EA Engineering, Science, and Technology

The Maple Building
3 Washington Center
Newburgh, NY 12550
Telephone: 845-565-8100
Fax: 845-565-8203

29 August 2001

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

RE: Summary of the April 2001 Aqueous Diffusion Sampling Pilot Study for Site 9, 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 April 2001 aqueous diffusion sampling pilot study conducted at Site 9, Naval Air Station, Brunswick, Maine. This was the first aqueous diffusion pilot study conducted at Site 9.

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 in use at Site 9. Due to the fact that vinyl chloride is the primary contaminant of concern at the site, this study was conducted to predominantly focus on vinyl chloride, although other volatile organic compounds (VOC) concentrations were tracked as well. This assessment was conducted by placing aqueous diffusion samples at three separate intervals along the screened interval of the 9 monitoring wells analyzed primarily for vinyl chloride and VOCs at Site 9. Samples were then collected and analyzed to quantify the degree of vertical stratification of VOC and vinyl chloride 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.

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 30 March 2001, the samplers were placed in the 9 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). It should be noted that monitoring wells MW-NASB-072 and MW-NASB-021 have 5-ft screen intervals. Therefore, two diffusion samplers were placed as follows: shallow (0-2 ft below top of well screen) and deep (2.5-4.5 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 25-26 April 2001. All planned sampling intervals were collected. 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 volatilize 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. A source water blank was collected by pouring the source water used in the diffusion samplers directly into the appropriate sample containers and sending the containers to the laboratory for analysis. Duplicate aqueous diffusion samples were collected from each of the three different intervals in monitoring well MW-NASB-069. The equipment blank, source water 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 contaminants of concern listed in the Final Long-Term Monitoring Plan for Site 9 (EA 19991). Attachment B provides graphs for each of the 9 monitoring wells included in this pilot study. The laboratory Form I summary tables are included in the Monitoring Event 18 Report for Site 9.

Table 1 provides a general overview of the results of the April 2001 aqueous diffusion sampler pilot study.

The following qualitative observations were made based on this pilot study:

- At one sampling location (MW-NASB-074), ground-water samples collected from the diffusion sampler pilot study reported trace concentrations of VOCs (3 µg/L or less of total VOCs). This is consistent with previous long-term monitoring results at these monitoring wells.

1. EA Engineering, Science, and Technology. 1999. Final Long-Term Monitoring Plan, Site 9 (Neptune Drive Disposal Site), Naval Air Station, Brunswick, Maine. August.

- At one location (MW-NASB-227), the ground-water samples collected from the diffusion samplers reported higher results than the ground-water sample collected following low-flow sampling.

- At five locations (MW-NASB-021, MW-NASB-022, MW-NASB-071, MW-NASB-072, and MW-NASB-075), VOCs were not detected at any of the diffusion sampling intervals or in the low-flow sample. This was the first sampling event in which monitoring well MW-NASB-021 was sampled. The results for the four remaining wells are consistent with previous long-term monitoring results.

- At one location (MW-NASB-076), previous long-term monitoring results have shown a low-level concentration of vinyl chloride. The low-flow sample results for this well collected during Monitoring Event 18 indicated vinyl chloride at a level of 2J µg/L. Vinyl chloride was not detected in any of the three diffusion samplers.

- At one location (MW-NASB-069), no definite trend could be identified for vertical stratification of VOCs. At this location, the interval with the highest total VOC concentration was not consistent between the regular sample and the duplicate sample.

- In comparing the vinyl chloride concentrations in the diffusion samples and low-flow samples, vinyl chloride was detected in wells MW-NASB-069 and MW-NASB-076. The results for MW-NASB-069 indicated higher vinyl chloride concentrations in samples collected via diffusion samplers.

CONCLUSIONS

Based on the results of the April 2001 diffusion sampler pilot study, the following conclusions are provided:

- In general, good reproducibility was noted between the low-flow sample and the diffusion samples at locations that have had historically low or no VOCs detected.

- Analyte exceedances of the State of Maine Maximum Exposure Guidelines (MEGs)/Federal Maximum Contaminant Levels (MCLs) detected in low-flow collected samples were also detected in related aqueous diffusion samples, with the exception of vinyl chloride in monitoring well MW-MW-NASB-076. At this location, the diffusion sample result did not exceed the MEGs/MCLs (non-detect) while the low-flow sample did. The results at MW-NASB-076 suggest that the pump may draw vinyl chloride into the area, an effect that diffusion samplers cannot reproduce. It is also possible that the diffusion samplers did not capture any vinyl chloride, suggesting that diffusion samplers may be unable to capture low levels of vinyl chloride (below 2J µg/L), or that a lower detection/capture limit exists.

- Duplicate sample results indicate samples collected by diffusion samplers have good reproducibility.

RECOMMENDATIONS

Based on these results, EA provides 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 study collected during Monitoring Event18, one sampling interval can be monitored at 7 of 9 sampling points to accurately track changes in VOC concentrations. It is recommended that diffusion samples continue to be taken at three sampling intervals for MW-NASB-069 and MW-NASB-076 in order to add to the existing baseline data and to identify any emerging trends at these two sampling points.

- During Monitoring Event 19 (September 2001), collect one ground-water sample using aqueous diffusion samplers installed at 7 of 9 monitoring wells included in the pilot study. Furthermore, aqueous diffusion samplers should be installed at shallow, mid-point, and deep intervals at MW-NASB-069 and MW-NASB-076. The recommended sampling intervals for each well are summarized on Table 1.

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 Engineering Field Activity Northeast with this summary. If there are any questions, please do not hesitate to contact either of the undersigned.

Sincerely,

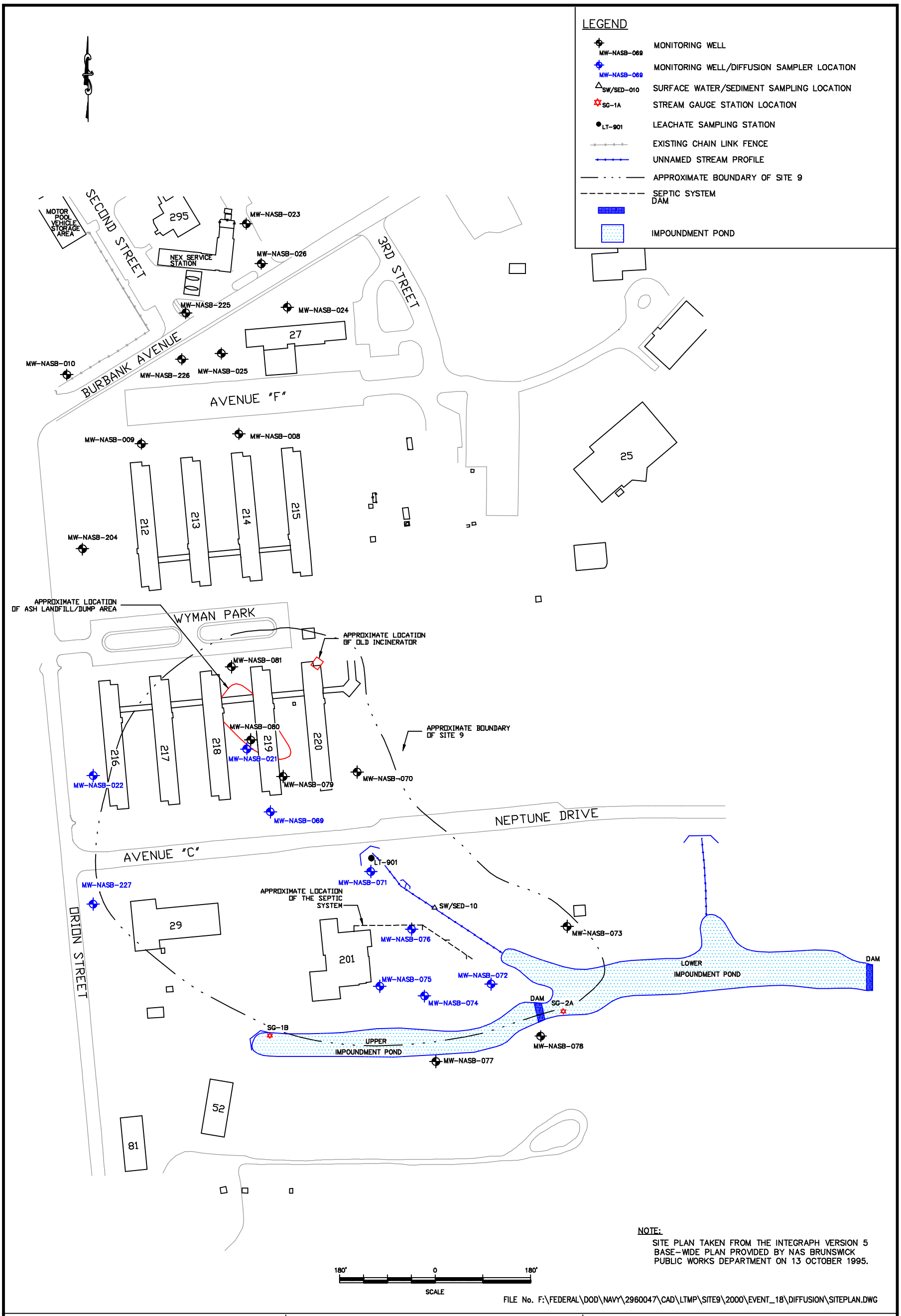
Alexander Easterday

Alexander C. Easterday, P.G.
Project Manager

Peter L. Nimmer/mkp
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, EFANE (1 copy)
C. Lepage, Lepage Environmental Services (1 copy)
J. Shultz, EA (1 copy)
G. Calderone, EA (1 copy)
Administrative Record (2 copies)



NOTE:
SITE PLAN TAKEN FROM THE INTEGRAPH VERSION 5 BASE-WIDE PLAN PROVIDED BY NAS BRUNSWICK PUBLIC WORKS DEPARTMENT ON 13 OCTOBER 1995.

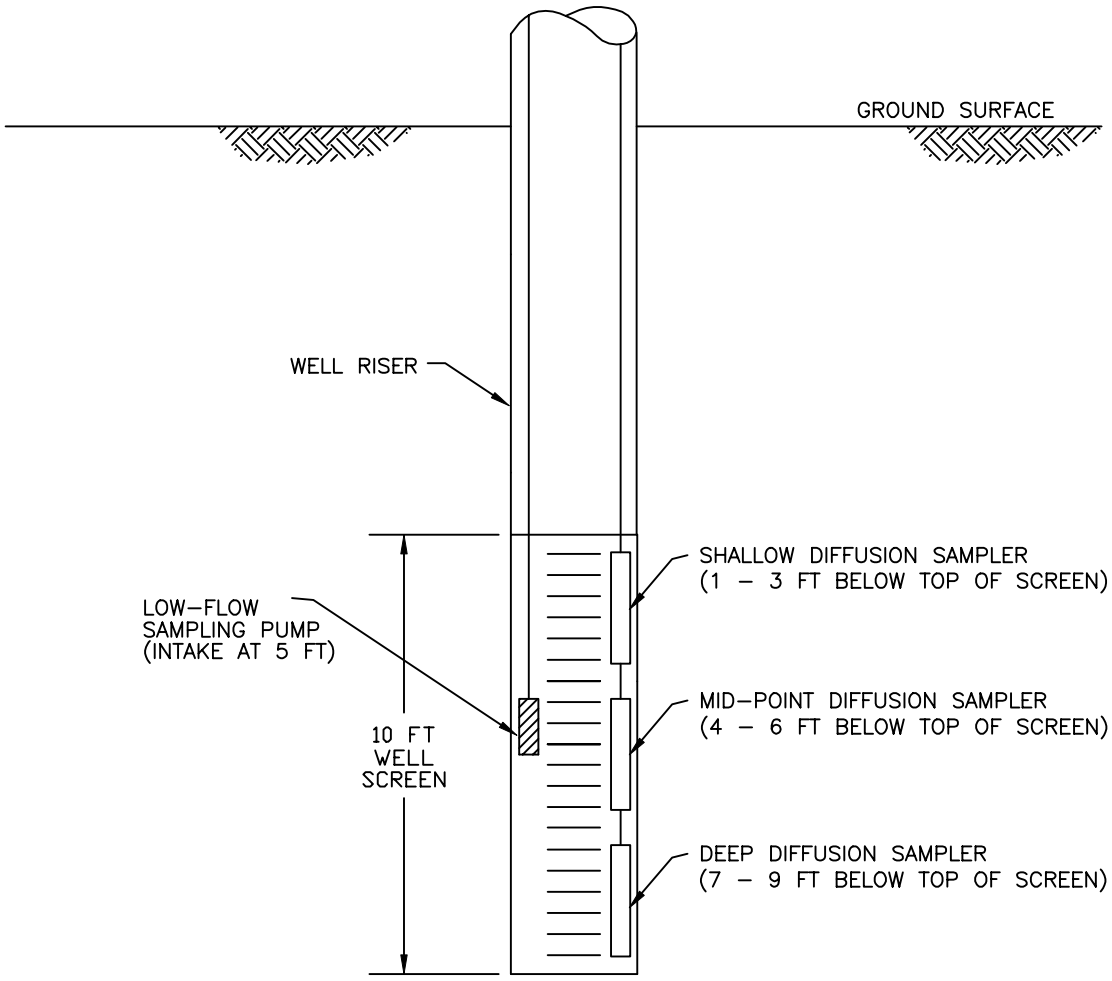
FILE No. F:\FEDERAL\DOD\NAVY\2960047\CAD\LTMP\SITE9\2000\EVENT_18\DIFFUSION\SITEPLAN.DWG

EA ENGINEERING, SCIENCE, AND TECHNOLOGY

SITE 9
(NEPTUNE DRIVE DISPOSAL SITE)
NAVAL AIR STATION
BRUNSWICK, MAINE

FIGURE 1
SITE PLAN

PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT NO	FILE No.
AE	SAP	SAP	SYC	1"=180'	5 JULY 2001	29600.47	SITEPLAN



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 FOR SITE 9
APRIL 2001

Monitoring Well	Monitoring Event 18 Ground-Water Total VOC Concentration[(a)]	Summary of Monitoring Event 18 Diffusion Sampler Study Results	Diffusion Sampler Interval with Higher Total VOCs in Monitoring Event 18	Diffusion Sampler Interval Recommended for Sampling during Monitoring Event 19
MW-NASB-021	Low	Low VOC reported in samples (less than 1 µg/L)	All non-detect	Deep
MW-NASB-022	Low	Low VOC reported in samples (less than 1 µg/L)	All non-detect	Deep
MW-NASB-069	Moderate	Mid-point slightly higher than deep sample; duplicate results show deep sample slightly higher that midpoint	Mid-point and deep	Shallow, mid-point, and deep
MW-NASB-071	Low	Low VOC reported in samples (less than 1 µg/L)	All non-detect	Deep
MW-NASB-072	Low	Low VOC reported in samples (less than 1 µg/L)	All non-detect	Deep
MW-NASB-074	Low	Low VOC reported in samples (less than 3 µg/L)	All the same	Deep
MW-NASB-075	Low	Low VOC reported in samples (less than 1 µg/L)	All non-detect	Deep
MW-NASB-076	Low	Low VOC reported in samples (less than 1 µg/L)	All non-detect	Shallow, mid-point, and deep
MW-NASB-227	Moderate	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

TABLE 1 SUMMARY OF GROUND-WATER SAMPLES COLLECTED FROM SITE 9 ON 25 AND 26 APRIL 2001
VOLATILE ORGANIC COMPOUNDS BY U.S. ENVIRONMENTAL PROTECTION AGENCY METHOD 8260B

			MW-NASB-021			MW-NASB-021 (Dup)	MW-NASB-022			
			Low-flow sample	Shallow Diffusion Sample	Deep Diffusion Sample	Low-flow sample	Low-flow sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound/Element	MEG (a)	MCL (b)	0	0	0	0	0	0	0	0
Total VOC	---	---	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, total	70	70	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Acetone	---	---	(<5U)	13B*	13B*	(<5U)	(<5U)	17B*	16B*	15B*
Ethylbenzene	700	700	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Toluene	1,400	1,000	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Trichloroethene	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Vinyl chloride	0.15	2	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Xylenes, total	600	10,000	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)

			MW-NASB-069				MW-NASB-069 (Dup)			
			Low-flow sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Low-flow sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound/Element	MEG (a)	MCL (b)	0	0	0	0	0	0	0	0
Total VOC	---	---	97	66	117	113	108	44	101	123
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, total	70	70	44	36	67	52	51	29	58	57
Acetone	---	---	(<5U)	12B*	14B*	14B*	(<5U)	14*	14*	16B*
Ethylbenzene	700	700	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Toluene	1,400	1,000	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Trichloroethene	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Vinyl chloride	0.15	2	**53**	**30**	**50**	**61**	**57**	**15**	**43**	**66**
Xylenes, total	600	10,000	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)

TABLE 1 (CONTINUED)

			MW-NASB-071				MW-NASB-072		
			Low-flow sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Low-flow sample	Shallow Diffusion Sample	Deep Diffusion Sample
Compound/Element	MEG (a)	MCL (b)	0	0	0	0	0	0	0
Total VOC	---	---	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, total	70	70	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Acetone	---	---	(<5U)	15*	12B*	13*	(<5U)	10*	9*
Ethylbenzene	700	700	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Toluene	1,400	1,000	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Trichloroethene	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Vinyl chloride	0.15	2	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Xylenes, total	600	10,000	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)

			MW-NASB-074				MW-NASB-075			
			Low-flow sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Low-flow sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound/Element	MEG (a)	MCL (b)	0	0	0	0	0	0	0	0
Total VOC	---	---	2.5	2	2	2	ND	ND	ND	ND
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, total	70	70	2	2	2	2	(<1U)	(<1U)	(<1U)	(<1U)
Acetone	---	---	(<5U)	14*	16*	16*	(<5U)	13*	15*	7*
Ethylbenzene	700	700	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	0.5J	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Toluene	1,400	1,000	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Trichloroethene	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Vinyl chloride	0.15	2	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Xylenes, total	600	10,000	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)

TABLE 1 (CONTINUED)

			MW-NASB-076				MW-NASB-227			
			Low-flow sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample	Low-flow sample	Shallow Diffusion Sample	Mid-depth Diffusion Sample	Deep Diffusion Sample
Compound/Element	MEG (a)	MCL (b)	0	0	0	0	0	0	0	0
Total VOC	---	---	2	ND	ND	ND	2.6	6.9	4.6	4.6
1,1-Dichloroethane	70	---	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
1,2-Dichloroethene, total	70	70	(<1U)	(<1U)	(<1U)	(<1U)	2	2	2	2
Acetone	---	---	(<5U)	13*	13*	13*	(<5U)	15B*	15B*	16B*
Ethylbenzene	700	700	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Tetrachloroethene	3	5	(<1U)	(<1U)	(<1U)	(<1U)	0.6J	0.9J	0.6J	0.6J
Toluene	1,400	1,000	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)
Trichloroethene	5	5	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	4	2	2
Vinyl chloride	0.15	2	**2J**	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)
Xylenes, total	600	10,000	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)	(<1U)

(a) MEG (Maximum Exposure Guideline) obtained from State of Maine Department of Human Services Maximum Exposure Guidelines, memorandum dated 23 October 1992. Dashes (---) indicate compound has no applicable MEG.
(b) MCL (Maximum Contaminant Level) obtained from 40 CFR Parts 141 and 142 (U.S. EPA 1998). Dashes (---) indicate compound has no applicable MCL.

NOTE:
Units are micrograms per liter (µg/L).
Total VOC calculation does not include common laboratory contaminants (Acetone or Methylene Chloride) or VOCs detected in the Trip Blank or Method Blank.
ND = No VOCs detected.
U = Not detected. Sample quantitation limits are shown as (<____U).
J = Estimated concentration.
B = Compound detected in associated method blank.
* = Result is qualified as a false-postive due to blank contamination (rinsate, trip, source water, or method blanks) based upon EA's analytical data quality review conducted in accordance with the LTMP and EPA Region I Data Validation Guidlines
Only those analytes detected in at least one of the samples, and chemicals of concern listed in the Final Long-Term Monitoring Plan (EA 1999b), are shown on this table.
Concentrations highlighted with gray and bold type denote exceedance of MEG or MCL.

TABLE 2 SUMMARY OF QUALITY CONTROL SAMPLES COLLECTED FROM SITE 9 BETWEEN 24 APRIL AND 03 MAY 2001
VOLATILE ORGANIC COMPOUNDS BY U.S. ENVIRONMENTAL PROTECTION AGENCY METHOD 8260B

			EP-QD-001	EP-QS-001	QT-002	QT-004	QT-005
			QC Sample	QC Sample	QC Sample	QC Sample	QC Sample
			Source Water Blank	Rinsate Blank	Trip Blank	Trip Blank	Trip Blank
Compound/Element	MEG (a)	MCL (b)	0	0	0	0	0
Total VOC	---	---	ND	2	ND	ND	ND
Acetone	---	---	(<5U)	19	(<5U)	(<5U)	(<5U)
Benzene	---	---	(<1U)	2	(<1U)	(<1U)	(<1U)
Methylene chloride	---	---	(<1U)	(<1U)	0.6J	0.7J	(<1U)
Vinyl chloride	---	---	(<2U)	(<2U)	(<2U)	(<2U)	(<2U)

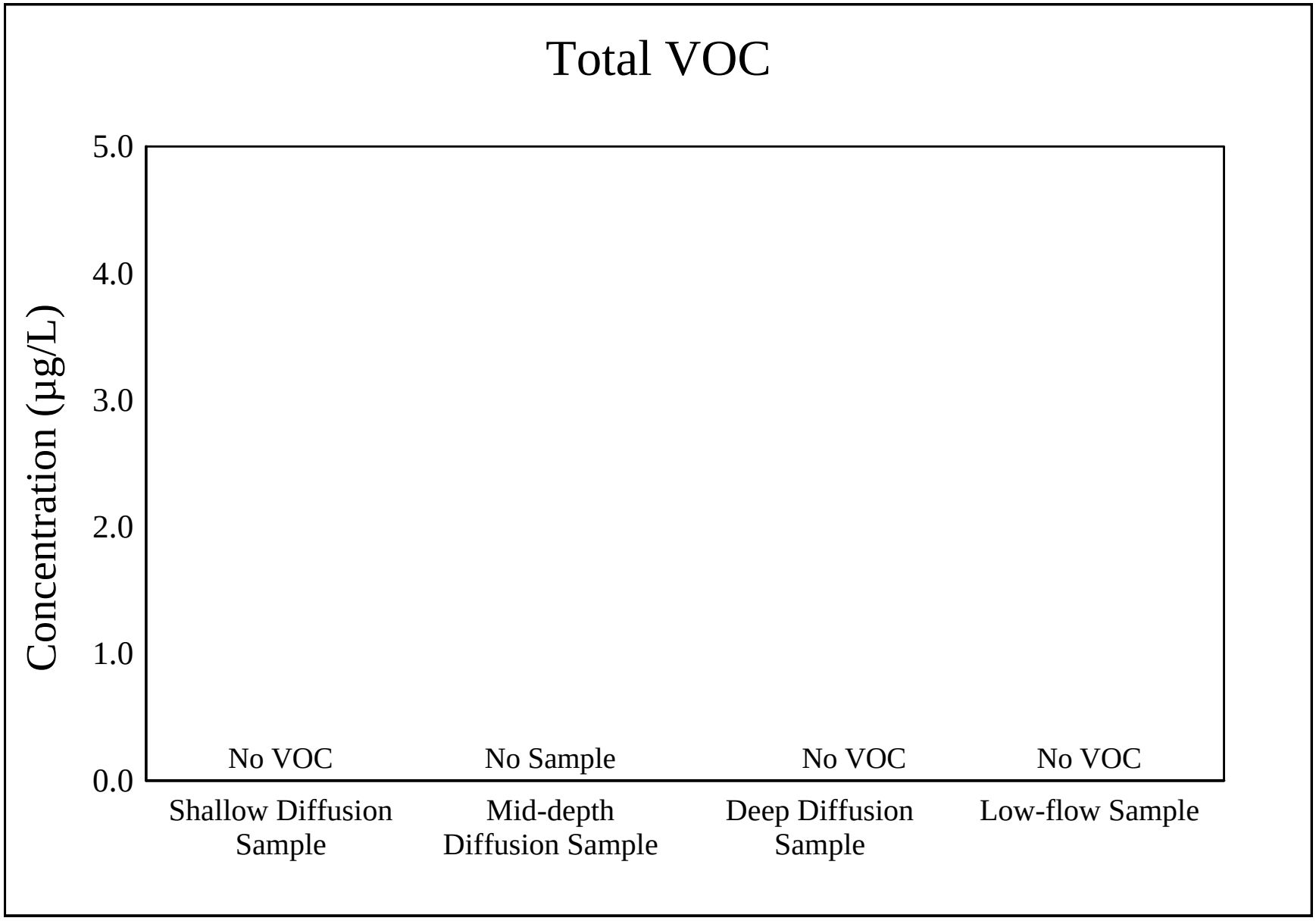
(a) MEG (Maximum Exposure Guideline) obtained from State of Maine Department of Human Services Maximum Exposure Guidelines, memorandum dated 23 October 1992. Dashes (---) indicate compound has no applicable MEG.
(b) MCL (Maximum Contaminant Level) obtained from 40 CFR Parts 141 and 142 (U.S. EPA 1998). Dashes (---) indicate compound has no applicable MCL.

NOTE:
Units are micrograms per liter (µg/L).
Total VOC calculation does not include common laboratory contaminants (Acetone or Methylene Chloride) or VOCs detected in the Trip Blank or Method Blank.
ND = No VOCs detected.
U = Not detected. Sample quantitation limits are shown as (<____U).
J = Estimated concentration.
Only those analytes detected in at least one of the samples, and chemicals of concern listed in the Final Long-Term Monitoring Plan (EA 1999b), are shown on this table.

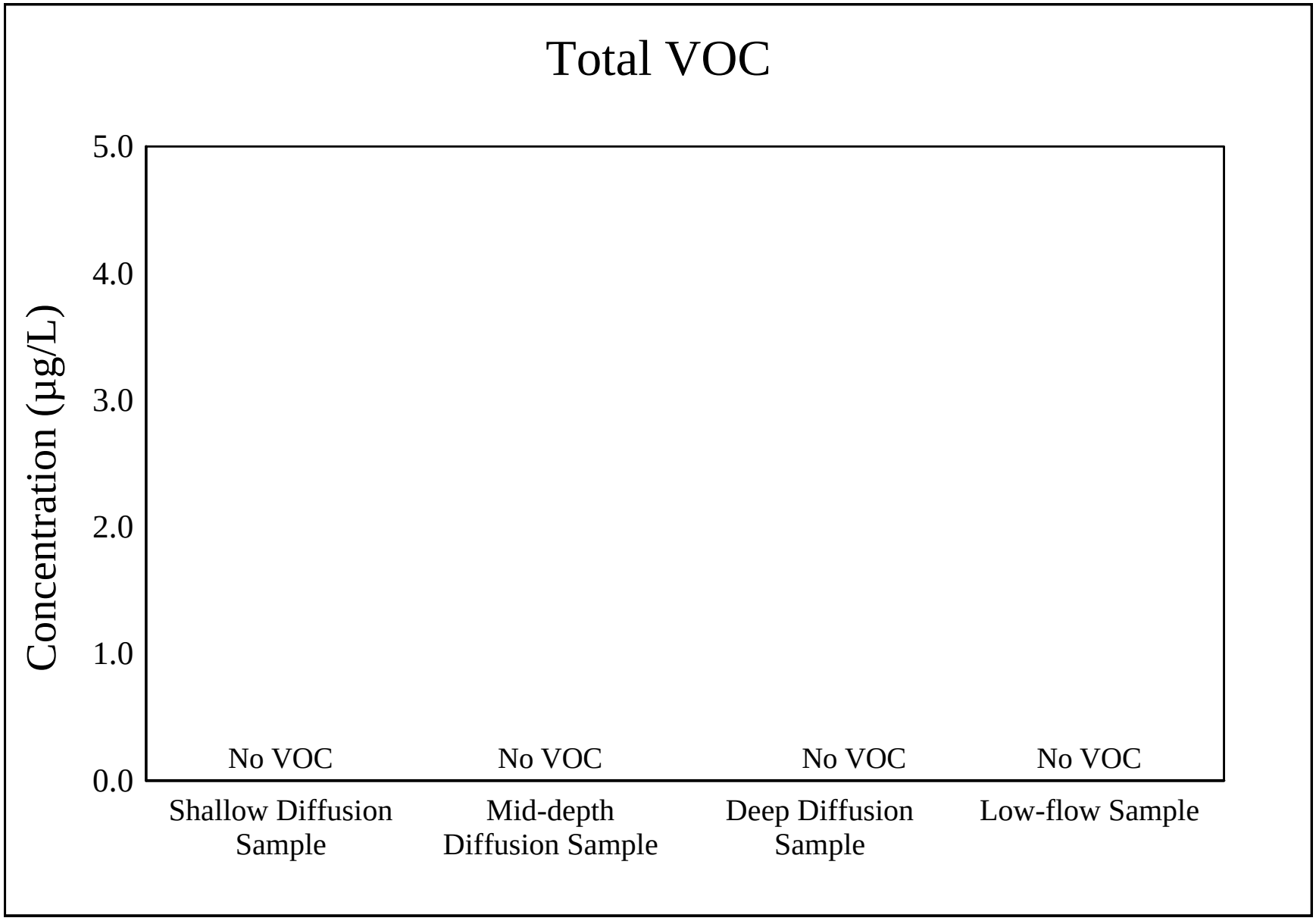
Attachment B

Graphs Summarizing Total Volatile Organic Compound Results for Monitoring Event 18

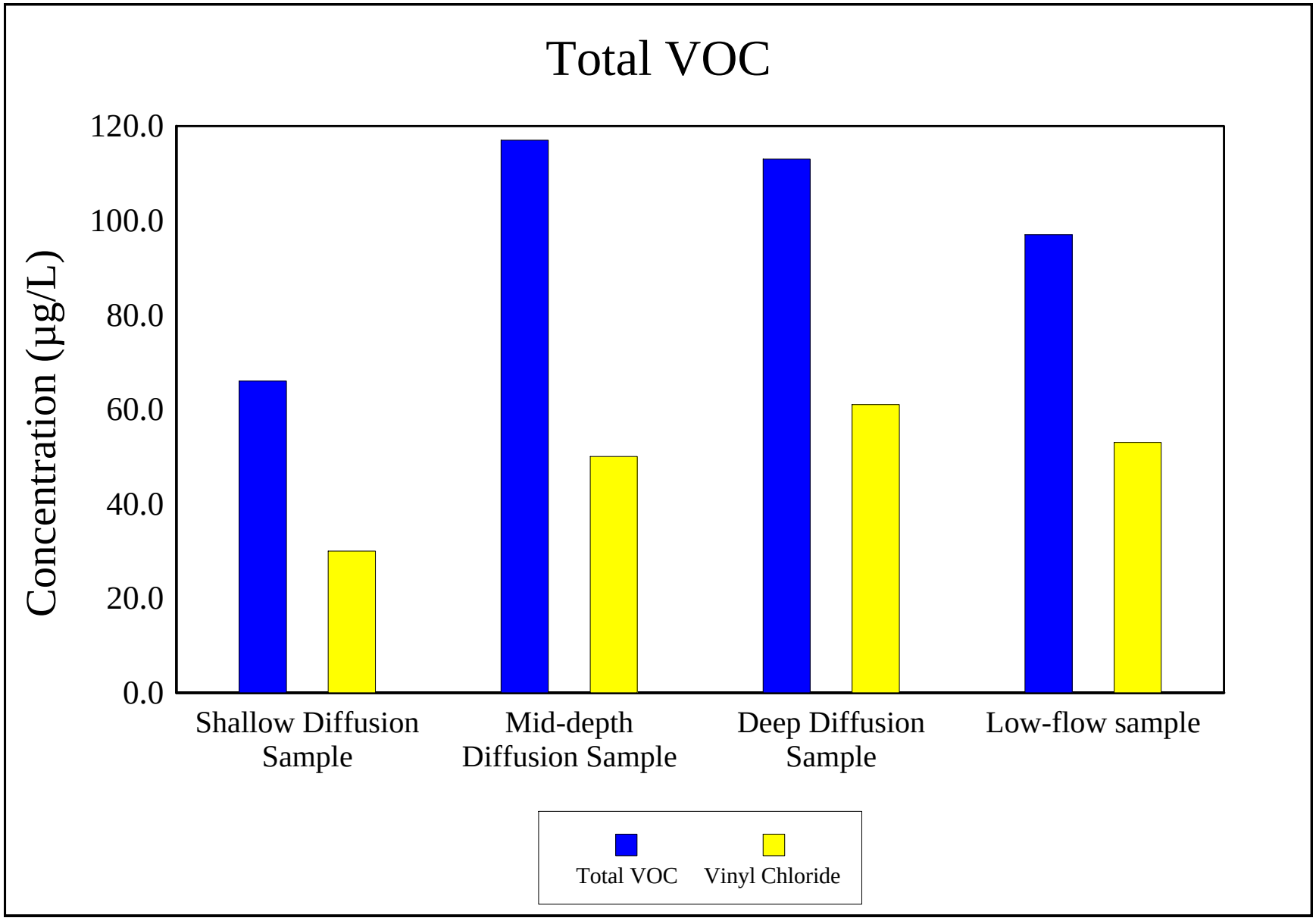
Site 9
MW-NASB-021



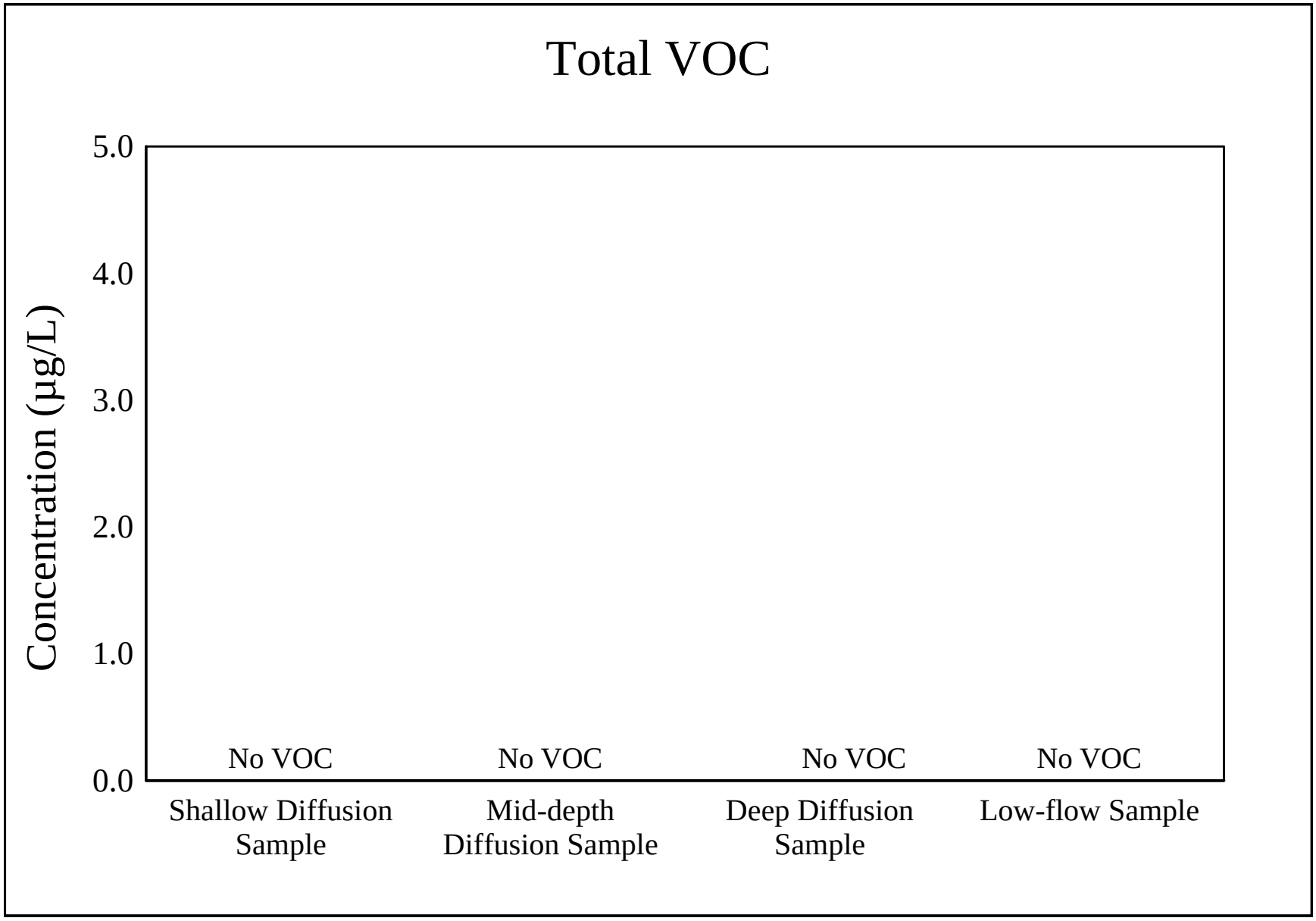
Site 9
MW-NASB-022



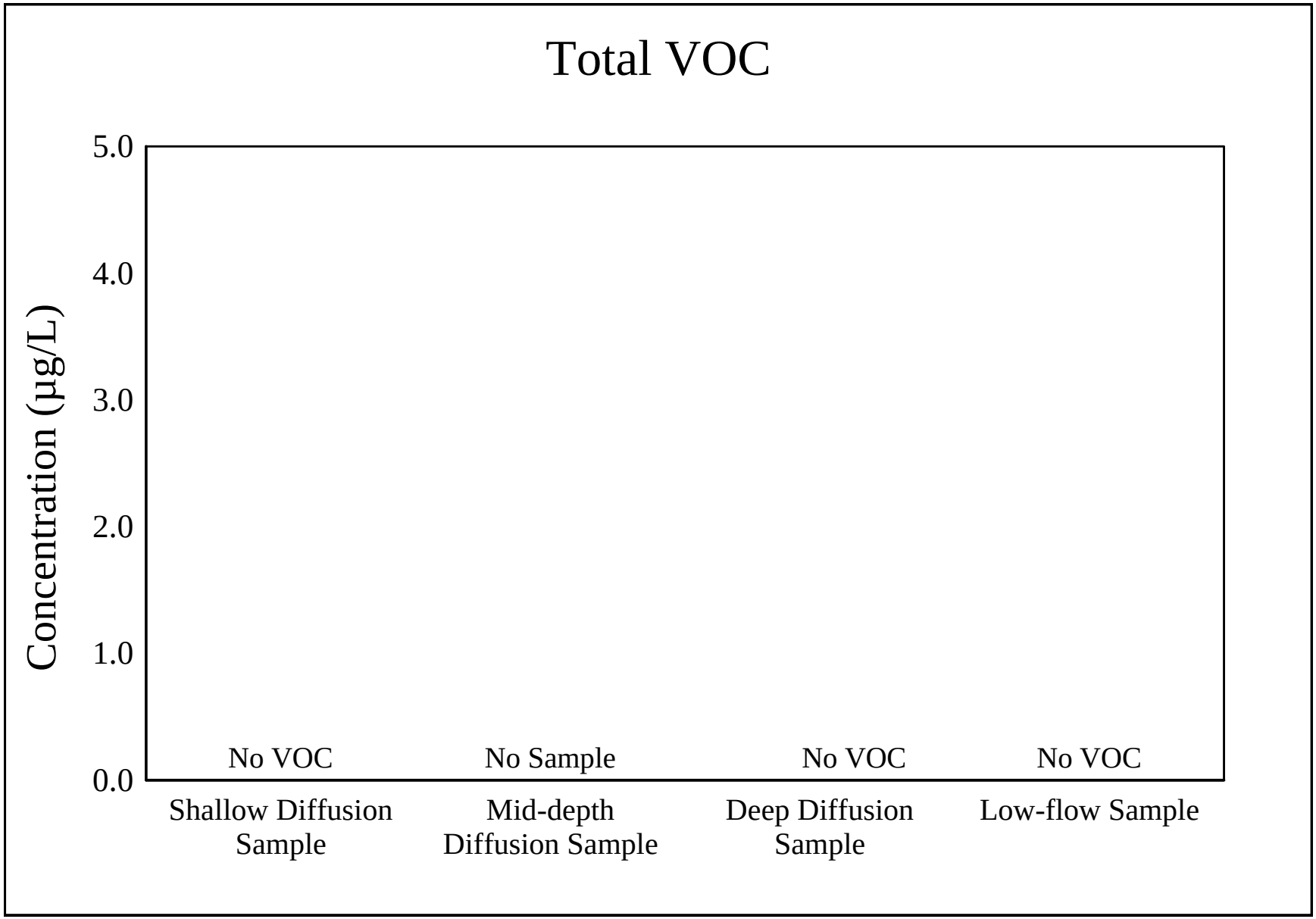
Site 9
MW-NASB-069



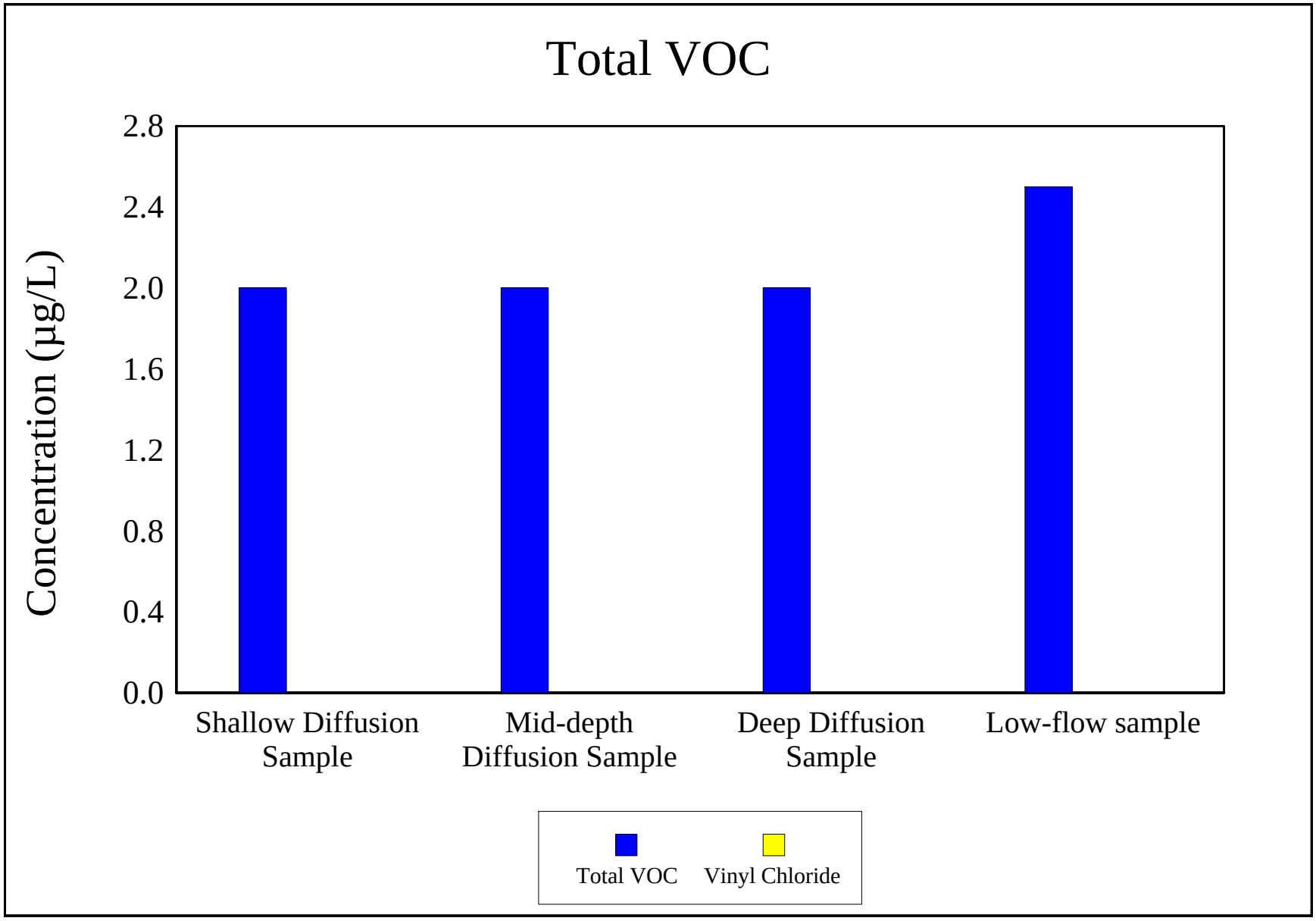
Site 9
MW-NASB-071



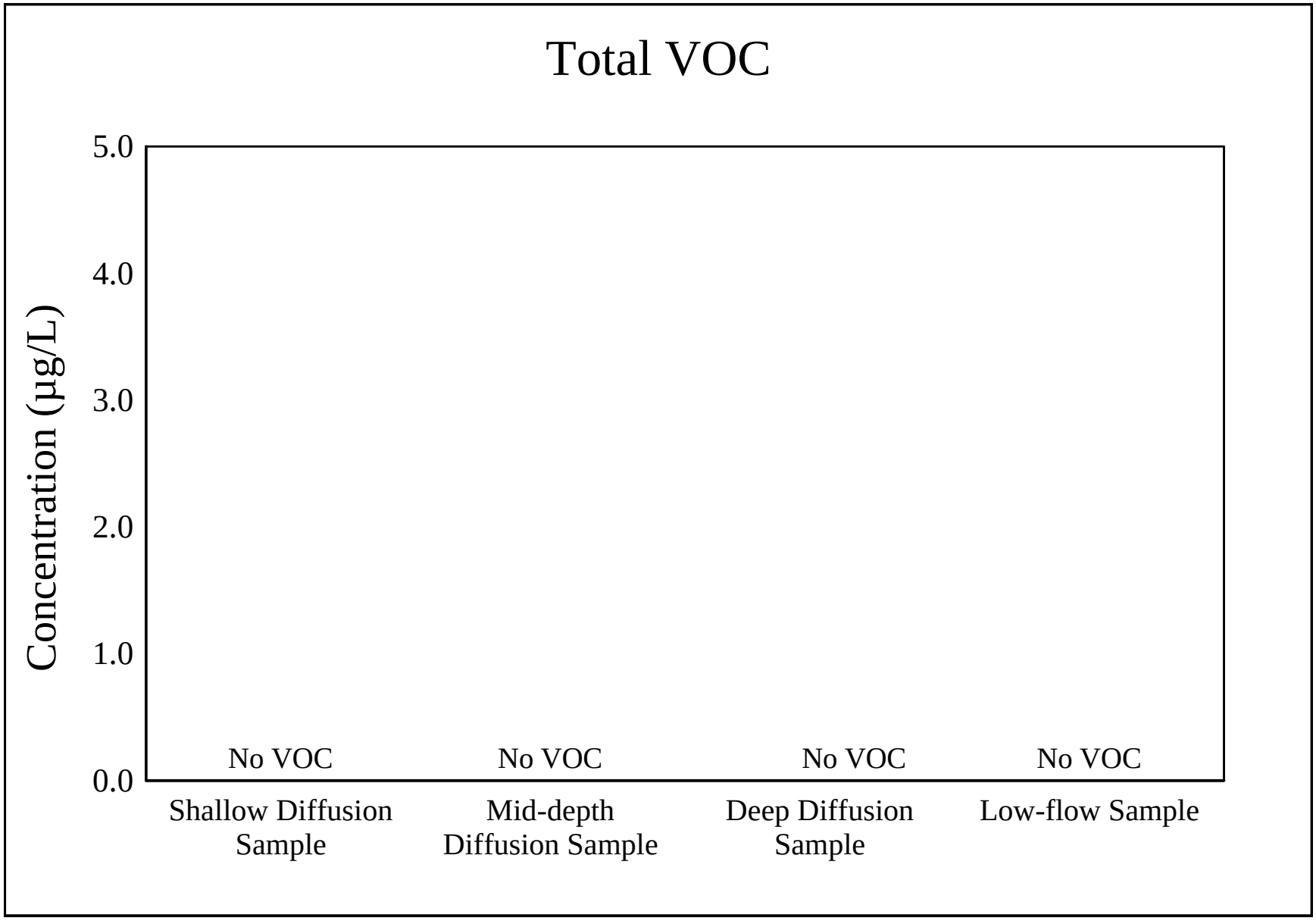
Site 9
MW-NASB-072



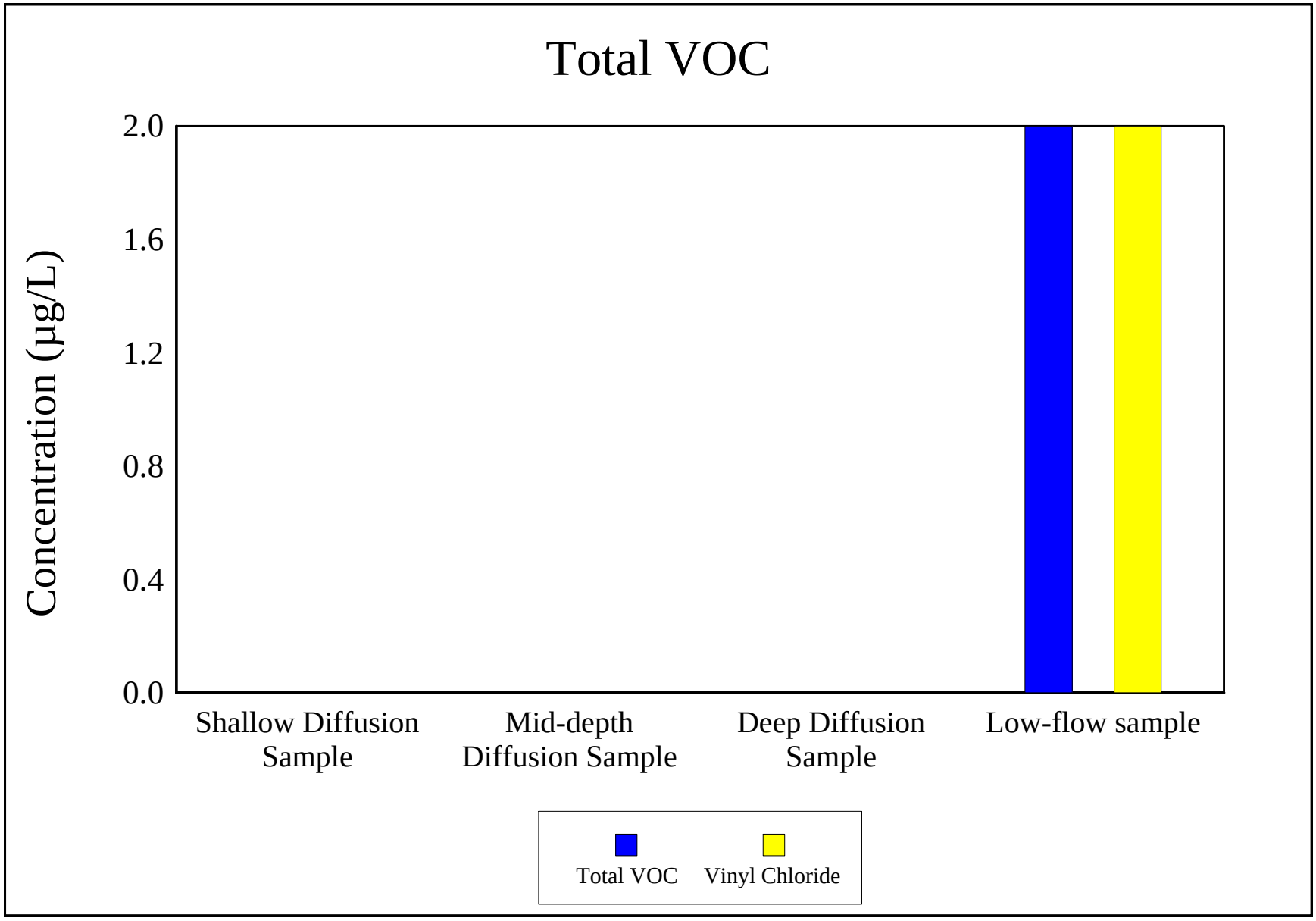
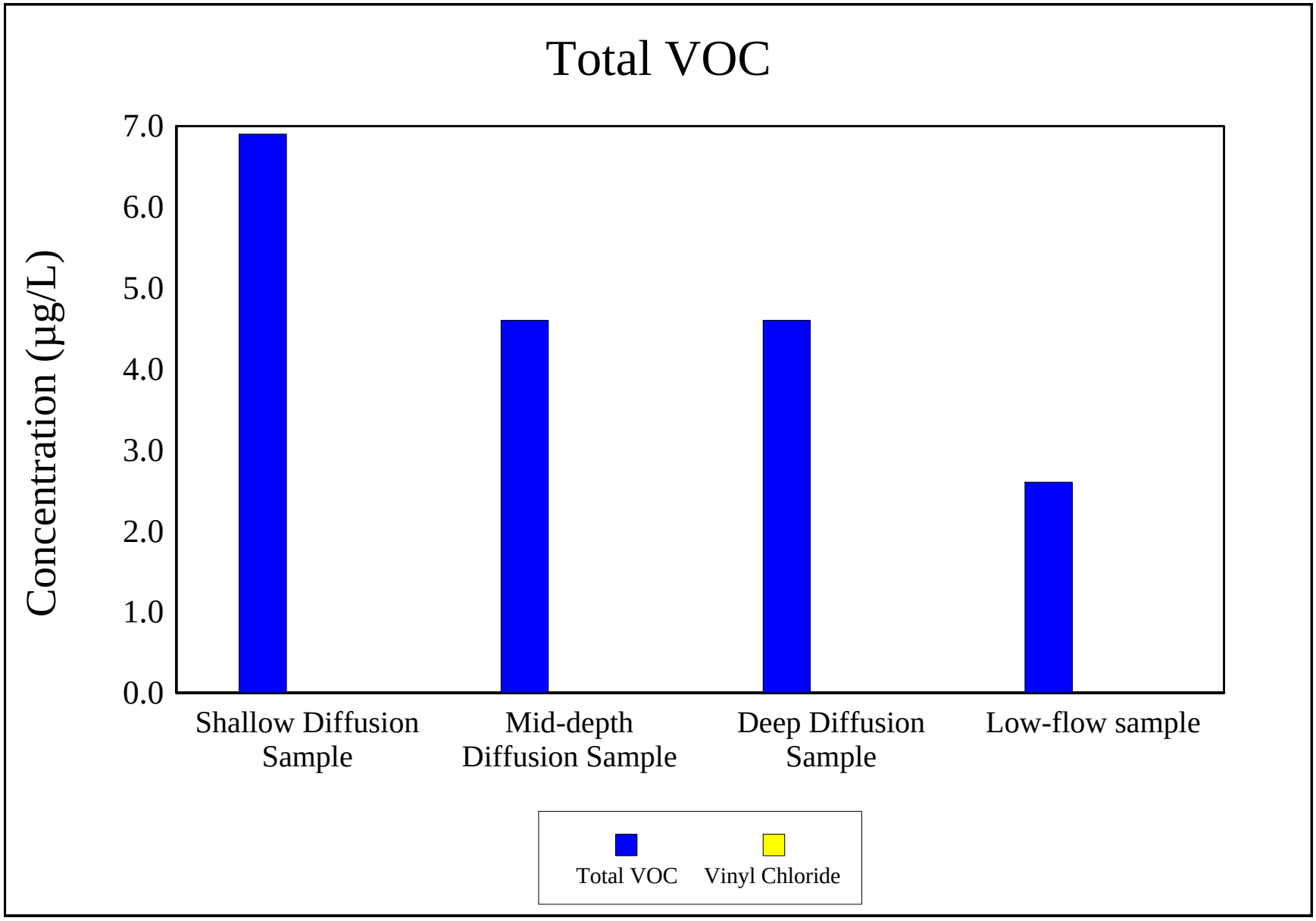
Site 9
MW-NASB-074



Site 9
MW-NASB-075



Site 9
MW-NASB-076



Site 9
MW-NASB-227