DRAFT PERMIT

Wes Moore
Governor

Serena McIlwain
Secretary

Air and Radiation Administration

1800 Washington Boulevard, Suite 720
Baltimore, MD 21230

☐ Construction Permit ☒ State Permit to Operate

PERMIT NO.:
510-2263

DATE ISSUED:
TBD

PERMIT FEE:
N/A

EXPIRATION DATE:
September 30, 2028

LEGAL OWNER & ADDRESS
CSX Transportation, Inc.
500 Water St; J-275
Jacksonville, 32202-4422
Attention: Ms. Rebecca Hensley

SITE
Curtis Bay Piers Facility
1910 Benhill Ave
Curtis Bay, MD 21226
Premises # 510-2263
AI # 10261

SOURCE DESCRIPTION

Coal storage and transfer facility.

This source is subject to the conditions described on the attached pages.

Program Manager

Director, Air and Radiation Administration

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This permit-to-operate incorporates requirements for the following registered installations:

ARA Registration No.	Description	Date of Installation
510-2263-9-0352 and 9-0335	Coal, ore, limestone, and other dry material transfer and storage facility that primarily consists of the following stationary source process related equipment: Railcar unloaders; Material belt conveyors (including transfer towers); Stacking silos; Material storage piles; and; Ship and barge loading equipment. SP-1 - Limestone, iron ore, coal storage including three (3) 84” wide conveyors added to the dry material and storage operation in 2013. Added a continuous conveyor belt (BC-7) to replace the damaged conveyor in the existing North Reclaim Tunnel and conducted associated equipment repairs to the tunnel roof, BC-7 head chute, the A/B drives, the BC-7 tensioner, replacement of the BC-7 truss, and installation of the steel support frame for the BC-2 tensioner in 2022.	1923, modified in 1980, 2013, and 2022
	Coal Facility – equipped with railcar unloaders and ship and barge loading	1980

Part A – General Provisions

(1) The application (Form 26) received on July 18, 2023 at the Maryland Department of the Environment ("Department") for the renewal of the Permittee's permit-to-operate is incorporated into this permit by reference. If there are any conflicts between representations in the application and representations in this permit, the representations in the permit shall govern. Estimates of dimensions, volumes, emissions rates, operating rates, feed rates and hours of operation included in the application for renewal do not constitute enforceable numeric limits beyond the extent necessary for compliance with applicable requirements.

(2) Upon presentation of credentials, representatives of the Maryland Department of the Environment and the Baltimore City Health Department shall at any reasonable time be granted, without delay and without prior notification, access to the Permittee's property and permitted to:

(a) determine compliance with the requirements of this permit and any applicable regulations;

(b) sample, as necessary to determine compliance with requirements of this permit and applicable regulations, any materials stored or processed on site, any waste materials, and any discharge into the environment;

(c) inspect any monitoring equipment required by applicable regulations or by any permit issued by the Department's Air and Radiation Administration;

(d) review and copy any records, including all documents required to be maintained by this permit and by applicable regulations, relevant to the Department's determination of compliance with an air pollution control requirement; and

(e) obtain any photographic documentation or evidence necessary to determine compliance with the requirements of this permit and applicable regulations.

(3) If any provision of this permit is declared by proper authority to be invalid, the remaining provisions of the permit shall remain in effect.

(4) Nothing in this permit authorizes the violation of any rule or regulation or the creation of a nuisance or air pollution.

Part B – Applicable Regulations

(1) This source is subject to all applicable federal air pollution control requirements.

(2) This source is subject to all applicable federally enforceable State air pollution control requirements including, but not limited to, the following regulations:

(a) COMAR 26.11.01.04A(1) – Requirements for Testing
"The Department may require any person to conduct or have conducted testing to determine compliance with this subtitle. The Department, at its option, may witness or conduct these tests. This testing will be done at a reasonable time, and all information gathered during a testing operation will be provided to both parties."

(b) COMAR 26.11.01.07C – Report of Excess Emissions
"(1) In the case of any occurrence of excess emissions, expected to last or actually lasting for 1 hour or more, from any installation required by COMAR 26.11.02.13 to obtain a State permit to operate, the owner or operator shall report the onset and shall report the termination of the occurrence to the Department by telephone.

(2) Telephone reports of excess emissions shall include the following information:
(a) The identity of the installation and the person reporting;
(b) The nature or characteristics of the emissions (for example, hydrocarbons, fluorides);
(c) The time of occurrence of the onset of the excess emissions and the actual or expected duration of the occurrence; and
(d) The actual or probable cause of the excess emissions."

(c) COMAR 26.11.02.09A – Sources Subject to Permit to Construct and Approval
"A person may not construct or modify or cause to be constructed or modified any of the following sources without first obtaining, and having in current effect, the specified permits to construct and approvals: (6) All sources, including installations and air pollution control equipment, except as listed in Regulation .10 of this chapter--permit to construct required."

(d) COMAR 26.11.06.03C – Particulate Matter from Unconfined Sources
"(1) A person may not cause or permit emissions from an unconfined source without taking reasonable precautions to prevent particulate matter from becoming airborne. These reasonable precautions shall include, when appropriate as determined by the Department, the installation and use of hoods, fans, and dust collectors to enclose, capture, and vent emissions. In making this determination, the Department shall consider technological feasibility, practicality, economic impact, and the environmental consequences of the decision."

(e) COMAR 26.11.06.03D – Particulate Matter from Materials Handling and Construction
"A person may not cause or permit any material to be handled, transported, or stored, or a building, its appurtenances, or a road to be used, constructed, altered, repaired, or demolished without taking reasonable precautions to prevent particulate matter from becoming airborne. These reasonable precautions shall include, but not be limited to, the following when appropriate as determined by the control officer:

(1) Use of water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land.
(2) Application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stockpiles, and other surfaces which can create airborne dusts.
(3) Installation and use of hoods, fans, and dust collectors to enclose and vent the handling of dusty materials. Adequate containment methods shall be employed during sandblasting of buildings or other similar operations.
(4) Covering, at all times when in motion, open-bodied vehicles transporting materials likely to create air pollution. Alternate means may be employed to achieve the same results as would covering the vehicles.
(5) The paving of roadways and their maintenance in clean condition.
(6) The prompt removal from paved streets of earth or other material which has been transported there by trucks or earth moving equipment or erosion by water."

(3) This source is subject to all applicable State-only enforceable air pollution control requirements including, but not limited to, the following regulations:

(a) COMAR 26.11.02.13A – Sources Subject to State Permits to Operate.
"A. Except for a source that is covered by a Part 70 permit, a person may not operate or cause to be operated any of the following sources without first obtaining, and having in current effect, a State permit to operate as required by this regulation: (38) Coal or ore export loading or unloading installations."

(b) COMAR 26.11.02.14D – Procedure for Obtaining State Permit to Operate and Permits to Construct Certain Sources and Permits to Construct Control Equipment on Existing Sources.
"A complete application for the renewal of a State permit to operate shall be submitted not later than 60 days before the expiration date in a State permit to operate. If a timely application for a renewal has been submitted, the current State permit to operate remains in effect until the Department makes a final decision to issue or deny the permit."

(c) COMAR 26.11.02.19C – Information Required to be Maintained by a Source.
"(1) Beginning January 1, 1994, the owner or operator of a source for which a permit to operate is required shall maintain records necessary to support the emission certification, including the following information:
(a) The total amount of actual emissions of each regulated pollutant and the total of all regulated pollutants;
(b) An explanation of the methods used to quantify the emissions and the operating schedules and production data that were used to determine emissions, including significant assumptions made;
(c) Amounts, types, and analyses of all fuels used;
(d) Emission data from continuous emission monitors that are required by this subtitle or EPA regulations, including monitor calibration and malfunction information;
(e) Identification, description, and use records of all air pollution control equipment and compliance monitoring equipment, including significant maintenance performed, malfunctions and downtime, and episodes of reduced efficiency of this equipment;

(f) Limitations on source operation or any work practice standards that significantly affect emissions; and
(g) Other relevant information as required by the Department.

(2) The logs and other records of information required by §C(1) of this regulation shall be retained for a period of 5 years and made available to the Department upon request.

(3) If the owner or operator of a source for which a permit to operate is required fails to maintain or provide the data required by this section, which the Department requests in order to verify the emissions during the previous calendar year, the annual emission-based fee for that source shall be based on the estimated allowable emissions, as defined in COMAR 26.11.01.01B(4), of that source, as determined by the Department."

(d) COMAR 26.11.02.19D – Emission Certification
"(1) Beginning January 1, 1994, the responsible official designated by the owner or operator of a source for which a permit to operate is required shall certify, as provided at Regulation .02F of this chapter, the actual emissions of regulated air pollutants from all installations at the plant or facility.

(2) Certification shall be on a form obtained from the Department and shall be submitted to the Department not later than April 1 of the year following the year for which certification is required.

(e) COMAR 26.11.06.08 – Nuisance
"An installation or premises may not be operated or maintained in such a manner that a nuisance or air pollution is created. Nothing in this regulation relating to the control of emissions may in any manner be construed as authorizing or permitting the creation of, or maintenance of, nuisance or air pollution."

(f) COMAR 26.11.06.09 – Odors
"A person may not cause or permit the discharge into the atmosphere of gases, vapors, or odors beyond the property line in such a manner that a nuisance or air pollution is created."

(g) COMAR 26.11.15.06 – Requirements for New Installations, Sources, or Premises
"A(1) Except as provided in §A(2) of this regulation, a person may not construct, modify, or operate, or cause to be constructed, modified, or operated, any new installation or source without first demonstrating to the satisfaction of the Department using procedures established in this chapter that total allowable emissions from the premises of each toxic air pollutant discharged by the new installation or source will not unreasonably endanger human health."

Part C – General Operating Conditions

(1) The Permittee shall maintain and operate all installations and associated air pollution control equipment so as to assure full and continuous compliance with all applicable air pollution control regulations and permit conditions.

(2) The Permittee shall properly maintain, calibrate, and operate all control panel instrumentation and all devices employed to monitor performance of the facility's air pollution control devices.

(3) Fugitive dust from plant roads, uncovered stockpiles, and other surfaces that have the potential to create airborne dusts, shall be controlled by applying water, asphalt, oil, or suitable chemical dust suppressants or combination thereof, as necessary to comply with COMAR 26.11.06.03C and D.

(4) The Permittee shall not transfer more than 500,000 tons of limestone and iron ore, and 1,000,000 tons of coal during any rolling 12-month period at the dry material handling and storage operation at the limestone storage area (SP-1) installed in 2013 as authorized by ARA Registration No. 510-2263-9-0335. The Permittee shall notify the Department prior to increasing quantities and/or changing the types of any materials subject to this limitation. If the Department determines that such increases or changes constitute a modification, the Permittee shall obtain a permit-to-construct prior to implementing the modification. The three (3) 84" wide conveyors referenced in ARA Registration No. 510-2263-9-0335 are not subject to this limitation, nor does this tonnage limitation apply to other storage areas and conveyors at the facility.

(5) The Permittee shall continue to comply with Condition C(2) of the Permit to Construct issued on September 7, 2022 for the replacement of the damaged conveyor BC-7 that required:

(a) Equipping the North Reclaim Tunnel with improved tunnel air flow beyond a level prior to the December 30, 2021 incident, which shall be maintained at a minimum of 300 feet per minute (fpm).
(b) Installing and operating a fixed gas detection system inside the tunnel system to monitor for methane.
(c) Implementing preventative measures, including metal skirting panels around the conveyor and water sprays within the tunnel, which will be incorporated into the facility's Fugitive Dust Plan to ensure safe working conditions and minimize fugitive dust inside the tunnel.

(6) The Permittee shall comply with the requirements of the facility's May 2023 Fugitive Dust Plan. If the plan is amended by the Department, any amendments will be incorporated into this Permit to Operate, at which time the Permittee will be subject to them.

(7) The Permittee shall comply with the requirements of the facility's approved Fence Line Monitoring Plan and any future amendments proposed by the Permittee and approved by the Department. The current plan, approved by the Department on June 26, 2023, is included in Appendix 2 of this permit.

Part D – Physical Barrier and Dust Control Requirements

(1) The Permittee shall construct a physical barrier to prevent coal dust from being transported from any coal storage piles on the site into the surrounding community. The physical barrier must at a minimum surround all coal storage piles completely, either individually or in a single enclosure within the facility's property boundary, except where openings are needed to allow vehicular access into and out of the interior of the structure or where necessary to allow for the movement of coal into or out of the physical barrier via conveyors. If the barrier is open to the atmosphere from above, the maximum coal pile height shall be maintained at a level that is less than the height of the physical barrier at all times.

(2) Within 120 days following the issuance date of this Permit to Operate, the Permittee shall send a notification to and seek approval from the Department on the type of physical barrier that it intends to use to satisfy the Part D(1) requirement of this Permit to Operate. The application shall include revisions to the Fugitive Dust Plan applicable when the physical barrier system chosen to satisfy the Part D(1) requirement is in operation. Once approved by the Department the revisions will be incorporated into the Permit to Operate.

(3) Within 18 months of the Department's approval of the Permittee's physical barrier system, the Permittee shall complete construction and place in operation the physical barrier required under the Part D(1) requirement of this Permit to Operate.

(4) Within 180 days following the issuance date of this permit, the Permittee shall install and operate a system to apply water to rail cars loaded with coal at the point such cars enter the property line of the coal terminal governed by this Permit to Operate. The system should be designed to apply water of a sufficient amount to wet the exposed coal while avoiding the creation of an overspray that would need to be collected and discharged.

(5) Within 30 days of operating the system required by condition D(4) above, the Permittee shall submit an operational plan describing conditions under which the system meeting the D(4) requirement will not be operational, including a discussion supporting the selection of those conditions. Upon approval of those conditions by the Department, the Permittee shall operate the plan in accordance with the provisions set forth in the operational plan.

(6) Within 120 days following the issue date of this permit, the Permittee shall replace the existing water spray system in the railcar unloading sheds with a system that uses atomized spray nozzles to increase the overall dust control efficiency. Documentation for meeting the increased control efficiency requirement shall be provided to the Department within the same 120-day period. The improved nozzle system will be incorporated into the Fugitive Dust Plan within 90 days of the replacement nozzle system being installed.

Part E – Record Keeping and Reporting

(1) The Permittee shall maintain for at least five (5) years, and shall make available to the Department upon request, records of the following information:

(a) Records of the monthly amounts of limestone, iron ore, and coal processed in the dry materials handling and storage operation at the limestone storage area (SP-1) associated with ARA Registration No. 510-2263-9-0335. The three (3) 84" wide conveyors referenced in ARA Registration No. 510-2263-9-0335 are not subject to this requirement, nor does this requirement apply to other storage areas and conveyors at the facility.

(b) Records of all coal and ash speciation data used to determine toxic air pollutant emissions and a copy of the most recent, premises-wide air toxics compliance demonstration.

(c) A copy of the current, Department-approved Fugitive Dust Plan and all records required by the plan to ensure compliance with COMAR 26.11.06.03D.

(d) A copy of the current, Department-approved Fence Line Monitoring plan and all records required by the plan.

(2) The Permittee shall maintain at the facility for at least five (5) years records necessary to support annual certifications of emissions and demonstrations of compliance for toxic air pollutants. Such records shall include, if applicable, the following:

(a) mass emissions rates for each regulated pollutant, and the total mass emissions rate for all regulated pollutants for each registered source of emissions;

(b) accounts of the methods and assumptions used to quantify emissions;

(c) all operating data, including operating schedules and production data, that were used in determinations of emissions;

(d) amounts, types, and analyses of all fuels used;

(e) any records, the maintenance of which is required by this permit or by State or federal regulations, that pertain to the operation and maintenance of continuous emissions monitors, including:

(i) all emissions data generated by such monitors;

(ii) all monitor calibration data;

(iii) information regarding the percentage of time each monitor was available for proper service; and

(iv) information concerning any equipment malfunctions.

Note: Fence line particulate monitors installed and operated in accordance with the Permittee's Fence Line Monitoring Plan are not considered continuous emissions monitors subject to this requirement.

(f) information concerning operation, maintenance, and performance of air pollution control equipment and compliance monitoring equipment, including:

(i) identifications and descriptions of all such equipment;

(ii) operating schedules for each item of such equipment;

(iii) accounts of any significant maintenance performed;

(iv) accounts of all malfunctions and outages; and

(v) accounts of any episodes of reduced efficiency.

(g) limitations on source operation or any work practice standards that significantly affect emissions; and

(h) other relevant information as required by the Department.

(3) The Permittee shall submit to the Department by April 1 of each year during the term of this permit a certification of emissions for the previous calendar year. The certifications shall be prepared in accordance with requirements, as applicable, adopted under COMAR 26.11.01.05 – 1 and COMAR 26.11.02.19D.

(a) Certifications of emissions shall be submitted on forms obtained from the Department.

(b) A certification of emissions shall include mass emissions rates for each regulated pollutant, and the total mass emissions rate for all regulated pollutants for each of the Permittee's registered sources of emissions.

(c) The person responsible for a certification of emissions shall certify the submittal to the Department in the following manner:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

(4) The Permittee shall submit to the Department, by April 1 of each year during the term of this permit, a written certification of the results of an analysis of emissions

of toxic air pollutants from the Permittee's facility during the previous calendar year. Such analysis shall include either:

(a) a statement that previously submitted compliance demonstrations for emissions of toxic air pollutants remain valid; or

(b) a revised compliance demonstration, developed in accordance with requirements included under COMAR 26.11.15 & 16, that accounts for changes in operations, analytical methods, emissions determinations, or other factors that have invalidated previous demonstrations.

(5) The Permittee shall report, in accordance with requirements under COMAR 26.11.01.07, occurrences of excess emissions to the Compliance Program of the Air and Radiation Administration.

APPENDIX 1
Fugitive Dust Plan

FUGITIVE DUST CONTROL PLAN

CSX TRANSPORTATION, INC.
CURTIS BAY PIERS
BALTIMORE, MARYLAND
Premises No. 510-2263

Revised MAY 2023

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1.0 INTRODUCTION

CSX Transportation, Inc. (CSXT), Curtis Bay Piers is a material storage, transfer, and shipment terminal located at 1910 Benhill Avenue, Baltimore, Maryland, 21226. Curtis Bay Piers currently operates under Permits to Construct and Operate[1], each for Premises No. 510-2263, issued by the Maryland Department of the Environment (MDE). Potential fugitive air emissions sources at Curtis Bay Piers result from the following operations:

- Railcar unloading,
- Material transfer via covered conveyors,
- Coal stacking tubes,
- Material storage piles,
- Marine vessel loading,
- Vehicle parking, and
- Paved and unpaved roadways.

CSXT utilizes various operational controls and water sprays to prevent and control fugitive dust emissions. Water used for dust suppression is supplied from an onsite stormwater reclaim and collection system, with backup water supply from city sources.

Figure 1 shows the facility layout.

Curtis Bay Piers is manned 24 hours per day. Site supervisors conduct daily briefings with employees and contractors for safety, weather, and operations. Safety bulletins are used to communicate daily weather conditions, including forecasted high winds, tornados, and thunderstorms; as well as dry conditions that could potentially promote fugitive dust. All personnel are trained and instructed to promptly notify management if any dust is observed during daily operations. Upon notice, additional control measures, such as more frequent water spraying, can be implemented as necessary. The water spray system for dust control can be manually started at any time from onsite or remotely. During severe weather or other unsafe weather conditions observed by employees, there will be a STOP WORK communication across the site.

CSX aims to maintain 100 percent compliance with all rules and safety procedures. Employees are empowered to immediately address hazardous conditions; STOP WORK and halt operations if they observe hazardous or unsafe conditions.

It has been the experience of the historical operations at the facility that visible emissions monitoring, as required by the operating permit, has been adequate to control fugitive dust from the coal piles and during loading and unloading operations. To evaluate and enhance our dust control measures, CSXT will

[1] Permit to Operate issued October 1, 2018, Control No. B-05570, Permit to Construct issued September 7, 2022, Control No. B-07188.

implement an opacity monitoring program for a period of twelve (12) months to aid in the identification and discovery of fugitive dust emissions at the facility. Section 5.0 contains additional details on how the visible emission cameras will be used to evaluate the effectiveness of the facility's fugitive dust control measures. On November 6, 2022, CSXT submitted the *CSXT Curtis Bay Piers Visible Emissions (VE) Camera Test Protocol* to the Department which contained descriptions of the program's proposed objectives, test methods, equipment, and timeline.

The objectives of the 12-month opacity monitoring program include:

- Determine if there are fugitive dust concerns at the facility;
- Quantify any concerns in percent opacity consistent with best practices; and
- Evaluate whether additional fugitive dust controls are necessary based on monitoring test results.

CSXT will routinely review and update this Fugitive Dust Control Plan to continuously improve and minimize sources of fugitive dust emissions and implement precautions to prevent particulate matter from becoming airborne.

2.0 AIR REGULATORY OVERVIEW

The following Code of Maryland Air Regulations (COMAR) sections apply to air emissions sources at Curtis Bay Piers:

- COMAR 26.11.01.03: Delineation of Areas—Area III is defined as "the Baltimore metropolitan area of the state comprising Baltimore City and the counties of Anne Arundel, Baltimore, Carroll, Harford, and Howard."

- COMAR 26.11.01.04A(1): Testing and Monitoring—MDE "may require any person to conduct or have conducted testing to determine compliance with this subtitle."

- COMAR 26.11.01.07C: Report of Excess Emissions—This regulation requires permittees to report "any occurrence of excess omissions, expected to last or actually lasting for 1 hour or more."

- COMAR 26.11.02.09A: Permits to Construct—This regulation requires permittees to obtain a permit-to-construct if any installation is to be modified in a manner that causes a change in the quantity, nature, or characteristics of emissions referenced in the permit-to-construct issued for that installation.

- COMAR 26.11.06.02C: Visible Emissions—"In Areas III and IV, a person may not cause or permit the discharge of emissions from any installation or building, other than water in an uncombined form, which is visible to human observers."

- COMAR 26.11.06.03B(2): Particulate Matter from Confined Sources—In Areas III and IV, "a person may not cause or permit to be discharged into the outdoor atmosphere from any other installation, particulate matter in excess of 0.03 [grain per standard cubic foot dry] gr/SCFD (68.7 [milligrams per dry standard cubic meter] mg/dscm)."

- COMAR 26.11.06.03D: Particulate Matter from Material Handling and Construction—"A person may not cause or permit any material to be handled, transported, or stored, or a building, its appurtenances, or a road to be used, constructed, altered, repaired, or demolished without taking reasonable precautions to prevent particulate matter from becoming airborne. These reasonable precautions shall include, but not be limited to, the following when appropriate as determined by the control officer:

    (1) Use of water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land.

    (2) Application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stockpiles, and other surfaces which can create airborne dusts.

    (3) Installation and use of hoods, fans, and dust collectors to enclose and vent the handling of dusty materials. Adequate containment methods shall be employed during sandblasting of buildings or other similar operations.

    (4) Covering, at all times when in motion, open-bodied vehicles transporting materials likely to create air pollution. Alternate means may be employed to achieve the same results as would covering the vehicles.

    (5) The paving of roadways and their maintenance in clean condition.

    (6) The prompt removal from paved streets of earth or other material which has been transported there by trucks or earth moving equipment or erosion by water."

- COMAR 26.11.06.08: Nuisance—"An installation or premises may not be operated or maintained in such a manner that a nuisance or air pollution is created. Nothing in this regulation relating to the control of emissions may in any manner be construed as authorizing or permitting the creation of, or maintenance of, nuisance or air pollution."

- COMAR 26.11.06.09: Odors—"A person may not cause or permit the discharge into the atmosphere of gases, vapors, or odors beyond the property line in such a manner that a nuisance or air pollution is created."

The following Part C operating conditions are incorporated into CSXT's permit to operate and are applicable to air emissions sources and operations at Curtis Bay Piers:

- Curtis Bay Piers "shall maintain and operate all installations and associated air pollution control equipment so as to assure full and continuous compliance with all applicable air pollution control regulations and permit conditions."
- Curtis Bay Piers "shall properly maintain, calibrate, and operate all control panel instrumentation and all devices employed to monitor performance of the facility's air pollution control devices."

3.0 POTENTIAL FUGITIVE AIR EMISSIONS SOURCES AND CONTROL MEASURES

Sources of fugitive air emission sources at the facility include roadways and parking (paved and unpaved); railcar unloading; material stacking and storage; material conveying; and ship loading. For clarity, CSX does not process coal at Curtis Bay Piers. Various controls have been implemented to prevent and minimize dust. Controls include operating practices, physical controls, and water sprays. On site personnel continually observe the site for evidence of dust and work together to ensure controls are properly operating. CSX will continue to evaluate and measure the existing dust controls and operating practices to ensure compliance and will evaluate additional controls for future improvements.

3.1 UNPAVED ROADWAYS

CSXT minimizes the road surface silt loading on all unpaved roadways and parking areas throughout the facility by keeping the unpaved roadways clean and free of any debris and applying water as necessary. Vehicle traffic onsite is predominately light-duty vehicles. Fugitive dust from unpaved roads is influenced by surface material moisture content and vehicle speed. The following methods are used to minimize dust on unpaved roads:

- The average vehicle weight traveling on the unpaved roadways will be predominately restricted to CSXT vehicles that average less than 5 tons.
- CSXT maintains a water truck onsite and waters the unpaved roadway surfaces to increase the moisture content of the surface material as deemed necessary based on visual observations and operational experience.
- Speed limits are posted throughout Curtis Bay Piers to reduce the maximum vehicle speed on unpaved roadways to no more than 14.5 mph.
- Watering and posted speed limits represent reasonable precautions for minimizing fugitive dust emissions from unpaved roadways at Curtis Bay Piers.

3.2 PAVED ROADWAYS AND PARKING AREAS

Most of the roadways at the facility are paved. CSXT minimizes the silt loading and fugitive dust on the paved roadways and parking areas throughout Curtis Bay Piers by employing the following best practices:

- Sweeping the road surfaces with a sweeper truck and flushing the road surfaces with water as deemed necessary based on visual observations and operational experience.
- Vehicles traveling on the paved roadways will be predominately restricted to employee, CSXT, and contractor vehicles with an average weight of less than 5 tons.
- Sweeping, flushing with water, and posted speed limits represent reasonable precautions[2] for minimizing fugitive dust emissions from paved roadways and parking areas at Curtis Bay Piers.
- A water spray truck will be utilized at least weekly on primary pathways as noted in **Figure 2** unless weather has deemed the activity unnecessary (e.g., rain, ice, or snow). A summary of water truck activity (water spray dates, times, and movement) will be saved to an internal network drive on a monthly basis.

See **Figure 2** for a map of the truck watering route.

3.3 RAILCAR UNLOADING

Dry material is received at Curtis Bay Piers in railcars and is unloaded through the use of a rotary railcar unloading process. Railcars are rotated to dump the dry material into a hopper for transfer via belt conveyors. There are three enclosed railcar dumper buildings (dumpers) at the facility. Each dumper is open at both ends for the railcars to enter and exit. The building design minimizes potential fugitive dust emissions by blocking wind. Weather permitting, fugitive dust is controlled with fixed water sprays located on both sides of the dumper buildings and along the side wall. The water sprays are activated automatically as the railcar is dumping or can be operated manually, as necessary, based on visual observations. VE camera testing and/or visual observations can also be used to evaluate the effectiveness of the water sprays at the railcar dumper buildings. During inclement cold weather conditions, facility history has shown that coal solidifies with ice and minimizes potential dust.

3.4 MATERIAL STORAGE PILES AND STACKING TUBES

CSXT maintains several areas for outdoor material storage at Curtis Bay Piers. Coal is conveyed to storage piles via a network of covered belt conveyors and coal stacker tubes. Coal is released inside the stacker tube to the height of the active pile; coal flows out of perimeter windows on the tubes to forms storage piles.

[2] U.S. EPA, AP-42, Section 13.2.2., Unpaved Roads, Section 13.2.2.3. November 2006.

This arrangement of multiple perimeter windows minimizes the drop distance, which in turn minimizes dust emissions.

The coal piles are also shaped and compacted by bulldozers. The pile shaping procedures use operational experience and best practices to compact the material and minimize fugitive dust and coal pile height. Bulldozers are only used for shaping the storage piles and for coal reclamation during ship loading.

Fugitive dust from the storage piles is also controlled with the use of water sprayers located at the top of each stacker tube and around the perimeter of the storage areas. CSXT employs a dust suppression system and a wind fence as a best practice for minimizing potential fugitive dust emissions from outdoor material storage piles. The wind fence was selected after considering other options such as screens and tree plantings. Additional information on the wind fence follows in section 3.4.2.

CSX will continue to evaluate the potential for additional dust control measures around the facility such as wind breaks and barriers that would reduce wind velocity across the site; and the potential usage of dust suppression chemicals on the coal piles and at transfer points in addition to water. Vegetation wind breaks under consideration include shrubs and tree planting along the facility's fenceline.

3.4.1 DUST SUPPRESSION SYSTEM

CSXT maintains a sophisticated dust suppression system designed to control fugitive particulate matter emissions associated with the handling, transferring, and storage of coal. The dust suppression system utilizes a network of water sprays located throughout the facility. These water sprays have been strategically placed around the perimeter of the north and south storage piles, around the RP1 storage area, and on top of each stacking tower (there are 8 stacking towers in total) to ensure the highest degree of dust control. The dust suppression system is capable of operating in automatic and manual modes. The dust suppression system utilizes real time weather data to monitor wind speed, wind direction, and rain activity. US National Weather Service data are integrated to help the system anticipate and respond to weather forecast changes. The dust suppression system's multiple operating modes are described in the following chart:

System Operating Modes	Description
Standard Automatic Mode	This mode is the system default spray cycle, each water sprayer operates once every four hours
Wind Detection Mode	If the system detects onsite wind speeds greater than 12 miles per hour (mph), the **Wind Detection Mode** will activate and increase the watering frequency to once every hour. Wind speed is measured at the top of Tower 8 at 150 feet above grade. Wind speed at this height is typically greater than wind speed measured at the ground level or at the top of the coal storage piles.
Early Warning System	The system includes a weather service feature that monitors local weather forecasts for *Severe Weather* as defined by the National Weather Service and high winds. If *Severe Weather* is forecasted within 3 hours, the spray frequency is changed to once every hour. Thus, the system relies on proactive water spraying at increased frequencies based on forecasted weather.
High Wind Mode	When wind events are detected above 12 mph, the spray system has the capability of automatically adjusting both the ground and tower sprays toward the direction of the wind to improve coal moisture content and minimize potential dust.
Manual Mode	The system can be manually triggered to spray any specific area at any time. Employees and contractors are instructed to watch for dust and alert management to trigger manual spray. The spray system can be manually activated through onsite systems or mobile devices.
Override Capability	If the system is disabled by manual activation (**Manual Mode**) and a high wind event is approaching or detected, the **Wind Detection Mode** will override and activate the system to immediately operate.

See **Figure 3** for the dust suppression system layout and location of each water spray nozzle system.

As described in the above chart, the weather service feature tracks rain and wind events. Certain rain event intensities can trigger the spray system to pause operation ranging from a few hours to up to 24 hours depending on the amount of rainfall over a period of time. An onsite meteorological station monitors for wind and rain and creates triggers for the system. Trigger settings are modified based on actual site conditions and visual observations to ensure fugitive dust emissions are controlled.

The 12 mph wind velocity set point for the automatic Wind Detection Mode is considered a conservative set point. Fugitive dust emissions from the storage piles are expected at wind velocities of greater than 12 mph and the maximum pile height is approximately 100 feet. Lowering this wind velocity set point below 12 mph was evaluated, but is not expected to further reduce fugitive emissions. Hence the established set point was retained following a review of available literature related to wind velocity and particulate matter emissions from storage piles.[3]

In addition to the weather service monitoring, CSX annually trains employees and contractors with the CSX safety rules (CSX SAFE WAY) curriculum. This training includes adjustments to field operations during *Severe Weather* events such as tornados and thunderstorms. During such an event, operations will cease and personnel will relocate to a safe assembly area. Outside operations such as truck movement, bulldozers, and vessel loading would stop during severe weather conditions. The dust suppression system would remain in operation for dust control.

CSX will continue to evaluate the effectiveness of the dust suppression system as well as evaluate additional controls such as the usage of dust suppression chemicals in addition to water spray to determine if the spray effectiveness can be further improved.

3.4.2 WIND FENCE

CSXT installed a thirty (30) foot high DustTamer Wind Fence for 315 linear feet along the south side of the property in order to help effectively reduce the wind speeds and minimize potential fugitive dust. The DustTamer Wind Fence is designed to exert a drag force on oncoming wind velocity and reduce wind speeds. The fence allows air to pass through and help equalize the differential pressure, thereby lowering the wind velocity and minimizing particulate matter from becoming airborne.

The placement of the existing wind fence along the southern border was selected to minimize wind action on the coal storage piles and minimize dust that could travel in the north and northwest direction from the

[3] *See, e.g.*, AP-42, Chapter 13.2.5: Industrial Wind Erosion Updated 2006 and WRAP Fugitive Dust Handbook (2006), Chapter 9. These sources provide a threshold wind velocity (defined as the wind speed at which measurable emissions are expected to commence) of 22 mph measured at 7 meters above the ground surface for coal storage piles. This converts to approximately 27.7 mph at 150 feet. The 12 mph wind velocity set point used for the dust suppression system's automatic Wind Detection Mode (measured at 150 feet above ground level) is more conservative than the threshold wind speeds referenced in the literature.

facility; in the direction of the closest residential areas. Note the predominant wind directions, as measured from the nearest certified weather station (BWI airport) are from the north and northwest direction.

CSX will continue to evaluate and measure the effectiveness of the existing wind fence as well as model potential effectiveness and feasibility of additional wind fence locations. Visual observations are one example of methods used to confirm the effectiveness of the existing DustTamer Wind Fence.

3.5 MATERIAL CONVEYING

Dry material is moved across the property with the use of covered conveyors and enclosed transfer points. Covered conveyors and enclosed transfer points minimize potential fugitive dust emissions by protecting the material from the effects of the wind. Water sprays are strategically located at several points throughout the material conveying process and are activated as necessary to minimize dust, based on visual observations.

Conveyors are designed with 45 degree sides to minimize movement and loss of coal during conveying operations and to minimize the effects of wind.

Material conveyors are covered or completely enclosed in the reclaim tunnels, but 100 percent coverage is not possible in all areas. For the areas not covered or enclosed, the conveyors are equipped with windscreens, where practical, to minimize the effect of the wind across the conveying belt. Water sprays have been installed inside the North and South Reclaim Tunnels in compliance with the Permit to Construct.

The use of covered conveyors, enclosed transfer points, and water sprays, as necessary, represent reasonable precautions for minimizing fugitive dust emissions from material conveying at Curtis Bay Piers. CSX will continue to evaluate and measure effectiveness of conveyor transfer points and enclosures for potential system improvements. Visual observations are one example of methods used to confirm the effectiveness of dust controls.

3.6 SHIP/BARGE LOADOUT

CSXT loads dry material into ships and barges through a barge/shiploader, equipped with a vertical telescoping chute to minimize potential fugitive dust emissions. A telescoping chute minimizes the drop height of the material and the effect of wind within the hold of the ship. The ship loadout operator performs continual visual observations for potential emissions and manually activates water spray controls upstream of the ship loadout process to minimize fugitive dust emissions, as necessary.

The use of a telescoping chute during ship/barge loadout and water sprays, as necessary, during ship loadout represent reasonable precautions for minimizing fugitive dust emissions from ship/barge loadout at Curtis Bay Piers.

4.0 NUISANCE DUST

CSXT is dedicated to ensuring its compliance with COMAR Title 26, Subtitle 11, Chapter 6.03(D), Particulate Matter from Material Handling and Construction. CSXT will continue to take reasonable precautions to prevent particulate matter from becoming airborne by adhering to this fugitive dust control plan. If neighboring properties or the public notify CSXT of any complaint(s) regarding fugitive dust emissions from Curtis Bay Piers, CSXT will work with state and/or local authorities to identify the source of the fugitive dust emissions; ensure the proper operation of the dust suppression system at the facility; and address the complaint in a timely manner. Operational records will be reviewed in response to reports of nuisance dust.

In November 2022, CSXT submitted a Fence Line Monitoring Plan to measure PM_{10} and $PM_{2.5}$ at the facility. In accordance with the Fence Line Monitoring Plan, CXT will install and operate a fenceline monitoring system consisting of one continuous federal equivalent method (FEM), at least one collocated $PM_{10}/PM_{2.5}$ sensor, and multiple $PM_{10}/PM_{2.5}$ sensors around the facility.

5.0 OPACITY MONITORING

In reviewing the Fugitive Dust Control Plan, CSX evaluated measures that could be utilized to ensure that the facility's existing dust control measures are adequately controlling fugitive dust from coal storage and handling operations. The facility's sophisticated dust suppression system, along with covered conveyors, enclosures, sweeping, and visual emission observations, adequately controls fugitive dust during facility operations. Nonetheless, CSX will continually evaluate additional dust control measures and features to further enhance and improve the facility's fugitive dust control practices.

Emissions that are visible to the human eye are normally comprised of particulate matter (PM) ranging from PM10-100 microns or more. The fugitive dust associated with coal handling operations are primarily larger than PM_{10}. Visible emissions are regulated by level of opacity, meaning the level at which the dust reduces the transmission of light or obscures an observer's view. Opacity is measured in five percent increments, from 0 to 100 percent, increasing as the visible emissions ability to obscure the background increases. Opacity cameras are considered the best available control technology (BACT) for measuring fugitive dust.[4] The use of opacity cameras will provide a consistent means to measure visible emissions at the facility and evaluate whether fugitive dust from the coal piles and unloading/loading operations is adequately controlled by existing practices.

Therefore, CSX will conduct a twelve (12) month monitoring program for opacity focused on the facility's fence line as described in the Visible Emissions Camera Test Protocol submitted to the Department on

[4] See Federal Register of June 30, 2015, (80 FR 37366)(FRL-9928-66-OAR), RTR for Ferroalloy NESHAP, 40 CFR 63 Subpart XXX, https://www.regulations.gov/document/EPA-HQ-OAR-2010-0895-0280.

November 6, 2022. The monitoring program will use two visual emission (VE) cameras to digitally monitor and measure visible emissions with the digital camera opacity technique (DCOT) (ASTM D7520-16, *Standard Test Method for Determining the Opacity of a Plume in the Outdoor Ambient Atmosphere*, aka EPA Alternative Method 082). The opacity monitoring program will include:

- Mounting all-weather pan-tilt-zoom (PTZ) cameras to allow visible observations of the CSXT fence line.
- Formal observations will be recorded in coordination with onsite visual observations.
- Camera VE observations with be reported in standard Visible Emission Observation (VEO) form format.
- An evaluation of the effectiveness of current fugitive dust control measures.

The data generated from the opacity monitoring program will be used to determine if action levels or other alerts are warranted by observed conditions. The data may also inform whether adjustments to the dust controls in place at the facility are needed. For example, the camera observations will allow CSXT to determine if specific locations or certain operations have greater need for fugitive dust control.

Note that opacity monitoring is not applicable during extreme weather events, such as fires and hurricanes, per EPA guidance.[5] Cameras will record a higher opacity bias during heavy rain events. Similarly, it is unsafe for employees to perform a visible emissions observation during severe weather events.

6.0 TRAINING

CSXT provides annual training to all Curtis Bay Piers employees on the requirements and conditions of this Fugitive Dust Control Plan and the air operating permit at Curtis Bay Piers. Training includes the identification of fugitive dust emissions sources at Curtis Bay Piers, the reasonable precautions employed to minimize fugitive dust emissions from becoming airborne, and the means of deploying dust control measures as needed. This Fugitive Dust Control Plan will be reviewed and updated as necessary prior to annual training events.

All personnel are empowered to stop operations and/or implement the Dust Suppression System in the event of fugitive dust observations.

[5] See: Treatment of Air Quality Data Influenced by Exceptional Events (Homepage for Exceptional Events) | US EPA, and 40 CFR Section 50.14 – Treatment of Air Quality Monitoring Data Influenced by Exceptional Events.

7.0 SUMMARY OF CONTROL MEASURES

CSXT employs the following fugitive dust control measures to minimize particulate matter from becoming airborne at Curtis Bay Piers:

Facility Activity	Control Measures	Evidence and Recordkeeping
Unpaved roadways	Watering, as necessary	Log of water spray activities
	Vehicle weight minimization	Log of visual observations
	Posted speed limits	Signs in place
Paved roadways and parking areas	Sweeping, as necessary	Log of visual observations
	Watering, as necessary	Log of water spray
	Posted speed limits	Signs in place
Railcar unloading	Minimize wind with enclosure design	Log of visual observations
	Automatic water sprays when dumping	Log of water spray activity
Material storage piles	Automatic and manual water sprayers	Log visual observations
	Water sprays on ground around the storage pile perimeter and on towers	Log of water spray activity
Material conveying	Covered conveyors	Log of visual observations
	Enclosed transfer points	Maintenance Procedures
Ship/barge loadout	Telescoping chute for material drop and wind	Log of visual observations
	Water sprays, as necessary	Log of water spray activity
Fugitive Dust Training	Annual Employee Training Annual Contractor Training	Log of training events Log of training events

Daily observations and records are maintained by the facility as confirmation of dust control measures and related activities: water suppression, water trucks, relevant equipment maintenance. Records are available for MDE review upon request.

On site records include:

- Water suppression system operations (existing)
  - Date/time and duration of each nozzle
  - Reason for water spray (operation mode recorded)
  - Daily weather conditions
  - Maintenance inspection and repair
- Water truck operations
  - Electronic log of date/time and duration
  - Electronic log of path traveled
  - Comments and observations during activity
  - Routine inspection and maintenance records
- Log of visual observations (Updated)
  - Date/time
  - Person
  - Activities observed
  - If VE is observed, a summary of actions taken
- Log of employee and contractor training

Summary of Changes

The following table is used to track the main changes as this document is revised.

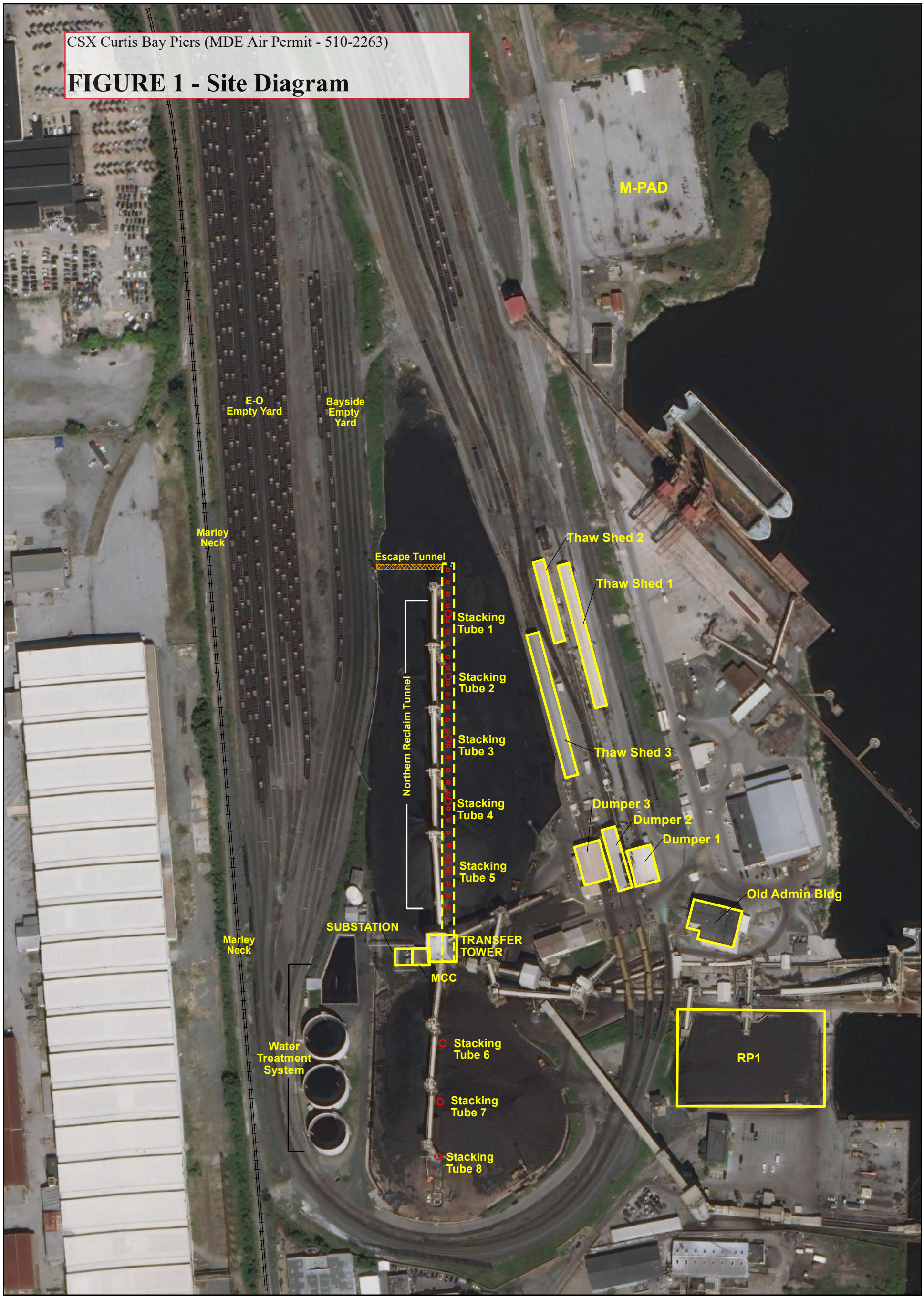
Version	**Description of Change**
11/6/2022	Section 5.0 - 6-month opacity test and related test protocol
5/24/2023	Section 3.2 - Additional recordkeeping for water spray truck operations, information on frequency of water truck operations, and inclusion of a map of truck watering route.
	Section 3.4 - Information on additional dust control measures under consideration.
	Section 3.4.1 - improved description of Dust Suppression System operating modes and adjustments to operations prior to and during severe weather. Added discussion of wind speed set point for Wind Detection Mode.
	Section 3.4.2 - Added information regarding criteria for wind fence evaluation.
	Section 5.0 - increased opacity test duration from 6-months to 12-months and provided clarification on number of cameras and more information on severe weather events.
	Section 6.0 - Annual training for employees and contractors, an existing practice that is added to the plan. Review of plan in advance of annual training.
	Section 7.0 - Updated recordkeeping information

Figure 1

Facility Layout

CSX Curtis Bay Piers (MDE Air Permit - 510-2263)

FIGURE 1 - Site Diagram



Legend

- Approximate location of North Reclaim Tunnel
- Buildings
- Approximate location of Northwest Escape Tunnel
- Active Rail Line (Marley Neck)
- Stacking Tube (approximate)
- Feeder Port location (approximate)
- North Reclaim Tunnel Sump (~4'x4'x4')

Note: North Reclaim Tunnel location is shown offset east from the actual location because of the oblique aerial view.

0 160 320
Feet
1 inch = 200 feet

Map Date: 1/3/2022

CSX Curtis Bay Coal Terminal
1910 Benhill Ave., Curtis Bay, MD

NORTH RECLAIM TUNNEL LOCATION

MONTROSE ENVIRONMENTAL

User: KGPeters Location: On-Site Citrix
Path: T:_ENV\CSX\CSX_CurtisBayMD\MXD\F3_Tunnel Location_Rev1.mxd

Service Layer Credits: Source: Arcadis, Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 2

Truck Watering Routes

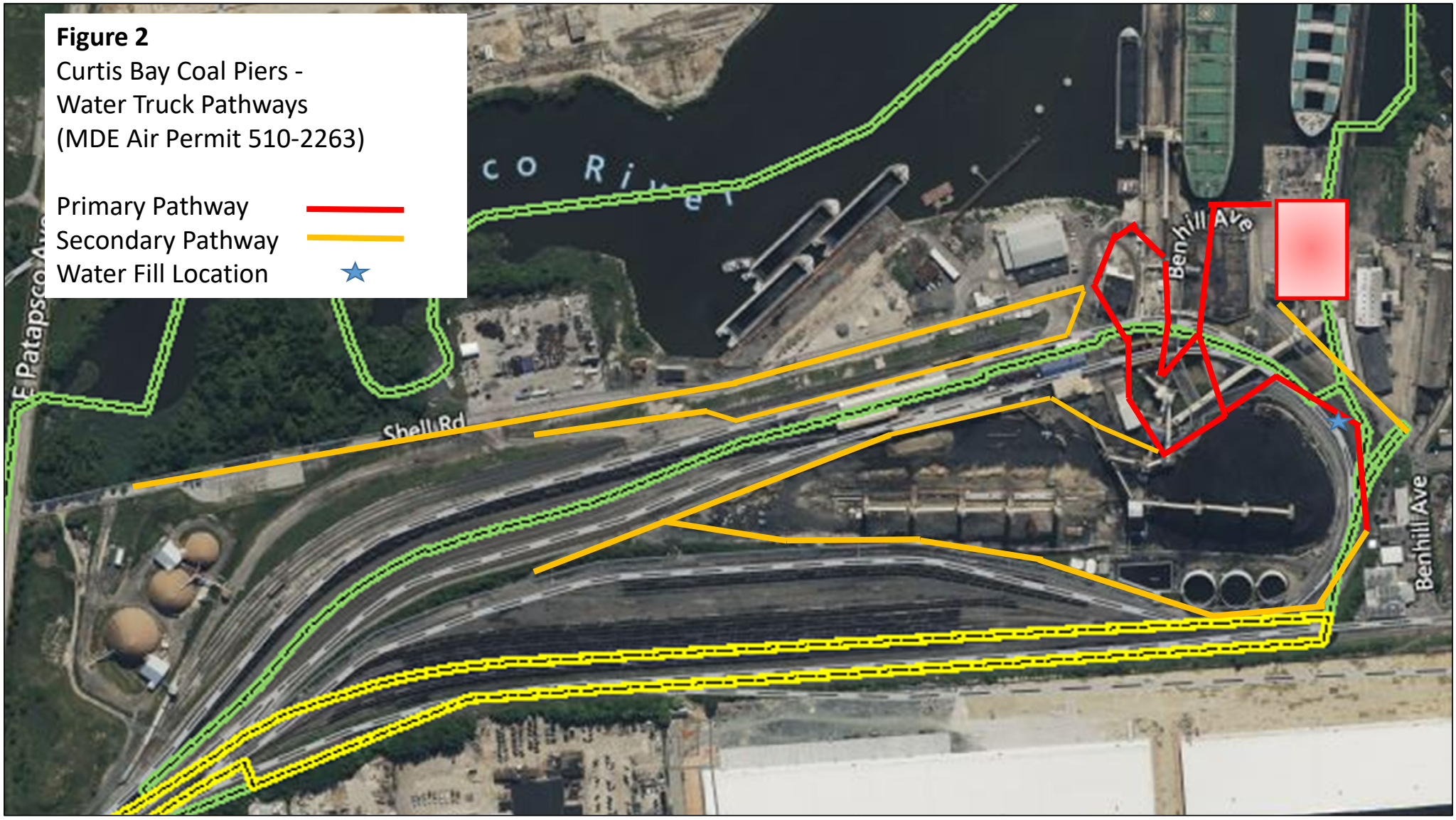


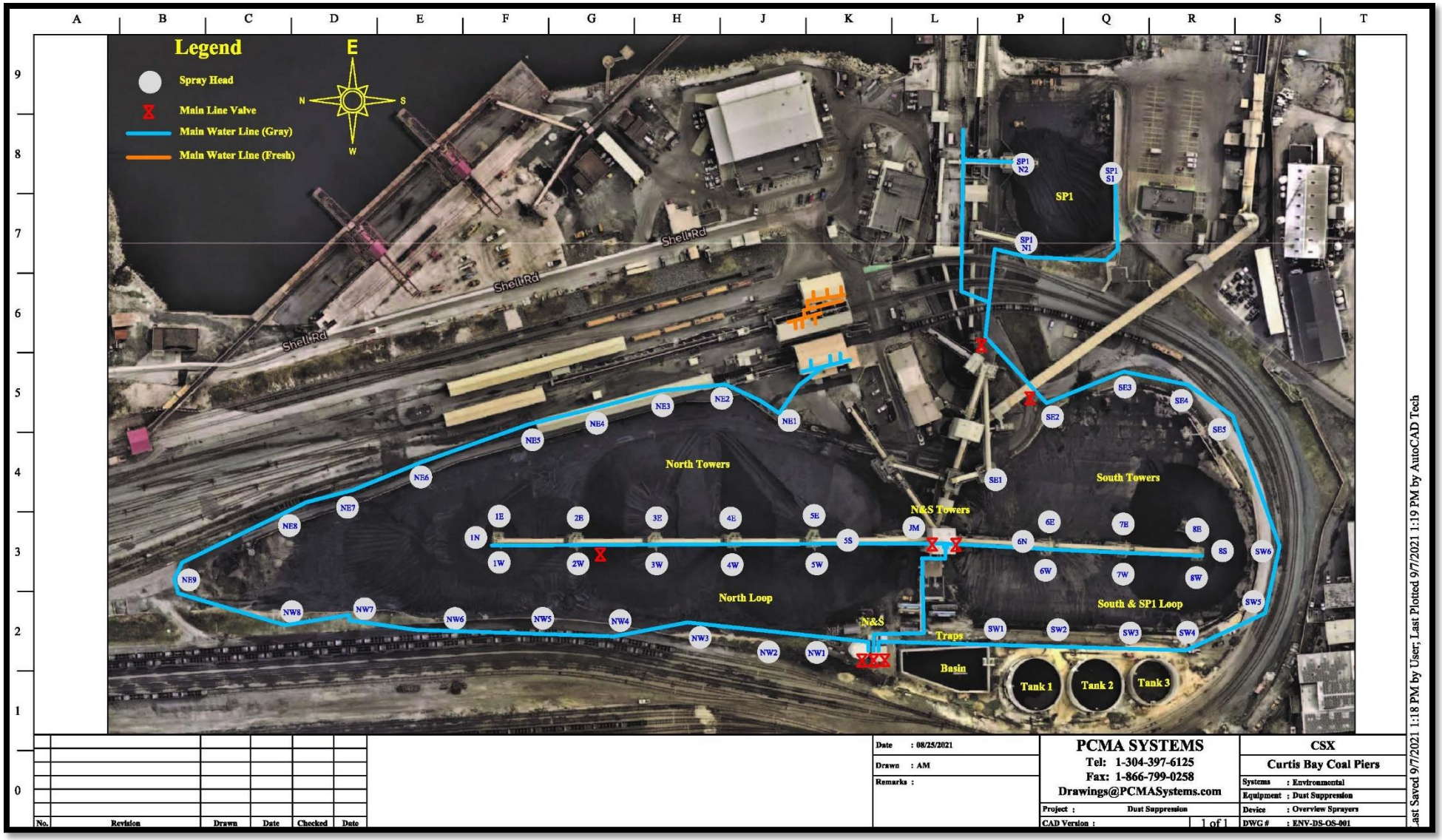
Figure 2
Curtis Bay Coal Piers -
Water Truck Pathways
(MDE Air Permit 510-2263)
Primary Pathway
Secondary Pathway
Water Fill Location
E Patapsco Ave
Shell Rd
Benhill Ave
Benhill Ave

Figure 3

Dust Suppression System Layout

CSX Curtis Bay – Fugitive Dust Plan (MDE Air Permit – 510-2263)

Figure 3 – Dust Suppression System Layout



APPENDIX 2
Fence Line Monitoring Plan

Maryland
Department of the Environment

Wes Moore, Governor
Aruna Miller, Lt. Governor

Serena McIlwain, Secretary
Suzanne E. Dorsey, Deputy Secretary

June 26, 2023

Raghu Chatrathi, Senior Director
Public Health, Safety and Environment
CSX Transportation
500 Water Street
Jacksonville, Florida 32202

Dear Mr. Chatrathi:

I am writing in reply to your letter of April 5, 2023, regarding CSX's response to the Department's previous letter that partially approved elements of the company's overall fence line monitoring plan for the Curtis Bay coal terminal. Upon review and consideration, the Department acknowledges that the use of the eight QuantAQ ModulAir PM sensors, along with the one federal equivalent method monitor (at site # 8) and the meteorological tower, satisfies the fence line monitoring equipment requirements imposed under the construction permit (Condition D.5) for the rebuild of the damaged conveyor system. As such, CSX's Fence Line Monitoring Plan dated November 6, 2022, is hereby approved. In accordance with Condition D.5, we will now move to incorporate the plan into the current operating permit, whereupon it will be enforceable under that permit. Note that in implementing the plan there remains the need to develop and implement a means to share and display data from the monitors with the Department and the public in as close to real time as practicable on a publicly accessible portal.

In your letter, you mention that "*CSX looks forward to continued discussions with the Department and the Curtis Bay community members regarding ways in which CSX can support the multi-pollutant monitoring effort underway in the Curtis Bay community.*" We share this desire and ask that, in the spirit of cooperation, CSX enter into an agreement with the Department committing to purchasing and installing additional monitors for deployment within the terminal to enhance the information gathering efforts being conducted by the community and the academic entities guiding it, including, but not limited to, the installation of multipollutant gas-phase and black carbon monitors.

Should CSX accept, we would like to begin discussions on the terms of an agreement, including mapping out a path forward for determining the type and number of monitors.

We look forward to your response.

Sincerely,

Christopher R. Hoagland, Director
Air and Radiation Administration

cc: Rebecca Hensley, CSX
Ryan Auvil, MDE
Steve Lang, MDE
Angelo Bianca, MDE

Fence Line Monitoring Plan

CSX TRANSPORTATION, INC.
CURTIS BAY PIERS
BALTIMORE, MARYLAND

Version November 6, 2022

Executive Summary

CSX Transportation, Inc. (CSX), Curtis Bay Piers is a material storage, transfer, and shipment terminal located at 1910 Benhill Avenue, Baltimore, Maryland, 21226. Daily operations at the CSX Curtis Bay Piers (CBP) involve the handling of coal and other bulk materials. These operations are conducted in compliance with a fugitive dust mitigation plan pursuant to the facility operating permit issued by the Maryland Department of Environment (Permit to Operate No. 510-2263).

CSX will implement this Fence Line Monitoring Plan (FLMP) in compliance with the Maryland Department of the Environment (MDE) Permit to Construct for Premises Number 510-2263 issued September 7, 2022 to monitor ambient air. As provided in Part D5 of the Permit to Construct, the FLMP includes:

- A plan for the installation and operation of a fence line monitoring system designed to monitor for fugitive dust.
- One (1) continuous Federal Equivalent Method (FEM) monitor for both PM10 and PM2.5 and at least one (1) collocated PM2.5/PM10 sensor
- Multiple PM2.5/PM10 sensors around the CSX property.
- A 10-meter meteorological monitoring system that meets all the requirements of the Quality Assurance Handbook for Air Pollution Measurement Systems - Volume IV: Meteorological Measurements should also be installed at an appropriate location on the CSX property.

The implementation of this plan is anticipated to be performed in five phases:

1. Start-up,
2. Integration and Normalization (I&N),
3. Initial Operating Capability (IOC),
4. Full Operational Capability (FOC), and
5. Operations and Maintenance.

CSX will engage an independent consultant to assist with data review and project implementation as well as to perform quality assurance and control.

Table of Contents

Related Online Reference Documents:

- Quality Assurance Handbook for Air Pollution Measurement Systems Volume 1, Principles and Field Guide
- Quality Assurance Handbook for Air Pollution Measurement Systems Volume 2, Ambient Air Measurements, 2017
- Quality Assurance Handbook for Air Pollution Measurement Systems Volume 4, Meteorological Measurements, 2008, 2012
- EPA Air Sensors Tool Box, Online current
- ASTM D7520-16 Determining the Opacity of a Plume in the Outdoor Ambient Atmosphere.
- Teledyne T640X Operations Manual
- EPA Standard Operating Procedure Teledyne Model 640x Real-Time Continuous PM Monitor
- Quant-AQ, ModulAir PM Operations Manual QAN-001

1. Introduction

CSX has implemented an evaluation process to determine appropriate equipment and methods for ambient air monitoring at the Curtis Bay, MD facility. This Fence Line Monitoring Plan (FLMP) meets the requirements of the Maryland Department of the Environment (MDE) Construction Permit for Premises Number 510-2263 issued September 7, 2022. The following sections of this plan outline the activities for the installation and operation of a site specific ambient air monitoring plan.

The ambient air monitoring equipment selected for installation at Curtis Bay Piers is presented in Section 3. The combination and co-location of a federal equivalent monitor (FEM) and multiple low cost sensors (LCS) will allow for data correlation, data analysis, objective quality assurance and control, and site evaluation. Monitor locations were determined using EPA guidance and facility dispersion modeling results. These monitor locations were also discussed with MDE. Section 4 contains a summary of the selected monitor site locations. The equipment, monitors and sensors require specific installation, maintenance, and calibration – these details are summarized in Sections 5, 6 and 7. The planned schedule is detailed in Section 8. The implementation of this plan is estimated to take between 12 and 24 months. Section 9 contains an overview of quality control and quality assurance (QA/QC) processes necessary for successful implementation of this FLMP.

2. Definitions

2.1. Particulate Matter

Particulate matter (PM) is a complex mixture of solid particles and liquid droplets found in the air. These particles may include dust, dirt, soot, smoke, and drops of liquid. Particulates are defined by their aerodynamic diameter for air quality regulatory purposes. PM2.5 represents particles smaller than 2.5 microns and PM10 represents particles smaller than 10 microns. Small dust particles (PM2.5 and PM10) are not visible to the human eye unless the concentration is considerable within the ambient air. PM10 may be large enough to be detected by the human eye in lower concentrations. PM10 and PM2.5 often derive from different emissions sources and also have different chemical compositions. Due to its light weight, size and resultant transient nature PM2.5 and PM10 are considered “Regional Pollutants” by the United States Environmental Protection Agency (EPA): the pollutant can be carried by the wind hundreds of kilometers from the point of origin.

Regional designations for Attainment or Non-Attainment represent localized achievement of EPA standards. EPA establishes National Ambient Air Quality Standards (NAAQS) for primary and secondary health standards for PM:

- PM2.5 annual average standards: 12.0 µg/m^3 primary and 15.0 µg/m^3 secondary,
- PM2.5 24-hour standard: 35 µg/m^3, and
- PM10 24-hour standards: 150 µg/m^3.

2.2. Visible Emissions

Air emissions that are visible to the human eye are normally comprised of particulate matter (PM) ranging from PM10-100 microns or more. The fugitive dust associated with coal handling operations are primarily larger than PM10. Visible Emissions are regulated in percent opacity: 0 percent opacity is not visible to the human eye and with 100 percent opacity the emission completely obscures the background behind the emission. Opacity is measured in five percent increments, from 0 to 100 percent, increasing as the visible emissions ability to obscure the background increases. Opacity serves as an indicator of PM emissions. CSX will utilize various visual observations to better understand operations, validate, and quality assure the PM and weather monitors.

3. Monitor Equipment Summary

CSX completed a review of available monitoring technology for applicability to permitted requirements. Equipment selection was based on data reporting, reliability, and project viability. Table 3.0 summarizes the capabilities of the monitoring equipment selected for the CSX FLMP, including data reported, verification and calibration requirements, and the estimated implementation period. Equipment selection was based on a review of currently available equipment specifications and capabilities, along with recommendations from industry professionals. CSX will communicate any changes with MDE should monitor availability be impacted by supply chain issues, or if there are other changes from the equipment listed in Table 3.0.

Table 3.0 – Summary of Selected Monitoring Equipment

Equipment	Data Reported	Verification/Calibration
FEM – Teledyne T640X	• Location • Date/Time • PM2.5 • PM10 • Wind Direction. • Wind Speed	• Monthly verification • Quarterly calibration • Semi-Annual cleaning • Annual filter change
LCS – QuantAQ ModulAir-PM	• Location • Date/Time • PM2.5 • PM10 • Wind Direction • Wind Speed	• Monthly visual check • Quarterly rotation with spare units • Annual calibration
MET Station – Campbell Scientific	• Location • Date/Time • Temperature • Relative Humidity Barometric Pressure. • Wind Speed • Wind Direction	• Quarterly operations check • Semi-Annual cleaning and calibration check.

4. Monitor Site Locations

Monitor site locations were determined based on wind rose data, air dispersion modeling results, and EPA guidance. CSX air modeling site characterization identified scenarios with higher parameter concentration. Monitors were located inside these areas and with correlated cross-wind locations. This will enable data comparison for predominant wind patterns across the facility. Table 4.0 lists a summary of monitor locations, Figure 4.0 shows wind rose data based on the BWI airport, and Figure 4.1 shows the eight selected equipment locations around the facility. Position 8 was selected as the FEM location based on potential modeled emission impacts and alignment with existing Curtis Bay community monitors. This FEM position meets the requirements of EPA Quality Assurance Handbook for Air Pollution Measurement Systems (QAHAPM) Volumes 1 and 2. LCSs were positioned with the FEM and around the property boundary per QAHAPM guidance. These planned locations were discussed with MDE.

The meteorological (MET) station was positioned based on discussions with industry professionals, collaboration with the Maryland Department of the Environment, and review of QAHAPM V4 siting procedures. The "M-Pad" material storage area of the facility was selected for the MET station (Figure 4.1, Location 5) due to flat ground; clearance from obstructions; not being located in wind tunnels or channels; and having space and electrical power available. A 10 meter tower is being planned for construction in the SW corner of the M-Pad as shown as Location 5 in Figure 4.1.

Table 4.0 - CSX Curtis Bay Monitor Locations

Map Location	Location	Latitude	Longitude	Power	Comments
1	**LCS 1**	39.22168	-76.581948	Yes	On guard shack at facility main entrance
2	**LCS 2**	39.22191	-76.58448	No	Pole on west side of Marley Neck track
3	**LCS 3**	39.22713	-76.584838	No	Pole in between tracks
4	**LCS 4**	39.22938	-76.585278	No	Pole in between tracks
5	**Met Tower**	39.22773	-76.58096	Yes	M Pad Storage Pad
5	**LSC 5**	39.22773	-76.58096	Yes	Co-located On MET Tower
6	**LCS 6**	39.22479	-76.580096	Yes	Approximate location at ore pier
7	**LCS 7**	39.22148	-76.576314	Yes	Eastern edge of dock
8	**FEM 1**	39.2232	-76.584003	Yes	On pump house; 16 ft from grade
8	**LCS 8**	39.2232	-76.584003	Yes	Co-located LSC with FEM
8	**LCS 9 spare**	39.2232	-76.584003	Yes	Co-located LSC with FEM- Spare
8	**LCS 10 spare**	39.2232	-76.584003	Yes	Co-located LSC with FEM- Spare

Figure 4.0 - Wind Rose from BWI Airport

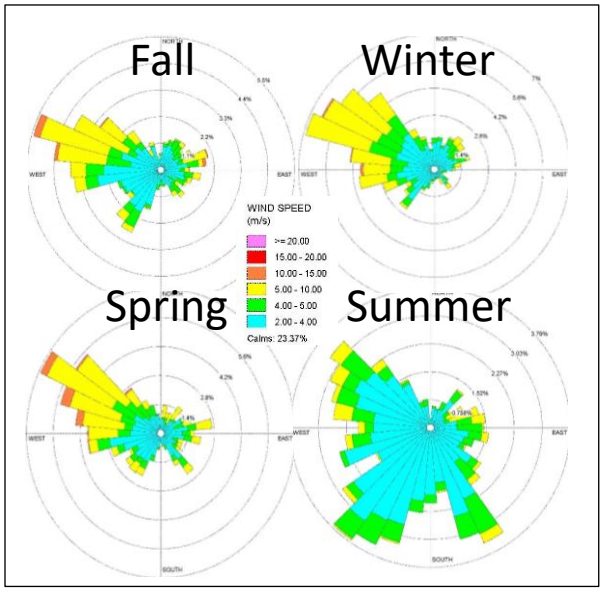
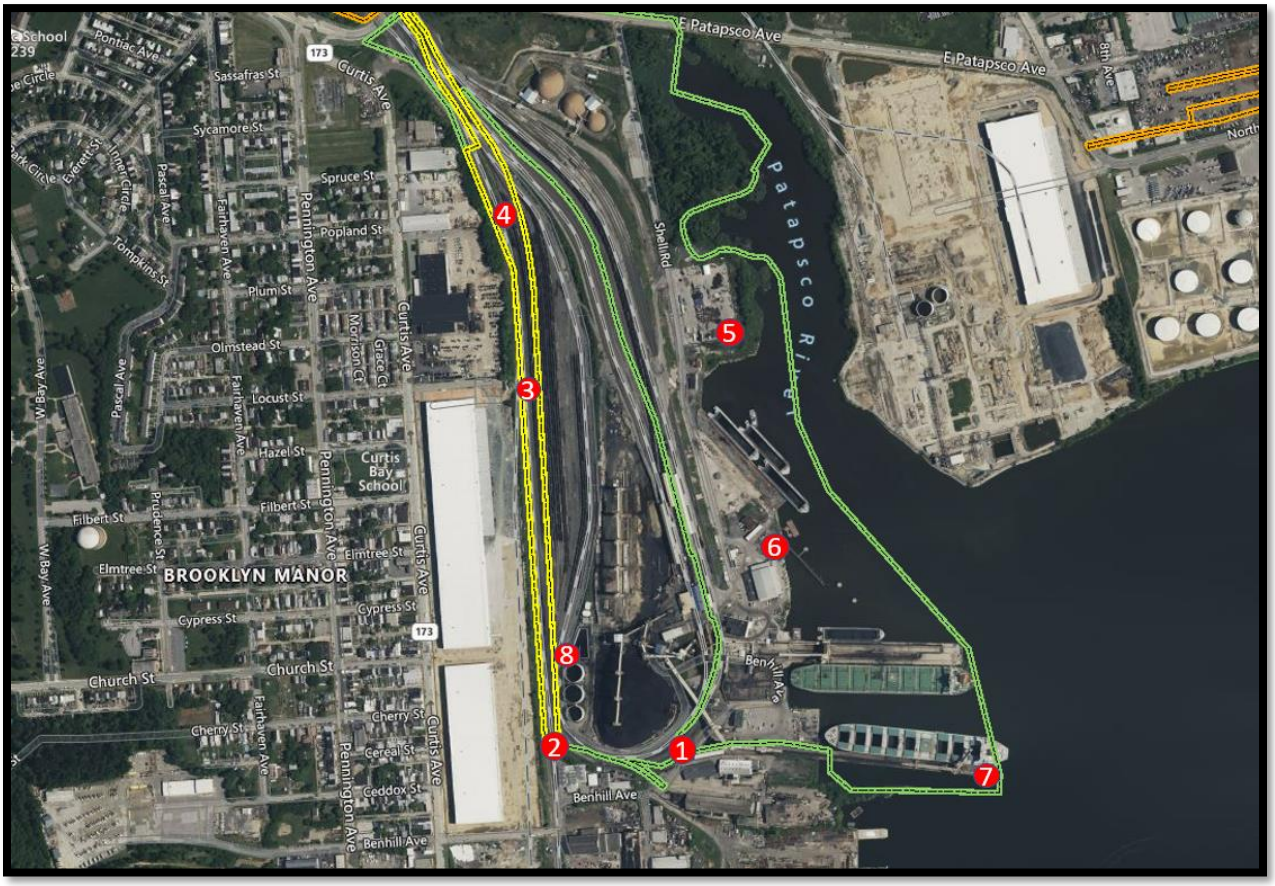


Figure 4.1 - CSX Curtis Bay Monitor Locations



5. Monitor Installation

Monitors will be installed in accordance with the site preparation guidance published in the QAHAPM V2 Ambient Air, and the respective manufacturer manuals for the specific monitor.

- **Mounting -** Sensors will be mounted firmly to the posts (approximately 6 feet above ground level) set in the eight locations shown in Figure 4.1. Fence monitors will be installed with corrosion resistant hardware. Mounting will be in a fashion that will enhance performance by ensuring the units are properly grounded and tightly secured. Quick disconnect pole mounts will be used to facilitate the LCS equipment rotation from the FEM location to the fence locations.
- **Power -** Most monitors will have 120 volt alternating current (VAC) power from the local grid with the exception of SW and NW corner positions, which will be solar powered units. See Table 4.0 for power options at each location. All units will be equipped with battery backup.

  Monitors near primary facility infrastructure, and the MET tower will be powered by local grid 120VAC power. This plug-in power is adequate to charge the batteries of the MET tower, FEM and LCS sensors. Full battery charge can operate the MET Station for approximately one week; the FEM for approximately 4 hours; and the LCS units for approximately 12 hours.

- **Security -** Monitors will be mounted on posts just inside the CSX property line to facilitate the security of the monitoring units. CSX will perform periodic security surveillance.
- **Communications –** Monitors will communicate via wireless communications with manufacturer cloud data systems. Each unit can be accessed via their online communications platform. CSX will engage an outside consultant to develop data export routines using the Application Program Interface (API) and a central data management system. Data will be maintained on a 5 year rolling basis.

6. General Monitoring Requirements

Monitoring requirements will be established during FLMP implementation. As the project progresses actionable data will be defined with reliable, repeatable, reproducible data at specific time increments. Data alert levels and subsequent actions will be defined to sustain operations. See Table 9.0 for an example of data alert levels.

Data integration will be necessary to enable quality checks as the implementation schedule transitions to the Initial Operational Capability (IOC) phase of the project. CSX will work with MDE to develop data checks, reporting format and frequency.

7. Validation and Calibration

7.1 FEM

The FEM will be calibrated based on the protocol as detailed in the EPA published Standard Operating Procedures for the Teledyne 640X. Calibrations will be performed when the monthly flow check or the quarterly maintenance check differs by more than ±4.1% of reference, 5.1% of the design flow rate for PM2.5 and 5.1% of the transfer standard for PM10. The temperature sensors and barometric pressure sensors for each PM sampler will be calibrated when they approach ±2.1 degrees C or ±10.1 mmHg difference, respectively. Specific troubleshooting will include the Teledyne Operators Guide. The monitor will be checked monthly and quarterly using procedures from published guidance, by qualified technicians, and documented as detailed in Appendix A.

Table 7.1 - FEM Sensor Measurement Quality Objectives

Parameter	Sample Method	Reporting Unit	Operating Range	Resolution	Data Collection Frequency	Evidence of Completeness
PM2.5	Dual Laser Particle Counter	ug/m^3	0-100,000 ug/ m3	0.1 ug/m^3	1-minute	75% of every hour the 1-minute data will be recorded.
PM10	Dual Laser Particle Counter	ug/m^3	0-100,000 ug/m^3	0.1 ug/m^3	1-minute	75% of every hour the 1-minute data will be recorded.

7.2. Low Cost Sensors

The FEM will be used for correlation and calibration of the LCS units to verify PM2.5 and PM10 data. During the project start-up phase, the FEM will be established and co-located with the LCS units at a single location (Figure 4.1, Location 8) for a minimum of one week. Data reported for the FEM and the LCS monitors will be compared using the FEM as the baseline. Any co-located LCS unit with a deviation of more than 20 percent from the FEM in a comparison of 24-hour averages will be inspected and repaired,

and possibly returned to the manufacturer for replacement. This 20 percent value is based on LCS manufacturer input. LCS units will be deployed to the fence line locations after confirmation of data correlation.

This plan includes spare LCS monitors co-located with the FEM to enable continuous correlation. A minimum of one LCS unit will be co-located with the FEM at all times. The co-location will assist in developing local correlation factors between the FEM and LCSs. Fence line LCS units will be rotated with spare LCS units during the quarterly maintenance activities.

If a co-located LCS/FEM unit varies more than 20% from the FEM unit based on 24-hr average data comparison, the unit will be checked for issues in the field, and possibly returned to the manufacturer for repair. Returned/repaired monitors will re-enter the facility after co-locating with the FEM for a period of no less than 1 week for quality assurance.

Table 7.2 - Low Cost Sensor Quality Objectives

Parameter	Sample Method	Reporting Unit	Operating Range	Resolution	Data Collection Frequency	Evidence of Completeness
PM2.5	Laser Particle Counter	ug/m^3	0-80,000 ug/m^3	1 ug/m^3	1-minute	75% of every hour the 1-minute data will be recorded
PM10	Laser Particle Counter	ug/m^3	0-80,000 ug/m^3	1 ug/m^3	1-minute	75% of every hour the 1-minute data will be recorded

7.3 Meteorological Station

Field calibrations of the meteorological equipment will be performed semi-annually as well as whenever an instrument exceeds specified control limits, undergoes major maintenance or repair, or fails a performance audit. Meteorological equipment calibrations will be performed with equipment that is in current calibration and is traceable to National Institute of Standards and Technology (NIST) or Laboratory Accreditation & Assessment Services (A2LA) standards. The meteorological station is composed of multiple weather monitoring devices, each device has separate data quality verification requirements. **Appendix C** contains references for data quality objectives of each weather monitor.

7.4. Routine Maintenance

Routine maintenance will be performed per the published manufacturer requirements for each monitor type and site-specific experience. Maintenance instructions are detailed in EPA and equipment manufacturer documents: EPA Standard Operating Procedure (SOP) Teledyne Model 640X; and the LCS by Quanta QAM01 ModulAir Operations Guide. Weather instrument maintenance is also dictated by the QAHAPMS V4. Table 7.4 summarizes equipment routine maintenance activities.

Table 7.4 – Summary of Routine Maintenance

Equipment	Monthly	Quarterly	Semi-Annual	Annual
FEM – Teledyne T640X	Monthly inspection; record with EPA form (Appendix A)	Clean inlet; Calibration with SpanDust (SPAN)	Clean optical channels and relative humidity/temp sensors	Change filters
LCS – QuantAQ Modulair	Visual inspection; data verification	Quarterly rotation of spare units from FEM location; clean, reset time, clear MicroSD	n/a	Data calibration check with FEM
Weather Monitors	Data Availability	Data compare to fence line monitors	Calibration check per Appendix C	Accuracy check per Appendix C

8. Monitoring Project Schedule

The FLMP will be implemented in an iterative fashion to improve capability, data quality, and quality assurance as the system matures. There will be five phases:

1. Start-up,
2. Integration and normalization (I&N),
3. Initial Operating Capability (IOC),
4. Full Operational Capability (FOC), and
5. Operations and Maintenance.

(1) Start-up – During the Start-up phase, monitors will be installed across the facility, powered up, calibrated, and data reporting confirmed. Key tasks during the Start-up phase include:

- Purchase equipment,
- Establish all monitoring locations,
- Receive monitoring equipment and begin calibration process, and
- Initiate data communication.

Upon Start-up, there will be stand-alone data sets:

- FEM: PM2.5, PM10 in 1-minute data averaged over 24 hours,
- LCS: PM2.5, PM10 in 1-minute data averaged over 24 hours, and
- Weather attributes in 1-minute data averaged over 24 hours.

The Start-up phase will be complete when all equipment is installed and operational.

Note - the three data sets are managed independently of each other; manual integration will be required to review and validate the data sets.

(2) Integration and Normalization (I&N) - During this phase, CSX will compare data sets to confirm proper operation and identify necessary field adjustments. The goal is to ensure equipment produces a normalized set of actionable data. Tasks included in this phase:

- Application Program Interfaces (API) will be designed to extract data from the separate manufacturer systems,
- Implement and sustain data extractions to investigate for irregularity and phenomenon,
- Implement and sustain API from cloud data sources with correction factors, and
- Build Quality Assurance Plan.

(3) Initial Operating Capability (IOC) - The IOC phase will involve significant discovery and anomaly resolution to convert actionable data into actionable information. The independent consultant will be engaged to help understand limits, resolve anomalies discovered through data comparison, data completeness, availability, and interpretation, and to implement QA/QC data solutions. The phase will include:

- Manual review of normalized data sets,
- Establish alert limits for monitor types, and
- Development of QA/QC data checks and implement solutions.

This phase will be considered complete once the anomalies of the system are understood; data streams are verified; cross monitor checks are implemented and operational, and quality control is implemented.

(4) Full Operational Capability (FOC) - The FOC phase includes the development and sustainment of knowledge-based data reporting. This phase includes:

- Internal operations and controls reporting; and
- External community engagement and education.

The FOC phase will be complete when reporting dashboards have been deployed and CSX had demonstrated abilities to operate and sustain necessary elements of the FLMP.

(5) Operations and Maintenance – The monitoring systems will require ongoing equipment operations and maintenance to sustain the knowledge-based reporting. CSX will determine an appropriate review frequency for this FLMP.

The projected implementation is estimated to be 12-24 months to achieve full capabilities.

9. Quality Assurance and Quality Control

The plan is designed to monitor ambient air conditions surrounding the facility. Quality assurance and quality control (QA/QC) processes are established to verify and validate monitoring data results.

Ambient air monitoring equipment manufacturers have documented that their sensors are sensitive to weather impacts such as temperature and humidity changes. Additional data impacts may include transient PM and Regional Air Pollutants that follow global wind patterns. CSX will implement procedures to verify and validate PM data to better understand site conditions and regional air impacts.

The FEM will be defined as the data benchmark at the facility. During the project start-up phase:

- LCS monitors will be co-located with the FEM and shall not vary more than 20%, based on 24-hour averaged data over 7 days,
- If LCS monitor data vary more than 20% from the FEM standard, the LCS will be inspected and repaired, or possibly will be returned to the manufacturer for troubleshooting,
- LCS equipment that passes the 20% test will be deployed to the fence line positions,
- CSX will maintain spare equipment at the FEM location to establish a rotation that will bring each fence unit through the calibration cycle annually for approximately three months.

CSX will perform data verification and validation quarterly:

- Rolling 24 hour 1-minute data will be compared for FEM and LCS locations. If LCS data correlate within 20% the equipment is assumed calibrated,
- If LCS data do not correlate within 20%, then co-located LCS equipment will be compared to each other. If they correlate within 10%, then it will be assumed the FEM requires recalibration,
- For any LCS that fails correlation beyond 20%, it will be assumed faulty. Faulty equipment will be inspected and repaired, and possibly returned to the manufacturer for repair.

During the quarterly maintenance and QA, LCS monitors will be rotated from the FEM location to fence locations. This quarterly cycle will ensure each of the LCS units is validated and re-calibrated at least once annually.

The meteorological system provides background weather conditions for all PM readings. CSX will utilize secondary methods to investigate high PM monitor data: weather conditions and visible observations will help define operating conditions. High PM readings may be influenced by relative humidity and barometric pressure. The QA/QC review of the weather system will be provided by the contractor's semi-annual calibration checks per the QAHAPMS V4.

CSX intends to develop a summary of QA/QC data checks for all equipment. An example of potential data checks is shown in Table 9.0.

Table 9.0 – Potential Data Checks

Monitor	Pollutant	Normal Data Correlation	Alert	Action 1	Action 2	Action 3	Action 4
FEM	PM2.5 ug/m^3	< 20 % with co-located units	> 35 ug/m^3 on rolling 24 hr average	Visual Verify	Trigger Controls	Cross Check with Up and Down wind Monitors	Document event in lessons learned for review
LCS	PM2.5 ug/m^3	< 20 % with co-located units	> 35 ug/m^3 on rolling 24 hr average	Visual Verify	Trigger Controls	Cross Check with Up and Down Wind Monitors	Document event in lessons learned for review

Monitor	Pollutant	Normal Data Correlation	Alert	Action 1	Action 2	Action 3	Action 4
FEM	PM10 ug/m^3	< 20 % with co-located units	> 150 ug/m^3 on rolling 24 hr average	Visual Verify	Trigger Controls	Cross Check with Up and Down wind Monitors	Document event in lessons learned for review
LCS	PM10 ug/m^3	< 20 % with co-located units	> 150 ug/m^3 on rolling 24 hr average	Visual Verify	Trigger Controls	Cross Check with Up and Down wind Monitors	Document event in lessons learned for review
Weather Monitors	Wind Speed m/s	< 5 m/s	> 5 m/s	Trigger Controls	Check for drop in Fence Monitors	Cross check with Up and Down wind Monitors	Document event in lessons learned for review
Weather Monitors	Wind Direction Degrees North = 0	Except 70-140 degrees	70-140 degrees Wind into the community	Trigger Controls into wind	Check West Fence for VE	Cross check all west PM for high	Document event in lessons learned for review
Weather Monitors	Relative Humidity	< 65%	> 65%	Cross check east side locations with west side Monitors	Visually validate any higher-than normal readings on water side	Compare >60% readings with <60% readings water side	Document event in lessons learned for review

9.1 Potential Data Issues

This plan is designed utilizing proven high quality, high reliability equipment. However, it is our understanding that these monitors do not have substantial operating experience at sites with large size fugitive particles. That is, sites with particle size substantially greater than PM10 such as Curtis Bay Piers.

Both the FEM and the LCS equipment are also known to be sensitive to changes in atmospheric humidity, barometric pressure, and temperature. These changing conditions are likely at this facility. During the implementation of this FLMP we will strive to understand known data issues that may occur, such as:

- Resolution of time synchronization,
- Impact of high humidity and operating temperatures,
- Impact of barometric pressure changes, and
- Impact of high PM exposure.

Time synchronization – The FEM and MET station sensors are designed to align with the National Time Server (NTS). These data sets should synchronize and match in time sequence. LCS monitors do not utilize the NTS and their data may experience slight differences in time between each LCS.

During the Integration and Normalization (I&N) phase, time synchronization differences will be worked to resolution. Solutions may include:

- Development of adjustment factors or tolerance bands to the comparison averages,
- Sum the 1-minute data into 24-hour averages for comparison purposes to provide an acceptable time offset, and
- Time resolution may require larger average blocks.

Humidity - During the first year, it is anticipated that LCS sensors located on the eastern side of the facility will not be able to operate in high humidity or saltwater conditions. CSX will investigate technologies and recommend solutions to normalize known high or low readings. Enhanced data analytics may be required to resolve for site specific weather conditions.

High Exposure to Particulate Matter - The coal storage piles at CBP are a potential large particle fugitive dust source (i.e., particle size substantially greater than 10 microns). Each of the equipment manufacturers has disclosed known data issues with their equipment for the detection of larger particles. The particle weight may plug filters or the air intakes. CSX will analyze for these conditions and discuss potential resolution.

Appendix A – EPA Inspection Form for FEM

		Order of Monthly Checks:
Station:		1. Document any alarms and then clear. 2. Record parameters as found from Dashboard. 3. Take instrument "Off Scan" from data system 4. Perform zero test; clean PM_{10} well. 5. Perform verifications of: a. BP b. Ta c. Total flow (16.67 lpm) d. Sample flow (5.0 lpm) e. Span Dust (performed quarterly) 6. Perform, only if needed calibrations of pressure, flow, and PMT. 7. Put instrument back together. 8. Clear any remaining alarms 9. Wait minimum of 10 minutes to ensure PM concentrations are representative of ambient air. 10. Record "After" parameters from Dashboard in far-right column. 11. Bring instrument back on line to data system.
Operator:		
Analyzer S/N:		
Date:		
Time monitor out of service (LST):		
Time monitor back in service (LST):		
Any alarms enabled? List alarm/date/time if applicable		

Parameters from Dashboard:					***As found / After***	
Amb P. (mm Hg)		PMT Setting		Current PMT hv		
Amb T. (°C)		Box T. (°C)		LED Temp. (°C)		
$PM_{2.5}$ Conc. (µg/m³)		ASC Heater Duty		Pump PWM (%)		
PM_{10} Conc. (µg/m³)		Sample Temp. (°C)		Sample Flow (lpm)		
PM_{10} STP (µg/m³)		Sample RH (%)		Valve PWM (%)		
Package Version				Total Flow (lpm)		

Monthly QC Checks:					
Audit Device:		**S/N:**		**Last Cert. Date:**	
	Verifications:		**Calibrations:**		
QC Check	**Audit Actual**	**T640x**	**Audit Actual**	**T640x**	**Tolerance**
Zero Test	NA		Re-zero if any issues found and corrected:		0.0 on each PM metric
BP					+/- 10 mm Hg
Ta					+/- 2°C
Total Flow 16.7 lpm					+/-5% of T640x (e.g., 15.87 – 17.54 lpm)
Sample Flow 5.00 lpm					+/-5% of T640x (e.g., 4.75 – 5.25 lpm)
Bypass Flow 11.7 lpm (only as needed)					+/-5% of T640x (e.g., 11.12 – 12.29 lpm)

Additional Checks and Maintenance (longer than monthly):						***Date Completed***
Quarterly	**Span Dust™** (+/- 0.5 value on Span Dust™ bottle)	Peak Ch. = PMT Setting = Peak Ch. Counts =				
	Inlet	1. Clean PM_{10} Inlet (above PM_{10} well)				
Every 6 Months		1. Clean Optical Chamber 2. Clean RH Sensor 3. Clean Ta Sensor				
Every 12 months or if valve or pump PWM value approaches 80%		1. New internal (5.0 lpm) Disposable Filter Unit (DFU) [inside front panel] 2. New external (11.67 lpm) Disposable Filter Unit (DFU) [at back of instrument]; It is recommended to change both DFUs on the same day.				

Appendix B – LCS Equipment Details

- QuantAQ (quant-aq.com)
- Modulair-PM Product Manual

Appendix C - Meteorological Station – Weather Monitoring Devices

QAHAPM Vol 4 summarizes the QA/QC requirements for each of the Meteorological Monitors.

Table 0.12 Siting and Exposure for Meteorological Sensors[a]

Measurement	Distance from Obstruction	Distance Above Ground	Recommended Group Cover	Comments
Wind Speed/Direction	10x the height of the obstruction	10 meters	Grass or gravel	The standard exposure of the wind instruments over level, open terrain is 10 meters above ground
Temperature/Dew Point	1.5x the tower diameter	1.25 to 2 meters	Non-irrigated or un-watered short grass, or natural earth	The surface should not be concrete or asphalt or oil-soaked. Reflection from these surfaces may affect the performance of the sensor.
Vertical Temperature Difference	1.5x the tower diameter	2 meters and 10 meters	Non-irrigated or un-watered short grass, or natural earth	The surface should not be concrete or asphalt or oil-soaked. Reflection from these surfaces may affect the performance of the sensor.
Solar Radiation	2 meters	2 to 10 meters	No requirements	Sensor should be free from obstructions above the plane of the sensor. It should be located so that shadows will not cast on the device.
Barometric pressure	1meter	1 to 10 meters	No requirements	The location should have uniform, constant temperature, shielded from the sun, away from drafts or heaters
Precipitation	2x to 4x the obstruction height	30 cm, minimum	Natural vegetation or gravel	Asphalt or concrete should be avoided to avoid splashing the gage. The gage should be high enough to avoid it being covered by snow.

Table 0-3 NCore Meteorological Measurement Quality Objectives

Measurement	Method	Reporting Units	Operating Range	Resolution	Minimum Sample Frequency	Raw Data Collection Frequency	Completeness
(Required)							
Ambient Temperature	Thermistor	°C	-30 – 50	0.1	Hourly	1 minute	75%
Relative Humidity	Psychrometer/ Hygrometer	%	0 – 100	0.5	Hourly	1 minute	75%
Wind Speed	Cup, prop or sonic anemometer	m/s	0.5 – 50.0	0.1	Hourly	1 minute	75%
Wind Direction	Vane or sonic anemometer	Degrees	0 – 360 (540)	1.0	Hourly	1 minute	75%
Vector Data Wind Speed Wind Direction	DAS[2] Calculations	 m/s degrees	 0 – 50.0 0 – 360	 0.1 1.0	Hourly	 1 minute 1 minute	75%
(Optional)							
Solar Radiation	Pyranometer	Watts/m^2	0 – 1100	10	Hourly	1 minute	75%
Precipitation	Tipping Bucket	mm/hr	0 – 25 mm/hr	0.2 mm	Hourly	1 minute	75%
Barometric Pressure	Aneroid Barometer	mb	600 – 1100	0.5	Hourly	1 minute	75%

Table 0-4 NCore Calibration and Accuracy Criteria

Measurement	Verification/Calibration			Accuracy		
	Type	Acceptance Criteria	Frequency	Type	Acceptance Criteria	Frequency
Ambient Temperature	3 pt. Water Bath with NIST-traceable thermistor **or** thermometer	±0.5 ºC	Semi-Annually	3 pt. Water Bath With NIST-traceable thermistor **or** thermometer	±0.5 ºC	Annually
Relative Humidity	NIST-traceable Psychrometer **or** standards solution	±7% RH	Semi - Annually	NIST-traceable Psychrometer **or** standards solution	±7% RH	Annually
Wind Speed	NIST-traceable Synchronous Motor, CTS method[a]	±0.25m/s ≤5m/s; 5%>2m/s not to exceed 2.5m/s	Semi-Annually	NIST-traceable Synchronous Motor	0.25m/s ≤5m/s; 5%>2m/s not to exceed 2.5m/s	Annually
Wind Direction	Solar Noon, GPS Magnetic Compass, CTS method[a]	±5 degrees; includes orientation error	Semi-Annually	Solar Noon, GPS or Magnetic Compass	±5 degrees; includes orientation error	Annually
Solar Radiation	NIST-traceable Pyranometer	10 w/m3 below 200 w/m3 above 200 w/m3 ±5%	Semi-Annually	NIST-traceable Pyranometer	10 w/m3 below 200 w/m3 above 200 w/m3 ±5%	Annually
Barometric Pressure	NIST-traceable Aneroid Barometer	±3 mb	Semi-Annually	NIST-traceable Aneroid Barometer	±3 mb	Annually
Precipitation	Separatory funnel and graduated cylinder	±10% of input volume	Semi-Annually	Separatory funnel and graduated cylinder	±10% of input volume	Annually