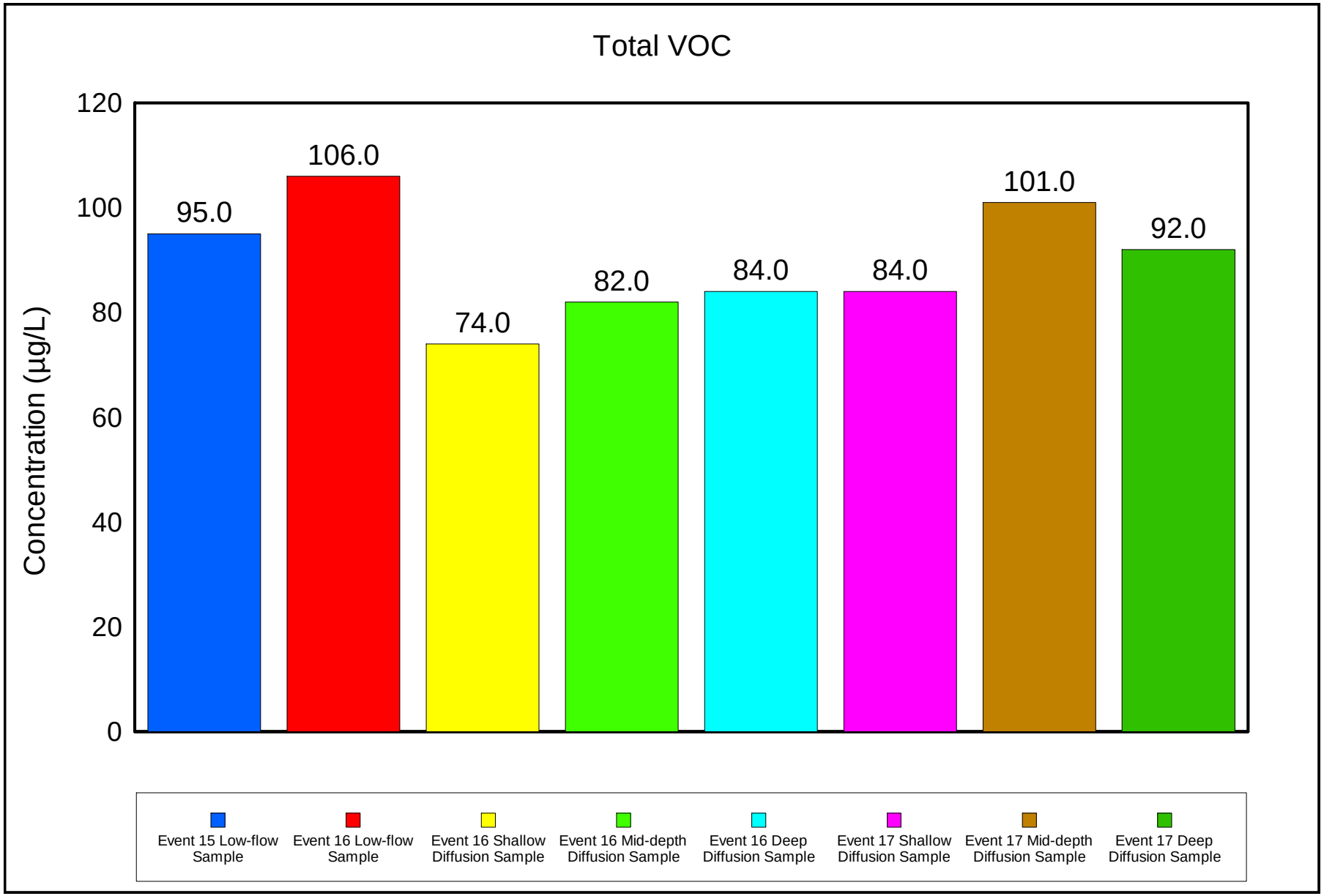
A value of zero was used for non-detects and B qualified results when calculating Total VOC.

MW-224



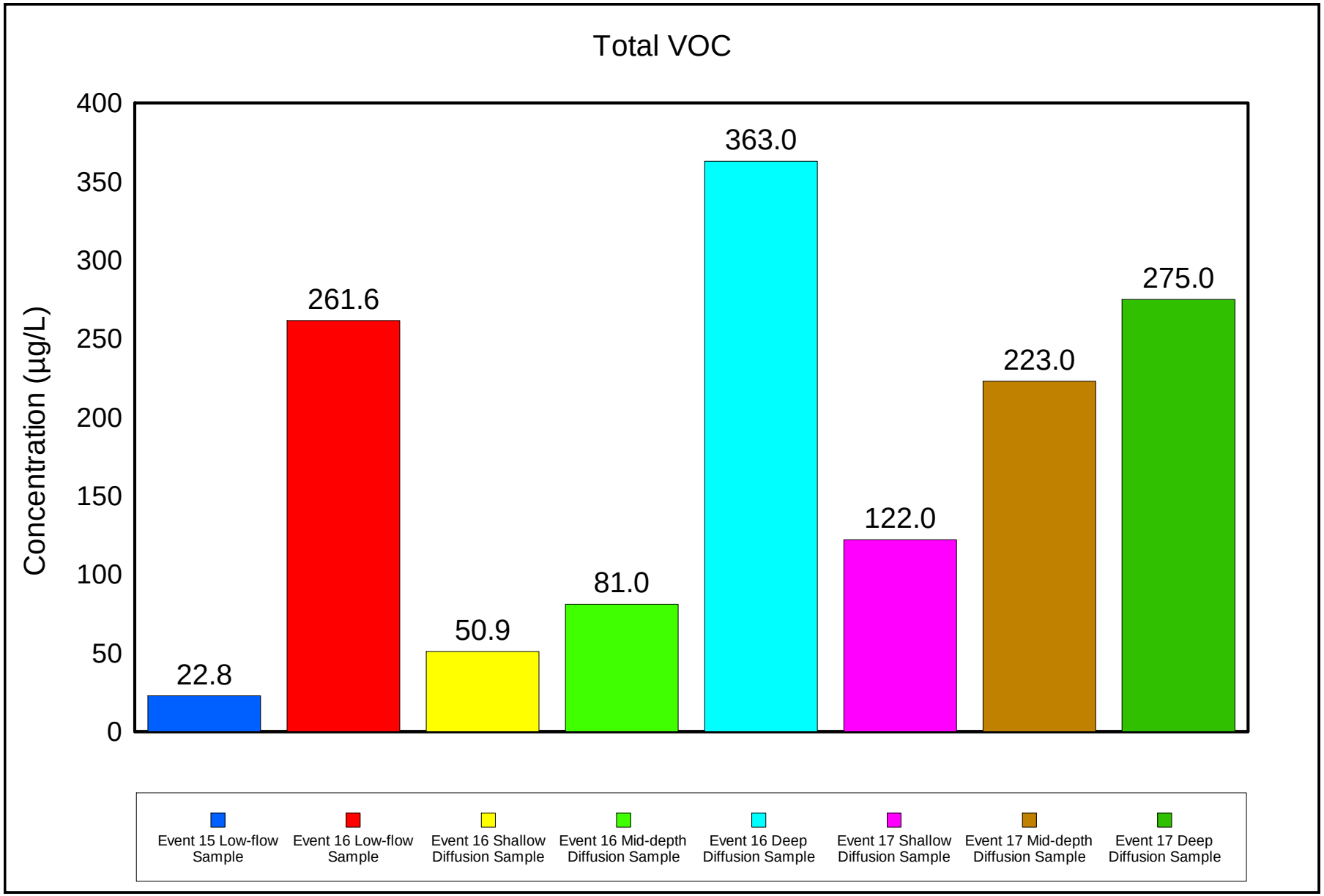
A value of zero was used for non-detects and B qualified results when calculating Total VOC.

MW-229A



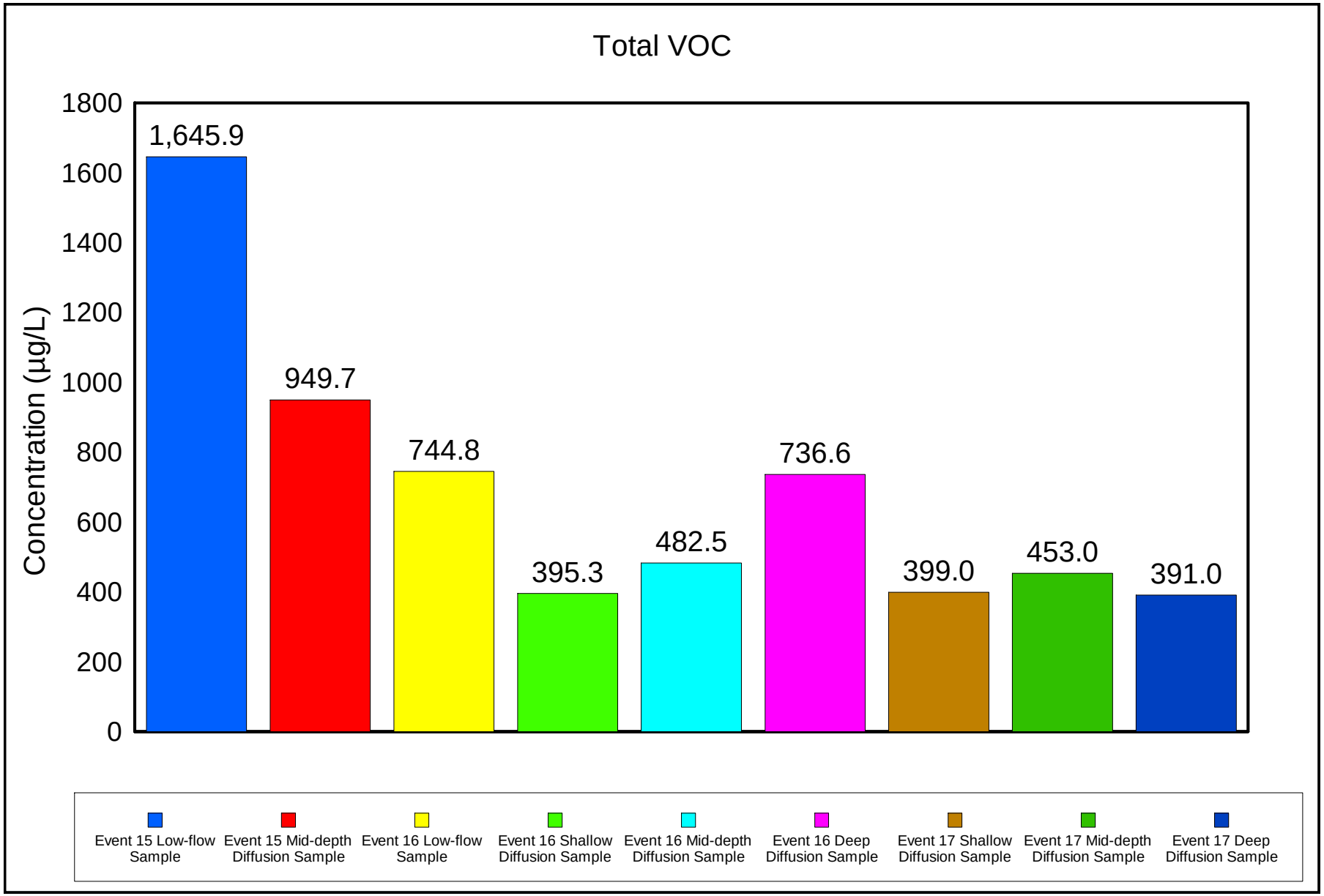
A value of zero was used for non-detects and B qualified results when calculating Total VOC.

MW-306



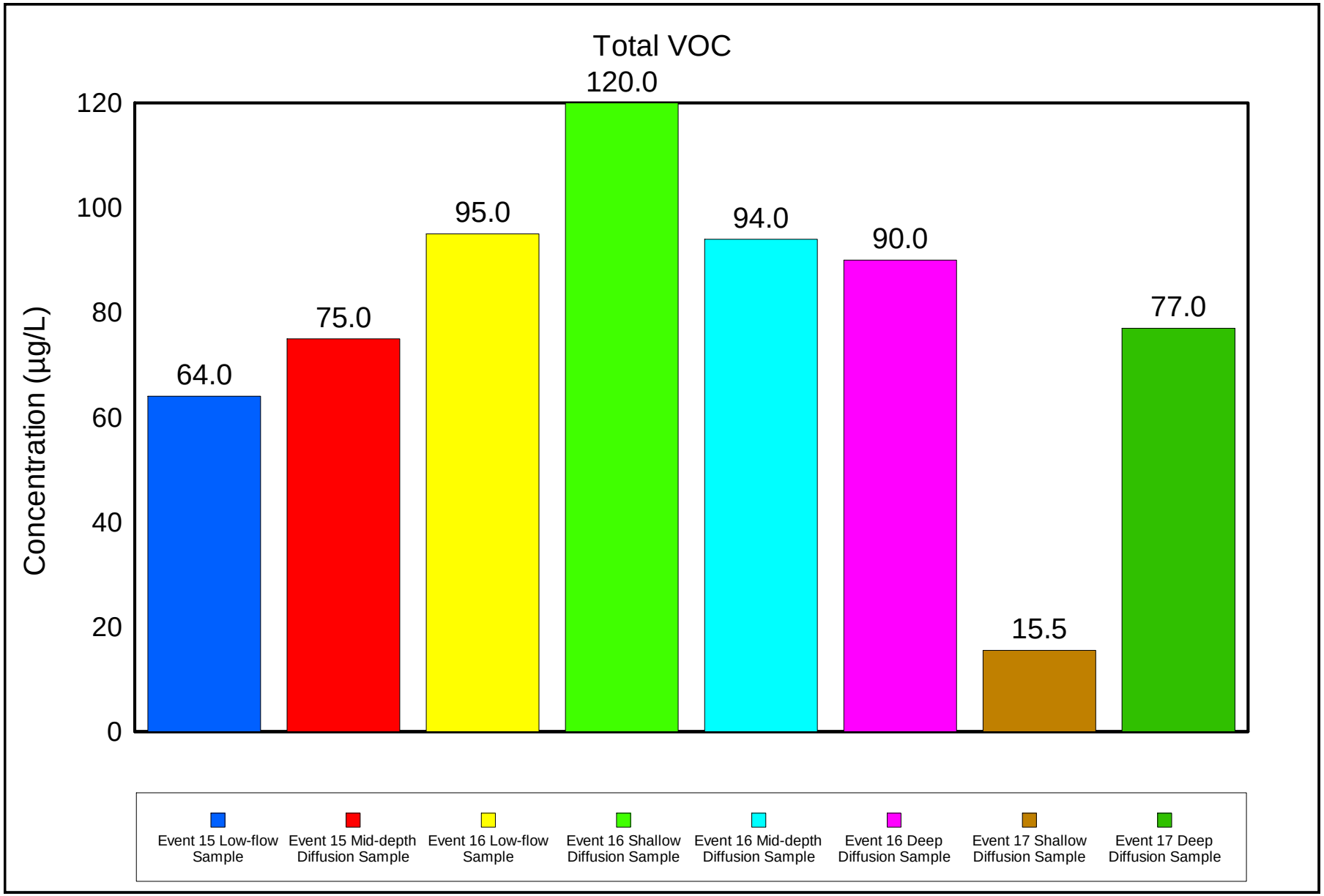
A value of zero was used for non-detects and B qualified results when calculating Total VOC.

MW-311



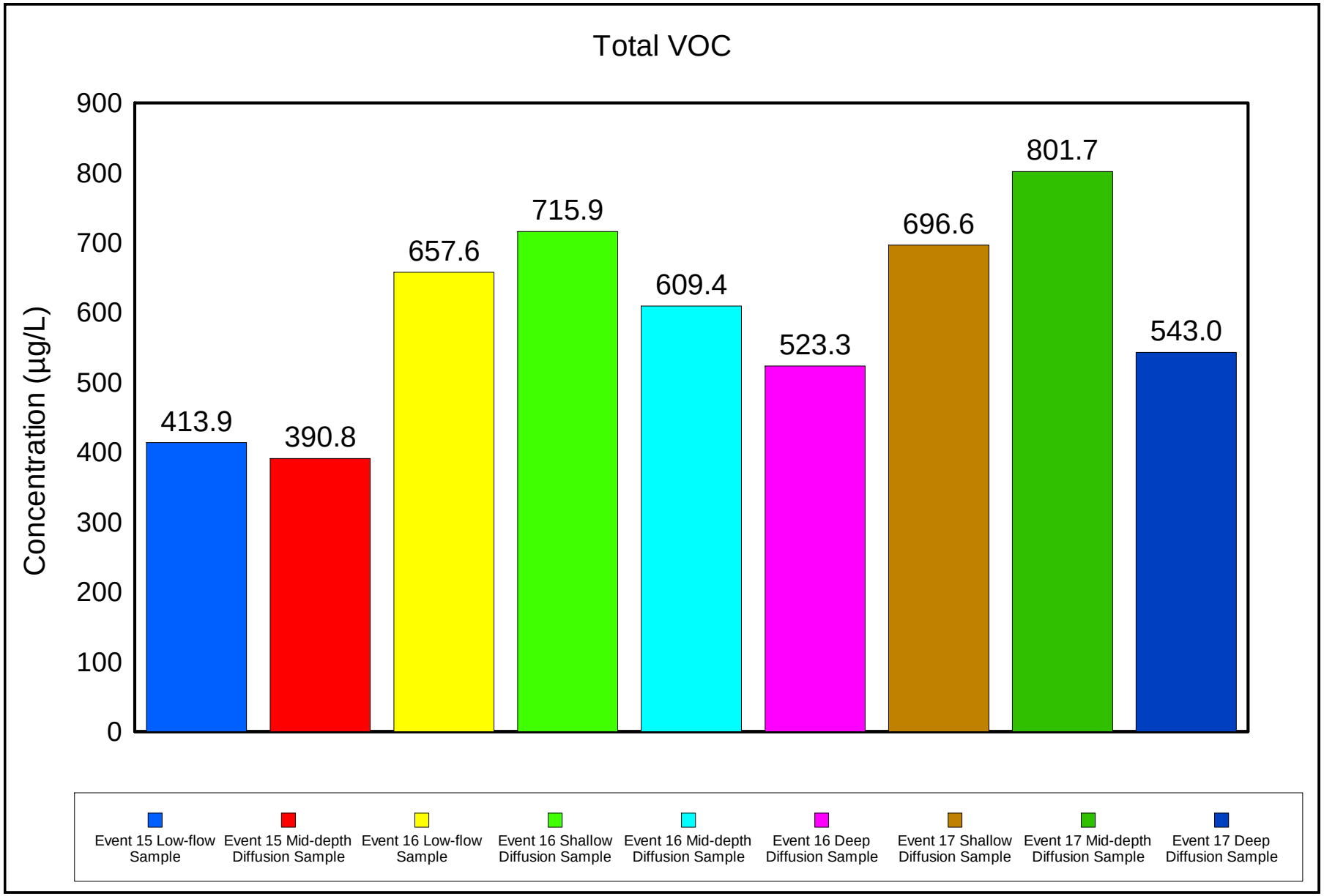
A value of zero was used for non-detects and B qualified results when calculating Total VOC.

MW-319



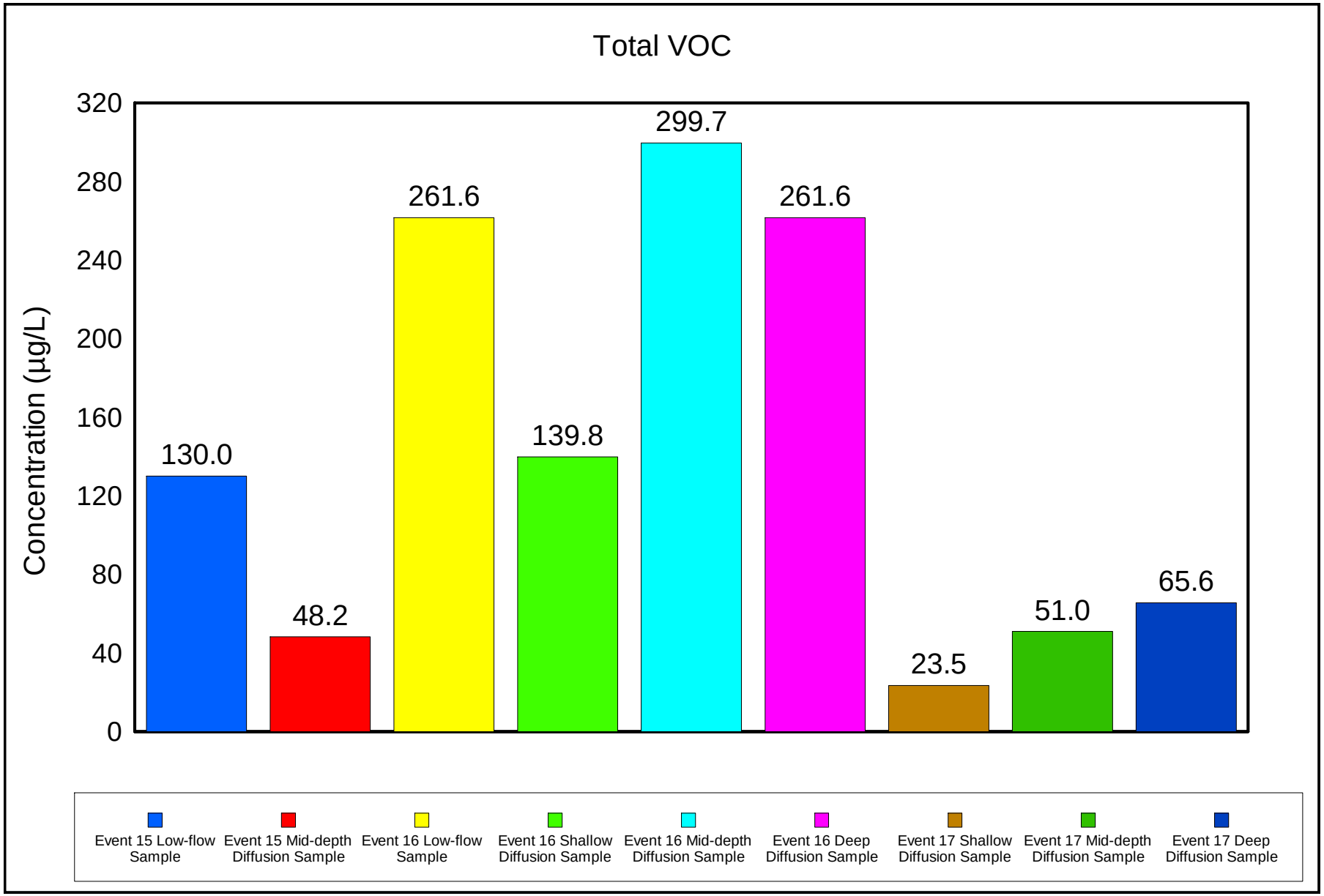
A value of zero was used for non-detects and B qualified results when calculating Total VOC.

MW-331



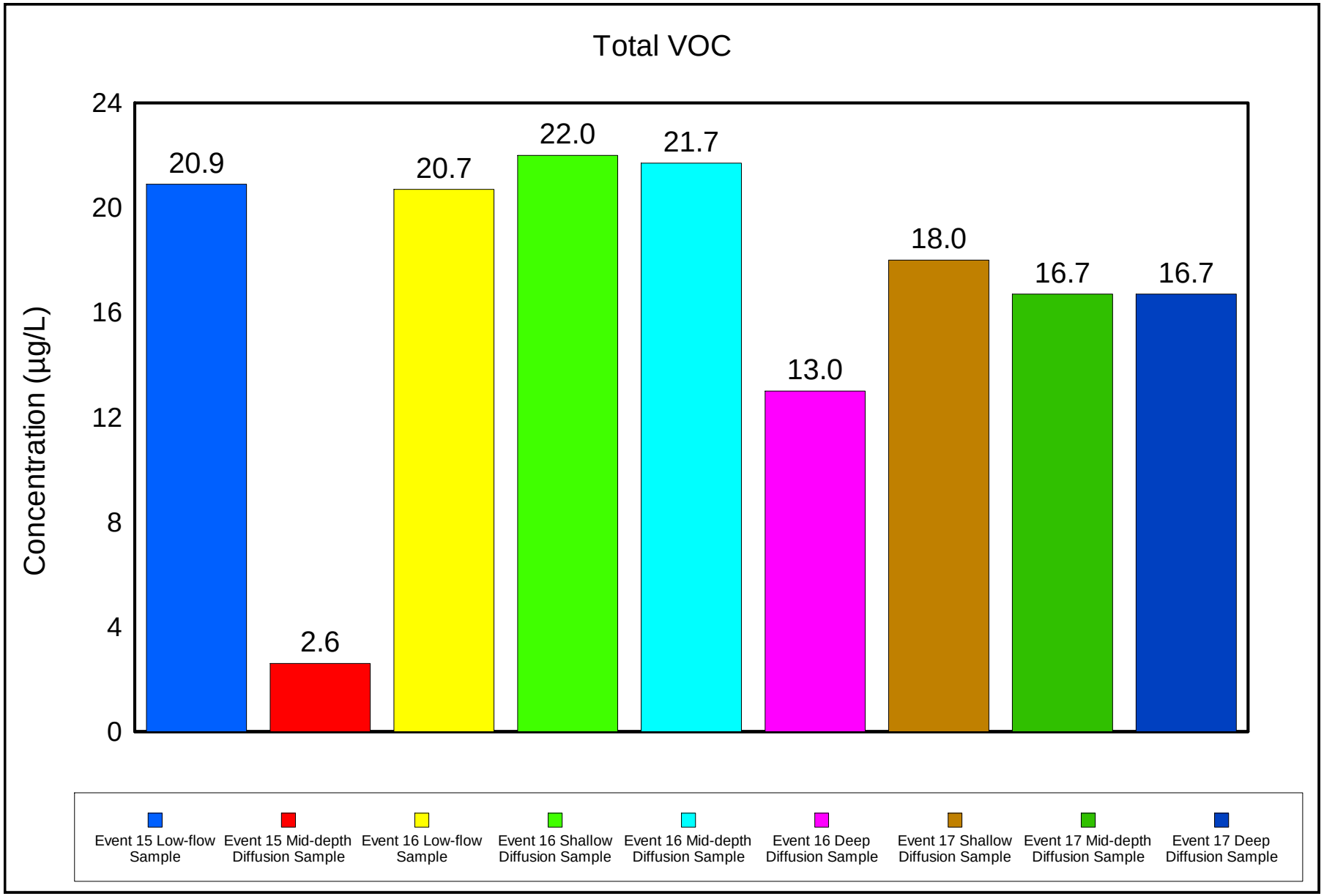
A value of zero was used for non-detects and B qualified results when calculating Total VOC.

MW-332



A value of zero was used for non-detects and B qualified results when calculating Total VOC.

MW-NASB-212

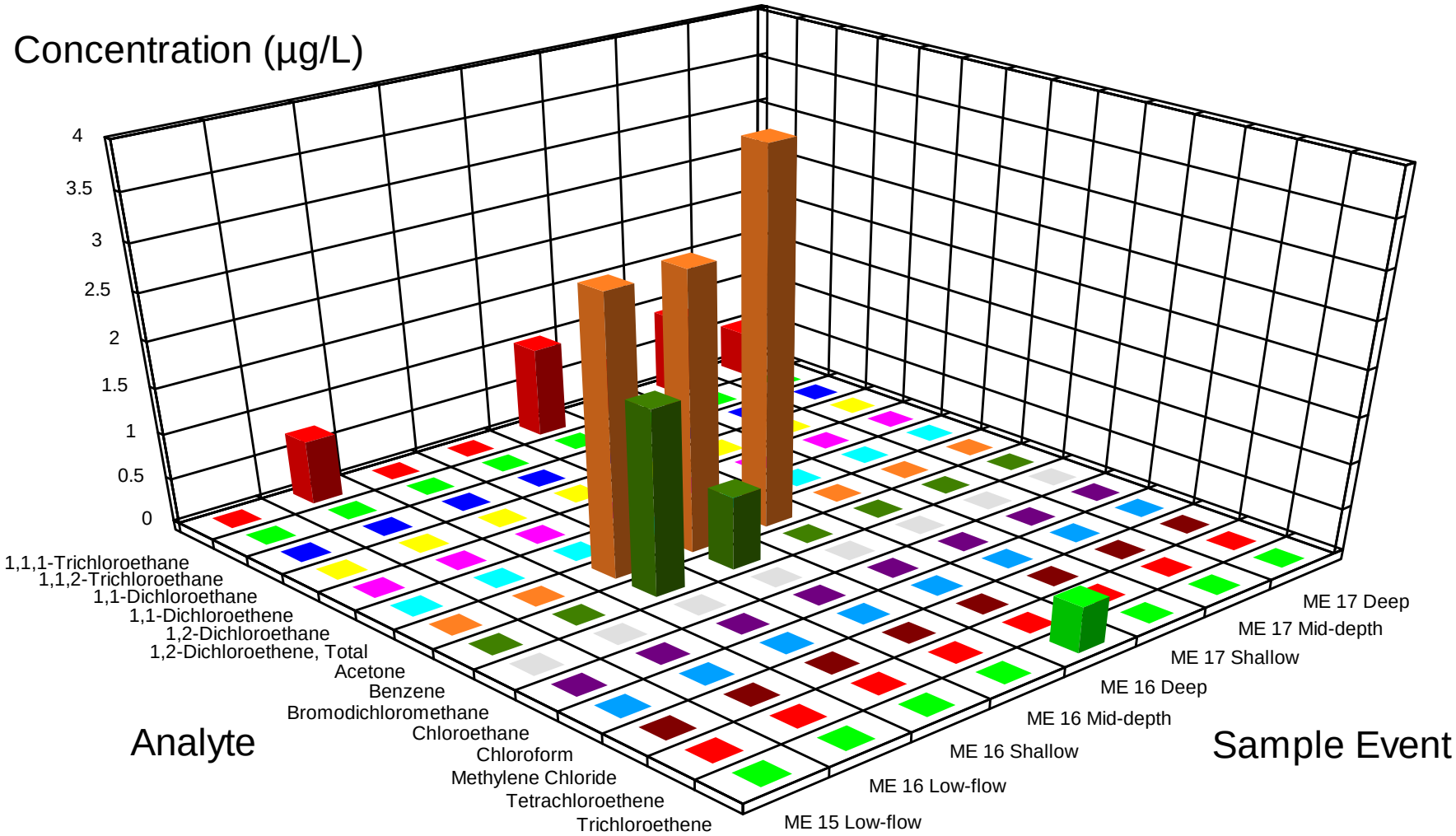


A value of zero was used for non-detects and B qualified results when calculating Total VOC.

Attachment C

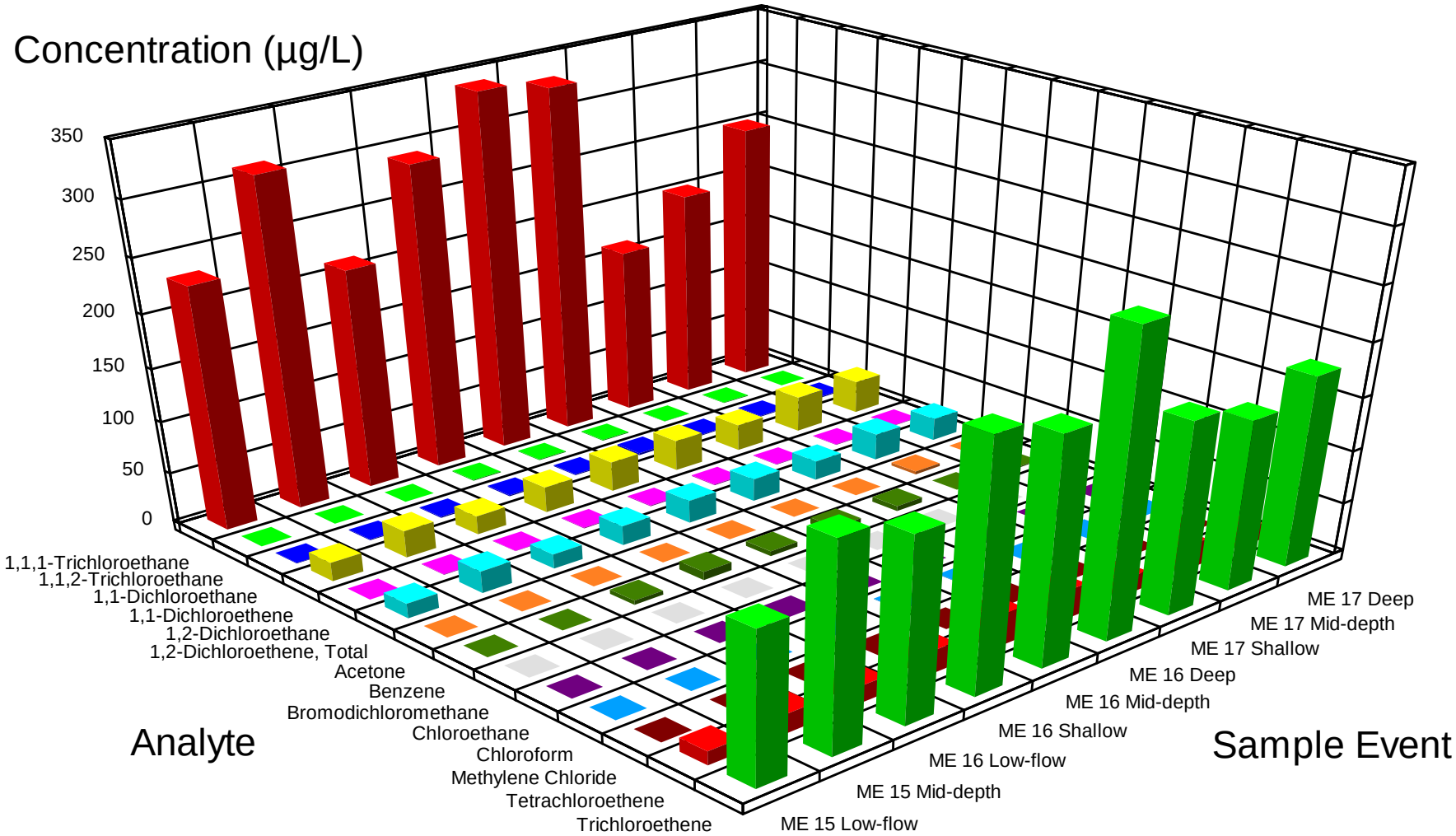
Graphs Summarizing Analytical Results for Monitoring Events 15, 16, and 17

MW-105A



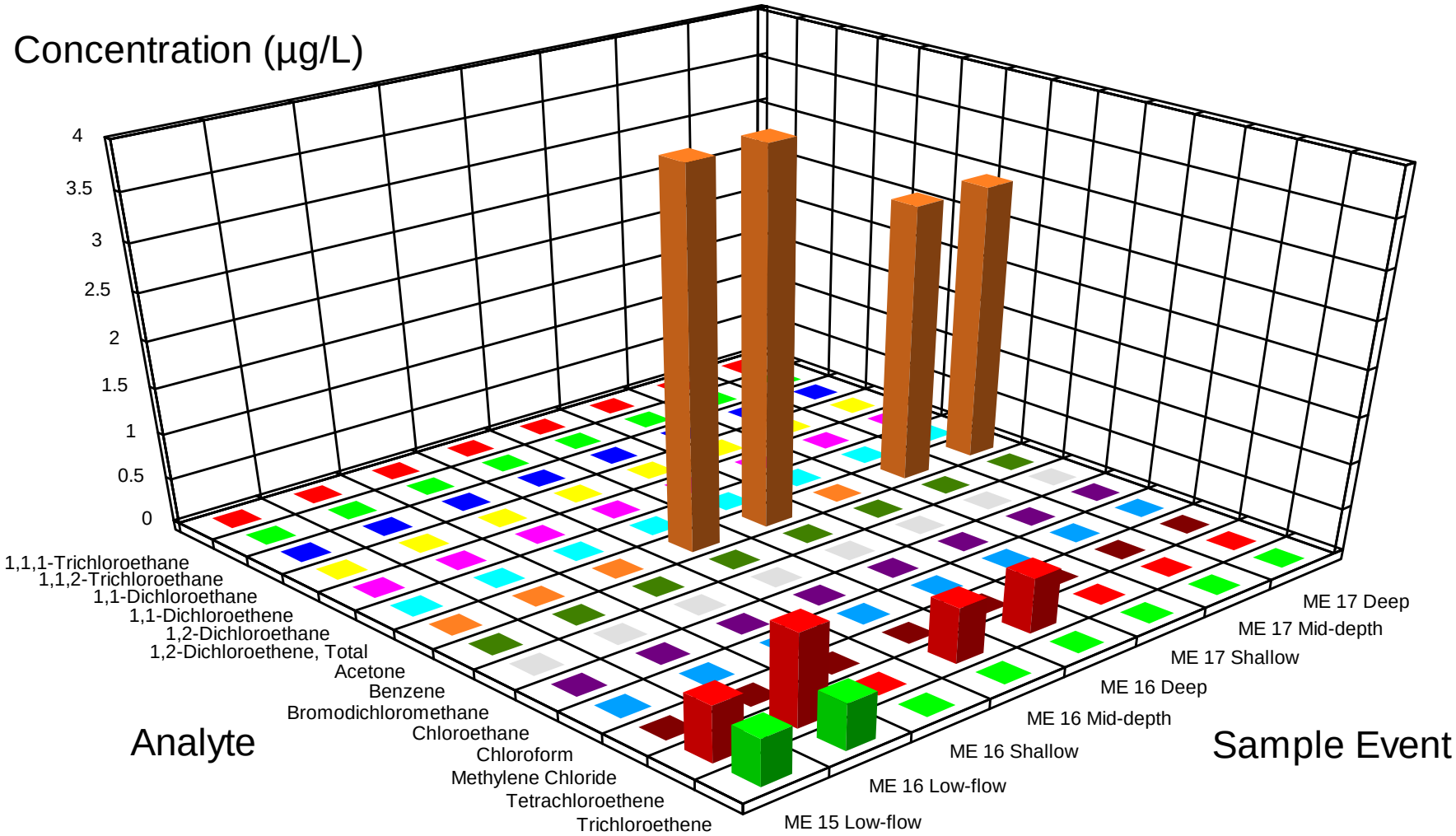
Note: Non-detects and B qualified results are plotted as zero.

MW-205



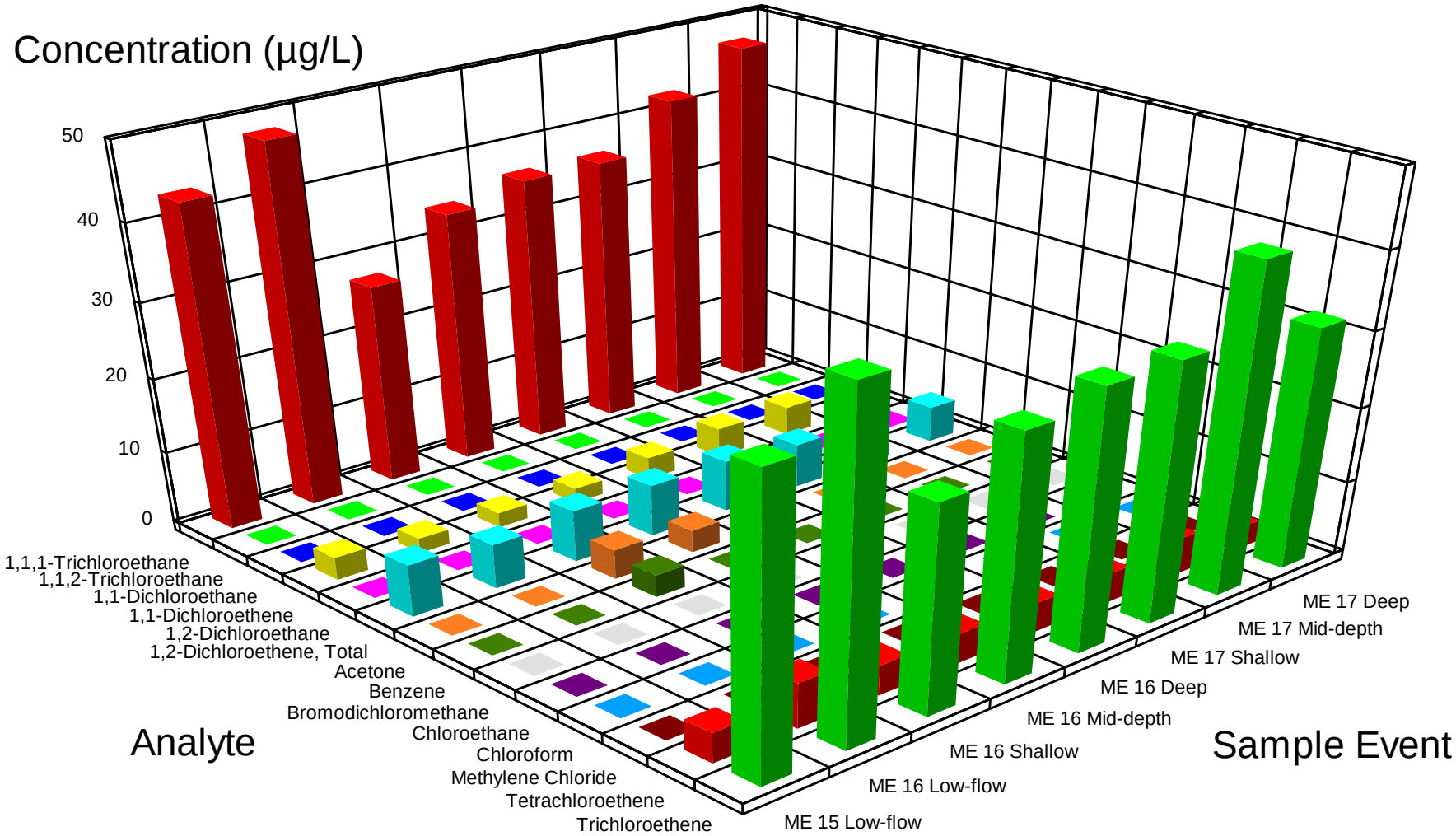
Note: Non-detects and B qualified results are plotted as zero.

MW-224



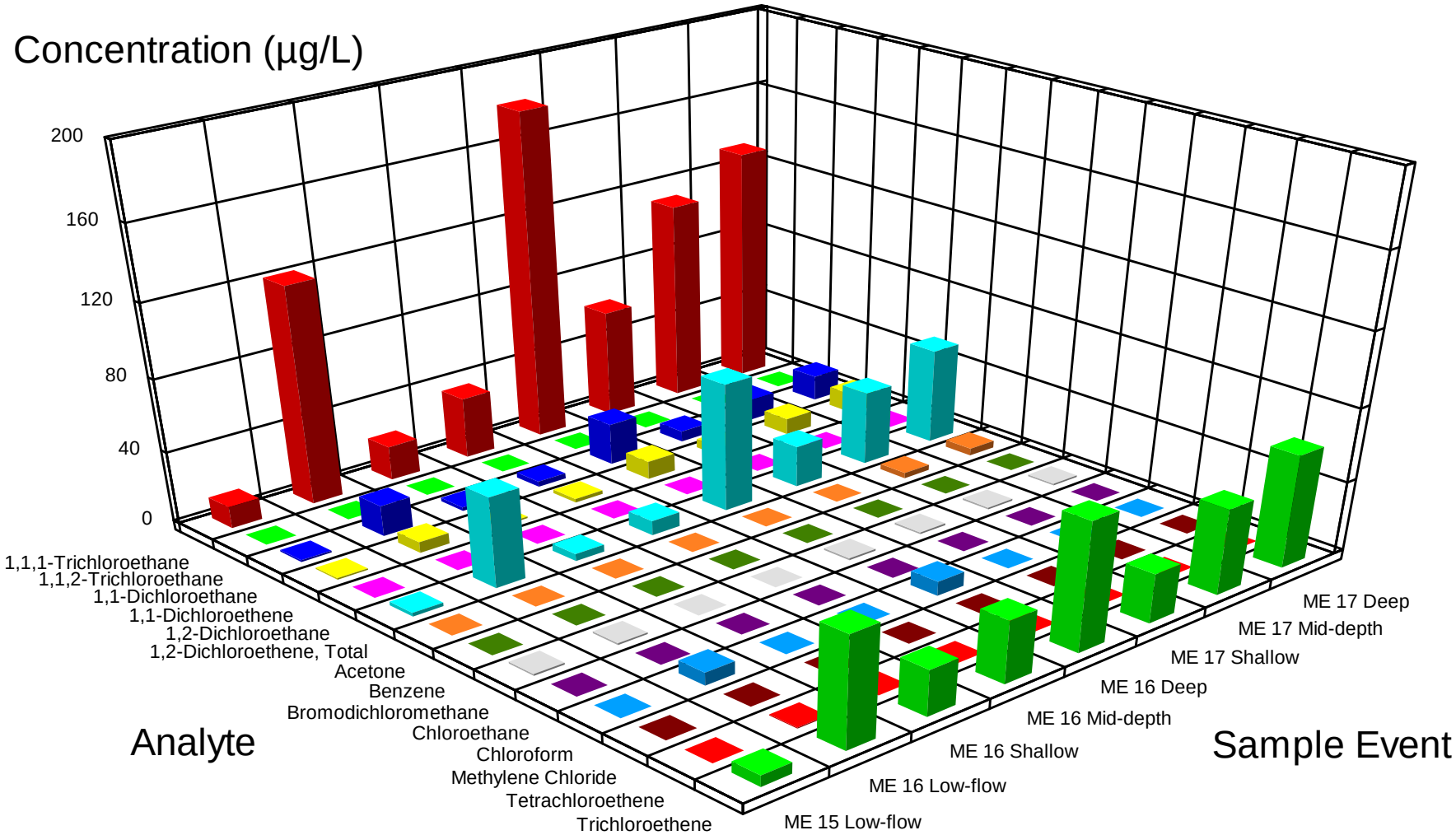
Note: Non-detects and B qualified results are plotted as zero.

MW-229A



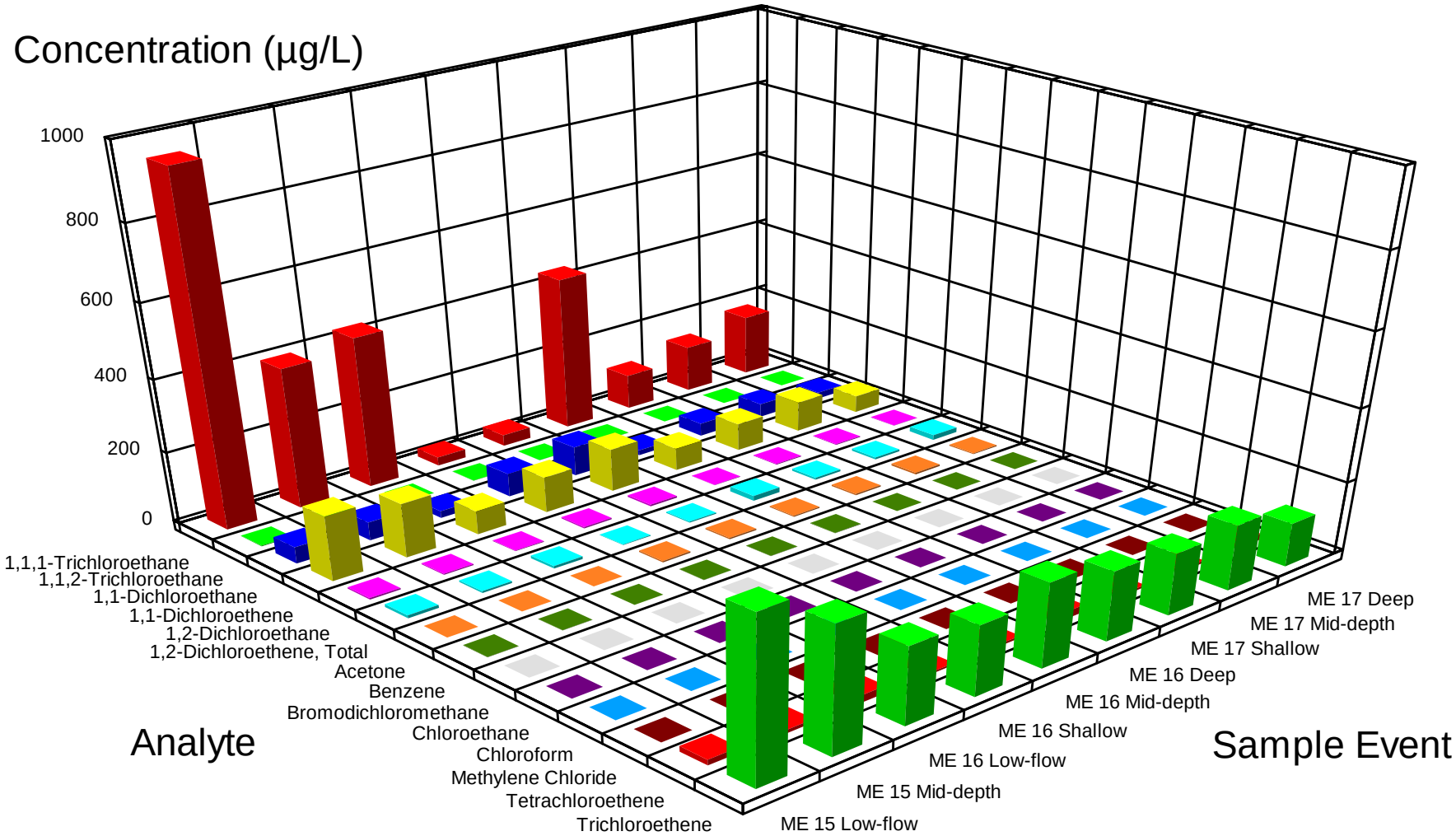
Note: Non-detects and B qualified results are plotted as zero.

MW-306



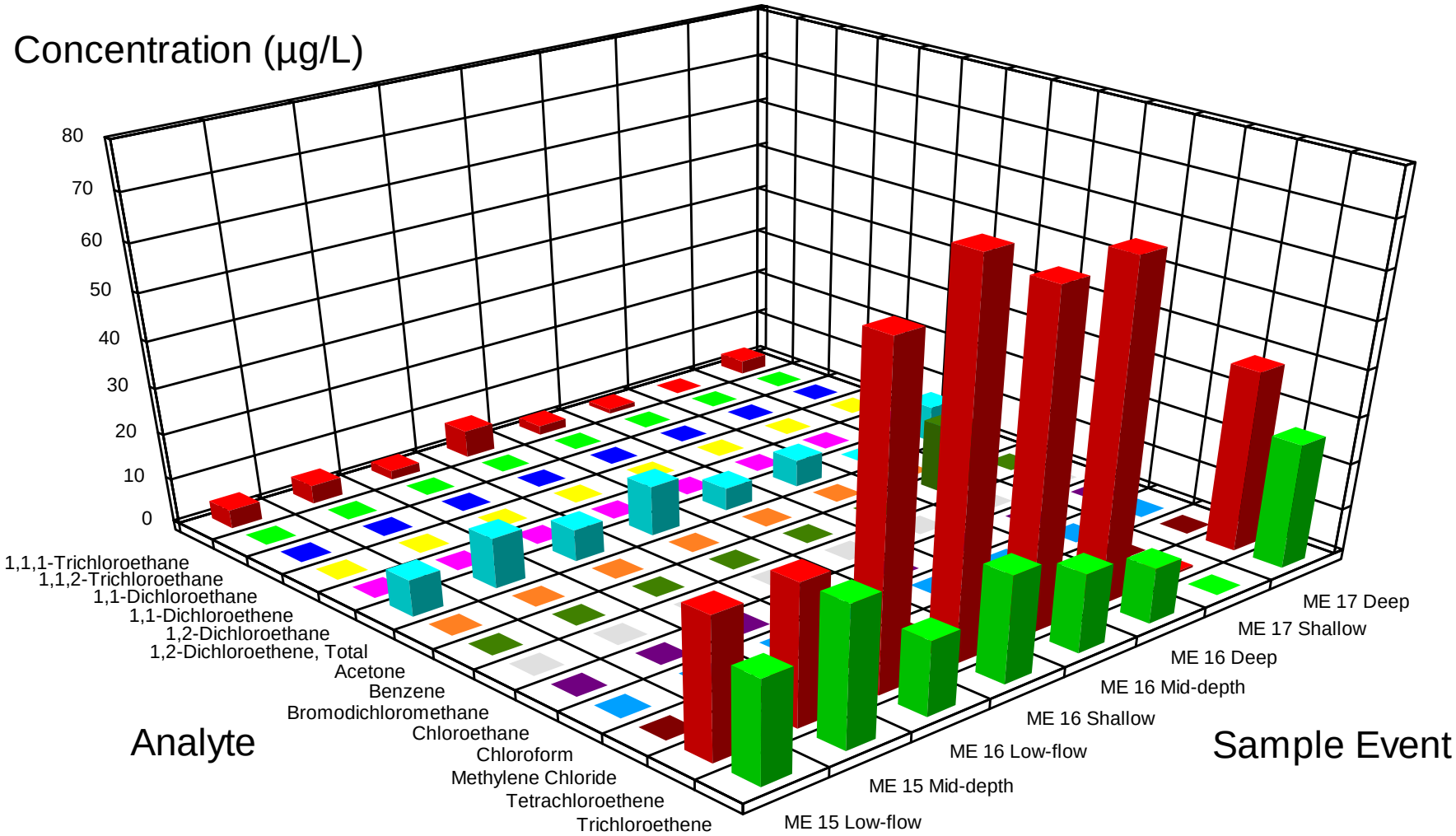
Note: Non-detects and B qualified results are plotted as zero.

MW-311



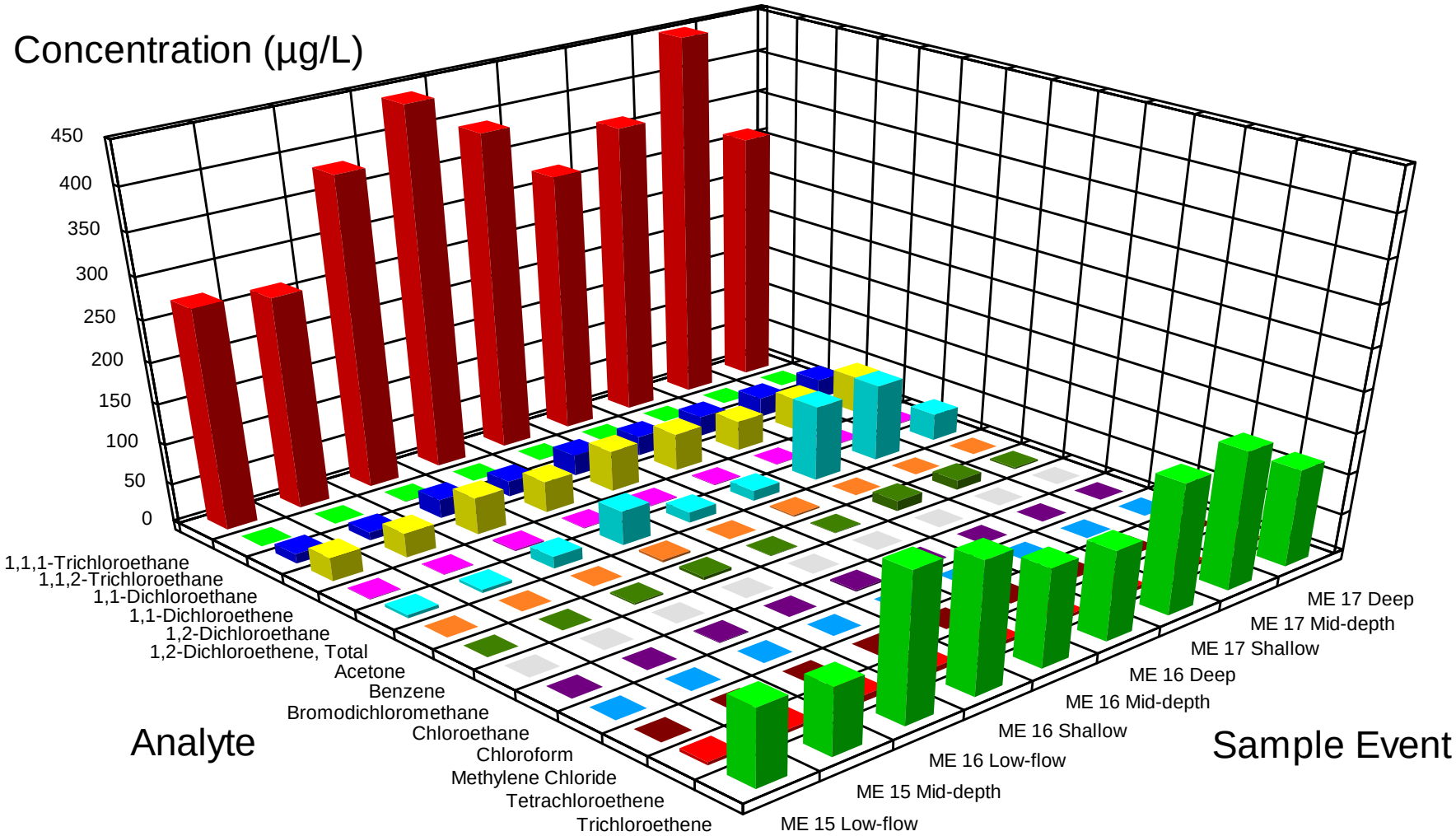
Note: Non-detects and B qualified results are plotted as zero.

MW-319



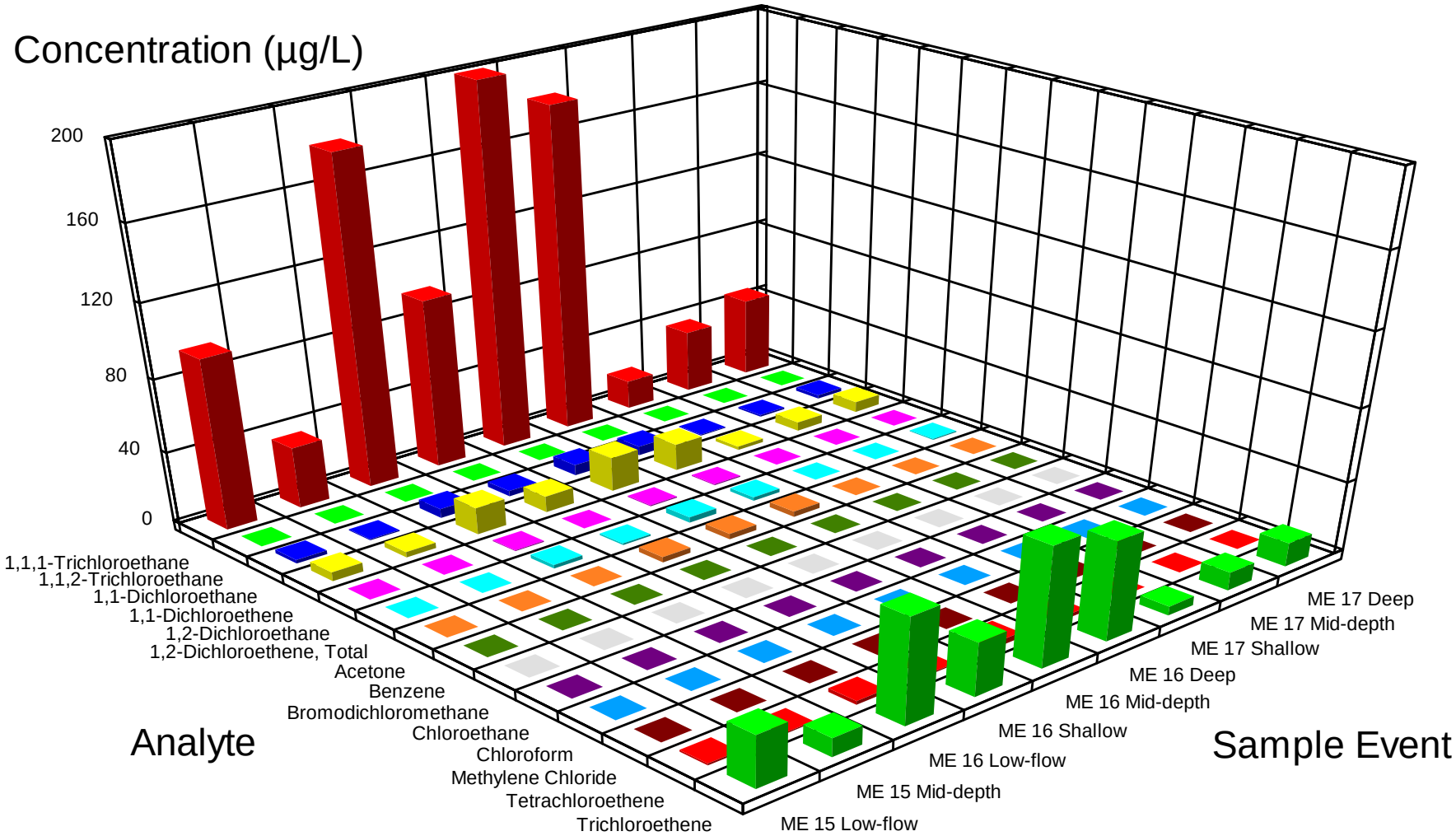
Note: Non-detects and B qualified results are plotted as zero.

MW-331



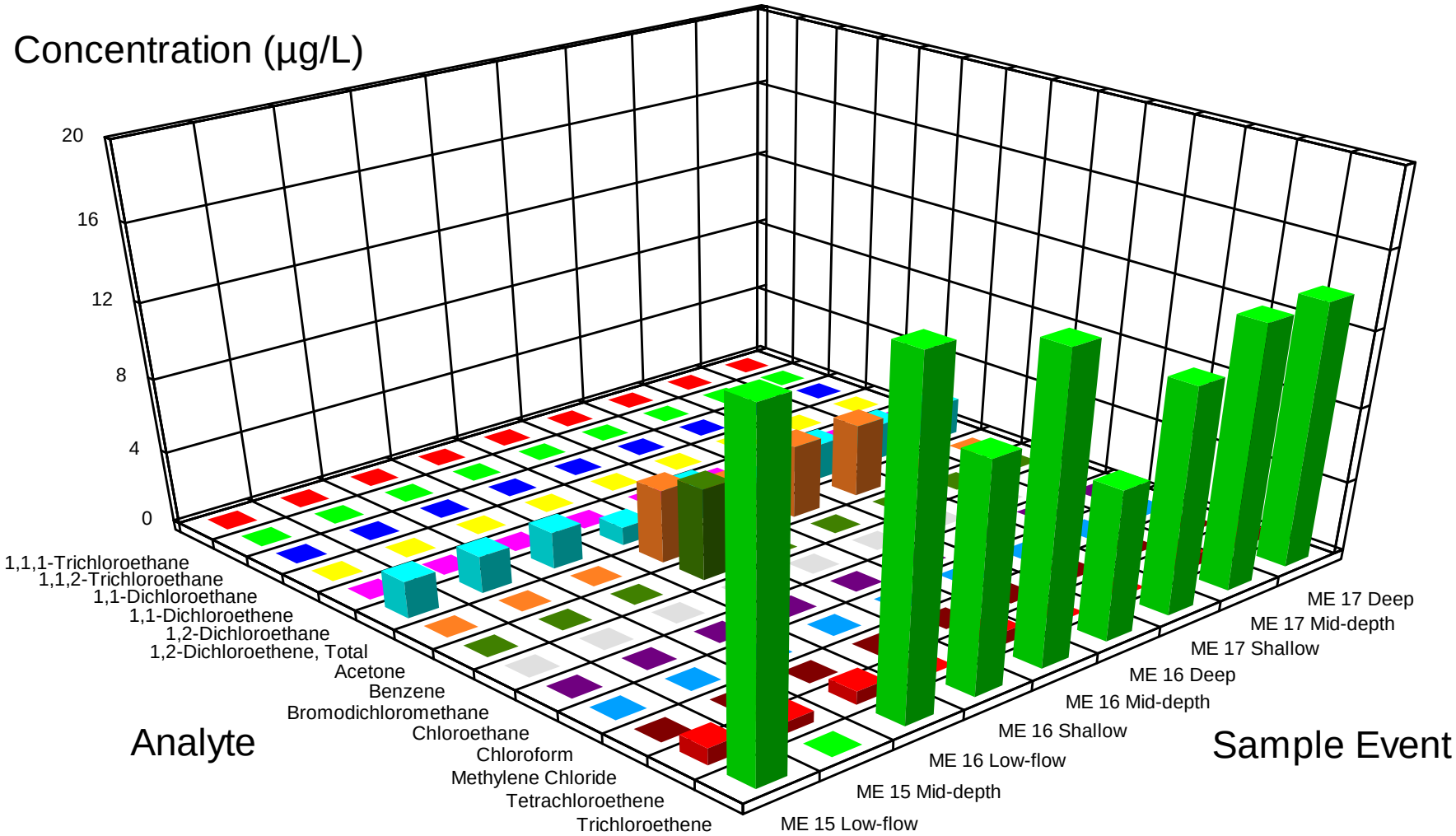
Note: Non-detects and B qualified results are plotted as zero.

MW-332



Note: Non-detects and B qualified results are plotted as zero.

MW-NASB-212



Note: Non-detects and B qualified results are plotted as zero.