# Memo

**SUBJECT**
Evaluation of Potential Dust Transport at Point Hennepin

**DATE**
November 8, 2024

**DEPARTMENT**
Environmental

**COPIES TO**
Jackie Saling, Arcadis
Michael Gerdenich, BASF

**TO**
Eric Larson, EGLE

**OUR REF**
Point Hennepin Dust Memo

**PROJECT NUMBER**
30229361

**NAME**
Russell Jalbert
205 930-5937, russ.jalbert@arcadis.com
Andrea Golli
330-515-5721, andrea.golli@arcadis.com

## Objective/Purpose

EGLE has requested that BASF evaluate the potential for dust being transported by wind from Point Hennepin (Pt. Hennepin) toward Grosse Ile. Based on the current Site conditions and the multiple lines of evidence analysis described below, the probability of windblown particulate matter originating from Pt. Hennepin is low. Therefore, transport of dust toward Grosse Ile via wind is not expected and air monitoring is not necessary. BASF will continue its ongoing vegetation expansion and maintenance activities to ensure that any exposed soil areas that may have the potential to create airborne dust during high wind events are minimized.

## Brief History of Site

Pt. Hennepin is a 225-acre river island within the Detroit River located immediately north of Grosse lle and east of Wyandotte, Michigan. Pt. Hennepin was used as a repository for distiller blow-off (DBO), a byproduct of soda ash production that was deposited on Pt. Hennepin from 1911 until 1951. Additionally, the island was used to produce salt brine from 1943 until 1980 when the manufacturing of soda ash ceased. Since that time, the Site has undergone stabilization, filling of sinkholes, and habitat development. Currently, the surface of the island consists of a soil layer that ranges in thickness from six inches to two feet that supports a vegetation cover of grasses, bushes, shrubs, and small trees.

BASF is currently working with Michigan's Department of Environment, Great Lakes, and Energy (EGLE) to investigate the potential for groundwater from the site to discharge to the Detroit River. BASF is also continuing efforts to effectively manage stormwater, manage slope stability, shoreline protection, and the island's overall appearance. These efforts are designed to develop and promote a sustainable maintenance program that is protective of human health and the environment. The overarching goal for the Site is to obtain closure through EGLE's Part 201 program that incorporates a sustainable perimeter groundwater management approach and allows for the establishment of the Site as a wildlife refuge.

## General Site Conditions

Currently, almost all 225-acres of Pt. Hennepin is vegetated (Photos 1, 2, 3, 6, 7, and 12 in Attachment 1), with the primary exception being a network of gravel and small grass/gravel roads along the island's perimeter and extending inland. The vegetation consists mainly of grasses, bushes, shrubs, and small trees. One gravel road is

maintained from the bridge to the central sink hole to accommodate occasional truck traffic to this area. Any dust that would be generated from infrequent vehicle traffic on this access road would be related to imported gravel. Other than infrequent truck traffic on this gravel road, there are currently no construction activities on the island that would generate dust.

Soil boring data collected during Arcadis's 2023 piezometer installations along the island perimeter as well as recently advanced geotechnical borings on the interior of the island indicate that DBO is not present at the surface but is found at depths of six inches to two feet below ground surface (bgs). There are a few isolated areas where DBO is present near the surface which includes an area on the east side of the island (Photos 9 and 10). This area is wet most of the year which reduces the likelihood of wind generated dust (see precipitation data on Table 1 through 3). When drying of the of this area does occur, a crust is formed on the surface decreasing the likelihood of the DBO being windblown, even in dry conditions (Photo 10). BASF is working to extend vegetation to this area.

Note that the thin vegetation in the southeast corner of the island in a low laying marshy area is a result of the area being saturated most of the year which has limited the ability of the grasses to grow (Photo 4). The wet conditions limit the potential for dust generation in this area. Additionally, DBO is not evident on the ground surface in this area and there is no vehicle or pediatrician traffic that disturbs the soil to generate dust.

BASF is evaluating stormwater management, slope stability, shoreline protection and the overall appearance of the island. During a soil investigation to support these activities in 2022 and 2023, twenty-one (21) soil samples were collected. Sample locations were selected to represent areas with potential for surface erosion or exposed DBO. Samples were analyzed for pH and a variety of soil nutrients, including near surface (0 to1 ft below ground surface) and deeper soil (2-3 feet below ground surface). In 2024, additional soil samples were collected during a grading project. Soil samples were collected from 3 soil horizons: 1) the upper six inches, 2) from 6 inches to 2 feet, and 3) below 3 feet. A sample was collected from each of these three layers and submitted for analysis. Refer to Attachment 2 for a summary of the results and a figure with soil sample locations. Overall results show that surficial soil had an average pH at 7.8. Any dust that generated on the island would have similar characteristics to the surface soil which is in a typical soil pH range.

# Local Meteorology

While the Site conditions result in very low potential for the generation and/or transport of dust offsite, a review of local meteorological conditions was also conducted to determine the potential frequency for windblown dust to be lifted off the ground surface and transported toward Grosse Ile, south of Pt. Hennepin. Seasonal weather conditions can affect local soil conditions identifying periods when the soil condition may be moist or dry, snow-covered, covered with seasonal grasses/vegetation or barren. Precipitation, precipitation type, and relative humidity play important roles in soil moisture. The island is in a region that routinely experiences below freezing temperatures and is snow covered for significant periods of time during the winter months (Table 3) significantly limiting the potential for windblown dust. In addition, it is likely that, when not frozen, the ground material is inherently wet during winter and through early Spring due to limited surface moisture evaporation as a result of shorter days along with lower solar insolation and sun angles. The monthly average precipitation, snowfall, and snow cover datasets for the past 10 years (2015-2024) observed at the nearby Wyandotte, Michigan weather station are provided in Tables 1 through 3.

**Table 1 10-Year Monthly Precipitation (inches)**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | 1.64 | 1.64 | 0.95 | 2.14 | 5.99 | 5.94 | 2.64 | 3.51 | 2.3 | 2.41 | 2.55 | 2.85 | 34.6 |
| 2016 | 1.43 | 2.43 | 5.06 | 2.26 | 2.97 | 0.78 | 3.48 | 6.8 | 4.98 | 3.02 | 1.84 | 2.72 | 37.8 |
| 2017 | 3.08 | 1.62 | 4.88 | 3.02 | 4.97 | 1.58 | 3.11 | 5.21 | 0.98 | 2.73 | 4.49 | 1.76 | 37.4 |
| 2018 | 1.36 | 4.45 | 2.86 | 4.31 | 7.82 | 3.88 | 0.88 | 2.63 | 5.78 | 3.33 | 3.91 | 1.65 | 42.9 |
| 2019 | 2.73 | 2.17 | 2.63 | 3.89 | 5.74 | 3.03 | 1.94 | 3.52 | 3.9 | 3.69 | 2.86 | 2.47 | 38.6 |
| 2020 | 4.58 | 1.44 | 3.77 | 2.41 | 3.56 | 3.16 | 5.72 | 7.47 | 2.66 | 3.27 | 2.64 | 1.98 | 42.7 |
| 2021 | 1.1 | 1.59 | 2.08 | 2.17 | 1.86 | 4.62 | 6.28 | 6.05 | 5.48 | 5.37 | 2.18 | 3.15 | 41.9 |
| 2022 | 0.65 | 2.78 | 2.23 | 2.68 | 4.24 | 2.56 | 1.6 | 2.69 | 1.25 | 0.69 | 1.93 | 2.31 | 25.6 |
| 2023 | 3.4 | 3.32 | 3.08 | 3.75 | 1.02 | 2.78 | 7.24 | 5.05 | 1.8 | 2.41 | 1.25 | 2.3 | 37.4 |
| 2024 | 5.18 | 0.17 | 2.04 | 4.75 | 2.83 | 3.48 | 5.41 | 5.11 | 1.42 | - | - | - | *30.4* |
| Avg. | 2.52 | 2.16 | 2.96 | 3.14 | 4.1 | 3.18 | 3.83 | 4.8 | 3.24 | 2.99 | 2.63 | 2.35 | *37.6* |

Note: Data downloaded from the Midwestern Regional Climate Center website.

**Table 2 10-Year Monthly Snowfall (inches)**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | 14.5 | 26.8 | 3 | T | M | M | M | 0 | 0 | T | 5 | 1.4 | 50.7 |
| 2016 | 9.2 | 9.8 | 7.5 | 2.1 | T | 0 | T | 0 | 0 | 0 | 0.1 | 18.5 | 47.2 |
| 2017 | 13.1 | 2.1 | 7.7 | 0.1 | 0 | 0 | 0 | T | 0 | T | T | 23.3 | 46.3 |
| 2018 | 9.7 | 21.7 | 5.6 | 2.2 | 0 | 0 | 0 | 0 | 0 | 0 | 6.1 | 0.3 | 45.6 |
| 2019 | 14.5 | 7.2 | 3.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9.1 | 2.2 | 36.8 |
| 2020 | 10.4 | 14.9 | 1.8 | 4.7 | 0.7 | 0 | 0 | 0 | 0 | 0 | 1.9 | 11.9 | 46.3 |
| 2021 | 5.9 | 22.8 | 0 | 4.5 | 0 | 0 | 0 | 0 | 0 | 0 | 6.6 | 3.3 | 43.1 |
| 2022 | 9.4 | 20.2 | 3.7 | 4.4 | 0 | 0 | 0 | 0 | 0 | 0 | 2.9 | 5.1 | 45.7 |
| 2023 | 11.6 | 2 | 15.5 | 0.1 | T | T | 0 | 0 | 0 | 0 | 2.1 | T | 31.3 |
| 2024 | 16 | 2.5 | 0.7 | 0.1 | 0 | 0 | 0 | 0 | 0 | - | - | - | 19.3 |
| Avg. | 11.4 | 13 | 4.9 | 1.8 | 0.1 | 0 | 0 | 0 | 0 | 0 | 3.8 | 7.3 | 42.8 |

Note: Data downloaded from the Midwestern Regional Climate Center website. “T” signifies Trace amount of snowfall (< 0.1 inch).

**Table 3 10-Year Monthly Snow Cover (inches)**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | 6 | 18 | 13 | 0 | M | M | M | 0 | 0 | 0 | 4 | T |
| 2016 | 6 | 4 | 4 | T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 2017 | 6 | 6 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | T | 9 |
| 2018 | 8 | 14 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 2019 | 5 | 5 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 1 |
| 2020 | 6 | 5 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | T | 4 |
| 2021 | 2 | 15 | T | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 |
| 2022 | 5 | 8 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 |
| 2023 | 6 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 2024 | 7 | T | T | 0 | 0 | 0 | 0 | 0 | 0 | - | - | - |
| Avg. | 6 | 8 | 4 | 2 | - | - | - | - | - | - | 3 | 4 |

Note: Data downloaded from the Midwestern Regional Climate Center website. “T” signifies Trace amount of snowfall (< 0.1 inch).

This precipitation data shows that the island receives greater than 37 inches of rain a year. The summer months when evaporation is most likely to dry out the soil are also the months with the greatest precipitation between May and September where there is an average of 3.18-4.8 inches per month. The island receives snowfall that blankets the island approximately November through April. This would only leave one month of the year, October, where there is no snowfall and less rain. Note, that even in October, the average precipitation is 2.99 inches rain. Taking into account all of the precipitation data evaluated, the likelihood of dry conditions that would support the generation of dust is low.

An analysis of the prevailing winds was conducted to evaluate whether airborne particulate matter (i.e., dust), if generated, has the potential to impact the closest residences situated to the south of the Pt. Hennepin. The potential for transport of particulate matter as airborne dust is dependent on particle size of the surface material, moisture content, condition of the top layer (i.e., crusted over or loose), wind speed as well as the duration of the high wind event. To support this analysis, wind data (e.g., wind speed and direction) that is continuously observed and recorded at the Grosse Ile Municipal Airport (Station #725373 54819) was evaluated. The winds experienced at this location are approximately 5 miles south of Pt Hennepin and are therefore representative for the island. A 5-year annual wind rose was created using the data from Grosse Ile airport (2019-2023) as well as the period when snow cover will least likely be present (June – October). Wind roses are used to display the direction, speed, and frequency of observed winds observed in a specific area. A wind rose displays the direction(s) from which the prevailing winds (i.e., dominant wind direction) have been observed over a specified period of time. Typically, a 5-year wind dataset provides a good representation of the expected observed winds for a specific location. In addition, the wind rose shows the frequency of the different wind speed classes recorded for each wind direction sector (i.e., every 10 degrees). The longer the wind speed class colored area, the more frequent that wind speed range was observed. On the other hand, the opposite is true where the thinner colored area

shows a less frequent occurrence of that specific wind speed / wind direction combinations. The color scheme used by the wind rose software ranges from gray, yellow, red, blue, green and cyan (low to high). The lower speed winds usually dominate the wind rose analysis since those wind speeds occurred more frequently. The wind roses were created showing the direction that winds are coming “from” and are presented in Figures 1 and 2.

**Figure 1 – 5-Year Annual Wind Rose (FROM) – Grosse Ile Municipal Airport**

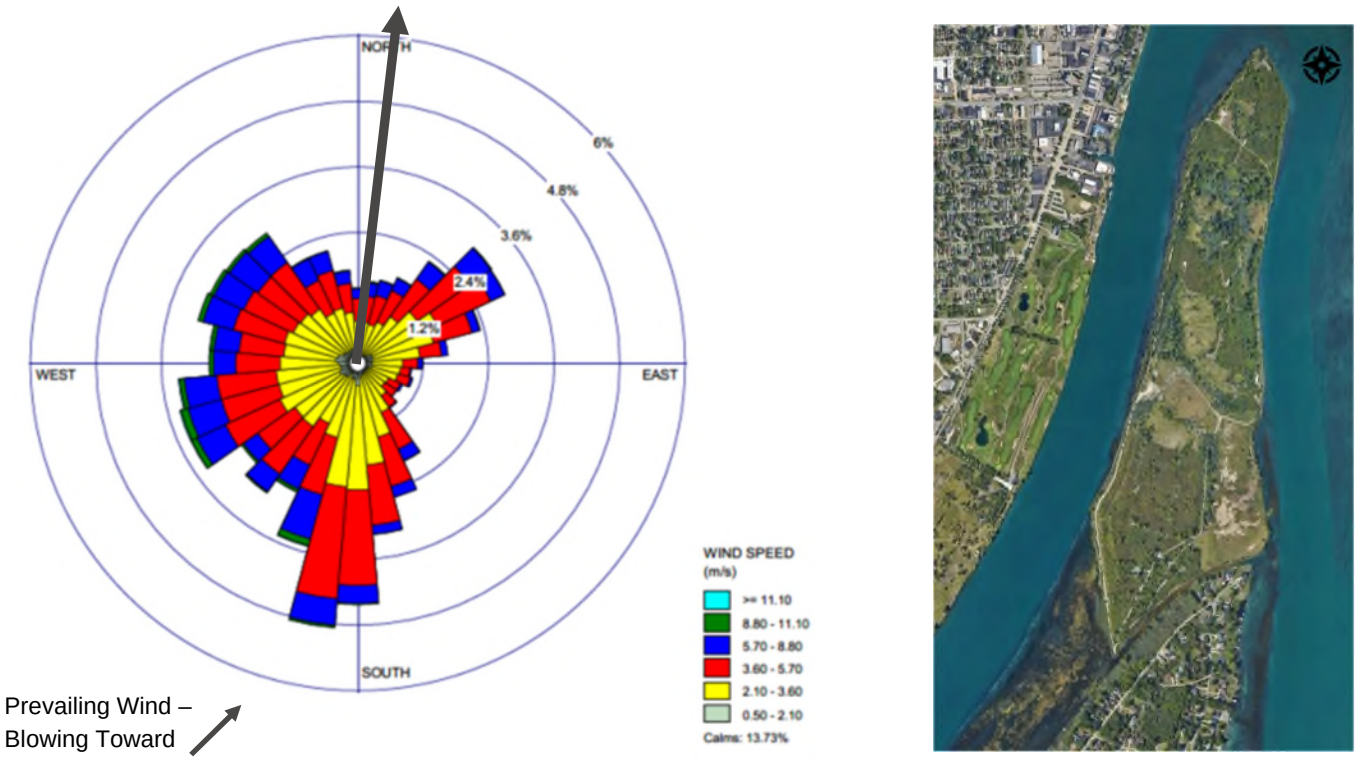
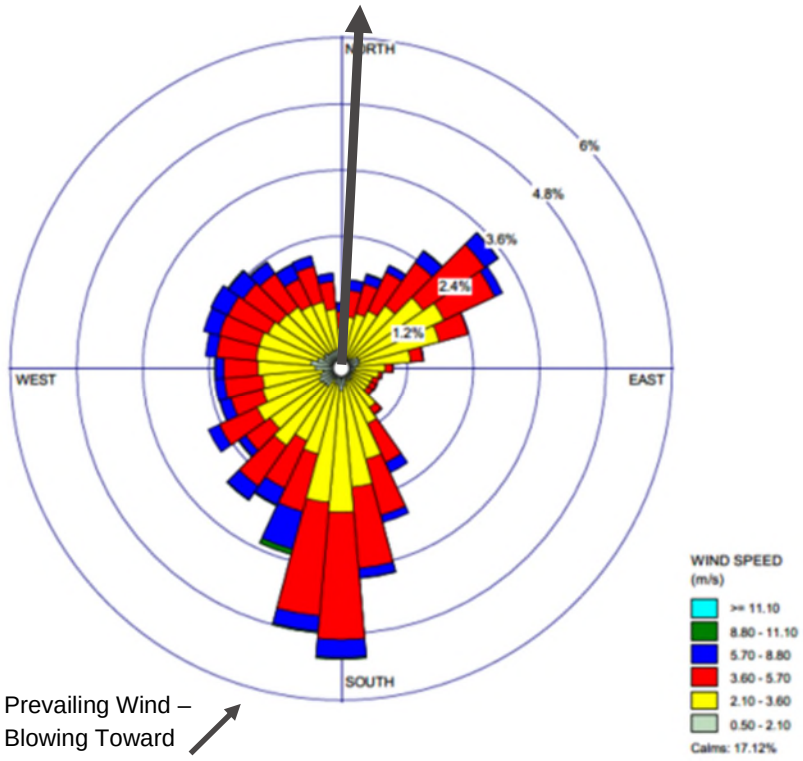



**Figure 2 – June-October 5-Year Wind Rose (FROM) – Grosse Ile Municipal Airport**



Overall, the prevailing winds blow from the south toward the north, therefore, blowing away from Grosse Ile. The second most frequent direction the wind blows from is northeast to southwest. The wind pattern is consistent for the annual time period as well as the summer/ autumn period, but the summer/autumn shows a lower frequency of higher wind speeds (identified by the absence of green and cyan colors in the presented wind roses). Average annual wind speed is 3.17 m/s (7.1 mph), whereas the summer autumn average is 2.71 m/s (6.1 mph). In addition, the summer months have lower wind speeds than the annual average.

Based on particulate matter exposure guidance (Coherd et. al., 1985), erodible particulate matter (i.e., dust) is dependent on the amount of erodible particles that may be present at the ground-level threshold friction velocity necessary for initiating movement of these particles on the ground surface. Note that crusted over surfaces or surfaces completely covered with vegetation and grasses are thought to have no or a very limited reservoir of erodible particles. Coherd et. al. established a cutoff threshold friction velocity of 75 cm/sec which corresponds to an ambient windspeed of approximately 10 m/s (22 mph). For this discussion and review of the nearby wind data, it has been assumed that a wind speed of greater than 8.8 m/s (19.6 mph) is the necessary to transport dust particles. The criteria are based on the wind speed category ranges used as a default in the wind rose software, WRPLOT, where the two highest category bins are 8.8 – 11.1 m/s (19.7 – 24.8 mph) and greater than 11.1 m/s (>24.8 mph). A wind speed frequency analysis was conducted using these two wind speed categories. Wind directions from approximately 340$^{o}$ to 10$^{o}$ blow toward Grosse Ille. Based on the five years of hourly wind data (2019-2023) reviewed, the wind blew greater than 19.7 mph approximately 1.4% of the time. If the analysis only looks at the wind directions impacting the northern portion of Grosse Ile, the occurrences drop to 0.08% of the time (~7 hours per year on average). If only the summer and fall months are analyzed (i.e. when wet and/or snow-covered conditions are less likely to exist), the frequency drops to average of less than 3 hours per year. Therefore, there is a very low likelihood that the higher winds necessary to erode particles from the ground surface in the few unvegetated, not wet, or not crusted areas on the island and then be transported in a southerly direction where the nearest residences are located.

# Conclusion

Based on the current Site conditions that include vegetation coverage on the island, limited exposed soil surface areas, and no construction activities, the probability of windblown particulate matter generation is very low. Recent soil sampling at the island shows that soils at the surface are nutrient rich and at a neutral pH. The very few exposed areas are either crusted over, frozen/snow covered, or continually moist based on the seasonal weather conditions, also pointing a very low potential for windblown particulate matter. Additionally, the local meteorological data indicates there is less than 3 hours per year that wind blows at the required speed and direction to transport dust from the Point Hennepin toward Grosse Ile. Therefore, transport of dust toward Grosse Ile via wind is not expected and air monitoring is not necessary. BASF will continue its ongoing efforts to promote plant growth and maintenance activities to minimize exposed soil areas that may have the potential to create airborne dust during high wind events.

Enc.

Attachment 1 - Photograph Log

Attachment 2 – 2022 and 2023 Soil Data

# References

Golder Associates USA Inc. Geotechnical Data Report for Point Hennepin, Grosse Ile, Wayne County, Michigan. February 9, 2022

cli-MATE. Midwestern Regional Climate Center. Purdue University. http://mrcc.purdue.edu/CLIMATE accessed on: 8/29/2024.

Coherd, Chatten. Muleski, Gregory E. et. al. Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites. Midwest Research Institute. Office of Health and Environmental Assessment, ORD, USEPA. 1985

# Attachment 1

## Photograph Log

# Photograph Log

BASF
Dust Memo
Point Hennepin

**Photograph: 1**

**Description:**
General View of vegetation on the island. Photograph taken near SMW/DMW-8

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

**Photograph: 2**

**Description:**
View of cleared vegetation along access path in the southern portion of the island.

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

# Photograph Log

BASF
Dust Memo
Point Hennepin

**Photograph: 3**

**Description:**
Mow lines in the southeast side of the island.

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

**Photograph: 4**

**Description:**
Southeast corner of the island with dry soil and thin vegetation from being saturated in the wetter seasons.

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

# Photograph Log

BASF
Dust Memo
Point Hennepin

**Photograph: 5**

**Description:**
Gravel road being succeed with grasses in the south portion of the island.

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

**Photograph: 6**

**Description:**
Maintained access through vegetation near B-4.

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

# Photograph Log

BASF
Dust Memo
Point Hennepin

**Photograph: 7**

**Description:**
Vegetation and mowed road in the northern end of the island.

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

**Photograph: 8**

**Description:**
Gravel road maintained to the Central Sinkhole on the southwest side of the island. Tree stumps and gravel piles visible.

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

# Photograph Log

BASF
Dust Memo
Point Hennepin

**Photograph: 9**

**Description:**
Saturated area with DBO near surface on the east side of island near SMW-5

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

**Photograph: 10**

**Description:**
Close-up view of saturated area showing crust layer and moisture in area in August during the dry season.

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

# Photograph Log

BASF
Dust Memo
Point Hennepin

**Photograph: 11**

**Description:**
Remnants of concrete pad and gravel pile in vegetated landscape in northern portion of the island.

**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

**Photograph: 12**

**Description:**
View of vegetation and riprap along the southern channel. Water level meter visible near PZ-11.

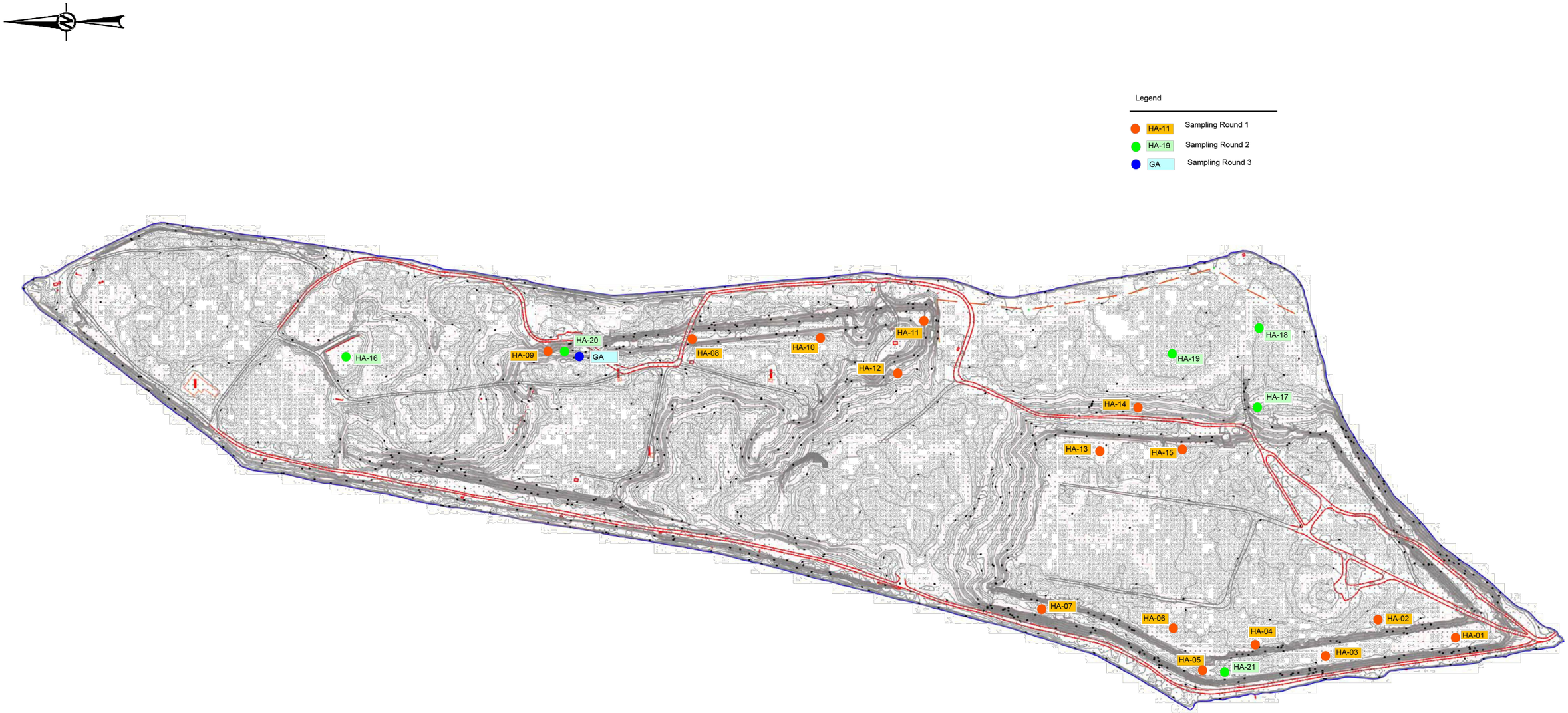
**Location:**
Point Hennepin

**Photograph taken by:**
Kara Donahue

**Date:** 8/21/2024

# Attachment 2

## 2022 and 2023 Soil Data




CLIENT
BASF

CONSULTANT
wsp

| | |
|---|---|
| YYYY-MM-DD | 2024-10-21 |
| DESIGNED | JJS |
| PREPARED | JJS |
| REVIEWED | |
| APPROVED | |

PROJECT
POINT HENNEPIN
GROSSE ILE TOWHSHIP, WAYNE COUNTY, MICHIGAN
SOIL NUTRIENT ANALYSIS

TITLE
**SOIL SAMPLE LOCATIONS**

| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| US0031423.3903 | | 0 | 1 |

Path: \\corp.pbwan.net\US\Central\Data\USDET100\CAD\Projects\24-USx-Projects\US0031423.3903_BASF\PRODUCTION\A-PI Hennepin Soil Samples\ | File Name: US0031423.3903_A001.dwg | Last Edited By: us\p700598 Date: 2024-10-21 Time:2:43:00 PM | Printed By: US\S700598 Date: 2024-10-21 Time:2:43:22 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

October 2024

**Table 1: BASF Point Hennepin Soils Analysis - 2022 Hand Augers**

| Analysis | Sample ID | HA-01 | | HA-02 | | HA-03 | | HA-04 | | HA-05 | | HA-06 | | HA-07 | | HA-08 | | HA-09 | | HA-10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Interval (ft bgs) | 0-1 | 2.5-3 | 0.5-1 | 2.5-3 | 0.5-1 | 2.5-3 | 0.5-1 | 2.5-3 | 0-1 | 3-3.5 | 0-1 | 2.5-3 | 0-1 | 2.5-3 | 0.5-1 | 3.5-4 | 0-1 | 3-3.5 | 0-1 | 2.5-3 |
| | Units / Date | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | |
| Copper | mg/kg | 3.0 | 3.5 | 8.1 | 2.6 | 8.3 | 3.1 | 6.2 | 5.2 | 6.9 | 4.6 | 11 | 6.3 | 7.6 | 3.2 | 8.00 | 2.1 | 5.2 | 5.1 | 8.6 | 2.9 |
| Iron | mg/kg | 3,800 | 4,200 | 5,400 | 3,200 | 5,100 | 2,800 | 6,100 | 6,500 | 4,100 | 3,900 | 7,600 | 6,000 | 5,100 | 4,200 | 5,100 | 2,400 | 2,700 | 2,000 | 5,000 | 2,900 |
| Sodium | mg/kg | 660 | 310 | 600 | 1,400 | 970 | 860 | 530 | 470 | 970 | 630 | 640 | 1,300 | 1,300 | 620 | 960 | 670 | 1,400 | 1,800 | 1,300 | 1,000 |
| Zinc | mg/kg | 15 | 26 | 56 | 11 | 52 | 18 | 45 | 37 | 45 | 26 | 66 | 32 | 43 | 22 | 49 | 15 | 32 | 12 | 52 | 22 |
| Manganese | mg/kg | 200 | 240 | 620 | 260 | 350 | 350 | 280 | 260 | 280 | 460 | 370 | 510 | 340 | 290 | 350 | 250 | 270 | 270 | 300 | 250 |
| Chloride | mg/kg | U | U | 140 | U | 12 | U | U | 64 | U | U | U | U | U | U | U | U | 460 | 1200 | 12 | U |
| Moisture | % | 22 | 25 | 38 | 25 | 37 | 41 | 21 | 23 | 37 | 44 | 35 | 36 | 37 | 26 | 36 | 35 | 38 | 41 | 37 | 29 |
| Potassium | mg/kg | 365 | 17 | 874 | 228 | 227 | 16 | 374 | 86 | 167 | 37 | 301 | 18 | 57 | 13 | 208 | 23 | 112 | 25 | 149 | 18 |
| Magnesium | mg/kg | 595 | 1,110 | 1,370 | 285 | 1,090 | 3,625 | 555 | 680 | 880 | 380 | 610 | 150 | 635 | 335 | 890 | 1,730 | 1,135 | 785 | 840 | 375 |
| Calcium | mg/kg | 14,150 | 18,550 | 14,000 | 27,550 | 13,550 | 21,350 | 15,200 | 23,650 | 14,900 | 28,450 | 15,900 | 28,900 | 23,250 | 28,750 | 15,200 | 25,400 | 16,300 | 26,050 | 15,650 | 27,950 |
| pH | Std Units | 7.8 | 7.7 | 7.9 | 7.7 | 7.7 | 7.7 | 7.5 | 10.2 | 7.9 | 7.9 | 7.7 | 7.5 | 7.9 | 7.9 | 7.5 | 8.2 | 7.8 | 8.3 | 7.7 | 8.3 |
| CEC | meq/100g | 76.6 | 99.9 | 83.7 | 99.9 | 77.4 | 99.9 | 81.6 | 99.9 | 82.3 | 99.9 | 85.4 | 99.9 | 99.9 | 99.9 | 84 | 99.9 | 91.2 | 99.9 | 85.6 | 99.9 |
| Phosphorous | mg/kg | 7.0 | 7.0 | 3.0 | 1.0 | 5.0 | 2.0 | 9.0 | 3.0 | 3.0 | 1.0 | 5.0 | 1.0 | 1.0 | 1.0 | 4.0 | 1.0 | 3.0 | 1.0 | 3.0 | 1.0 |
| Organic Matter | % | 3.7 | 5.2 | 9 | 3 | 12 | 9 | 4.6 | 4 | 8.3 | 2.3 | 9.7 | 1.7 | 6.1 | 2.6 | 7.4 | 9.4 | 7.4 | 2.1 | 7.5 | 2.3 |
| % K | % | 1.2 | NA | 2.7 | 0.4 | 0.8 | NA | 1.2 | 0.2 | 0.5 | 0.1 | 0.9 | NA | 0.1 | NA | 0.6 | NA | 0.3 | NA | 0.4 | NA |
| % Mg | % | 6.5 | 9.1 | 13.6 | 1.7 | 11.7 | 22.1 | 5.7 | 4.6 | 8.9 | 2.2 | 6.0 | 0.9 | 4.3 | 1.9 | 8.8 | 10.2 | 10.4 | 4.8 | 8.2 | 2.2 |
| % Ca | % | 92.3 | 90.9 | 83.7 | 97.9 | 87.5 | 77.9 | 93.2 | 95.3 | 90.6 | 97.8 | 93.1 | 99.1 | 95.5 | 98.1 | 90.5 | 89.8 | 89.3 | 95.2 | 91.4 | 97.8 |

U: Analyte not detected in this sample
NA: Analyte not analyzed for this sample

October 2024

**Table 1: BASF Point Hennepin Soils Analysis - 2022 Hand Augers**

| Analysis | Sample ID | | HA-11 | | HA-12 | | HA-13 | | HA-14 | | HA-15 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Interval (ft bgs) | | 0.5-1 | 3.5-4 | 0.5-1 | 2-2.5 | 0.5-1 | 3.5-4 | 0.5-1 | 2-2.5 | 0-1 | 2-2.5 |
| | Units | Date | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | | 11/21/2022 | |
| Copper | mg/kg | | 19 | 5.3 | 4.4 | 4.5 | 13 | 4.9 | 4.8 | 8.1 | 28 | 13 |
| Iron | mg/kg | | 5,700 | 2,500 | 2,300 | 2,400 | 7,900 | 4,100 | 3,900 | 5,600 | 7,700 | 6,500 |
| Sodium | mg/kg | | 530 | 2,500 | 1,400 | 2,500 | 470 | 570 | 440 | 600 | U | 380 |
| Zinc | mg/kg | | 61 | 7.5 | 18 | 9.5 | 80 | 28 | 35 | 48 | 130 | 54 |
| Manganese | mg/kg | | 200 | 250 | 210 | 250 | 520 | 390 | 230 | 290 | 240 | 240 |
| Chloride | mg/kg | | 32 | 380 | 26 | U | U | 54 | 92 | 12 | 19 | 16 |
| Moisture | % | | 30 | 34 | 25 | 18 | 36 | 63 | 24 | 20 | 28 | 13 |
| Potassium | mg/kg | | 267 | 16 | 42 | 18 | 153 | 14 | 197 | 27 | 393 | 276 |
| Magnesium | mg/kg | | 760 | 2,420 | 925 | 550 | 770 | 3,830 | 1,050 | 1,290 | 545 | 625 |
| Calcium | mg/kg | | 13,250 | 24,700 | 19,500 | 21,650 | 17,100 | 22,800 | 13,550 | 18,450 | 6,750 | 12,450 |
| pH | Std Units | | 7.8 | 10.4 | 7.7 | 7.8 | 7.5 | 8.8 | 7.8 | 8.1 | 7.5 | 8.3 |
| CEC | meq/100g | | 73.3 | 99.9 | 99.9 | 99.9 | 92.3 | 99.9 | 77 | 99.9 | 39.3 | 68.2 |
| Phosphorous | mg/kg | | 27 | 3.0 | 3.0 | 1.0 | 5.0 | 13 | 8.0 | 7.0 | 139 | 18 |
| Organic Matter | % | | 11.9 | 4.3 | 5.8 | 1.8 | 6.8 | 16.6 | 5.6 | 9.6 | 18 | 1.5 |
| % K | % | | 0.9 | NA | 0.1 | NA | 0.4 | NA | 0.7 | 0.1 | 2.6 | 1.0 |
| % Mg | % | | 8.6 | 14 | 7.3 | 4.1 | 7.0 | 21.9 | 11.4 | 10.4 | 11.6 | 7.6 |
| % Ca | % | | 90.4 | 85.9 | 92.6 | 95.9 | 92.6 | 78.1 | 88 | 89.5 | 85.9 | 91.3 |

U: Analyte not detected in this sample
NA: Analyte not analyzed for this sample

October 2024

**Table 2: BASF Point Hennepin Soils Analysis - 2023 Hand Augers**

| Analyte | Sample ID | HA-16 | HA-17 | HA-18 | HA-19 | HA-20 | HA-21 |
|---|---|---|---|---|---|---|---|
| | Interval (ft bgs) | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| | Units / Date | 1/26/23 | 1/26/23 | 1/26/23 | 1/26/23 | 1/26/23 | 1/26/23 |
| Boron | mg/kg | 13 | 4.1 | 6.5 | 4.8 | nd | nd |
| Copper | mg/kg | 15 | 23 | 22 | 21 | 6.9 | 11 |
| Iron | mg/kg | 1,500 | 23,000 | 22,000 | 21,000 | 3,900 | 9,600 |
| Sodium | mg/kg | 1,500 | 27 | 380 | 4,000 | 1,700 | 1,100 |
| Zinc | mg/kg | 100 | 73 | 56 | 61 | 39 | 53 |
| Manganese | mg/kg | 650 | 570 | 430 | 680 | 390 | 310 |
| Chloride | mg/kg | ND | ND | 400 | 14,000 | 190 | 46 |
| Moisture | % | 41 | 22 | 13 | 14 | 37 | 29 |
| Potassium | mg/kg | 71 | 126 | 57 | 56 | 108 | 140 |
| Magnesium | mg/kg | 1,910 | 335 | 450 | 200 | 1,230 | 640 |
| Calcium | mg/kg | 16,850 | 3,450 | 25,850 | 9,850 | 18,650 | 13,500 |
| Sulfur | mg/kg | 92 | 13 | 45 | 105 | 95 | 73 |
| pH | Std Units | 7.9 | 7.7 | 8.4 | 7.6 | 8.0 | 8.1 |
| CEC | meq/100g | 99.9 | 20.9 | 99.9 | 51.1 | 99.9 | 73.2 |
| Phosphorous | mg/kg | 2.00 | 5.00 | 1.00 | 6.00 | 2.00 | 4.00 |
| Bacarb-P | mg/kg | 9.00 | 8.00 | 4.00 | 9.00 | 5.00 | 6.00 |
| Nitrate | mg/kg | 1.6 | 1.8 | ND | 1.2 | 1.8 | ND |
| Ammonia | mg NH3-N/kg | 19 | 9.4 | 4.9 | 17 | 20 | 11 |
| Organic Matter | % | 6.7 | 4.9 | 0.8 | 1.3 | 6.2 | 3.3 |
| % K | % | 0.2 | 1.6 | 0.1 | 0.3 | 0.3 | 0.5 |
| % Mg | % | 15.9 | 13.7 | 2.8 | 3.3 | 9.9 | 7.3 |
| % Ca | % | 84 | 84.7 | 97.1 | 96.5 | 89.9 | 92.2 |

| | |
|---|---|
| U | Analyte not detected in this sample |
| NA | Analyte not analyzed for this sample |

October 2024

**Table 3: BASF Point Hennepin Soils Analysis - 2024 Graded Area Samples**

| Analyte | Sample ID | | Grade Area Samples | | |
|---|---|---|---|---|---|
| | Interval (ft bgs) | | 0-0.5 | 0.5-2 | 3-6 |
| | Units | Date | 2/20/24 | 2/20/24 | 2/20/24 |
| Boron | mg/kg | | 10 | 22 | 63 |
| Copper | mg/kg | | 5.1 | 4.6 | 4.8 |
| Iron | mg/kg | | 3,700 | 6,000 | 4,300 |
| Sodium | mg/kg | | 1,800 | 2,700 | 1,200 |
| Zinc | mg/kg | | 32 | 24 | 29 |
| Manganese | mg/kg | | 370 | 540 | 320 |
| Chloride | mg/kg | | ND | ND | 31 |
| Moisture | % | | 32 | 29 | 37 |
| Potassium | mg/kg | | 79 | 4.0 | 8.0 |
| Magnesium | mg/kg | | 840 | 220 | 1,415 |
| Calcium | mg/kg | | 21,500 | 30,850 | 28,800 |
| Sulfur | mg/kg | | 87 | 105 | 870 |
| pH | Std Units | | 7.4 | 8.0 | 8.4 |
| CEC | meq/100g | | 99.9 | 99.9 | 99.9 |
| Phosphorous | mg/kg | | 5.0 | 1.0 | 2.0 |
| Bacarb-P | mg/kg | | 5.0 | 1.0 | 7.0 |
| Nitrate | mg/kg | | 50.7 | ND | 1.02 |
| Ammonia | mg NH3-N/kg | | 23 | ND | ND |
| Organic Matter | % | | 4.8 | 2.0 | 2.4 |
| % K | % | | 0.2 | 0.0 | 0.0 |
| % Mg | % | | 6.1 | 1.2 | 7.6 |
| % Ca | % | | 93.7 | 98.8 | 92.4 |

| | |
|---|---|
| U | Analyte not detected in this sample |
| NA | Analyte not analyzed for this sample |