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SIXTH FIVE-YEAR REVIEW REPORT FOR BURLINGTON NORTHERN (BRAINERD/BAXTER PLANT) SUPERFUND SITE CROW WING COUNTY, MINNESOTA

Prepared by

U.S. Environmental Protection Agency
Region 5
CHICAGO, ILLINOIS

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LIST OF ABBREVIATIONS & ACRONYMS

AL	Action Level
AOROC	Administrative Order and Response Order by Consent
ASAOC	Administrative Settlement Agreement and Order on Consent
ARARs	Applicable or Relevant and Appropriate Requirements
BNSF	BNSF Railway
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Cfm	Cubic feet per minute
CFR	Code of Federal Regulations
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
EDD	Enforcement Decision Document
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FFS	Focused Feasibility Study
FYR	Five-Year Review
HBV	Health Based Value
HHRA	Human Health Risk Assessment
HRL	Health Risk Limit
IC	Institutional Control
LTU	Land Treatment Unit
MCL	Maximum Contaminant Level
µg/L	Micrograms per Liter
MDH	Minnesota Department of Health
MN	Minnesota
MPCA	Minnesota Pollution Control Agency
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RAA	Risk Assessment Advice
RI	Remedial Investigation
Site	Burlington Northern (Brainerd/Baxter Plant) Superfund Site
SLERA	Screening Level Ecological Risk Assessment
UECA	Uniform Environmental Covenants Act
UU/UE	Unlimited Use and Unrestricted Exposure

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The United States Environmental Protection Agency (EPA) prepared this FYR report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the sixth FYR for the Burlington Northern (Brainerd/Baxter Plant) Superfund Site ("Site"). The triggering action for this policy review is the completion date of the previous FYR. The FYR report has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of one operable unit (OU), which is addressed in this FYR report. OU1 addresses soil, sludge, and groundwater contamination at the Site.

The Site FYR was led by Leslie Patterson of EPA Region 5. Participants included Heriberto León, Community Involvement Coordinator for EPA, and Tom Reppe and Brad Leick of the Minnesota Pollution Control Agency (MPCA). The potentially responsible party (PRP), BNSF Railway (BNSF, formerly Burlington Northern Railroad Company), was notified of the initiation of the FYR on December 7, 2020. The review began on December 7, 2020.

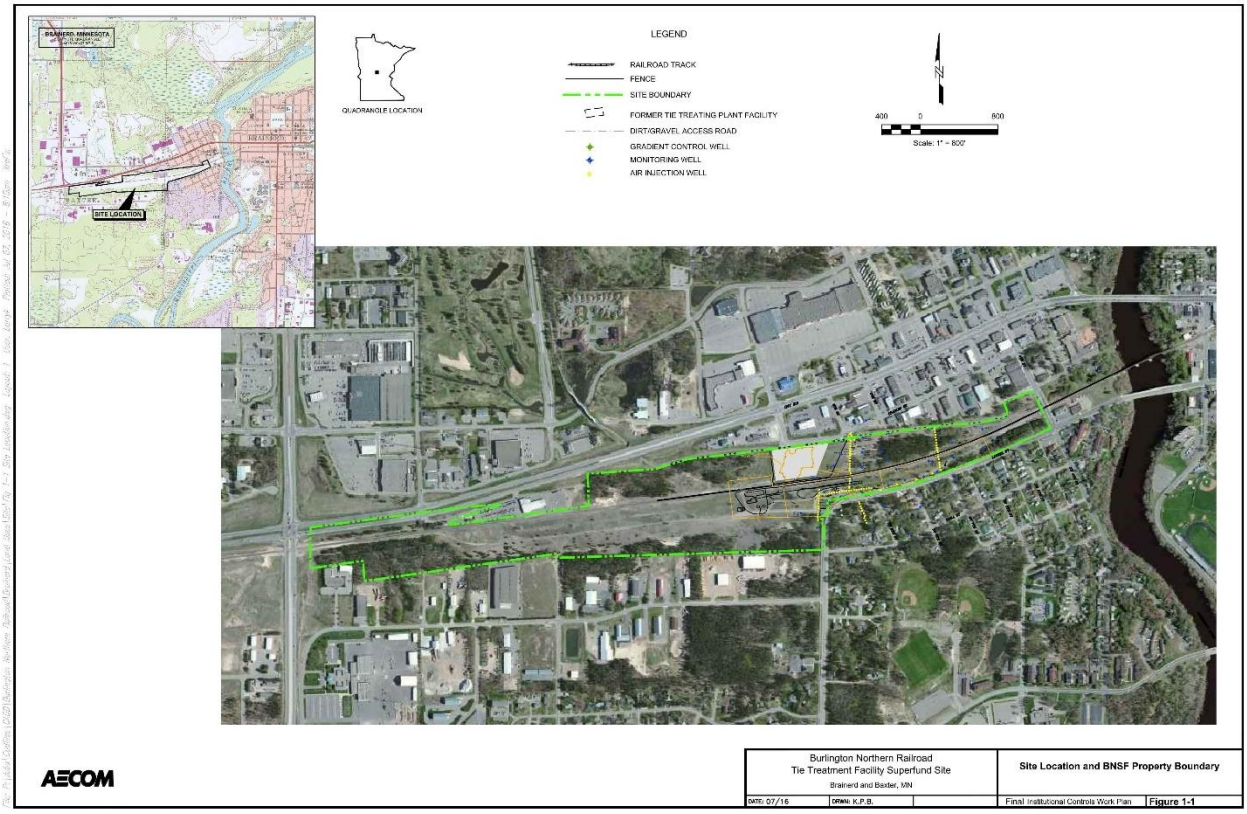
Site Background

The Site covers approximately 60 acres, owned by BNSF, on the corporate boundary between the cities of Baxter and Brainerd, Minnesota (MN) (see Appendix B). The current and reasonably anticipated future use of the Site is for rail transportation on the active main rail line that bisects the Site, as setback from the rail line, and for implementation of the remedial action. The Site is adjacent to areas of residential, industrial/commercial, and recreational (paved bicycle/pedestrian trail) use (*see* Figure 1 below).

Groundwater beneath the Site flows eastward and discharges into the Mississippi River approximately 3,000 feet from the source zone. BNSF and its predecessors treated rail ties at the Site from 1907 to 1985, using creosote mixed with either diesel fuel Nos. 5 or 6, and creosote mixed with coal tar. Wastewaters from the wood preserving operations were moved to an unlined surface impoundment for disposal, known as the CERCLA pond, and a second impoundment, known as the Resource Conservation and Recovery Act (RCRA) lagoon. Soil and groundwater beneath the CERCLA pond, the treatment areas, and the RCRA lagoon were impacted with multiple contaminants, including polycyclic aromatic hydrocarbons (PAHs), heterocycles, salts, oil and grease, benzene extractable hydrocarbons, and total phenolic compounds.

EPA proposed this Site for its National Priorities List (NPL) of hazardous waste sites on December 30, 1982, and the Site was listed on September 8, 1983.

Figure 1: Site Location



FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Burlington Northern (Brainerd/Baxter Plant)		
EPA ID: MND000686196		
Region: 5	**State:** MN	**City/County:** Baxter/Brainerd, Crow Wing County
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Leslie Patterson		

Author affiliation: EPA Region 5
Review period: 12/7/2020 – 9/16/2021
Date of site inspection: 9/14/2021
Type of review: Policy
Review number: 6
Triggering action date: 12/15/2016
Due date (five years after triggering action date): 12/15/2021

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Soil and groundwater beneath the CERCLA pond, the Process Locale, and the RCRA lagoon (Appendix B) were impacted with multiple contaminants, including PAH compounds, heterocycles, and phenols identified as the primary constituents of concern. Salts, oil and grease, and benzene extractable hydrocarbons were also identified as Site contaminants. More specifically, a 1985 Administrative Order and Response Order by Consent (AOROC) identified the following as hazardous substances, pollutants or contaminants released at the Site:

- Sludge from wood treating process
- Acenaphthylene
- Acenaphthene
- Anthracene
- Benzo(a)anthracene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Benzo(a)pyrene
- Chrysene
- Dibenzo(a,h)anthracene
- Fluorene
- Fluoranthene
- Naphthalene
- Phenanthrene
- Pyrene
- Ideno (1,2,3 CD) pyrene
- Oil and grease
- Phenol
- Salts

The 1986 Enforcement Decision Document (EDD) (U.S. EPA, 1986) and 1985 AOROC (U.S. EPA & MPCA, 1985) evaluated several potential exposure pathways and risks to receptors from these contaminants. These documents concluded that groundwater was a risk at the Site if it were

used for drinking water as the result of percolation of contaminants through sandy soil to the groundwater. Contaminated groundwater could potentially affect wells located downgradient from the Site and the water quality of the Mississippi River, although no impacts to either were found. The AOROC stated that there was an increased cancer risk if water and/or aquatic organisms were ingested from a water source contaminated with carcinogenic polycyclic aromatic hydrocarbons (cPAHs). The EDD stated that a fence around the waste area and the cover over the temporary waste stockpile prevents direct contact with the contaminated soil and sludge.

The 2015 Human Health Risk Assessment (HHRA) defined the following chemicals as Contaminants of Potential Concern for specific media (AECOM, 2015):

- Surface Soil (0-0.5 ft bgs and 0-2 ft bgs)
    - Benzo(a)anthracene
    - Benzo(a)pyrene
    - Benzo(b)fluoranthene
    - Benzo[k]fluoranthene,
    - Dibenzo[a,e]pyrene,
    - Dibenz[a,h]anthracene
    - Indeno[1,2,3-cd]pyrene
    - Naphthalene
    - Chrysene
    - Cobalt
    - 3-methylcholanthrene
    - Dibenzofuran
- Subsurface Soil (0-12 ft bgs)
    - 1-methylnaphthalene
    - 2-methylnaphthalene
    - Benzo[a]anthracene
    - Benzo[a]pyrene,
    - Benzo[b]fluoranthene
    - Benzo[k]fluoranthene
    - Carbazole
    - Chrysene
    - Dibenzo[a,e]pyrene,
    - Dibenz[a,h]anthracene
    - Fluoranthene, fluorene
    - Indeno[1,2,3-cd]pyrene
    - Naphthalene
    - Pyrene
    - 4-nitropyrene
    - Carbazole
    - 1,2,4-trimethylbenzene
    - 1,3,5-trimethylbenzene
    - Benzene

    - Dibenzofuran

- Groundwater

    - 1-methylnaphthalene
    - 2-methylnaphthalene
    - Benzo[a]pyrene
    - Naphthalene
    - Quinoline
    - 1,2,4-trimethylbenzene
    - Benzene
    - Biphenyl
    - Dibenzofuran
    - Ethylbenzene
    - Toluene
    - Xylenes (total)

- Soil to Groundwater Leaching

    - Cobalt
    - Mercury
    - Nickel
    - Vanadium
    - 1-methynaphthalene
    - 2-methylnaphthalene
    - Acenaphthene
    - Anthracene
    - Benzo[a]anthracene
    - Benzo[a]pyrene
    - Benzo[b]fluoranthene
    - Benzo[k]fluoranthene
    - Chrysene
    - Dibenzo[a,e]pyrene
    - Dibenzo[a,h]anthracene
    - Fluoranthene
    - Fluorene
    - Indeno[1,2,3-cd]pyrene
    - Naphthalene
    - Pyrene
    - 4-nitropyrene
    - 3-methylcholanthrene
    - p-Chloroaniline
    - p-Nitroaniline)
    - 1,2,4-trimethylbenzene
    - 1,3,5-trimethylbenzene
    - Acetone
    - Benzene

    - Dibenzofuran,
    - Ethylbenzene,
    - Xylenes-m,p,
    - o-Xylene
    - Toluene
    - Xylenes (total)

- Vapor Intrusion

    - 1,2,4-trimethylbenzene
    - Benzene
    - Biphenyl
    - Ethylbenzene
    - Naphthalene
    - Xylenes (total)

Response Actions

The 1985 AOROC (U.S. EPA & MPCA, 1985) provided for the PRP to perform the following response actions:

- Implement a groundwater gradient control system to mitigate the migration of contaminants;

- Complete a Feasibility Study;

- File and implement closure and post closure plans to close the wood treatment facility in accordance with 40 CFR 264 and/or 265, as appropriate, and Minn. Chapter 7045;

- Additional Remedial Investigation activities, including provisions for a treatment study; and

- A groundwater and surface water monitoring program to determine the effectiveness of the response actions.

The AOROC listed Action Levels (ALs) for the sums of two lists of contaminants for groundwater, which are shown in Table 1 below.

On June 4, 1986, EPA signed an EDD (U.S. EPA, 1986) which documented the remedial alternative selected for contaminated soil and sludge at the Site. The state of Minnesota was not a signatory to the EDD. The EDD stated the principal objective of the source control remedial actions is to prevent hazardous substances from migrating away from the contaminated site. Therefore, the EDD identified the following Remedial Action Objective (RAO) for sludges and soils:

- The objective of excavation is to remove sludges and soils which are grossly contaminated and contain free oils that could migrate to groundwater.

The EDD required excavation of visibly-impacted sludge and soil, but did not define numeric cleanup levels for contaminants in these media.

The 1986 EDD did not explicitly select a remedy for groundwater, but stated that the groundwater response action per the 1985 AOROC had been implemented and identified the following as the RAO for that groundwater response action:

- A groundwater gradient control system has been designed and implemented to prevent further migration of contaminants from the Site and remove contaminated water from the regional groundwater aquifer.

The EDD confirmed that the ALs established in the 1985 AOROC (as shown in Table 1 below) define groundwater contamination for the purpose of remedial action and that the groundwater gradient control well system shall continue pumping until concentrations in monitoring well samples are below these levels for at least two consecutive quarters.

Table 1: Action Levels (ALs)/Cleanup Goals for groundwater in the 1985 AOROC

	List 1 PAHs and heterocycles	List 2 PAHs and heterocycles
Cleanup level for the sum of compounds	0.028 µg/L	0.3 µg/L
Chemicals	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(j)fluoranthene Chrysene Dibenzo(a,h)anthracene Ideno(1,2,3-c,d)pyrene Quinoline	Acenaphthene Acenaphthylene Acridine Anthracene Benzo(b)thiophene Benzo(e)pyrene Benzo(h)fluoranthene 2,3-benzofuran Biphenyl Carbazole Dibenzothiophene 2,3-dihydroindene Fluoranthene Fluorene Indene Indole 1-methylnaphthalene 2-methylnaphthalene Naphthalene Perylene Phenanthrene Pyrene

To meet the RAOs identified above, the 1986 EDD selected a source control remedy for soil and sludge, which consisted of on-site treatment with capping, and included the following major components:

- Preparation of lined staging area for temporary storage of the sludge and contaminated soil.

- Removal of all standing water in the impoundment.

- Excavation and segregation of the sludges for subsequent free oil recovery.

- Excavation of visibly contaminated soil from both impoundments and subsequent storage in the staging area. The excavation areas will be backfilled and covered with clean soil.

- Preparation of a base for treatment area consisting of 4 feet of clean backfill with on-site soils, a 100-mil high density polyethylene (HOPE) liner, a leachate collection system, and 4 feet of clean backfill consisting of on-site soils (fine sands).

- Installation of a sump for collection of the storm water and leachate.

- Installation of an irrigation system.

- The land treatment of creosote focuses on the breakdown and transformation of organic constituents by aerobic microorganisms in the top layer of soil, and the immobilization of organics and inorganics constituents on the soil. The final goal of this treatment is not the complete degradation of all waste constituents, but is rather the transformation and immobilization of these constituents to render soil that is no longer toxic and does not leach harmful constituents. The estimated time to process the contaminated materials is 6 years.

- After the treatment process has been completed, a final RCRA approved cover will be installed.

Status of Implementation

BNSF began Site cleanup work pursuant to the 1985 AOROC, and signed by EPA, MPCA, and BNSF. Work progressed under MPCA oversight until EPA became the lead oversight agency in 2011. In 2012, EPA and BNSF entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) for BNSF to perform a Supplemental Remedial Investigation/Feasibility Study (RI/FS) to provide information on the extent of source mass contamination remaining at the Site that continues to feed the groundwater contaminant plume; define appropriate RAOs, contaminants of concern (COCs), and cleanup levels; evaluate alternatives to meet those objectives; and support a modified remedy selection.

Remedy Implementation for Soil and Sludge

In 1985, the PRP constructed an on-Site Land Treatment Unit (LTU) in the area of the former RCRA lagoon to treat sludges and contaminated soils. Approximately 13,000 cubic yards of impacted soil was tilled, irrigated and amended to maintain the optimum pH and nutrients levels under an MPCA RCRA permit. In 1995, after the final soil lift had been applied and detoxification had plateaued, the PRP constructed a final RCRA cover for the LTU, in accordance with the closure standards of Title 40 CFR § 264.111. The cap was surveyed

annually by a Minnesota licensed surveyor from 2001 through 2011, in accordance with the 2001 RCRA permit (now expired). The EPA-approved *Former RCRA Unit Operations and Maintenance Plan* (AECOM, 2014a) eliminates the annual cap survey due to lack of observed subsidence, but provides for routine inspection of the cover as an O&M activity. Leachate has also been collected from the former LTU since October 2001 (*see* Systems Operations/Operation & Maintenance Section of this FYR).

Remedy Implementation for Groundwater

In the fall of 1985, the PRP installed a groundwater gradient control system, including three extraction wells, southeast of the source areas. Between 1992 and 1996, in anticipation of reduced National Pollutant Discharge Elimination System (NPDES) discharge standards for naphthalene, the PRP installed and expanded a groundwater aeration (air sparge) line to facilitate biological breakdown of the contaminants. This resulted in significant decreases in naphthalene concentrations, and, in 1996, EPA approved the use of the air sparge system to pre-treat extracted groundwater before discharge to the storm sewer.

In 2001, BNSF performed a pilot test to see if the air sparging system could replace the gradient control system at preventing contaminated groundwater from migrating off-Site. It was observed that the natural groundwater flow direction was more toward the east than was previously indicated, and that contamination was migrating eastward. Subsequently, new monitoring wells were installed to further define lateral impacts in the area east of the former operational areas of the Site. The gradient control system was reactivated in 2005, and BNSF added a carbon polish system in 2006 to treat extracted groundwater and meet revised parameters and discharge limits for a reissued NPDES permit. The gradient control system has been inactive since 2008, when it was shut down to perform an air injection pilot study.

From 2006 to 2008, BNSF performed two phases of an air injection pilot study that included installation of a total of approximately 50 air injection points and additional monitoring wells. From 2009 through 2011, BNSF installed additional/replacement injection points, additional monitoring wells, and brought a new air compressor online. Nine spare air injection lines were also extended north of the mainline track for possible future use. Leak lines that were damaged during this work were subsequently repaired in December 2011, and the air injection system continues to be operated and maintained as described in Systems Operations/Operation & Maintenance Section of this FYR.

Supplemental RI/FS

In August 2015, EPA approved a *Supplemental Remedial Investigation (RI) Report* (AECOM, 2015) that further defined the extent and magnitude of Site contamination and potential unacceptable risks to human health and the environment. The *Supplemental RI Report*, which includes the HHRA, and screening level ecological risk assessment (SLERA) found:

- The former LTU is not a current or a long-term source to groundwater impacts at the Site.
- Residual impacts in soil do not present an unacceptable risk to human health that cannot be managed through implementation of appropriate long-term institutional controls (ICs) nor do they present a significant risk to potential environmental receptors.

- The air sparge system effectively replaces groundwater pumping and contains impacts to groundwater on-Site and treats groundwater downgradient of source areas to federal and state drinking water standards (federal Maximum Contaminant Levels (MCLs) and Minnesota Department of Health (MDH) Health Risk Limits (HRLs), Health Based Values (HBVs) and Risk Assessment Advice (RAA).

- Dense non-aqueous phase liquid (DNAPL) above and below the water table does not present an unacceptable long-term exposure risk to potential receptors under controlled land use and continuation of the air sparge system, but it is a continued source of contamination to on-Site groundwater.

- The Site poses potential unacceptable risks to construction workers exposed to subsurface soil and soil vapor, a hypothetical adult resident exposed to groundwater for consumption, and a hypothetical child resident exposed to surface soil and groundwater for consumption.

The HHERA also included a screening vapor intrusion evaluation in which maximum detected concentrations of volatile organic compounds in groundwater were compared to EPA's Vapor Intrusion Screening Levels, based on a full-time indoor worker scenario. The HHERA found that a potential risk to a hypothetical future on-Site resident or commercial worker from vapor intrusion may exist. The current maintenance worker is part-time and spends the majority of their time outdoors, so while commercial worker indoor air exposure is considered potentially complete, the HHERA found the current exposure pathway to be insignificant. (AECOM, 2015) BNSF is currently conducting a focused feasibility study (FFS) to evaluate remedial alternatives to address the potentially unacceptable risks identified in the HHRA and working to implement additional ICs to prevent potentially unacceptable exposures.

From 2016-2021, BNSF conducted several activities to support the screening and development of remedial alternatives, including preparing an *Alternatives Screening Technical Memorandum* (AECOM, 2016b); conducting a *Natural Source Zone Depletion Assessment* (Holm, R. & K. Geiser/AECOM, 2017b), (Holm, R. & K. Geiser/AECOM, 2017a); preparing a *Data Needs Assessment* (AECOM, 2017b); and preparing a draft *Supplemental Focused Feasibility Study Report* (AECOM, 2017c). In 2020, due to uncertainties in the effectiveness of in situ biosparging to treat groundwater contaminants, BNSF began a two-phase treatability study of this technology (AECOM, 2020b). BNSF installed and developed two biosparge well nests AI-92A/B/C and AI-94A/B/C), two sparging observation well nests (AI-93A/B/C and AI-95B/C), and four monitoring wells (MW-41AA/A/B/C).

In August 2020, BNSF initiated Phase 1 pre-startup field activities, which included: drilling and installing the Phase 1 biosparging and monitoring well network; baseline soil sampling to identify the presence of DNAPL above and below the water table and quantify organic contaminant concentrations; installing two soil vapor probes between the Operational Area and potential downgradient receptors; a baseline DNAPL assessment; and a baseline monitoring program.

BNSF performed Phase I field operations from September 2020 to April 2021, to determine parameters to design and implement the multi-year Phase 2 study. Phase I activities included a two-month startup biosparging step test during which air was injected into AI-92 and AI-94 nests

and AI-93 and AI-95 served as observation wells. This was followed by an approximately five-month long biosparging extended test to evaluate the delivery and distribution of dissolved oxygen (DO) at various air injection flow rates in the AI wells at each depth interval; monitored data in surrounding wells including changes in hydraulic head, DO, and oxygen reduction potential ORP to determine radius of influence and optimal pulse cycle timing; and measured changes in soil gas composition in the vadose zone as a result of biosparging. Details are available in the *In Situ Biosparging Treatability Study Phase 1 Report* (AECOM, 2021b).

The results from the Phase I study will be used to design the Phase II treatability study, in which BNSF will collect data to evaluate the effectiveness of in situ biosparging to permanently decrease concentrations of Site COCs in groundwater by treating DNAPL source mass. Phase II is expected to continue for at least three to five years and will inform the evaluation of remedial alternatives that involve in situ biosparging in the FFS.

Institutional Controls

The 1986 EDD did not require ICs as part of the remedial action, even though wastes were left on-Site and do not allow for UU/UE. However, Table 2 below summarizes existing and planned ICs that are needed for the Site for ensuring continued protectiveness. A map showing the area in which the ICs are planned is included in Appendix C.

In May 2016, BNSF prepared a *Final Land Uses and Institutional Controls Memorandum* (AECOM, 2016d), which recommended the planned ICs identified in Table 2. The 2016 memorandum recommended a Minnesota Uniform Environmental Covenants Act (UECA)-based environmental covenant on the blue and red outlined areas of the Site (shown in Appendix C). The environmental covenant would be to restrict future development to non-residential uses, notify prospective future owners of the potential risks associated with any property reuse of development, and restrict withdrawal and use of groundwater. In September 2016, EPA approved BNSF's Institutional Controls Work Plan (AECOM, 2016c), which further refined the planned ICs, and the steps and schedule for implementing ICs.

Status of Access Restrictions and ICs: ICs currently in place for the Site include a deed notification that was filed in 1995 for the RCRA landfill (former LTU area), as was required under the now-expired RCRA permit. The cities of Brainerd and Baxter also have enacted zoning ordinances; BNSF property south of the mainline track in Brainerd is zoned as R-2, Medium Density Residential, and R-3, High Density Residential, while property located north of the mainline track is zoned B-4, General Commercial. BNSF property located in Baxter is zoned I, Industrial Office, consistent with the current use of the property. In addition, City ordinances currently restrict installation of groundwater supply wells within City limits and require connection to the respective city municipal water supply systems, where available.

Current Compliance: Land uses observed during the September 14, 2021 FYR Site inspection were compliant with zoning and groundwater limitations, consistent with previous observations. The Site property is vacant or is being used for remediation components. The area of the Site south of the railroad track is zoned by the city of Brainerd as residential but was undeveloped and not in residential use at the time of the FYR Site Inspection. There was no evidence of any activity on or near the former LTU that would compromise the integrity of the cap. Fencing and

Table 2: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	IC Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
RCRA Landfill (Former LTU)	Yes	No	NE ¼ NE ¼, T133N, R28W, Section 8, Crow Wing County	Prohibit any activities that would compromise the integrity of the cap, and any uses except routine maintenance.	State Environmental Real Estate Notice, December 15, 1995 Planned UECA-based environmental covenant
Groundwater	Yes	No	All parcels within the City of Baxter adjacent to water supply lines[1]	Require connection to municipal water supply and restrict the installation of domestic water supply wells	City of Baxter Code, Title 8, Chapter 1, 8-1-10
	Yes	No	Parcels within the City of Brainerd adjacent to water supply lines[1]	Require connection to municipal water supply and restrict the installation of domestic water supply wells	City of Brainerd Code 4715.0310
	Yes	No	See Appendix C - areas outlined in red and blue	Prohibit unauthorized withdrawal of groundwater	Planned Uniform Environmental Covenants Act (UECA)-based environmental covenant
Soil	Yes	No	Parcels within the City of Baxter (including those areas outlined in red and blue in figure in Appendix C that are in Baxter)	Limit use (e.g., industrial office) of properties in Baxter	City of Baxter Zoning Ordinance, May 30, 2014
	Yes	No	Parcels within the City of Brainerd (including the portion of the area outlined in red in figure in Appendix C that is in Brainerd)	Limit use (e.g., general commercial, medium-density residential) of properties in Brainerd	City of Brainerd Zoning Ordinance, July 2014
	Yes	No	See Appendix C - areas outlined in red and blue	Limit use to non-residential; prohibit unauthorized soil disturbance (red area only)	Planned UECA-based environmental covenant

signage around the former LTU and along the boundary of the former facility were in good condition to prevent trespassing to these areas.

IC Follow up Actions Needed: Because current Site decision documents do not require ICs as part of the remedy, but ICs are needed in those areas that are not UU/UE, EPA must issue a decision document requiring ICs as part of the remedy. Further, the ICs identified in the *Institutional Controls Work Plan* (AECOM, 2016c), must also be implemented to prevent future potential exposure to Site contaminants and interference with the remedy (identified as "planned" in Table 2 below). As of August 2021, language for the environmental covenant was in development.

Long-Term Stewardship: The May 2016 *Final Land Uses and Institutional Controls Memorandum* (AECOM, 2016d) describes planned long-term stewardship actions. This includes conducting an annual review of Site use, an evaluation of continued adherence with ICs, and reporting the results of the review in the Annual Monitoring Report. These actions have not been taken because monitoring compliance with ICs is not currently part of the remedy, but they will be performed when the planned ROD Amendment incorporates ICs.

Systems Operations/Operation & Maintenance

BNSF performed routine operation and maintenance (O&M) activities during this FYR period, which included maintaining and inspecting the integrity of the landfill cap, collecting and managing the leachate generated by the former LTU, maintaining and operating the aquifer air injection system, and maintaining the inactive gradient control wells. O&M activities were performed in accordance with the *Operations and Maintenance Plan for the Aquifer Air Injection Treatment System* (AECOM, 2014c) and the *Former RCRA Unit Operations and Maintenance Plan* (AECOM, 2014a). Groundwater compliance monitoring was conducted in accordance with the 2013 *Quality Assurance Project Plan for Compliance Monitoring Activities* (AECOM, 2013b) or the 2018 *Quality Assurance Project Plan, Operations and Maintenance Activities* (AECOM, 2018b), and the *Groundwater Monitoring Plan*, (AECOM, 2014b) as updated in each Annual Report for the following year.

Three air injection wells (AI-52R, AI-82, and AI-30) are not operational, but stable contaminant concentrations and adequate treatment of contaminants without these injection points indicate that replacement or repair of these locations is unnecessary. Operational data indicates the system is functioning as designed to deliver air to the subsurface at a flow rate of approximately 2.5 cubic feet per minute (cfm) per injection point, except air injection points AI-25, AI-66, and AI-67, which operate at approximately 3.5 cfm.

In 2018, maintenance of the air injection system included repair of the electric motor on the air compressor; installation of a new air dryer; and installation of an oil/water separator unit for on-Site treatment and recycling of oily compressor condensate water.

[1] The *Final Institutional Controls Work Plan* (AECOM, 2016c) does not clarify whether site parcels are adjacent to municipal water supply lines. This will be clarified during implementation of the workplan.

Sitewide monitoring events were not conducted from 2017 through 2020 because, as described in Section 4.0 and Appendix C of the *2016 Annual Report* (AECOM, 2017a), groundwater monitoring results from 2003 to 2016 indicated that concentrations of Site contaminants in wells downgradient of the Phase I air sparge line had stabilized at or below ALs, MCLs, HRLs, and HBVs since approximately 2008. In Section 5.0 of the *2016 Annual Report*, which EPA approved on July 3, 2017 (Patterson, L./U.S. EPA, 2017a), BNSF proposed limiting groundwater sampling to a select number of monitoring locations in the vicinity of the Phase II air injection line from 2017 until completion of the FFS. However, the 2020 Annual Report revised this plan to include biennial and triennial sampling for most wells. (AECOM, 2021a)

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the last FYR as well as the recommendations from the last FYR and the current status of those recommendations.

Table 3: Protectiveness Determinations/Statements from the 2016 FYR

OU #	Protectiveness Determination	Protectiveness Statement
OU1/ Sitewide	Short-term Protective	The remedy currently protects human health and the environment because the air sparge system effectively contains groundwater contamination to the source area, and the discharge of contaminated water to the Mississippi River does not cause unacceptable ecological impacts. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: submit an FFS that evaluates remedial alternatives for contaminated groundwater and source areas; implement additional ICs and long-term stewardship procedures; review phenolic analytic data collected in 2016 and propose a program of additional sampling for phenolics to identify whether these are contaminants of concern, and issue one or more remedy modification document(s) that 1) specifies groundwater cleanup levels based on the current understanding of risk, 2) specifies beneficial use, if practicable, or explains why it is technically impracticable for parts of the plume, and if technically impracticable, specify a point of compliance for containment of groundwater contamination, 3) selects the existing air sparging system or other effective technology to contain or remediate contaminated groundwater and its sources, and 4) requires ICs preventing exposure to contaminated groundwater, soil and NAPL.

Table 4: Status of Recommendations from the 2016 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
OU1/ Sitewide	A FFS is needed to evaluate technologies capable of achieving groundwater restoration and support the remedy modification to air sparging and/or other technologies as recommended below.	Submit an FFS that evaluates remedial alternatives for contaminated groundwater and source areas.	Addressed in Next FYR	The PRP is performing an extended treatability study of in situ biosparging prior to finalizing the Focused Feasibility Study (FFS). Completing the pilot study is the focus of a recommendation in this FYR.	N/A
OU1/ Sitewide	The contaminants of concern and groundwater action levels established in the EDD and AOC[1] do not incorporate the current understanding of risk.	Issue a remedy modification document that specifies groundwater cleanup levels based on the current understanding of risk.	Addressed in Next FYR	The remedy modification will be documented at the close of the FFS, currently planned to be completed in FY2027.	N/A
OU1/ Sitewide	It is unclear whether the current groundwater remedy meets the NCP's general expectation of returning usable ground waters to their beneficial uses wherever practicable (40 CFR 300.430 (a)(l)(iii)(F)).	Issue a remedy modification document that specifies beneficial use, if practicable, or explains why it is technically impracticable for parts of the plume. If technically impracticable, specify a point of compliance for containment of groundwater contamination.	Addressed in the next FYR	The remedy modification will be documented at the close of the FFS, currently planned to be completed in FY 2027.	N/A

[1] In this FYR Report, the acronym "AOC" is retained here to preserve the exact language from the 2016 FYR Report; the current acronym is "AOROC".

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
OU1/ Sitewide	Groundwater extraction as required by the 1985 AOC[1] was found to potentially increase the rate of plume migration. A pilot test using air sparging for groundwater has attained containment more efficiently than the extraction method.	Modify the remedy to air sparging or other technology that best fits EPAs remedy selection criteria as documented in the FFS.	Addressed in the next FYR	The remedy modification will be documented at the close of the FFS, currently planned to be completed in FY 2027.	N/A
OU1/ Sitewide	The current decision documents do not specifically require ICs, although areas of the Site do not allow for UU/UE.	Issue a remedy modification document that requires ICs to ensure long-term protectiveness of human health and the environment.	Addressed in the next FYR	The remedy modification will be documented at the close of the FFS, currently planned to be completed in FY 2027.	N/A
OU1/ Sitewide	Areas of the site that do not allow for UU/UE do not have enforceable ICs to reduce or eliminate exposure to contaminated soil and groundwater.	Implement additional ICs and long-term stewardship procedures.	Addressed in the next FYR	Per the 2016 *Final Institutional Controls Work Plan*, an environmental covenants package was drafted but final language continues to be developed to implement this additional IC at the Site.	N/A

[1] In this FYR Report, the acronym "AOC" is retained here to preserve the exact language from the 2016 FYR Report; the current acronym is "AOROC".

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
OU1/ Sitewide	Phenolic compounds (2-, 3-, and 4-methylphenol, and 2,4-dimethylphenol) were detected in 2014 and 2015 at MW-39C at concentrations above the HRLs. Because many monitoring points have not been sampled for these compounds, the extent and magnitude of these contaminants is not clear.	Review phenolic analytic data collected in 2016 and propose a program of additional sampling for phenolics to identify whether these are contaminants of concern.	Complete	Additional sampling for phenolic compounds in 2016 confirmed did not detect phenolic compounds downgradient of the Phase II air injection line. (AECOM, 2017a)	5/2/2017

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

A public notice was made available by newspaper posting in the *Brainerd Dispatch* on December 23, 2020, stating that there was a FYR and inviting the public to submit any comments to EPA. A similar announcement was published on the site's website, www.epa.gov/superfund/burlington-northern-brainerd. No information or requests for an interview were received. The results of the review and the report will be made available at the Site information repository located at the Brainerd Public Library, 416 S. Fifth Street, Brainerd, MN.

Data Review

Groundwater Analytic Data

The air sparge system is consistently effective in treating contaminants to levels well below ALs, MCLs, HRLs, and HBVs before groundwater migrates off-site. The system is also largely effective in treating contaminants to levels near to or below MCLs, HRLs, and HBVs prior to groundwater reaching the second (Phase I) air injection line. This assessment is supported by comparing concentrations of contaminants in source area monitoring wells (including the former LTU area) to concentrations in wells downgradient of the first (Phase II) air injection line and the second (Phase I) air injection line, and by observing contaminant concentrations over time. Both

of these approaches are discussed below. Figure 2 shows the location of air injection wells and monitoring wells.

Table 5 presents the range of concentrations of total List 1 and total List 2 contaminants from the 2016 Sitewide monitoring event, in comparison to the List 1 and List 2 cleanup levels specified in the 1985 AOROC (shown in Table 1 above). The 2016 Sitewide monitoring event, like the Sitewide monitoring events for all five years (2011-2015) evaluated in the previous 2016 FYR (U.S. EPA, Region 5, 2016), demonstrate significant reductions in concentrations of List 1 and List 2 contaminants from the source area to downgradient of the Phase II air sparge line, and again to the farthest downgradient area beyond the Phase I air sparge line. These reductions in contaminant levels demonstrate that the air sparge system effectively prevents groundwater with List 1 and List 2 chemicals above the ALs from migrating from the site.

Contaminant concentrations in groundwater can also be evaluated over time and compared to federal MCLs and Minnesota HRLs, HBVs, and RAA. Groundwater monitoring data from 2003 through 2020 indicate that concentrations of naphthalene and benzene in groundwater have remained below these levels downgradient of the Phase II line during this FYR period. Graphs of these data are found in Appendix C to the *2020 Annual Report*. (AECOM, 2021a). Graphs of wells that were sampled through 2020 are included as Appendix F.

In 2014 and 2015, naphthalene concentrations above the MDH HRL of 70 micrograms per liter (µg/L) were detected at MW-13B for the first time in several years. Air flow at injection points AI-25, AI-66, and AI-67, located immediately upgradient of MW-13B, was increased to 3.5 cfm in November 2015. Naphthalene concentrations at MW-13B declined significantly from 2016 to 2020, with an estimated concentration of 0.018 µg/L detected in 2020, below the laboratory reporting limit of 0.042 µg/L and three orders of magnitude below the HRL of 70 µg/L. In 2021, EPA approved BNSF's proposal (AECOM, 2021a) to reduce the flow rate to 2.5 cfm. (Patterson, L./U.S. EPA, 2021)

In 2016, phenolic compounds were analyzed on a non-routine basis for comparison to applicable HRLs. Four phenolic compounds (2,4-Dimethylphenol, 2-Methylphenol, 3&4-Methlyphenol and Phenol) were detected at three of 38 locations (MW-19, MW-39C and TMP-13). Three of the compounds (2,4- Dimethylphenol, 2-Methylphenol and 3&4-Methlyphenol) exceeded their respective HRLs, but no phenolic compounds were detected downgradient of the Phase II Line, including off-Site locations.

Groundwater monitoring results are screened against a surface water criterion of 0.035 µg/L for anthracene, based on the MPCA's Class 2B-2C surface water standard for the Mississippi River, located approximately one-half mile to three-quarter mile east of the Site, to confirm no potential ecological risk to the river. Although the anthracene standard is not directly applicable to groundwater, nor is it a groundwater-surface water interface criterion, it was added as screening criterion to provide a basis for consideration of further analysis of groundwater conditions that may impact surface water. Figure 3 compares the maximum detected monitoring well anthracene concentrations from 2016 to 2020 with the Class 2B-2C criterion, with the wells downgradient of the Phase I and off-site air sparge lines shown at the right in orange. Maximum downgradient anthracene concentrations are near or below the criterion and are expected to attenuate further prior to reaching the Mississippi River. Therefore, this data supports finding the Site protective of ecological receptors.

Figure 2: Locations of Air Injection Wells and Groundwater Monitoring Wells, and Summary of 2020 Groundwater Monitoring Results

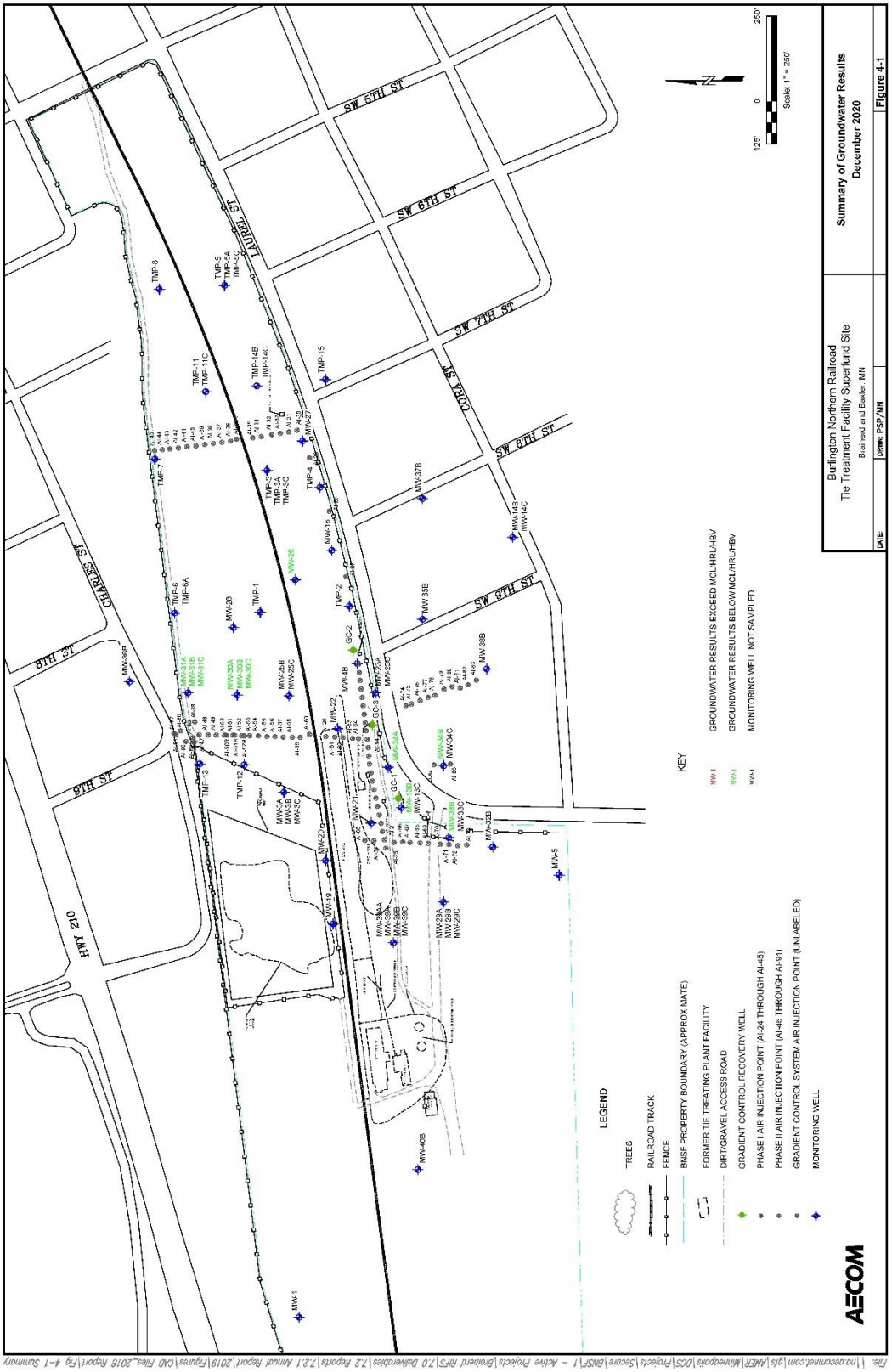
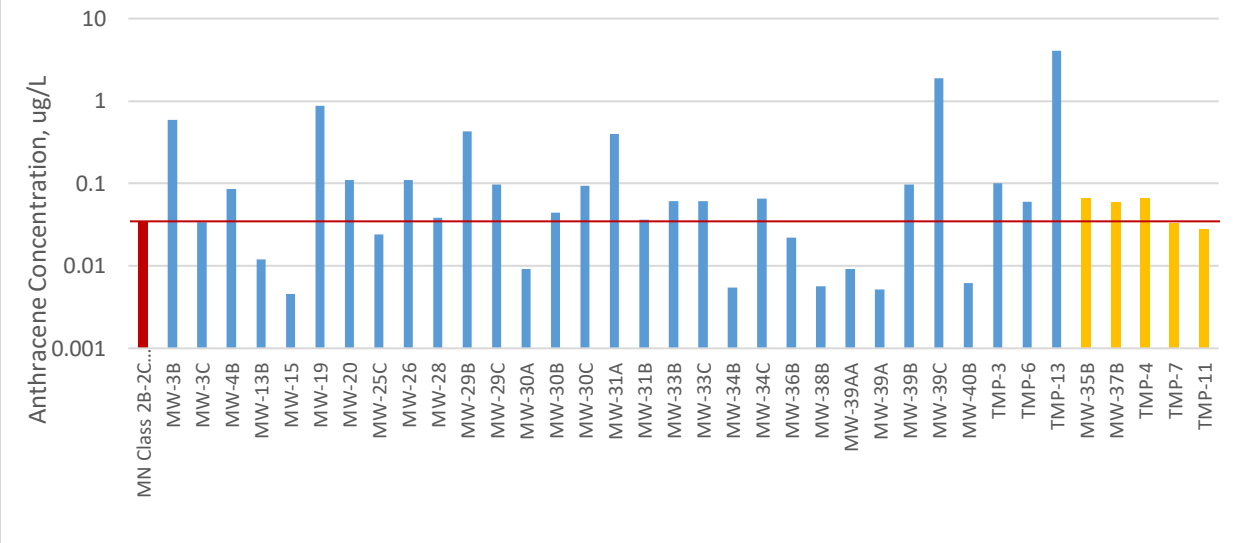


Table 5: Range of Concentrations of List 1 and 2 Contaminants From 2016 Sampling Event

	Extent of Treatment	**Total List 1 contaminants**		**Total List 2 contaminants**	
		Concentration range, µg/L	Location of highest concentration	Concentration range, µg/L	Location of highest concentration
AOROC ALs	N/A	0.028	N/A	0.3 ug/L	N/A
Source area wells[1]	No treatment	ND to 0.034	(MW-39C)	0.0052 to 6,893	(MW-39C)
LTU area wells[2]	No treatment	ND to 0.015	(TMP-13)	1.6 to 7,720	(TMP-13)
Downgradient of Phase II line[3]	Treatment by one air sparge line	ND to 0.018	(MW-4B)	ND to 77.9	(MW-13B)
Downgradient of Phase I and off-Site lines[4]	Treatment by both air sparge lines	ND to 0.0059	(MW-35B)	0.053 to 0.088	(MW-37B)

Figure 3: Maximum monitoring well anthracene concentrations, 2016-2020

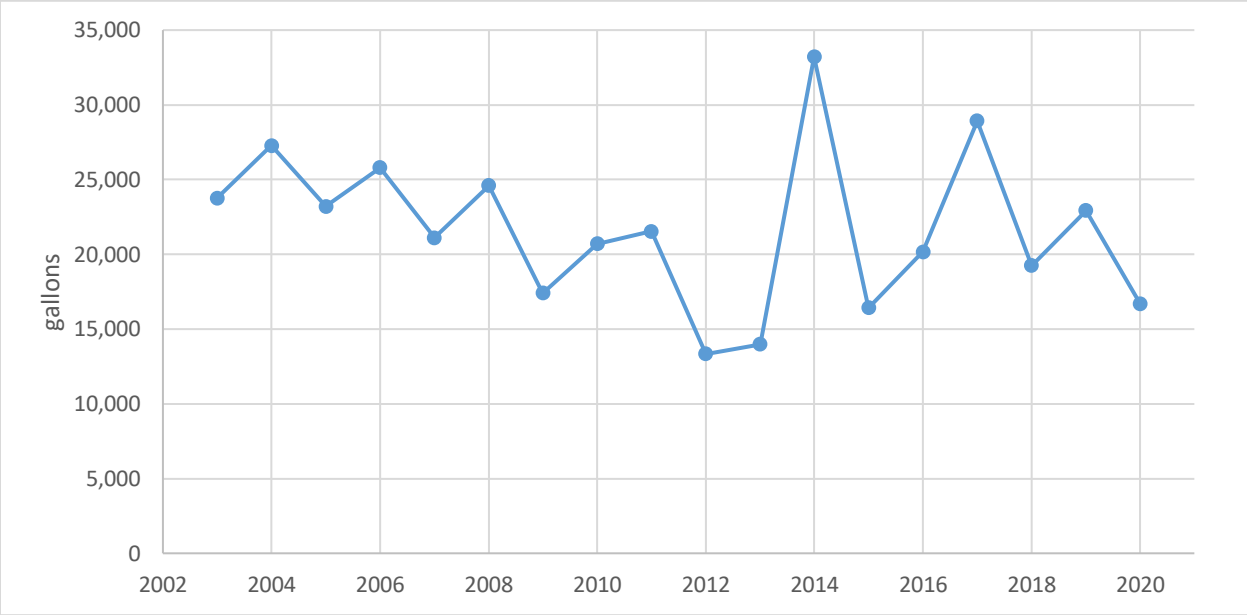


[1] "Source Area wells" are those in the former black dock/CERCLA pond area, including MW-21, MW-29A, B and C, and MW-39AA, A, B and C.
[2] "LTU area wells" are those east and south of the former LTU, including MW-3A, B, and C, MW-19, MW-20, TMP-12 and TMP-13.
[3] "Downgradient from Phase II line" wells include MW-4B, MW-13B and C, MW-15, MW-22, MW-23A and C, MW-24A, B and C, MW-25B and C, MW-26, MW-27, MW-28, MW-30A, B and C, MW-31A, B, and C, MW-33B and C, MW-34B and C, TMP-1, TMP-2, TMP-3, 3A, and 3C, TMP-4, TMP-6 and 6A, and TMP-7.
[4] "Downgradient from Phase I and off-Site lines" wells include MW-35B, MW-37B, TMP-5, 5A and 5C, TMP-8, TMP-11 and 11C, TMP-14B and C, and TMP-15.

Former LTU Leachate Collection

BNSF utilizes a cycle counter system to estimate the volume of leachate that drains from the leachate collection system. Figure 4 shows the estimated volume of leachate collected and treated annually, which is generally between 15,000 and 30,000 gallons. The leachate volumes are somewhat responsive to precipitation levels, and the capacity of the system is stable.

Figure 4: Estimated Volume of Leachate Collected Annually, 2003-2020



Site Inspection

The inspection of the Site was conducted on September 14, 2021. In attendance were Leslie Patterson of EPA, Tom Reppe and Brad Leick of MPCA, Greg Jeffries of BNSF, and Ron Holm, Kurt Geiser and Bill Brown of AECOM, contractor to BNSF. The purpose of the inspection was to assess the protectiveness of the remedy.

During the inspection, EPA observed the components of the air sparge system to be operational and in good condition. The fencing, signage, and vegetative cover at the former LTU area were in good condition, and there was no sign of trespass. The idle groundwater extraction equipment and structures are aging but remain on site because EPA has not yet formally selected an alternate remedy. EPA observed that areas adjacent to the Site have commercial/industrial and residential land uses consistent with previous Site visits and with IC objectives outlined in the Institutional Controls section of this FYR report. The FYR Inspection Checklist results and photographs are attached in Appendix D.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

No; while the former LTU was operated and closed, and continues to be maintained, as intended, the groundwater system that is operating is an air injection system, while the remedy selected was a groundwater gradient control system. However, groundwater cleanup levels are being achieved outside of the source areas by the air injection system.

Remedial Action Performance

The 1985 AOROC and 1986 EDD called for operation of a groundwater gradient control system to prevent further migration of contaminants from the Site and remove contaminated water from the regional groundwater aquifer. The remedial action is not operating as designed, because the air injection system that is operating does not control groundwater gradient. However, the air injection system is effectively containing the groundwater impacts to the source areas, preventing the migration of contaminants from the Site.

Groundwater cleanup levels are being achieved outside the source area, but not within the source impact area due to the presence of DNAPL and soil contamination above and below the water table. The current system is not likely to achieve cleanup levels throughout the source area in the foreseeable future. Therefore, EPA is overseeing the biosparging pilot study and FFS to determine if a remedy modification or supplemental remedy can accelerate progress to groundwater restoration.

System Operations/O&M

The current O&M and monitoring procedures are adequate to maintain the effectiveness of the former LTU.

The air injection system contains contaminated groundwater to the Site, even without injecting air at the offsite and downgradient air sparge wells. Routine maintenance of injection points that are no longer receiving adequate air flow is needed to maintain effectiveness and is provided for in the O&M plan ((AECOM, 2014c).

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Question B Summary:

No; the 1985 AOROC set cumulative ALs for the sums of two lists of contaminants rather than using federal and state promulgated standards or risk-based cleanup levels for specific contaminants. In addition, contaminants not included in the Site contaminant lists are present at the Site and may need to also be identified as Site COCs, which is discussed in more detail below.

Changes in Standards and TBCs

The 1985 AOROC defined two lists of contaminants and set an AL for the cumulative sum of each list, but neither the 1985 AOROC nor 1986 EDD identified any contaminant-specific federal or state promulgated standards to be groundwater cleanup levels as applicable or relevant and appropriate requirements (ARARs) or TBCs. Some of the Site contaminants on the two lists have federal MCLs, and/or Minnesota HRLs, HBVs, or RAA values, as shown in Columns 3 and 4 of Table 6 below. The lack of these standards as groundwater cleanup ARARs in the current decision documents does not affect current protectiveness because, based on collected monitoring data, groundwater contaminated above the federal and state drinking water levels is confined to the source area where no exposures currently exist. However, a CERCLA decision document is needed to document the federal and state promulgated drinking water standards as groundwater cleanup ARARs for the Site. This is planned to occur after completion of the FFS for the Site.

Changes in Toxicity and Other Contaminant Characteristics

Columns 2, 5, and 6 of Table 6 compare the groundwater ALs established in the 1985 AOROC with EPA generic Regional Screening Levels (RSLs) for tapwater. Several Site contaminants did not exceed screening levels in the 2015 HHRA, indicating that it may be appropriate to identify them as no longer being Site COCs.

The 1986 EDD describes List 1 as carcinogenic contaminants and List 2 as noncarcinogenic, but two contaminants in List 2 (1-methylnapthalene and naphthalene) are now also considered carcinogenic. Current risk assessment practice combines cPAHs in a benzo(a)pyrene equivalent factor according to their comparative toxicity with respect to benzo(a)pyrene, not as a sum of their concentrations. The tapwater RSLs for chemicals in List 2 range over several orders of magnitude, suggesting that a single AL for all the chemicals is inappropriate.

Table 6 also lists several chemicals not included in the List 1 and List 2 ALs, but that were identified in the 2015 HHRA (Section 3.2.4 and Attachment Q.2, Table Q2-5) as exceeding screening levels in groundwater at the Site. These include benzene, ethylbenzene, toluene, xylenes (total), dibenzofuran, and 1,2,4-trimethylbenzene. The presence of these chemicals above screening levels indicates that it may be appropriate to consider setting groundwater cleanup levels for them. Based on this information, a CERCLA decision document is needed to update the COCs established for the Site that need to be addressed. This is planned to occur after completion of the FFS for the Site.

Changes in Risk Assessment Methods

Risk assessment methods have undergone significant changes since the initial RI/FS in the 1980s. However, the 2015 HHRA and SLERA used current risk assessment methodology. It found that the Site may pose potential unacceptable risks in the future to the following receptors: a child resident exposed to surface soil and/or groundwater used for consumption; construction workers exposed to subsurface soil and soil vapor; an adult resident exposed to groundwater used for consumption; and a full-time indoor commercial worker from vapor intrusion to indoor air. BNSF is currently conducting an FFS to evaluate remedial alternatives to address the potentially

unacceptable risks identified in the HHRA and working to implement additional ICs to prevent potentially unacceptable exposures.

Table 6: Comparison of Action Levels for Contaminated Groundwater Established in the 1985 AOROC with Current Screening and Regulatory Levels for Site Contaminants

Compound	1985 AOROC ALs (µg/L)	Regulatory Standards		Comparison to Risk-Based Screening Levels	
		MCL (µg/L)	MDH HRL/ HBV/RAA (µg/L)	Tapwater RSL (µg/L, ELCR=1 × 10^{-6}, HI=0.1)	Exceedance (per 2015 HHRA)
Benz(a)anthracene	0.028	N/A	N/A	0.03	No
Benzo(a)pyrene		0.24	0.06 (HBV)[1]	0.025	Yes
Benzo(b)fluoranthene		N/A	N/A	0.25	Not detected
Benzo(g,h,i)perylene		N/A	N/A	N/A	No
Benzo(j)fluoranthene		N/A	N/A	0.065	No
Chrysene		N/A	N/A	25	No
Dibenzo(a,h)anthracene		N/A	N/A	0.025	Not detected
Indeno(1,2,3-c,d)pyrene		N/A	N/A	0.25	No
Quinoline		N/A	N/A	0.024	Yes
Acenaphthene	0.3	N/A	400 (HRL)/100[2]	53	No
Acenaphthylene		N/A	N/A	N/A	No
Acridine		N/A	N/A	N/A	No
Anthracene[3]		N/A	2000 (HRL)	180	No
Benzo(b)thiophene		N/A	N/A	N/A	No
Benzo(e)pyrene		N/A	N/A	N/A	Not detected
Benzo(k)fluoranthene		N/A	N/A	2.5	No
2,3-benzofuran		N/A	N/A	N/A	No
Biphenyl		N/A	300 (HRL)	0.083	Yes
Carbazole		N/A	N/A	N/A	No
Dibenzothiophene		N/A	N/A	6.5	No
2,3-dihydroindene		N/A	N/A	N/A	No
Fluoranthene		N/A	300 (HRL)/70[7]	80	No
Fluorene		N/A	300 (HRL)	29	No
Indene		N/A	N/A	N/A	No
Indole		N/A	N/A	N/A	No
1-methylnaphthalene[4]		N/A	N/A	1.1	Yes
2-methylnaphthalene		N/A	8 (RAA)	3.6	Yes
Naphthalene[9]		N/A	70 (HRL)	0.12	Yes
Perylene		N/A	N/A	N/A	Not detected
Phenanthrene		N/A	N/A	N/A	No
Pyrene		N/A	200 (HRL)/ 50[7]	12	No
Benzene	N/A	5	2 (HRL)[6]	0.46	Yes
Ethylbenzene		700	50 (HRL)	1.5	Yes
Toluene		1000	200 (HRL)	110	Yes
Xylenes (total)		10,000	300 (HRL)	19	Yes
Dibenzofuran		N/A	N/A	0.79	Yes
1,2,4-trimethylbenzene		N/A	100 (HRL)	5.6	Yes

[1] Protective of carcinogenic effects.
[2] Chronic HBV.
[3] Also screened against MPCA's Class 2B-2C surface water standard for the Mississippi River, 0.035 µg/L.
[4] Currently considered carcinogenic.

Changes in Exposure Pathways

The current and reasonably anticipated future land use on and near the Site remains a mix of industrial, commercial, and residential uses.

Expected Progress Towards Meeting RAOs

The air injection system successfully prevents groundwater contamination from migrating beyond the source area of the former facility. However, it is not likely to return the portion of the aquifer impacted by source material to its beneficial use. Therefore, EPA is overseeing the biosparging pilot study and FFS to determine if a remedy modification or supplemental remedy can accelerate progress to groundwater restoration.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. The Site is not overly vulnerable to climate change impacts.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None.

<table>
<tr><th colspan="5">Issues and Recommendations Identified in the Five-Year Review:</th></tr>
<tr><td rowspan="3">OU(s): 01/ Sitewide</td><td colspan="4">Issue Category: Remedy Performance</td></tr>
<tr><td colspan="4">Issue: A pilot study is needed to evaluate the effectiveness of in-situ biosparging at treating source mass and achieving groundwater restoration.</td></tr>
<tr><td colspan="4">Recommendation: Complete the in-situ biosparging pilot study to provide the basis for evaluating the effectiveness of in-situ biosparging in the Focused Feasibility Study.</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Party Responsible</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>No</td><td>Yes</td><td>PRP</td><td>EPA</td><td>6/30/2026</td></tr>
</table>

OU(s): 01/ Sitewide	**Issue Category**: Remedy Performance			
	Issue: The contaminants of concern and groundwater action levels established in the 1986 EDD and 1985 AOROC do not incorporate the current understanding of risk.			
	Recommendation: Issue a remedy decision document that updates the contaminants of concern for the Site and that specifies new groundwater cleanup levels based on the current understanding of risk.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	6/30/2027
OU(s): 01/Sitewide	**Issue Category**: Remedy Performance			
	Issue: It is unclear whether the current groundwater remedy meets the NCP's general expectation of returning usable ground waters to their beneficial uses wherever practicable (40 CFR 300.430 (a)(l)(iii)(F)).			
	Recommendation: Issue a remedy decision document that specifies beneficial use, if practicable, or explains why it is technically impracticable for parts of the plume. If technically impracticable, specify a point of compliance for containment of groundwater contamination.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	6/30/2027
OU(s): 01/ Sitewide	**Issue Category**: Remedy Performance			
	Issue: Groundwater extraction as required by the 1985 AOROC was found to potentially increase the rate of plume migration. A pilot test using air sparging for groundwater has attained containment more efficiently than the extraction method.			
	Recommendation: Modify the remedy in a decision document to air sparging or other technology that best fits EPAs remedy selection criteria as documented in the FFS.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	6/30/2027

OU(s): 01/ Sitewide	**Issue Category**: Institutional Controls			
	Issue: The current decision documents do not specifically require ICs as part of the remedy, although areas of the Site do not allow for UU/UE.			
	Recommendation: Issue a remedy decision document that requires ICs as part of the modified remedy to ensure long-term protectiveness of human health and the environment.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	6/30/2027
OU(s): 01/ Sitewide	**Issue Category**: Institutional Controls			
	Issue: Areas of the Site that do not allow for UU/UE do not have enforceable ICs to prevent exposure to contaminated soil and groundwater.			
	Recommendation: Implement additional ICs needed at the Site.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	6/30/2022
OU(s): 01/ Sitewide	**Issue Category**: Institutional Controls			
	Issue: Areas of the Site that do not allow for UU/UE do not have long-term stewardship procedures in place for monitoring and ensuring compliance with ICs once implemented.			
	Recommendation: Document and implement long-term stewardship procedures for monitoring and ensuring compliance with ICs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	6/30/2022

VII. PROTECTIVENESS STATEMENT

OU1 and Sitewide Protectiveness Statement(s)
Protectiveness Determination: Short-term Protective
Protectiveness Statement: The remedy currently protects human health and the environment because the air sparge system effectively contains groundwater contamination within the source area. Further, there are no on-Site residents, full-time indoor commercial workers, or subsurface construction workers, and the discharge of contaminated water to the Mississippi River does not cause unacceptable ecological impacts. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: • Complete a pilot study on the effectiveness of in-situ biosparging; • Issue one or more remedy decision document(s) that 1) specifies groundwater cleanup levels based on the current understanding of risk, 2) specifies beneficial use, if practicable, or explains why it is technically impracticable for parts of the plume, and if technically impracticable, specify a point of compliance for containment of groundwater contamination, 3) selects the existing air sparging system or other effective technology to contain or remediate contaminated groundwater and its sources, and 4) requires ICs preventing exposure to contaminated groundwater, soil and NAPL; • Implement additional ICs; and • Implement long-term stewardship procedures.

VIII. NEXT REVIEW

The next FYR report for the Burlington Northern (Brainerd/Baxter Plant Superfund Site is required five years from the completion date of this review.

APPENDIX A – REFERENCES AND DOCUMENTS REVIEWED

AECOM. (2013a). *Health and Safety Plan for Supplemental Remedial Investigations, Operations, Monitoring and Maintenance Activities.* February 2013: #05-922893.

AECOM. (2013b). *Quality Assurance Project Plan for Compliance Monitoring Activities.* February 2013: #05-487326.

AECOM. (2014a). *Former RCRA Unit Operations and Maintenance Plan.* January 2014: #05-924030.

AECOM. (2014b). *Groundwater Monitoring Plan.* March 2014: #05-924032.

AECOM. (2014c). *Operations and Maintenance Plan for the Aquifer Air Injection Treatment System.* January 2014: #05-924031.

AECOM. (2015). *Final Supplemental Remedial Investigation Report.* August 2015: #05-9203352.

AECOM. (2016a). *2015 Annual Report (Revised).* April 28, 2016: #05-928352 & 05-928353.

AECOM. (2016b). *Final Alternatives Development and Screening Technical Memorandum.* August 2016: #05-2003246.

AECOM. (2016c). *Final Institutional Controls Work Plan.* 2016: #05-929554.

AECOM. (2016d). *Final Land Uses and Institutional Controls Memorandum.* May 2016: #05-928351.

AECOM. (2016e). *Natural Source Zone Depletion Assessment Work Plan.* October 2016: #05-2003192.

AECOM. (2017a). *2016 Annual Report.* June 2017: #05-2003188.

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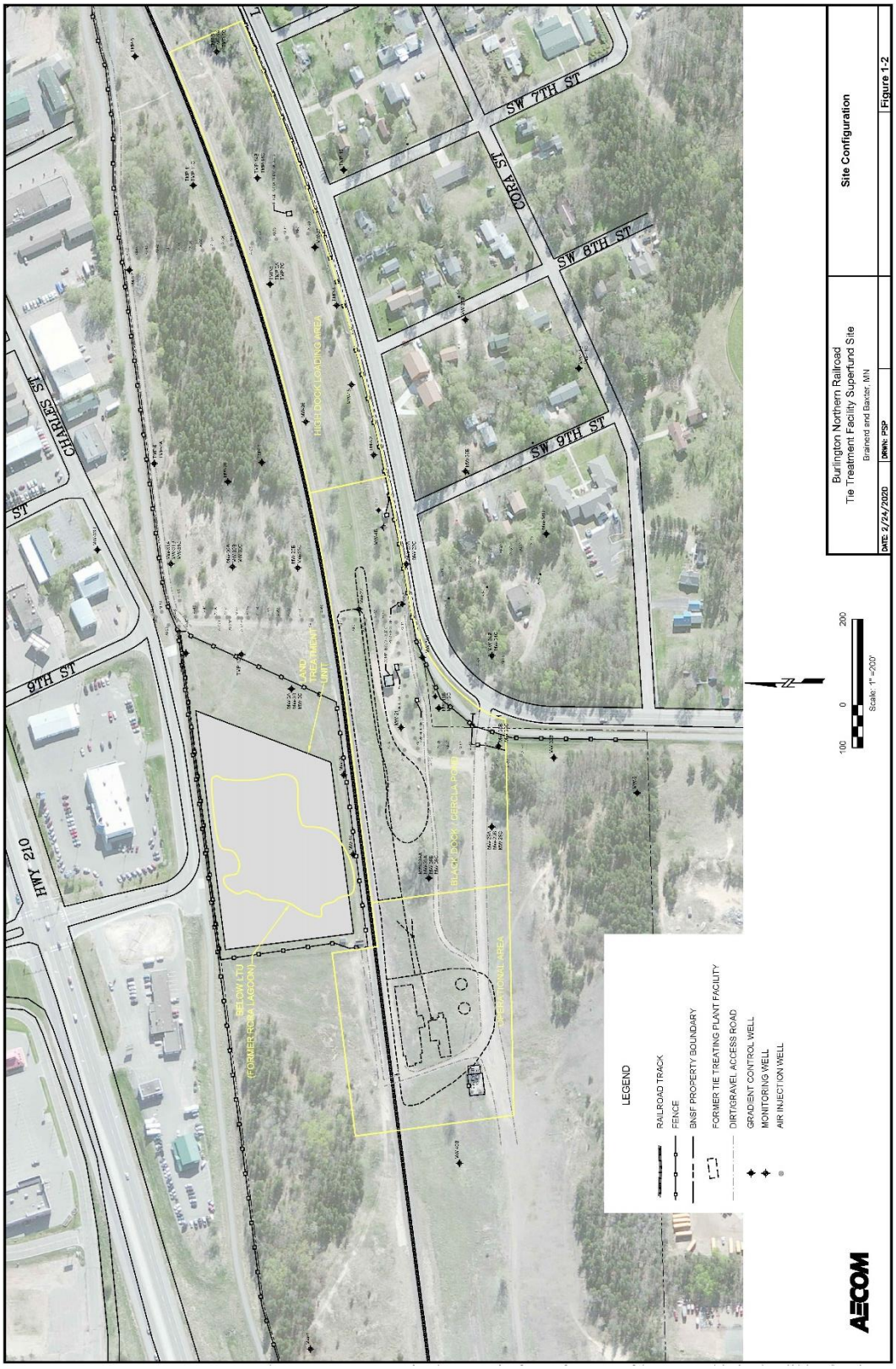
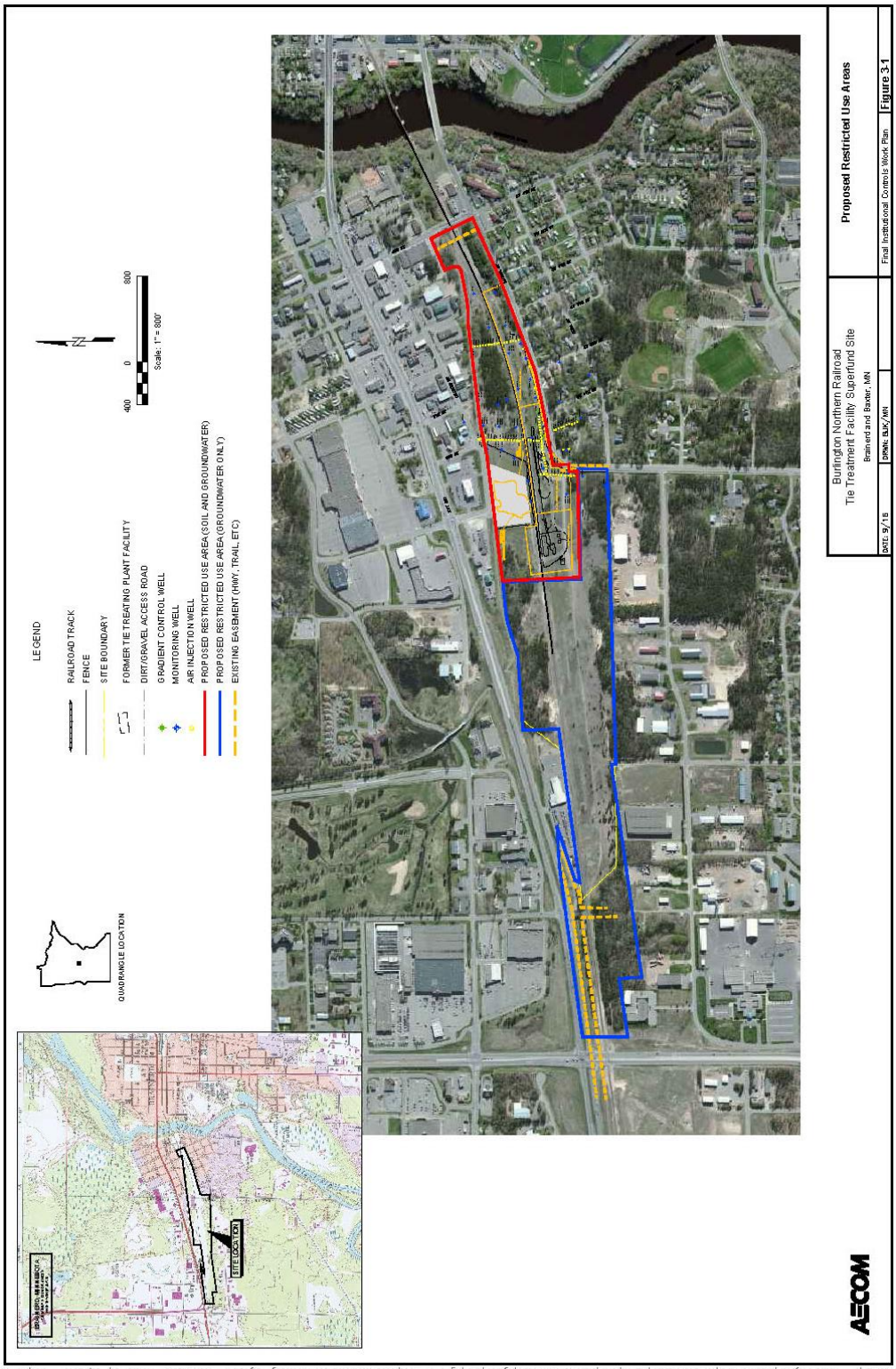
APPENDIX B

SITE CONFIGURATION



APPENDIX C

AREAS DESIGNATED FOR INSTITUTIONAL CONTROLS



File: Z:\1 - Active Projects\General RITS\7.0 Deliverables\7.2 Reports\7.2.6 IC Work Plan\Figures\CAD\Fig 3-1 - Proposed Restricted Use Areas.dwg, Layout: 1, User: klouab, Plotted: Sep 08, 2015 - 1:05pm

APPENDIX D – FIVE YEAR REVIEW INSPECTION CHECKLIST AND PHOTOGRAPHS

Site Inspection Checklist

I. SITE INFORMATION	
Site name: Burlington Northern (Brainerd/Baxter Plant) Superfund Site	**Date of inspection:** September 14, 2021
Location and Region: Baxter & Brainerd, MN, R5	**EPA ID:** MND000686196
Agency, office, or company leading the five-year review: Region 5 SEMD	**Weather/temperature:** 59°, low clouds

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☐ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other Air sparge system
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

Attendees:

Leslie Patterson, EPA
Tom Reppe, MPCA
Brad Leick, MPCA
Greg Jeffries, BNSF
Ron Holm, AECOM
Bill Brown, AECOM
Kurt Geiser, AECOM

1

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐at site ☐at office ☐by phone Phone no. _____
   Problems, suggestions; ☐Report attached _____

2. **O&M staff** (Bill Brown) _____ _____ _____
   Name Title Date
   Interviewed: ☐at site ☐at office ☐by phone Phone no. _____
   Problems, suggestions; ☐Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

   Agency MPCA
   Contact Tom Reppe Project Manager _____ _____
   Name Title Date Phone no.
   Problems; suggestions; ☐Report attached _____

   Agency MPCA
   Contact Brad Leick Hydrologist _____ _____
   Name Title Date Phone no.
   Problems; suggestions; ☐Report attached _____

   Agency _____
   Contact _____ _____ _____ _____
   Name Title Date Phone no.
   Problems; suggestions; ☐Report attached _____

   Agency _____
   Contact _____ _____ _____ _____
   Name Title Date Phone no.
   Problems; suggestions; ☐Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual (2014; SEMS #924031 ☐ Readily available ☐ Up to date ☐ N/A pdf.
   - ☐ As-built drawings (Appx. B to O&M manual) ☐ Readily available ☐ Up to date ☐ N/A
   - ☐ Maintenance logs ☐ Readily available ☐ Up to date ☐ N/A

   Remarks workplans in main building; equipment-specific logs in those buildings

2. **Site-Specific Health and Safety Plan** ☑ Readily available ☐ Up to date ☐ N/A
   - ☐ Contingency plan/emergency response plan ☑ Readily available ☐ Up to date ☐ N/A

   Remarks

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☐ N/A
   Remarks electronic

4. **Permits and Service Agreements**
   - ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
   - ☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
   - ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
   - ☑ Other permits wells ☐ Readily available ☐ Up to date ☒ N/A

   Remarks electronic

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
   Remarks

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☑ N/A
   Remarks

7. **Groundwater Monitoring Records** ☐ Readily available ☑ Up to date ☐ N/A
   Remarks electronic

8. **Leachate Extraction Records** ☑ Readily available ☐ Up to date ☐ N/A
   Remarks in main building; monthly scanned to office

9. **Discharge Compliance Records**
   - ☐ Air ☐ Readily available ☐ Up to date ☐ N/A
   - ☐ Water (effluent) ☐ Readily available ☐ Up to date ☐ N/A

   Remarks leachate discharged

10. **Daily Access/Security Logs** ☑ Readily available ☐ Up to date ☐ N/A
    Remarks they get scanned

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____

2. **O&M Cost Records**

☐Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
*Annual O&M costs are
Original O&M cost estimate_____ ☐Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☑ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A
   Remarks fencing maintained by DNR -

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
   Remarks signage is in place

C. Institutional Controls (ICs)

1. **Implementation and enforcement**
   Site conditions imply ICs not properly implemented ☐ Yes ☑ No ☐ N/A
   Site conditions imply ICs not being fully enforced ☐ Yes ☑ No ☐ N/A

   Type of monitoring (*e.g.*, self-reporting, drive by) _____
   Frequency _____
   Responsible party/agency _____
   Contact _____ _____ _____ _____
   Name Title Date Phone no.

   Reporting is up-to-date ☐ Yes ☐ No ☑ N/A
   Reports are verified by the lead agency ☐ Yes ☐ No ☑ N/A

   Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☑ N/A
   Violations have been reported ☐ Yes ☐ No ☑ N/A
   Other problems or suggestions: ☐ Report attached
   ICs are not part of decision document, but land use indicates non-residential use, no groundwater use known.

2. **Adequacy** ☐ ICs are adequate ☑ ICs are inadequate ☐ N/A
   Remarks ICs are being developed

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐ No vandalism evident
   Remarks frequent vandalism / entry through fence; was fixed

2. **Land use changes on site** ☐ N/A
   Remarks no changes

3. **Land use changes off site** ☐ N/A
   Remarks no changes

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☑ Roads adequate ☐ N/A
   Remarks roads are minimal, but adequate.

B. Other Site Conditions

Remarks

VII. LANDFILL COVERS ☑ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent ____ Depth ____
   Remarks former LTU has slight rolling depressions, not impacting protectiveness.

2. **Cracks** ☐ Location shown on site map ☑ Cracking not evident
   Lengths ____ Widths ____ Depths ____
   Remarks

3. **Erosion** ☐ Location shown on site map ☑ Erosion not evident
   Areal extent ____ Depth ____
   Remarks

4. **Holes** ☐ Location shown on site map ☑ Holes not evident
   Areal extent ____ Depth ____
   Remarks

5. **Vegetative Cover** ☑ Grass ☑ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks

6. **Alternative Cover (armored rock, concrete, etc.)** ☑ N/A
   Remarks

7. **Bulges** ☐ Location shown on site map ☑ Bulges not evident
   Areal extent ____ Height ____
   Remarks

8.	**Wet Areas/Water Damage**	☑ Wet areas/water damage not evident	
	☐ Wet areas	☐ Location shown on site map	Areal extent
	☐ Ponding	☐ Location shown on site map	Areal extent
	☐ Seeps	☐ Location shown on site map	Areal extent
	☐ Soft subgrade	☐ Location shown on site map	Areal extent
	Remarks		
9.	**Slope Instability** ☐ Slides	☐ Location shown on site map	☑ No evidence of slope instability
	Areal extent		
	Remarks		

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1.	**Flows Bypass Bench**	☐ Location shown on site map	☐ N/A or okay
	Remarks		
2.	**Bench Breached**	☐ Location shown on site map	☐ N/A or okay
	Remarks		
3.	**Bench Overtopped**	☐ Location shown on site map	☐ N/A or okay
	Remarks		

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1.	**Settlement**	☐ Location shown on site map	☐ No evidence of settlement
	Areal extent	Depth	
	Remarks		
2.	**Material Degradation**	☐ Location shown on site map	☐ No evidence of degradation
	Material type	Areal extent	
	Remarks		
3.	**Erosion**	☐ Location shown on site map	☐ No evidence of erosion
	Areal extent	Depth	
	Remarks		
4.	**Undercutting**	☐ Location shown on site map	☐ No evidence of undercutting
	Areal extent	Depth	
	Remarks		

5. **Obstructions** Type _____ ☐ No obstructions
☐ Location shown on site map Areal extent _____
Size _____
Remarks _____

6. **Excessive Vegetative Growth** Type _____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks _____

D. Cover Penetrations ☐ Applicable ☒ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks _____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks _____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks _____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks _____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks _____

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance
Remarks _____

2. **Gas Collection Wells, Manifolds and Piping**
☐ Good condition ☐ Needs Maintenance
Remarks _____

3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☒ N/A Remarks_____
F. Cover Drainage Layer	☐ Applicable ☒ N/A
1.	**Outlet Pipes Inspected** ☐ Functioning ☐ N/A Remarks_____
2.	**Outlet Rock Inspected** ☐ Functioning ☐ N/A Remarks_____
G. Detention/Sedimentation Ponds	☐ Applicable ☒ N/A
1.	**Siltation** Areal extent_____ Depth_____ ☐ N/A ☐ Siltation not evident Remarks_____
2.	**Erosion** Areal extent_____ Depth_____ ☐ Erosion not evident Remarks_____
3.	**Outlet Works** ☐ Functioning ☐ N/A Remarks_____
4.	**Dam** ☐ Functioning ☐ N/A Remarks_____
H. Retaining Walls	☐ Applicable ☒ N/A
1.	**Deformations** ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks_____
2.	**Degradation** ☐ Location shown on site map ☐ Degradation not evident Remarks_____
I. Perimeter Ditches/Off-Site Discharge	☐ Applicable ☒ N/A
1.	**Siltation** ☐ Location shown on site map ☐ Siltation not evident Areal extent_____ Depth_____ Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
Areal extent _____ Type _____
Remarks _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks _____

4. **Discharge Structure** ☐ Functioning ☐ N/A
Remarks _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent _____ Depth _____
Remarks _____

2. **Performance Monitoring** Type of monitoring _____
☐ Performance not monitored
Frequency _____ ☐ Evidence of breaching
Head differential _____
Remarks _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. ~~Groundwater Extraction Wells, Pumps, and Pipelines~~ Air Sparge System ☑ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☑ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks extraction system is not used. Equipment + buildings are aging and may be decommissioned at the appropriate time.

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks Some parts are ordered when needed

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System (Sparge) ☑ Applicable ☒ N/A + leachate / condensate

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☒ Carbon adsorbers
☐ Filters
☐ Additive (*e.g.*, chelation agent, flocculent)
☐ Others
☐ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually
☐ Quantity of surface water treated annually
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☑ Good condition ☐ Needs Maintenance
Remarks

3. **Tanks, Vaults, Storage Vessels**
☑ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
Remarks

4. **Discharge Structure and Appurtenances**
☐ N/A ☑ Good condition ☐ Needs Maintenance
Remarks

5. ~~**Treatment** **Compressor and other Building(s)**~~
☐ N/A ☑ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks

6. **Monitoring Wells** (pump and treatment remedy)
☑ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☑ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks

D. Monitoring Data

1. Monitoring Data
   ☑ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:
   ☑ Groundwater plume is effectively contained ☑ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☒ N/A
   Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Remedy as implemented injects air into groundwater to assist in degradation of organic contaminants. System is well maintained. Downgradient x off-site sparge lines are not currently operating because upgradient line effectively treats the contaminants.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

see recommendations from the 2016 FYRR.

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. none
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. treatability study underway

Figure D-1: Fencing between the Site and the recreational trail, southern Site boundary, near the Site entrance at the Highland Scenic Drive/Laurel Street intersection.

Figure D-2: Interior of the compressor building.

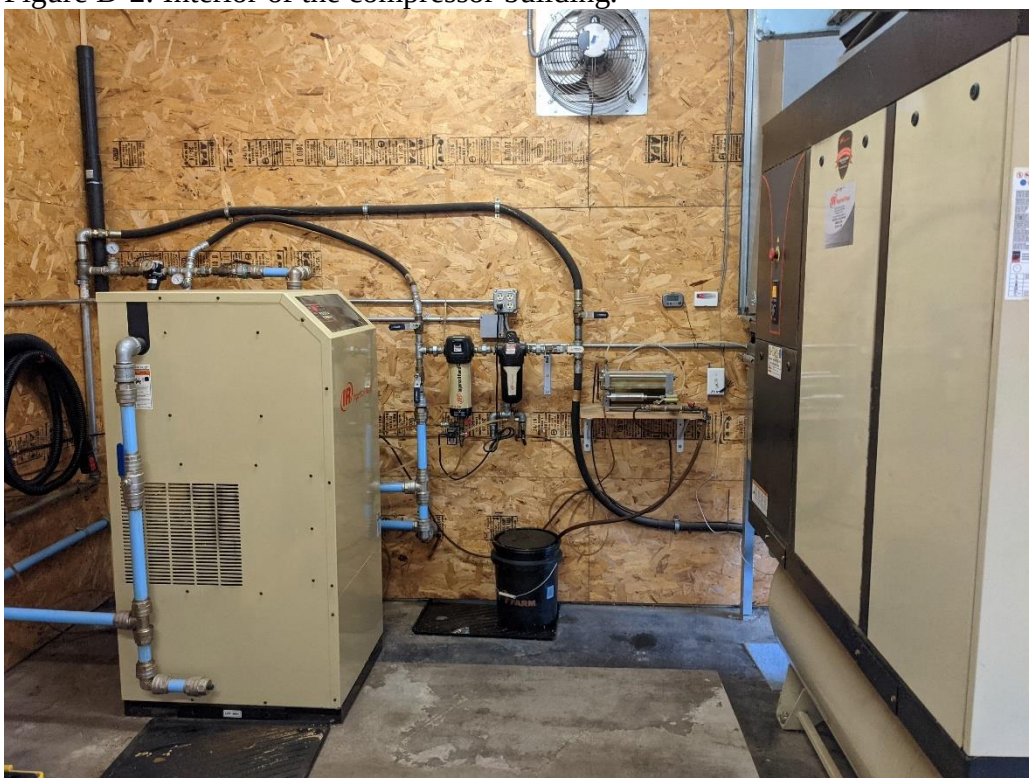


Figure D-3: Interior of the west air distribution building.

Figure D-4: Air distribution manifold.

Figure D-5: View along the southern fenceline line of air sparge wells along Laurel Street.

Figure D-6: Facing north, Phase II (upgradient) air sparge line.

Figure D-7: Fencing along the northern boundary that had previously been breached by trespassers.

Figure D-8: Signage and worn footpath from trespassers.

Figure D-9: View south along the Phase I (downgradient) air sparge well line.

Figure D-10: View south to the Phase II (upgradient) air sparge line, showing a directionally-drilled air sparge well head.

Figure D-11: Fencing and signage at the northeast corner of the former LTU.

Figure D-12: Activated carbon treatment system in the leachate treatment building at the southwest corner of the former LTU enclosure.

Figure D-13: Biosparge well nests AI-92 (AI-92A/B/C) and AI-94 (AI-94A/B/C) and observation well nests AI-93 (AI-93A/B/C) and AI-95 (AI-95B/C), constructed for Phase 1 of the biosparging treatability study.

Figure D-14: Monitoring well nest MW-41 (MW-41AA/A/B/C), constructed to evaluate in-situ biosparging effectiveness; equipped with data loggers.

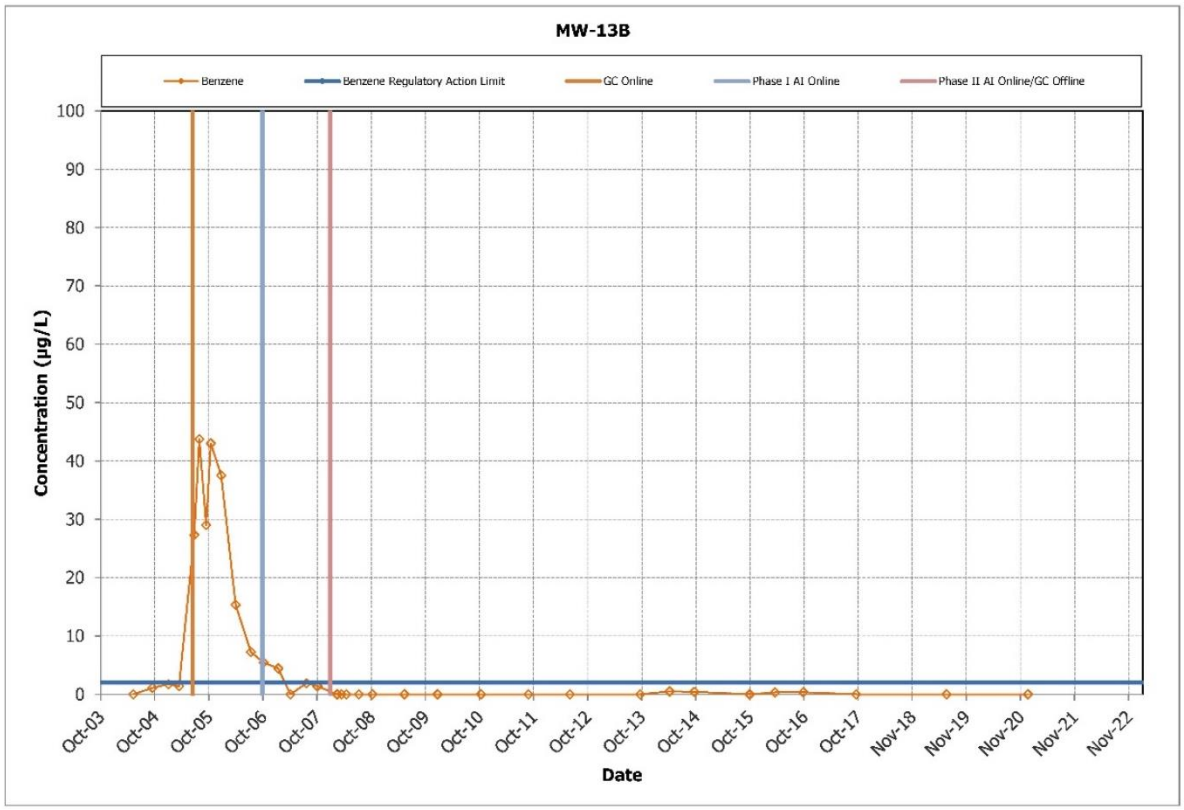
APPENDIX E – SITE CHRONOLOGY

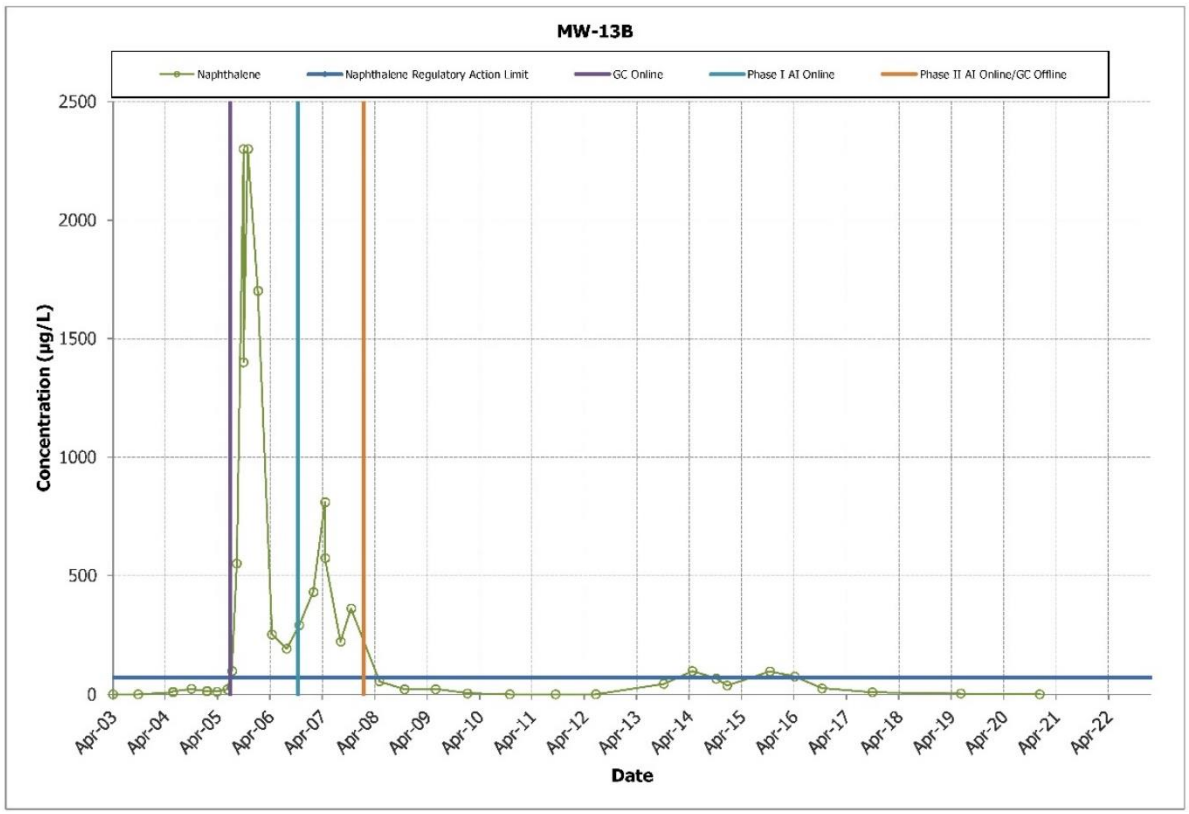
Event/Milestone	Date
Burlington Northern (Brainerd/Baxter Plant) Site discovered	12/31/1974
NPL Site listing proposed	7/16/1982
MPCA issues notice letters	10/05/1982
BNSF removes and treats wastewater from lagoons	12/31/1982
Final Listing on NPL	9/8/1983
MPCA issues NPDES Permit	1984
Administrative Order on Consent for RI/FS and RD/RA signed among MPCA, EPA, and BNSF	4/4/1985
BNSF conducts RI/FS	1984-1985
BNSF performs the remedial action identified in the 1985 AOROC (construct on-Site LTU and gradient control well system, and remove creosote)	October to December 1985
EPA signs EDD Document	6/4/1986
MPCA issues RCRA permit issued for the former LTU	December 1986
Oversight (or administration) transferred from MPCA Superfund to MPCA RCRA program	3/19/1991
MPCA reissues RCRA permit for landfill and groundwater oversight	September 1992
Air Sparging added as treatment response action to groundwater discharge	1992
First Five-Year Review Report (EPA lead)	1/27/1993
Remedial Action Report	November 1995
EPA signs Preliminary Close Out Report (Construction Complete)	9/18/1995
BNSF adds 13 additional sparge wells added in an east-west line for pre-treatment	Fall 1995
Second Five-Year Review Report (EPA lead)	3/13/1998
MPCA reissues RCRA Permit for the former LTU	8/1/2001
Gradient control wells discontinued to assess natural attenuation	December 2001
Eighteen additional monitoring wells installed to further assess trial shutdown of gradient control	2003 – 2005
Third Five-Year Review, which addressed soil only (MPCA lead)	9/30/2003
Groundwater oversight transferred to MPCA Superfund program	July 2005
BNSF conducts a supplemental soil investigation in response to the 2003 Five-Year Review	2005-2007
Focused Alternatives Analysis for groundwater plume	2005
Conditional approval of Air Injection Pilot System Phase 1 Work Plan	June 2006
BNSF initiates Phase I of the Air Injection Pilot Test	October 2006
BNSF activates Phase II of the Air Injection Pilot Test; gradient control wells not pumping	1/17/2008
Five-Year Review Supplemental Soil Investigation Report	June 2008
Supplemental groundwater and soil gas investigation conducted; additional monitoring well added	July 2008
BNSF adds additional off-Site air sparging points and monitoring wells	September 2008
Air Injection Pilot System Evaluation Completed	April 2009

Event/Milestone	Date
BNSF submits *Summary of Off-Site Response Action Activities* Report, recommending continued operation of the off-Site air injection points.	May 2009
Three sparge points added in vicinity of MW-31A	September 2011
EPA assumes lead for oversight of all Site media (RCRA LTU permit terminated)	November 2012
Fourth Five Year Review Report	12/23/2011
EPA and BNSF enter into an ASAOC for Supplemental RI/FS	12/18/2012
EPA approves the Final Supplemental RI Report	8/11/2015
EPA approves the Land Uses and Institutional Controls Memorandum	6/7/2016
Fifth Five Year Review Report	12/15/2016
BNSF begins treatability study fieldwork pursuant to July 2020 workplan	September 2020
O&M of air sparge wells and groundwater monitoring	Ongoing
O&M of former LTU containment unit	Ongoing

APPENDIX F –GROUNDWATER MONITORING WELL CONCENTRATION TRENDS 2003-2020

For trend charts for all monitoring wells, see the *2020 Annual Report*. (AECOM, 2021a)





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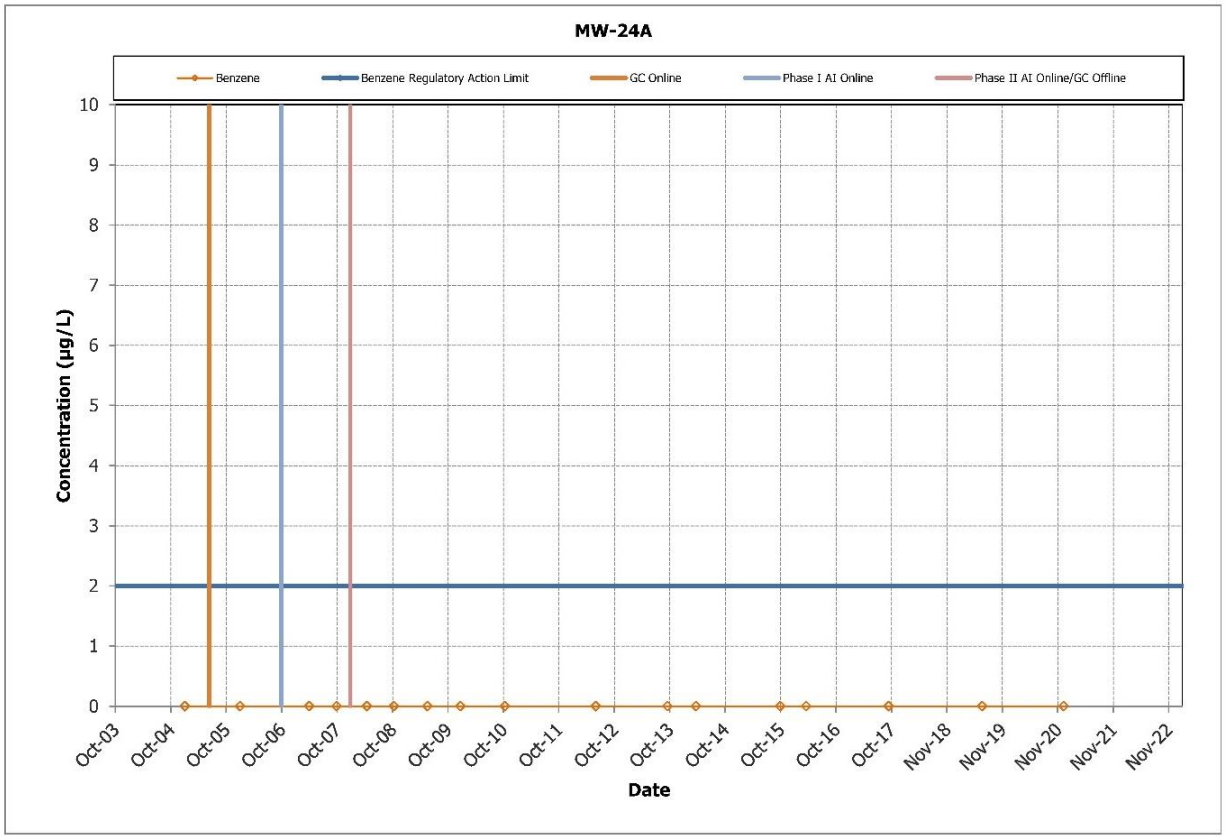

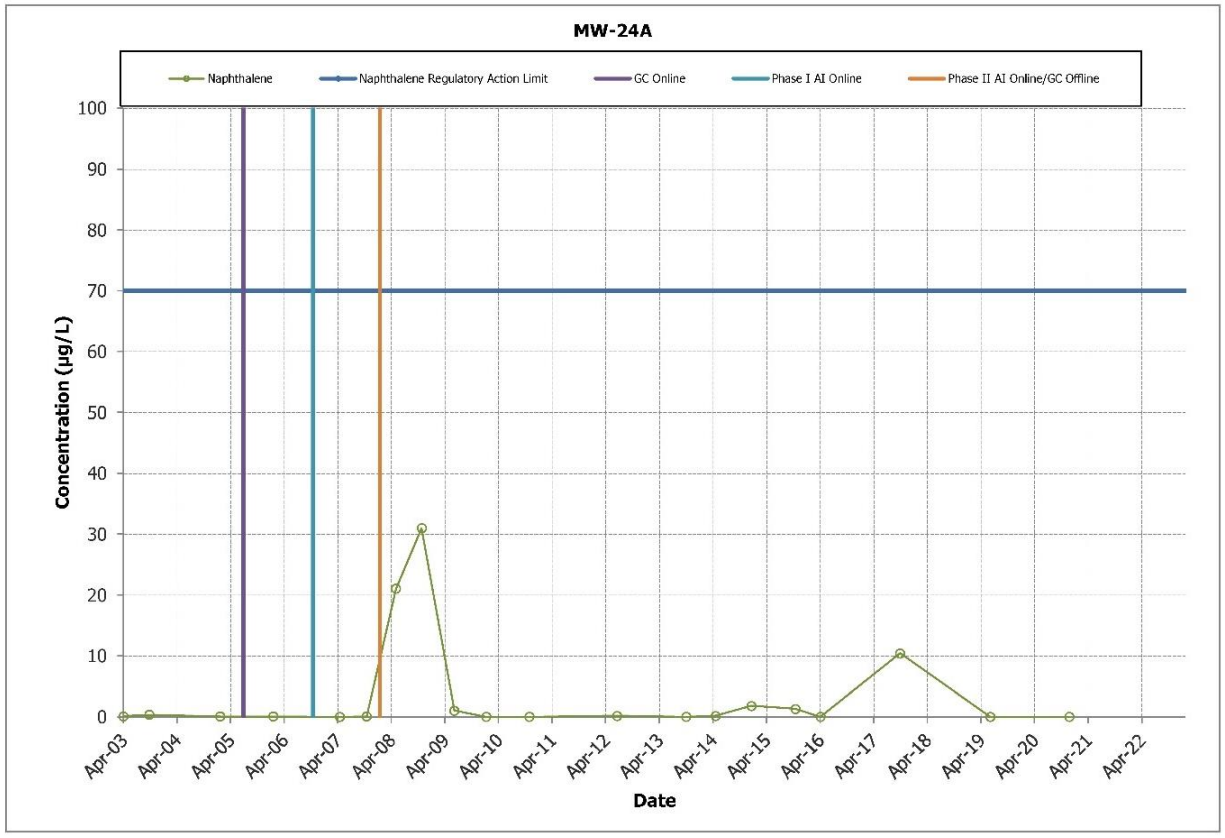

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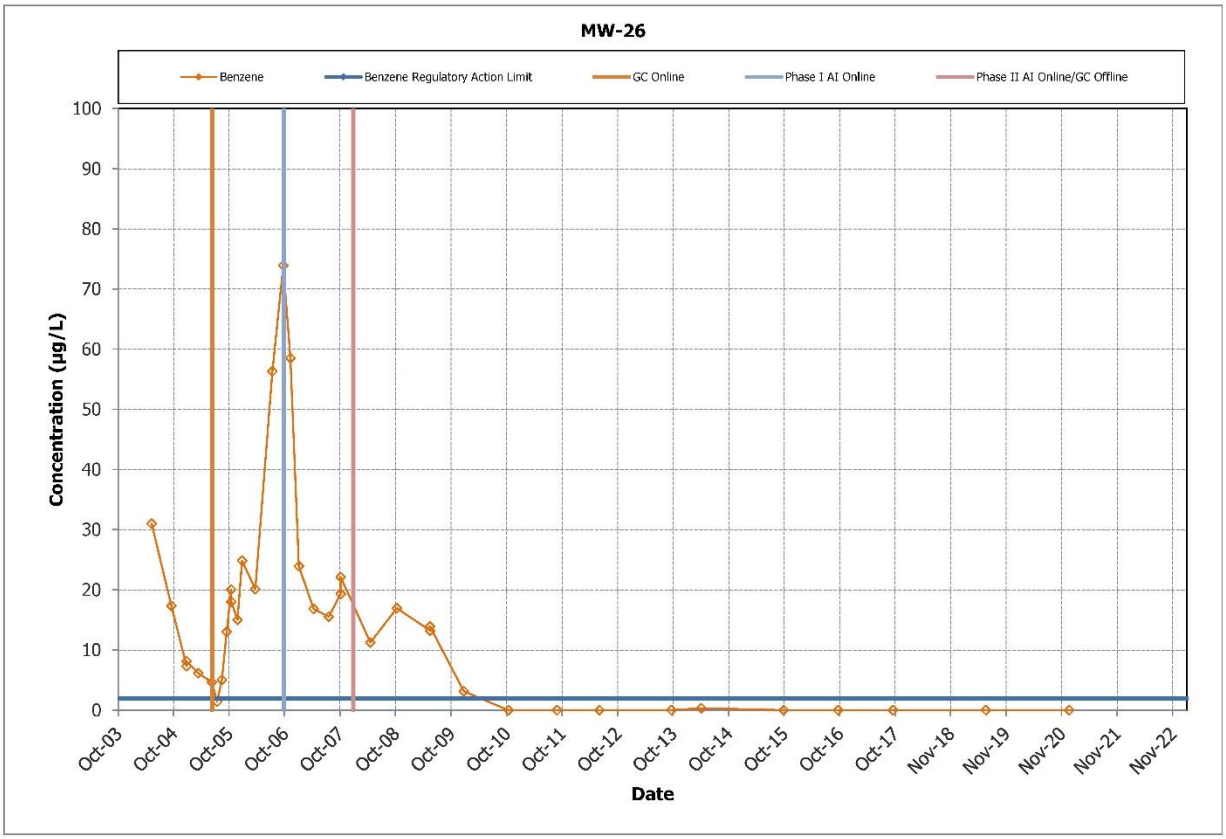

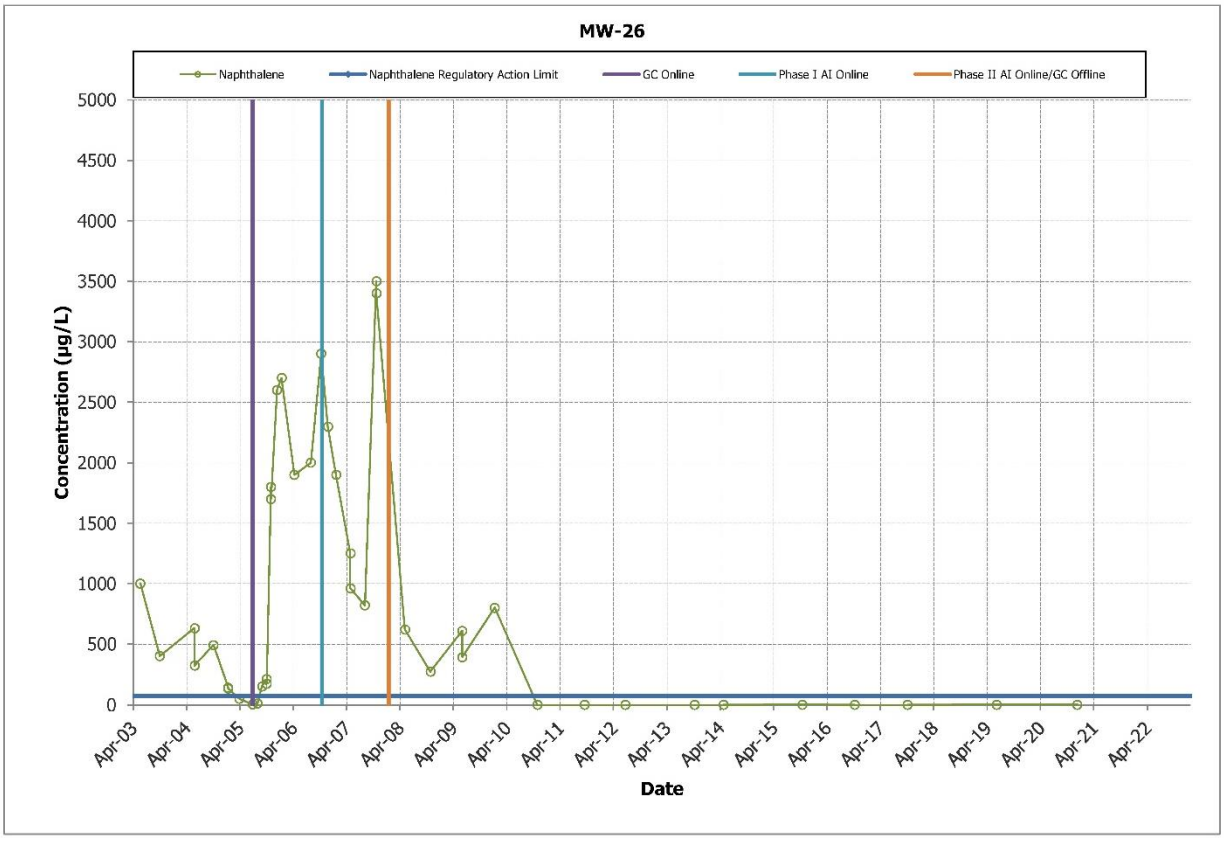

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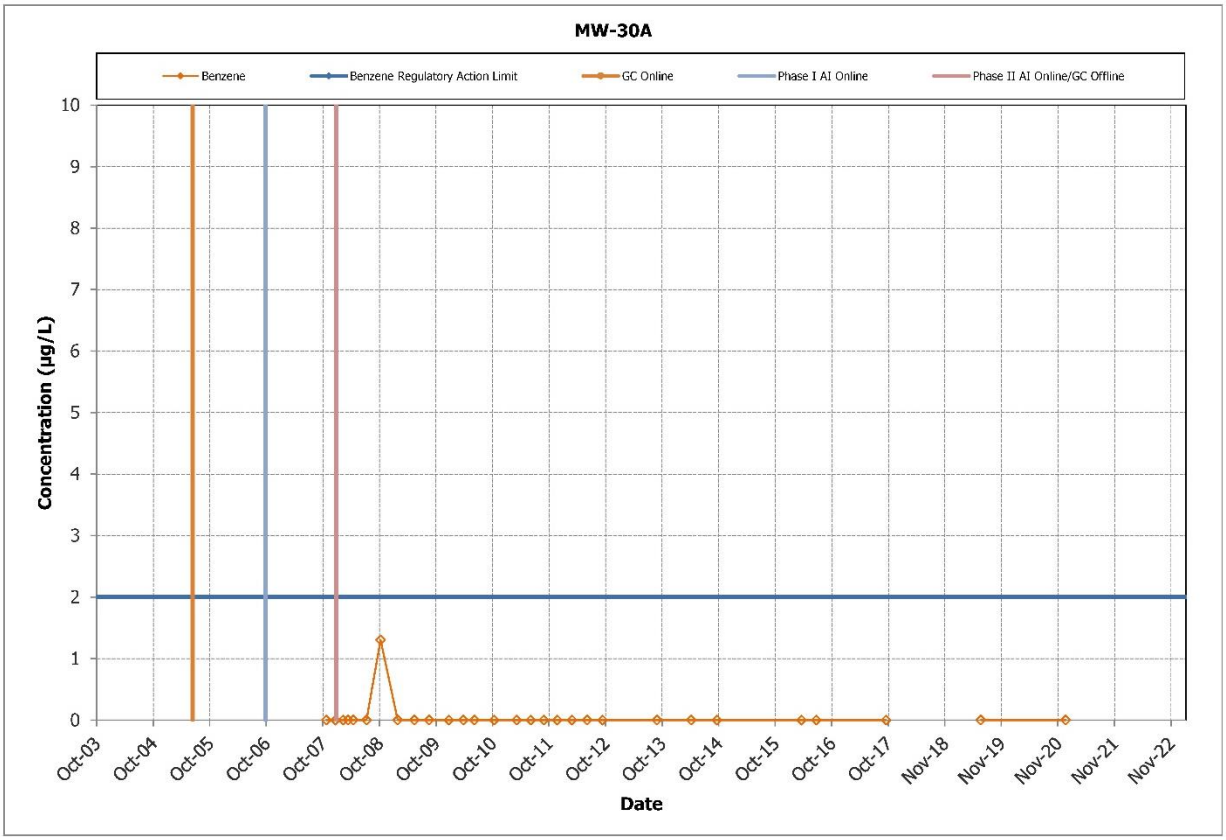

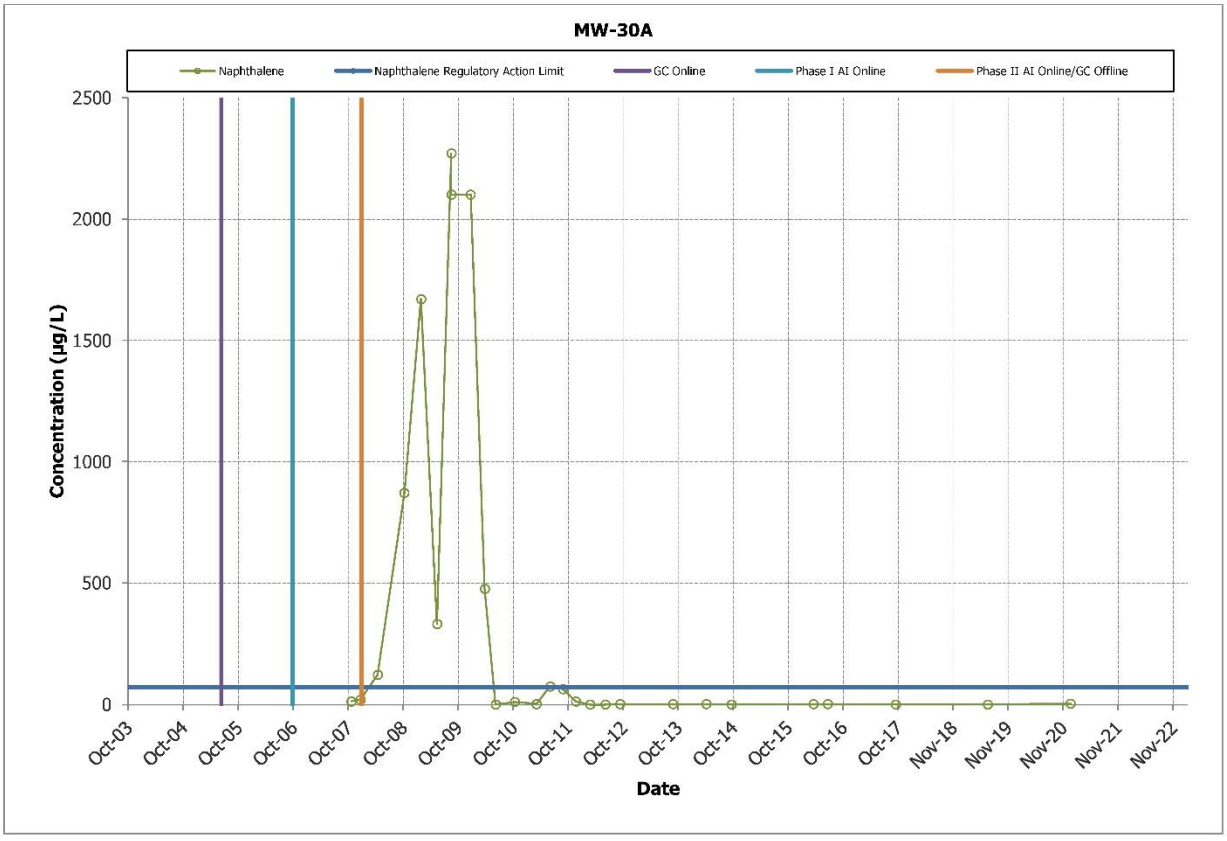

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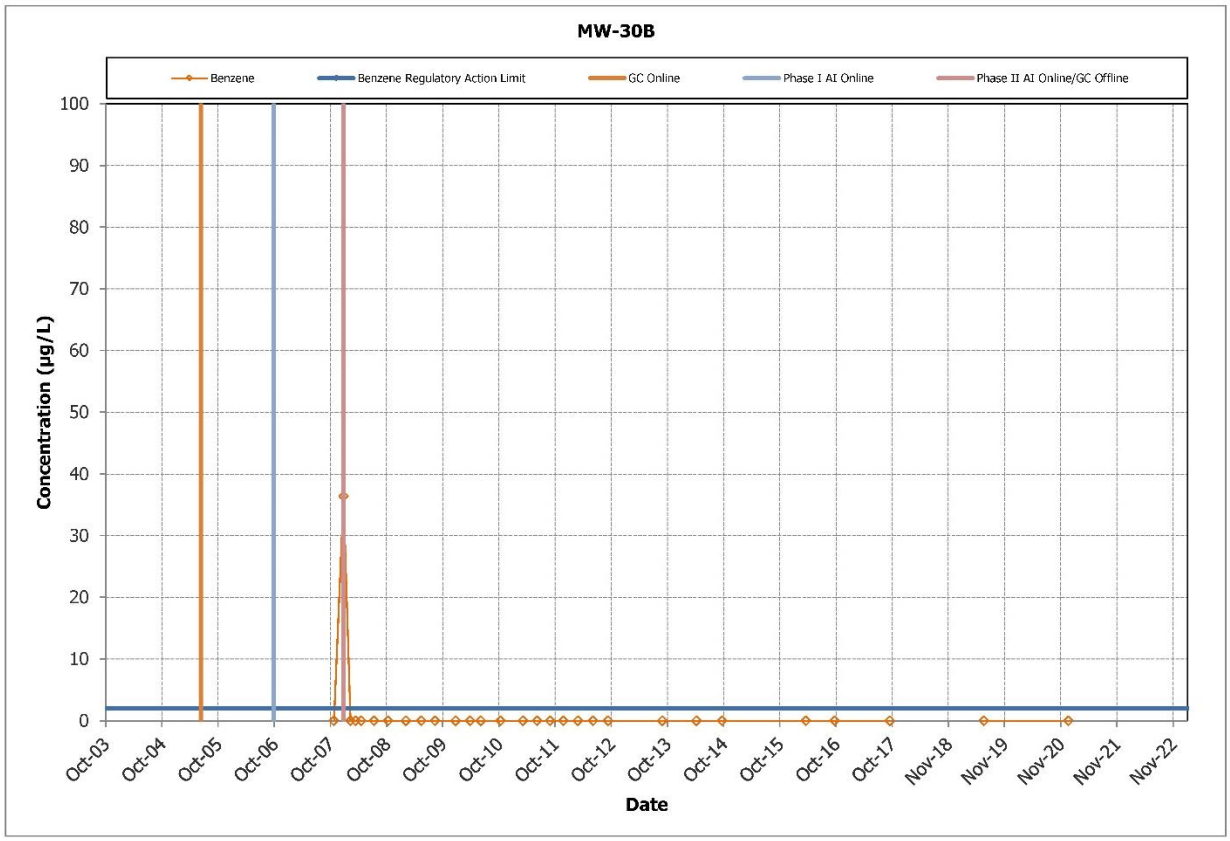

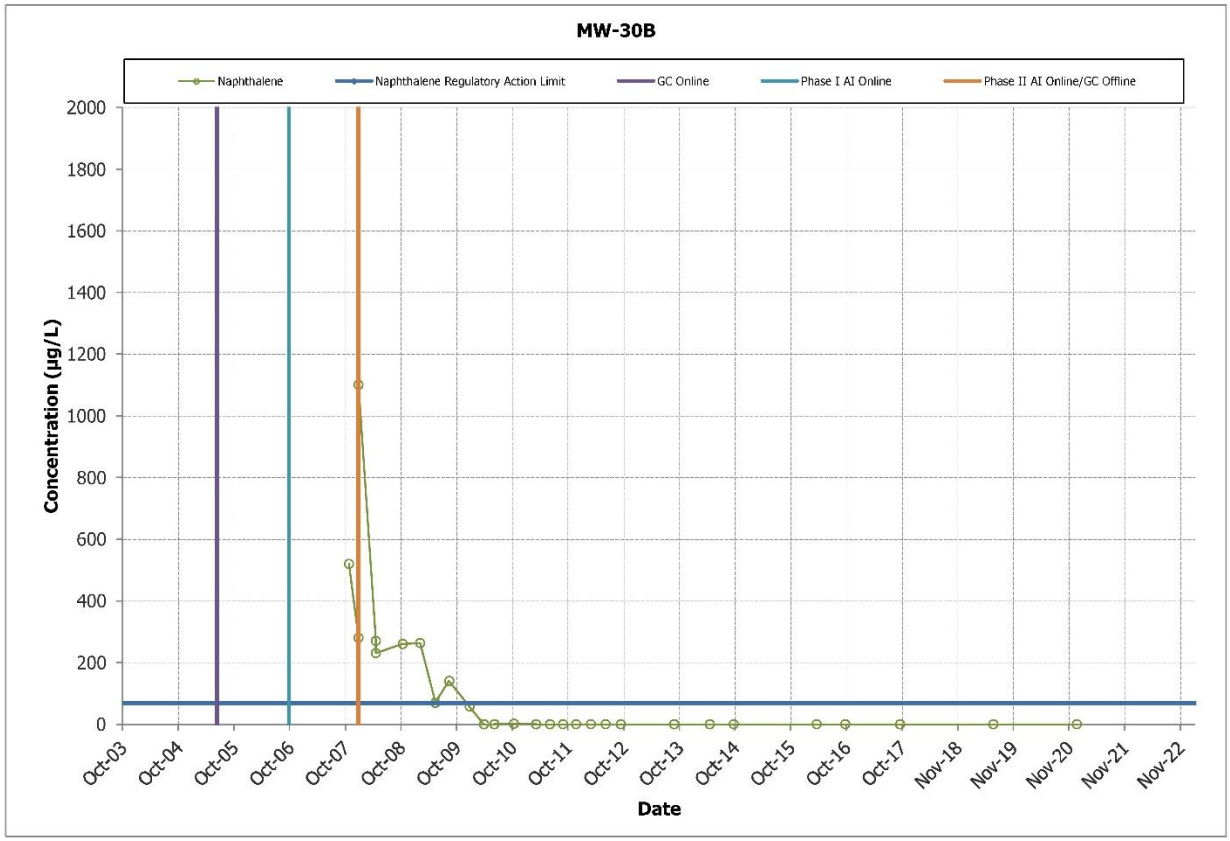

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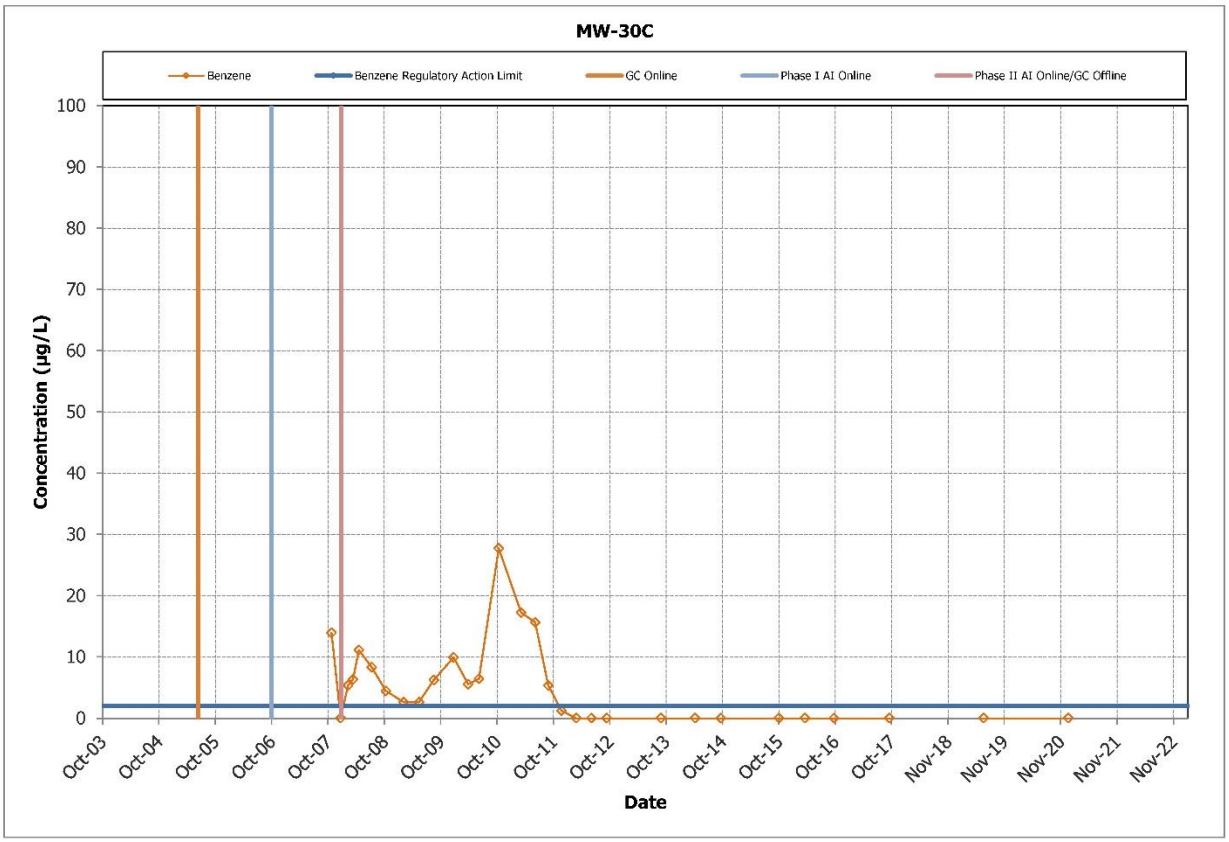

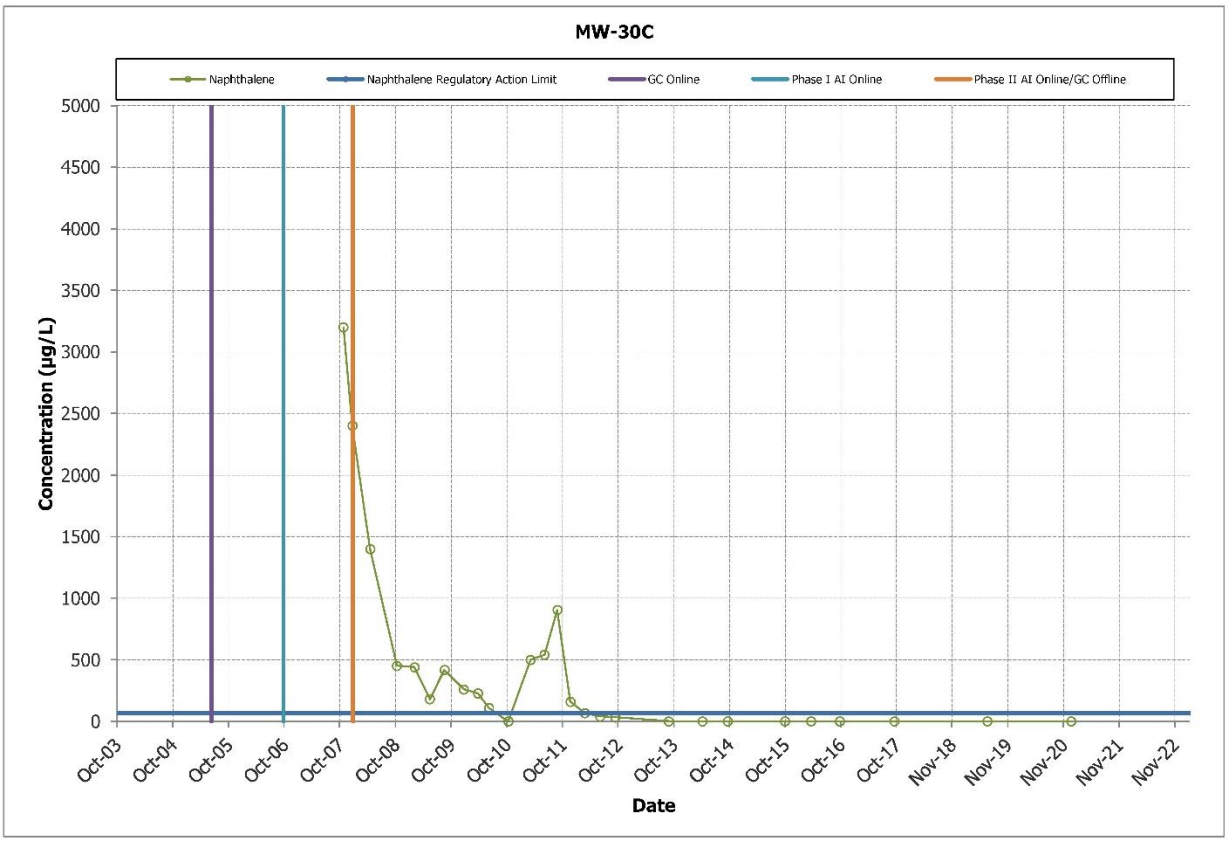

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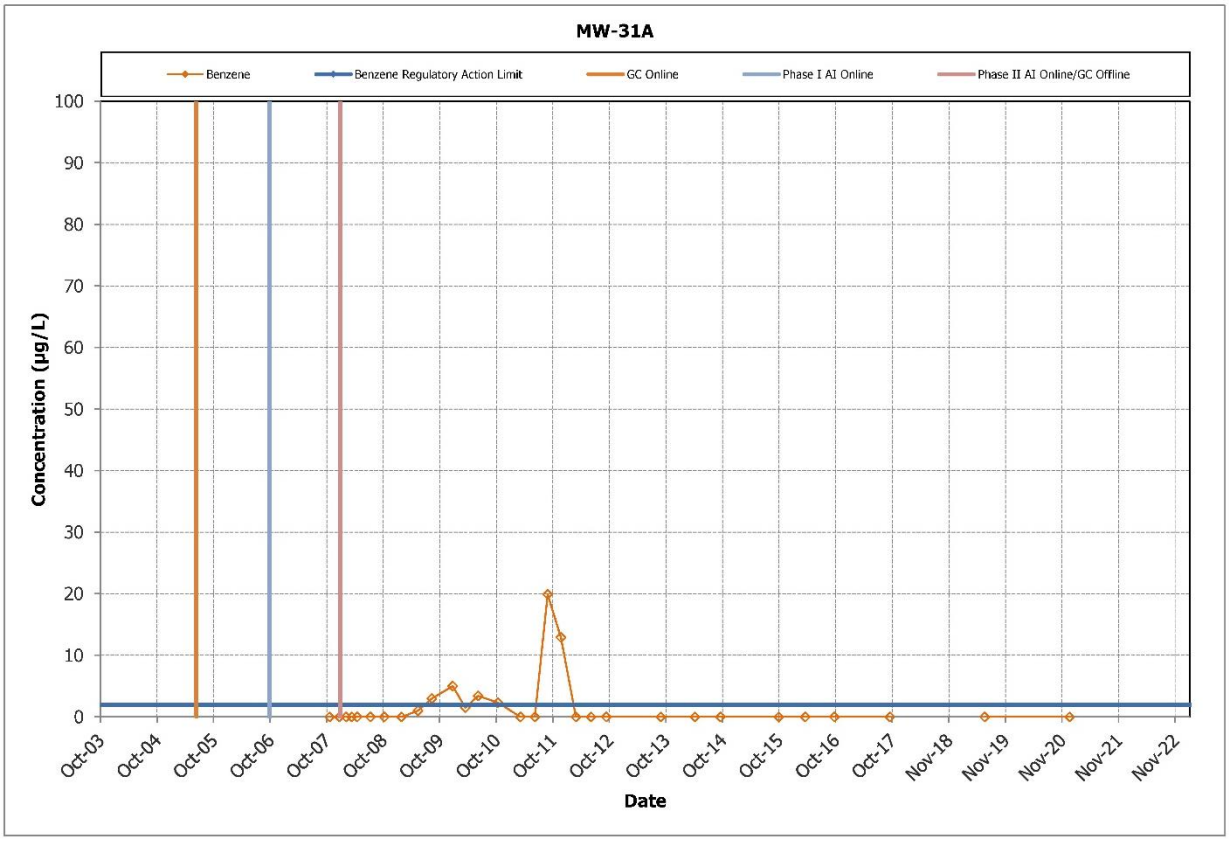

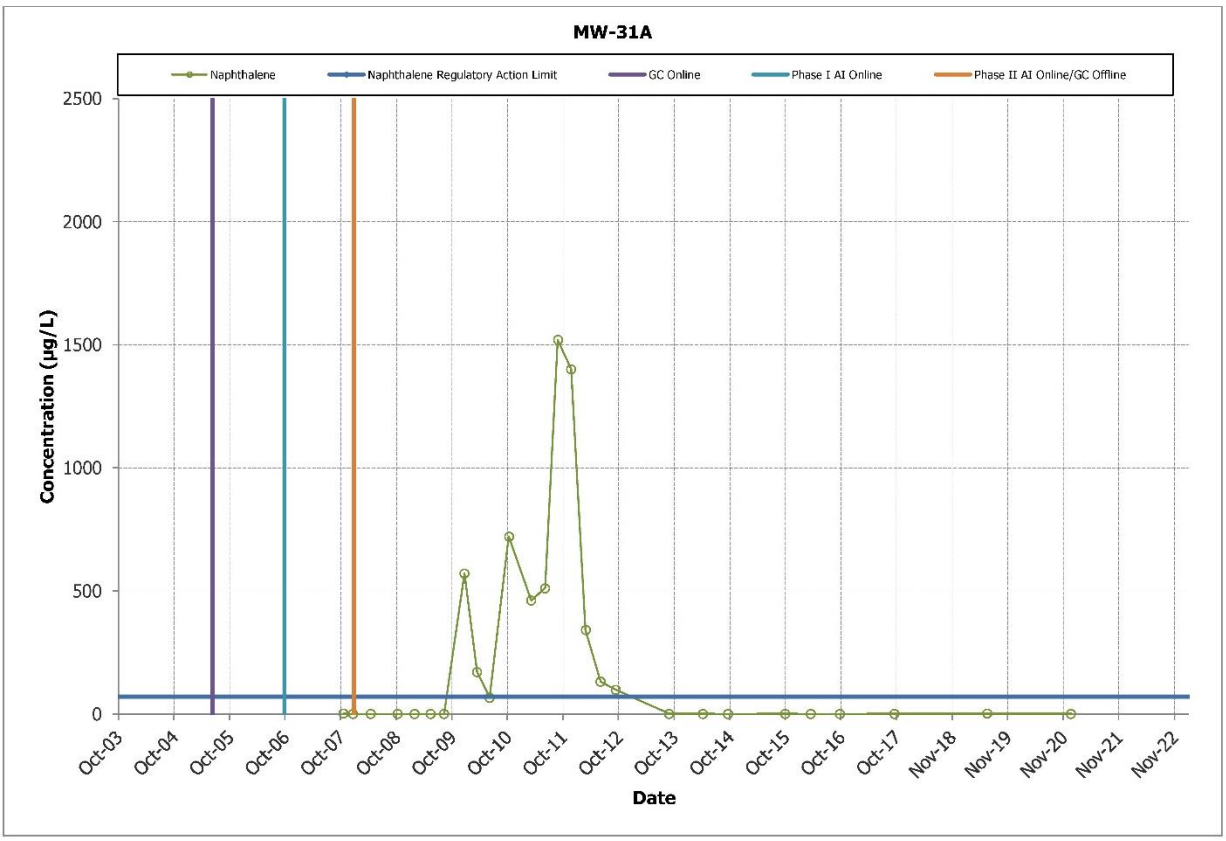

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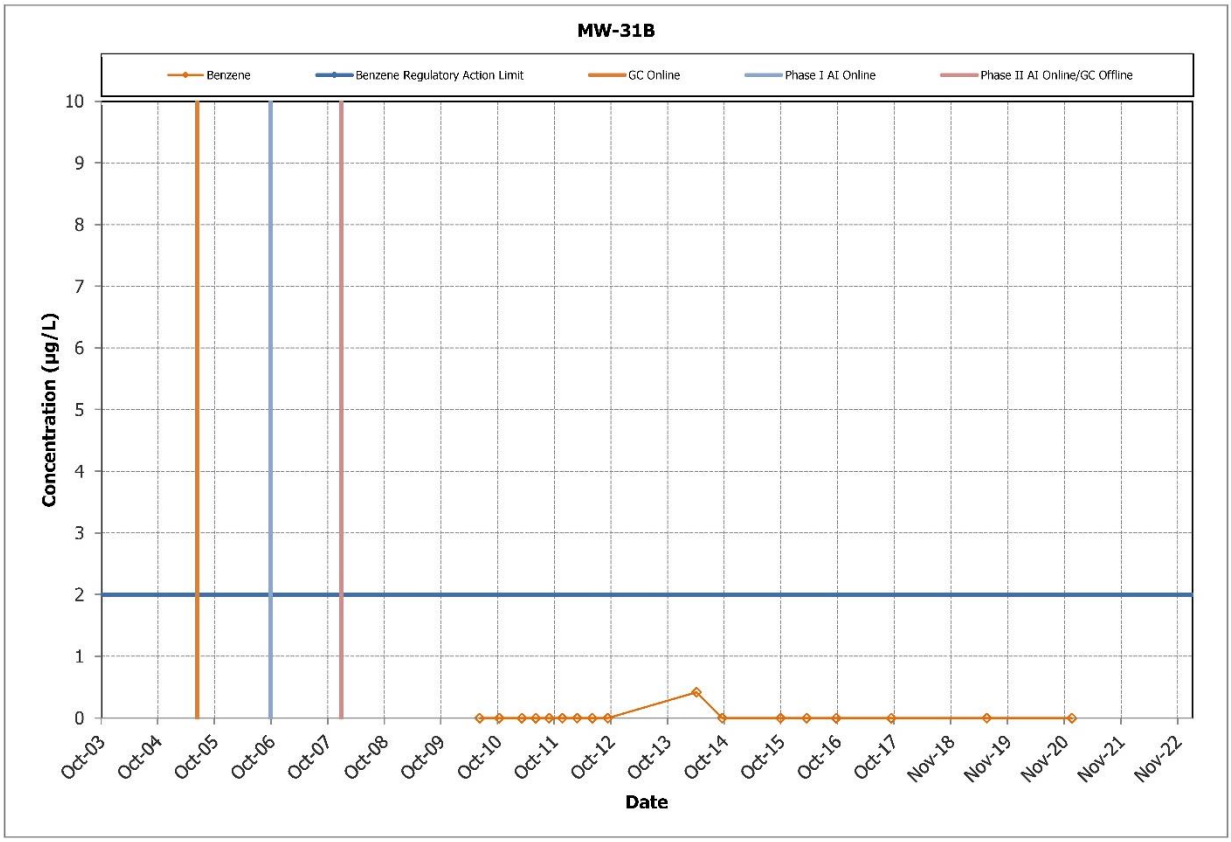

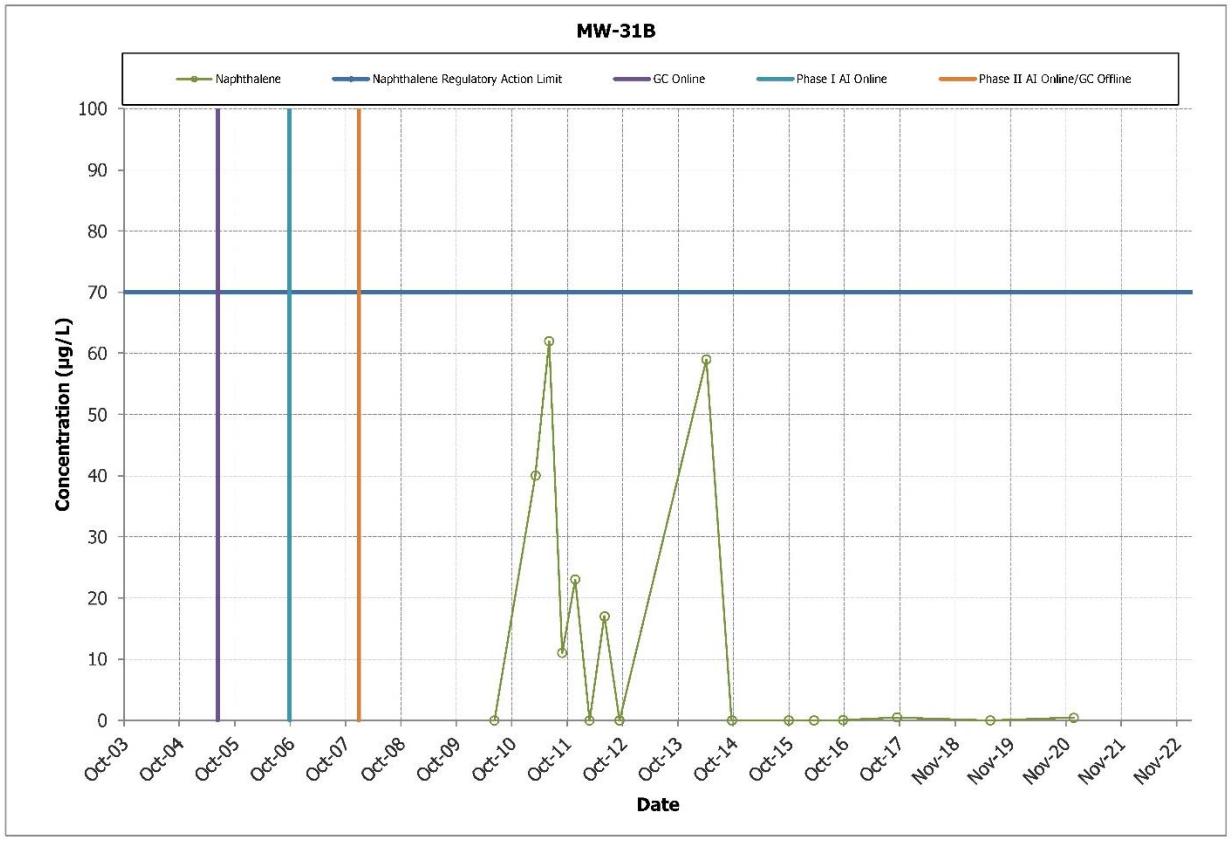

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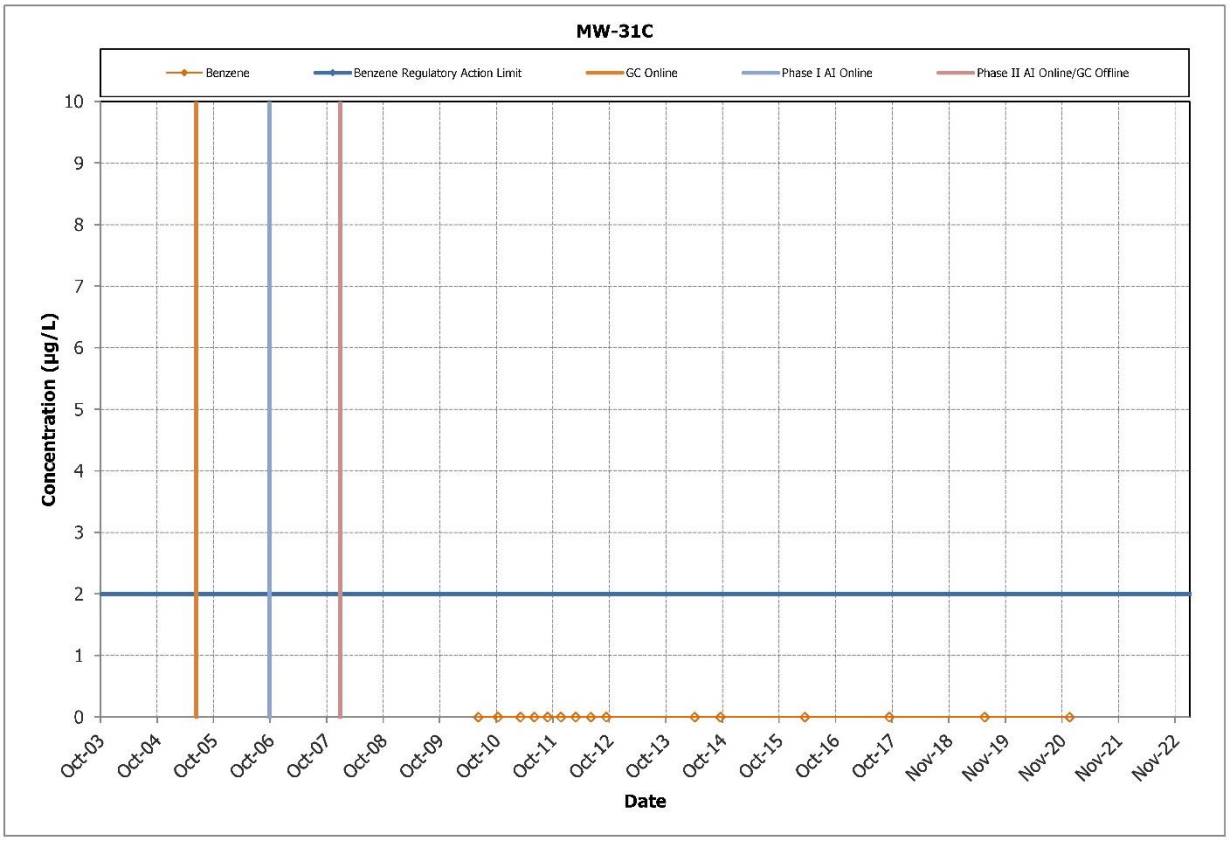

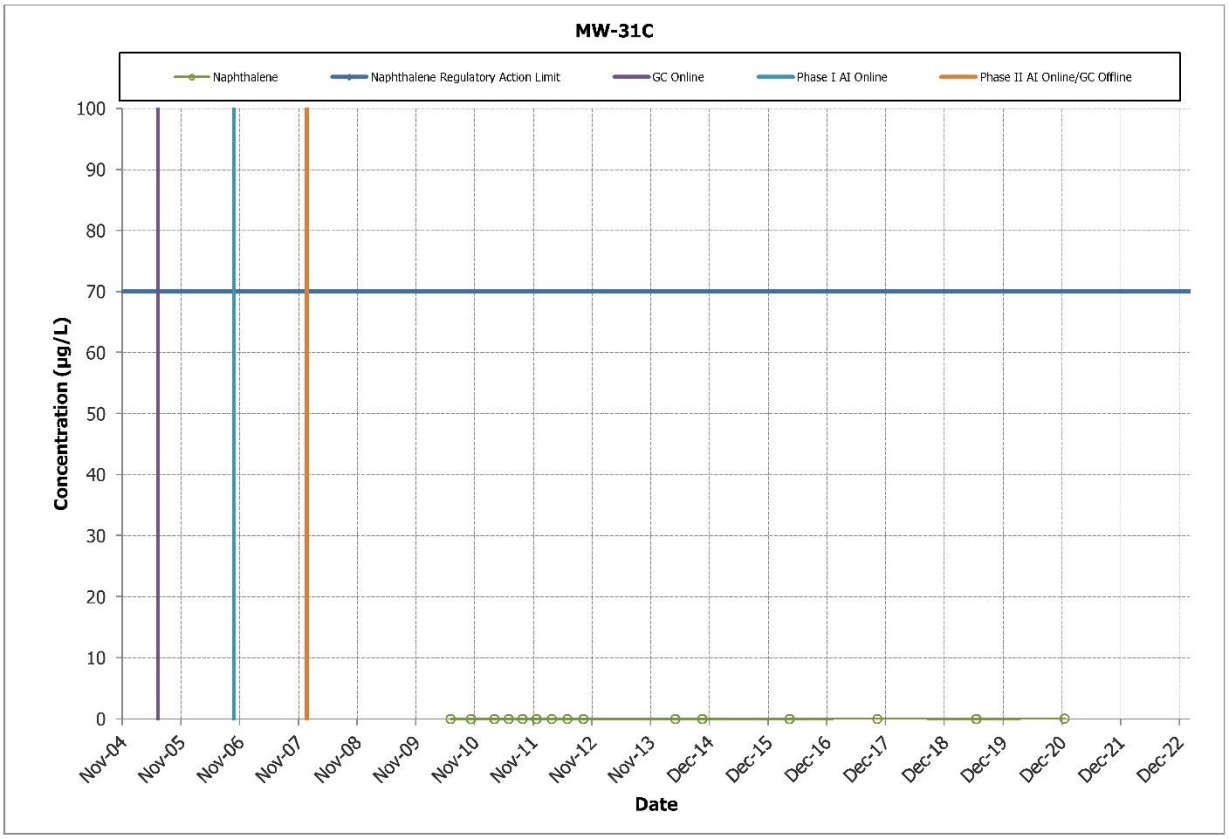

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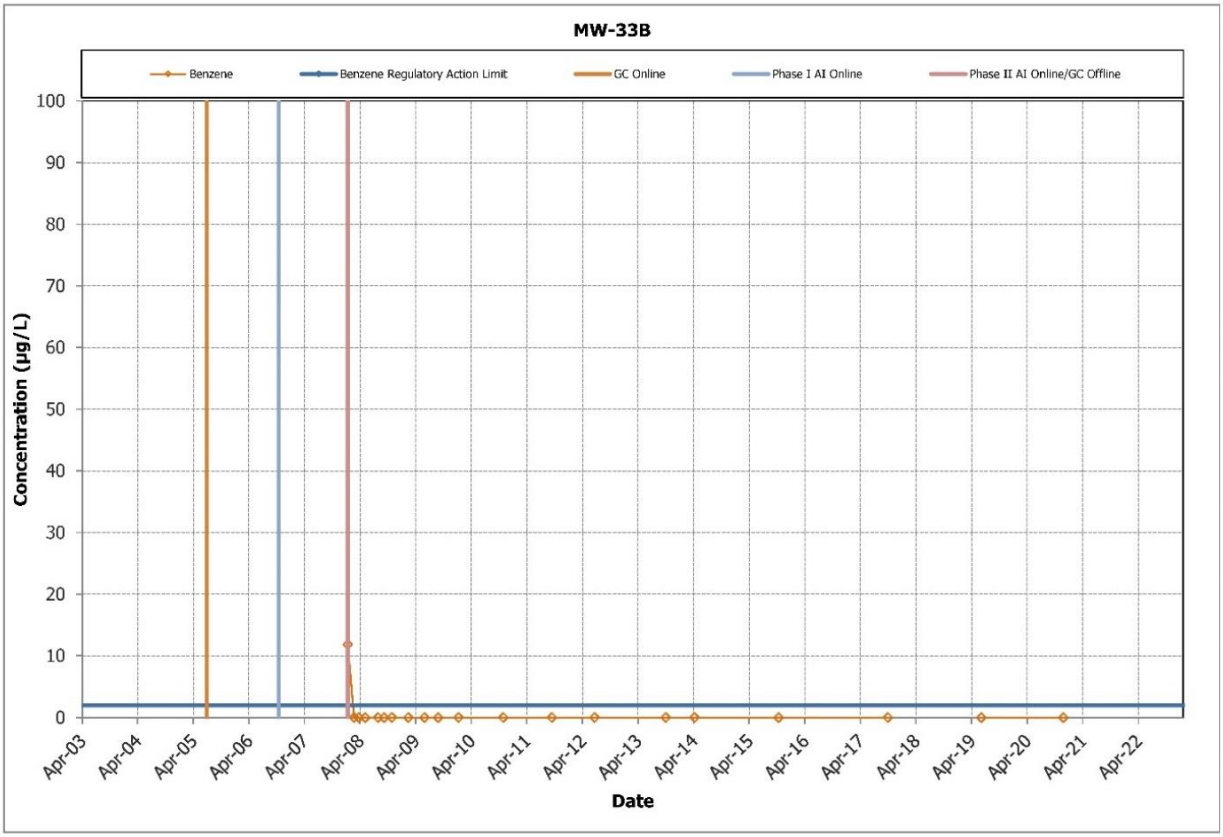

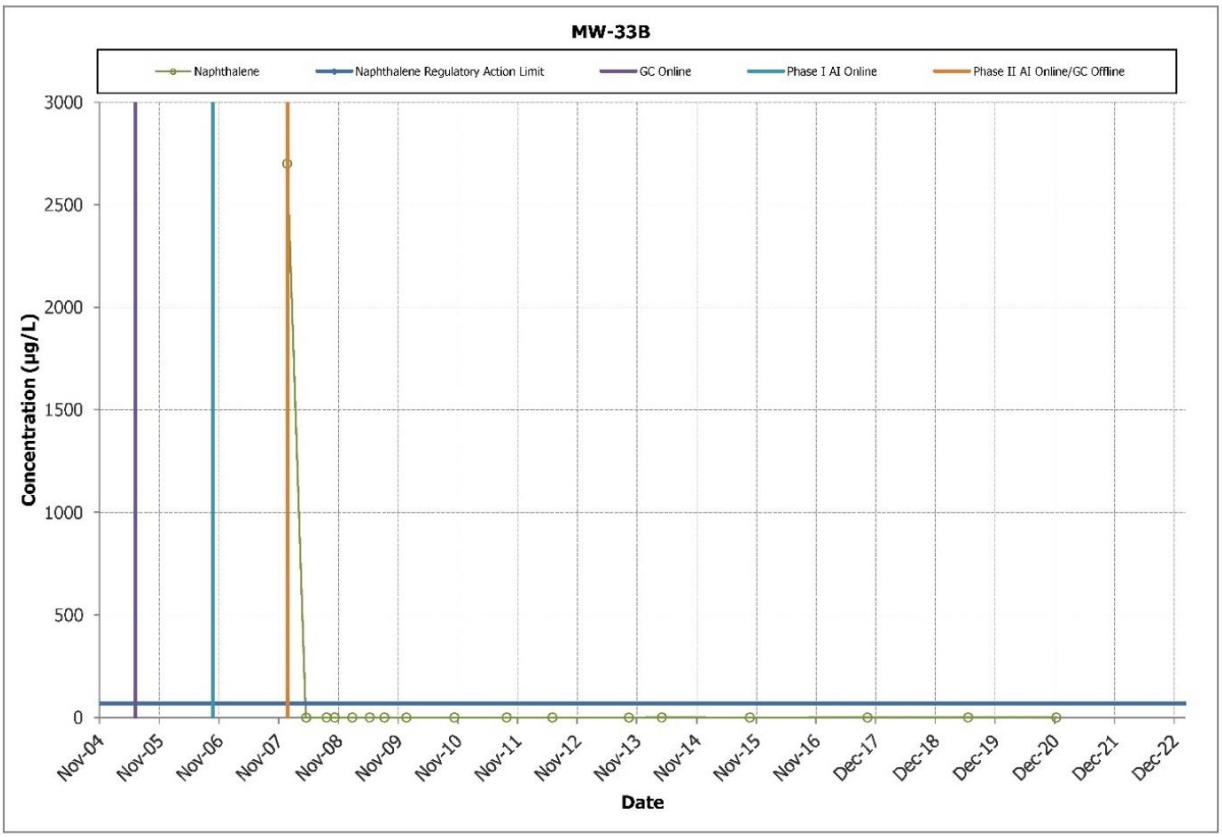

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