

Module1: Mann-Kendall Trend Test for Plume Stability (Non-parametric Statistical Test)

Site Name: *Former Texaco Facility*
 Site Address: *8701 Greenwood Avenue North, Seattle*
 Additional Description: *Natural Attenuation Analysis*

Well (Sampling) Location? **MW-11**
 Level of Confidence (Decision Criteria)? **85%**

1. Monitoring Well Information: Contaminant Concentration at a well: Quarterly sampling recommended.

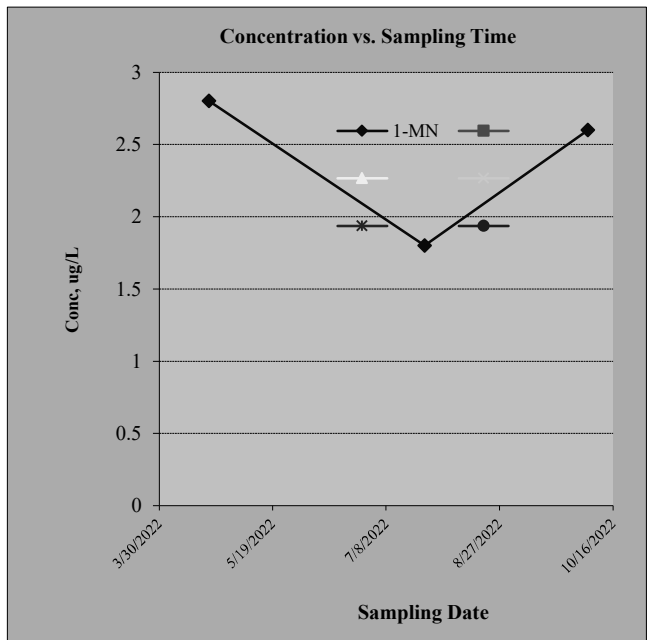
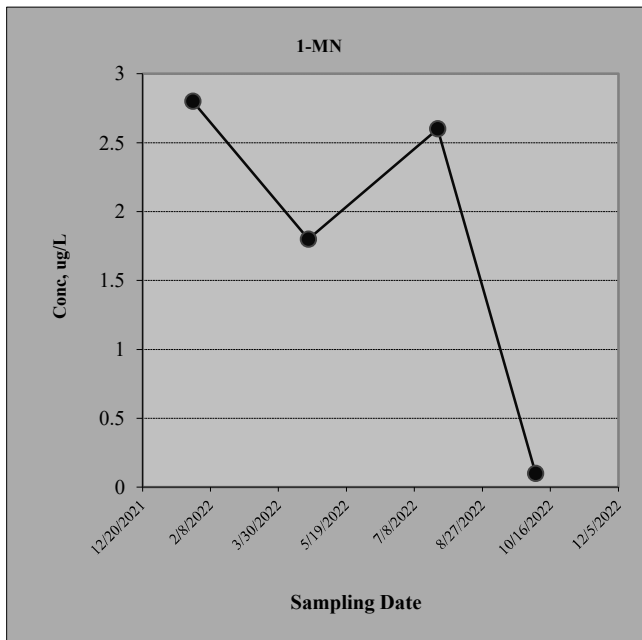
		Hazardous Substances (unit is ug/L)					
Sampling Event	Date Sampled	1-MN					
#1	1/26/2022	2.8					
#2	4/21/2022	1.8					
#3	7/25/2022	2.6					
#4	10/5/2022	0.1					
#5							
#6							
#7							
#8							
#9							
#10							
#11							
#12							
#13							
#14							
#15							
#16							

2. Mann-Kendall Non-parametric Statistical Test Results

Hazardous Substance?	1-MN					
Confidence Level Calculated?	83.30%	NA	NA	NA	NA	NA
Plume Stability?	Stable	NA	NA	NA	NA	NA
Coefficient of Variation?	CV <= 1	n<4	n<4	n<4	n<4	n<4
Mann-Kendall Statistic "S" value?	-4	0	0	0	0	0
Number of Sampling Rounds?	4	0	0	0	0	0
Average Concentration?	1.83	NA	NA	NA	NA	NA
Standard Deviation?	1.23	NA	NA	NA	NA	NA
Coefficient of Variation?	0.67	NA	NA	NA	NA	NA
Blank if No Errors found		n<4	n<4	n<4	n<4	n<4

3. Temporal Trend: Plot of Concentration vs. Sampling Time

Hazardous substance? **1-MN**
 Plume Stability? **Stable**



FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Vineta Mills, M.S.
Eric Young, B.S.

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fbi@isomedia.com
www.friedmanandbruya.com

January 30, 2023

Lynn Green, Project Manager
Evren Northwest, Inc.
PO Box 14488
Portland, OR 97293

Dear Mr Green:

Included are the additional results from the testing of material submitted on July 26, 2022 from the 1581-21001-02, F&BI 207422 project. There are 5 pages included in this report.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.



Michael Erdahl
Project Manager

Enclosures

c: Neil Woller, Paul Trone, Evan Bruggeman
ENW0130R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

CASE NARRATIVE

This case narrative encompasses samples received on July 26, 2022 by Friedman & Bruya, Inc. from the Evren Northwest 1581-21001-02, F&BI 207422 project. Samples were logged in under the laboratory ID's listed below.

<u>Laboratory ID</u>	<u>Evren Northwest</u>
207422 -01	Well-2-220725
207422 -02	Well-3-220725
207422 -03	Well-4-220725
207422 -04	Well-5-220725
207422 -05	Well-11-220725
207422 -06	Well-12-220725
207422 -07	EMW01-220725
207422 -08	MW-8-220725
207422 -09	Well-FD-220725
207422 -10	Trip Blank-220725

All quality control requirements were acceptable.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	Well-11-220725	Client:	Evren Northwest
Date Received:	07/26/23	Project:	1581-21001-02, F&BI 207422
Date Extracted:	07/26/22	Lab ID:	207422-05
Date Analyzed:	07/26/22	Data File:	072618.D
Matrix:	Water	Instrument:	GCMS12
Units:	ug/L (ppb)	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	21	11	65
Phenol-d6	13	11	65
Nitrobenzene-d5	82	50	150
2-Fluorobiphenyl	77	44	108
2,4,6-Tribromophenol	89	10	140
Terphenyl-d14	93	50	150

Compounds:	Concentration ug/L (ppb)
1-Methylnaphthalene	2.6

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	Method Blank	Client:	Evren Northwest
Date Received:	Not Applicable	Project:	1581-21001-02, F&BI 207422
Date Extracted:	07/26/22	Lab ID:	02-1832 mb3
Date Analyzed:	07/26/22	Data File:	072621.D
Matrix:	Water	Instrument:	GCMS9
Units:	ug/L (ppb)	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	22	10	60
Phenol-d6	13	10	49
Nitrobenzene-d5	87	15	144
2-Fluorobiphenyl	86	25	128
2,4,6-Tribromophenol	81	10	142
Terphenyl-d14	99	41	138

Compounds:	Concentration ug/L (ppb)
1-Methylnaphthalene	<0.2

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 01/30/23

Date Received: 07/26/23

Project: 1581-21001-02, F&BI 207422

**QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER
SAMPLES FOR SEMIVOLATILES BY EPA METHOD 8270E**

Laboratory Code: Laboratory Control Sample 1/0.5

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
1-Methylnaphthalene	ug/L (ppb)	5	80	76	64-93	5

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Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht - The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

207422

SAMPLE CHAIN OF CUSTODY 07-26-22

E03/AI/1004

Report To Lynn Green

Company EVREN-NW

Address 40 SE 24th Ave

City, State, ZIP Portland, Oregon 97214

Phone 503-452-5561

Email lynn@evren-nw.com

SAMPLERS (signature)

PROJECT NAME

1581-21001-02

PO #

REMARKS

MTCR Nocs and cPMTs

INVOICE TO

Project Specific RIs - Yes / No

Page #

1 of 1

TURNAROUND TIME

Standard Turnaround

RUSH

Rush charges authorized by:

SAMPLE DISPOSAL

Dispose after 30 days

Archive Samples

Other

ANALYSES REQUESTED

NWTPH-Dx	<input checked="" type="checkbox"/>
NWTPH-Gx	<input checked="" type="checkbox"/>
BTEX EPA 8021	<input checked="" type="checkbox"/>
MTCR # VOCs EPA 8260	<input checked="" type="checkbox"/>
PAHs EPA 8270	<input checked="" type="checkbox"/>
PCBs EPA 8082	<input checked="" type="checkbox"/>
CVOCS	<input checked="" type="checkbox"/>
total Pb, Cd	<input checked="" type="checkbox"/>
Dx = 1/5G	<input checked="" type="checkbox"/>
Volatile Organics	<input checked="" type="checkbox"/>
1-Methylnaphthalene	<input checked="" type="checkbox"/>

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	NWTPH-Dx	NWTPH-Gx	BTEX EPA 8021	MTCR # VOCs EPA 8260	PAHs EPA 8270	PCBs EPA 8082	CVOCS	total Pb, Cd	Dx = 1/5G	Volatile Organics	1-Methylnaphthalene	Notes	
WELL-2-220725	01A-H	07/15/22	14:08	GW	8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● per LG
WELL-3-220725	02 ↓		14:05	GW	8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● 8/3/22 ME
WELL-4-220725	03A-D		12:57	GW	4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
WELL-5-220725	04 ↓		11:02	GW	4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
WELL-11-220725	05A-H		11:10	GW	8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● per EC/LG
WELL-12-220725	06A-I		11:50	GW	9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● 1/6/22 ME
EMM01-220725	07A-H		12:49	GW	8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
MM-8-220725	08 ↓		15:03	GW	8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
WELL-FD-220725	09 ↓		9:35	GW	8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Top Blank-220725	10A-B			W	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

SIGNATURE

PRINT NAME

COMPANY

DATE

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Relinquished by:

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Received by:

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Received by:

PRINT NAME

COMPANY

DATE

TIME

Friedman & Bruya, Inc.

3012 16th Avenue West

Seattle, WA 98119-2029

Ph. (206) 285-8282

Dem Sells
Ann W Brugg

Samples received at 5:00

From: [Unruh, David \(ECY\)](#)
To: ["Lynn Green"](#); [Evan Bruggeman](#); [Erik Chapman](#)
Cc: [Maninder Singh](#)
Subject: RE: NW3329 - MW-11 PAHs Question
Date: Monday, January 30, 2023 10:17:02
Attachments: [image001.png](#)

Lynn,

Thank you for contacting the lab and including the requested data from MW-11. This should clear up our concerns about the well, there isn't a need for further sampling at this time. If you could please provide a .pdf the Mann-Kendall analysis provided in your earlier email, a time-series plot for 1-methylnaphthalene concentration at MW-11, and the lab report from the July sampling event, that should be sufficient. We're working on the second of two reviews of the letter and should have that to you soon. Thanks again for your work with this Site!

Best,
David

David Unruh, LG (he/him) | Department of Ecology | Toxics Cleanup Program | Site Manager
Cell: 206.459.6287 | Fax: 206.366.7810 | david.unruh@ecy.wa.gov
PO Box 330316, Shoreline, WA, 98133-9716

From: Lynn Green <lynng@evren-nw.com>
Sent: Friday, January 27, 2023 09:28
To: Unruh, David (ECY) <dunr461@ECY.WA.GOV>; Evan Bruggeman <evanb@evren-nw.com>; Erik Chapman <erikc@evren-nw.com>
Cc: Maninder Singh <MSingh@KAGreaterSeattle.Com>
Subject: RE: NW3329 - MW-11 PAHs Question

David, we received the lab data for the July 2022 sampling event for MW-11. Based on that data, the plume was determined to be staple at 85% level of confidence, and shrinking at 80% level of confidence. See attached. Based on this data, do you have any additional concerns with MW-11? Also, is this sufficient, so will you need us to write this up as a Technical Memorandum? Thanks, David! Lynn

Lynn D. Green, Ph. D.
P.G./R.G./L.G./C.E.G./L.E.G.
Principal Engineering Geologist / Hydrologist
EVREN Northwest, Inc
Environmental and Natural Resource Consulting
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From: Unruh, David (ECY) <dunr461@ECY.WA.GOV>
Sent: Wednesday, January 25, 2023 9:16 AM
To: Lynn Green <lynng@evren-nw.com>; Evan Bruggeman <evanb@evren-nw.com>; Erik Chapman <erikc@evren-nw.com>

Cc: Maninder Singh <MSingh@KAGreaterSeattle.Com>

Subject: NW3329 - MW-11 PAHs Question

Hi All,

I have a question about PAHs in a sample from MW-11 that came up during Ecology's review. Groundwater samples collected in January and April 2022 contained 1-methylnaphthalene slightly above the cleanup level. From what I could tell from the COC forms, it looks like the sample collected during the July 2022 monitoring event was analyzed for cPAHs, which do not include 1-methylnaphthalene. The October 2022 sample did not contain 1-methylnaphthalene above the reporting limit. Based on the two exceedances in January and April 2022, we do need to demonstrate that this contaminant plume at MW-11 is either stable or shrinking.

We can use the [MTCA Stat tools](#) and the [Monitored Natural Attenuation Guidance document](#) to analyze the stability of the 1-methylnaphthalene plume, particularly Package A under "Natural Attenuation of petroleum-contaminated groundwater". A Mann-Kendall non-parametric test can be used to evaluate plume stability. The test requires at least 4 consecutive quarters of data for evaluation. If the lab has the data for 1-methylnaphthalene for the July 2022 event, we can use that to evaluate plume stability at MW-11. If those data are not available, we'll need to continue to monitor PAHs at MW-11 until we do have 4 consecutive quarters of data.

Ecology is still continuing with its review of the Site NFA Likely letter and will still be able to issue you that opinion after the review process has been completed. I just wanted to keep you all up to date so we can continue collecting samples from MW-11 if the lab data from July are not available. Thank you for your understanding, please let me know if you have any further questions or concerns.

Thank you,
David

David Unruh, LG (he/him) | Department of Ecology | Northwest Regional Office - Toxics Cleanup Program | Site Manager

Cell: 206.459.6287 | Fax: 206.366.7810 | david.unruh@ecy.wa.gov

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