2025 Air Monitoring Network Plan for Minnesota

Appendix C

Lead Monitoring Waiver Renewal
U.S. Steel Corp. - Minntac

Summary

This is a request to renew the lead monitoring waiver for U.S. Steel Corp-Minntac (Minntac) which was originally approved by EPA on December 21, 2011. The original waiver request titled “Lead Monitor Siting and Monitoring Waiver Applicability Air Dispersion Modeling” was submitted to EPA in November 2011. Modeling for Minntac was reviewed and updated in January 2017. This 2017 modeling was the basis for requesting a renewal of the lead monitoring waiver, which was later approved by EPA. Modeling was again reviewed and updated in February of 2024; based on the review and updated modeling, the MPCA has determined that the Minntac facility is still eligible for a monitoring waiver. MPCA requests that EPA approves the continuation of the monitoring waiver for lead at Minntac.

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Introduction and background

On November 12th, 2008, the U.S. Environmental Protection Agency (EPA) strengthened the National Ambient Air Quality Standards (NAAQS) for lead (see 73 FR 66964) by revising the primary standard from 1.5 µg/m^3 for a quarterly average to 0.15 µg/m^3 for a rolling 3-month average and revising the secondary standard to be identical to the primary standard. As part of the process for siting monitors or applying for a monitoring waiver, all states were required to perform air dispersion modeling for sources with lead emissions exceeding 1.0 ton/year (tpy). If modeled concentrations were 0.075 µg/m^3 or less (50% of the NAAQS or less) for the rolling 3-month period, the state could apply for a waiver for siting a monitor at that source. Otherwise, if the modeling results showed the impacts were 50% or greater than the NAAQS, the state would be required to site a monitor for the source.

In July 2009, the Minnesota Pollution Control Agency (MPCA) submitted, for EPA review, the document "Lead Monitor Siting and Monitoring Waiver Applicability Air Dispersion Modeling". The document included modeling analyses for five sources in the state of Minnesota: Gopher Resources Corp. in Eagan, MN; Federal Cartridge in Anoka, MN; Grede Foundries in St. Cloud, MN; Dotson, Inc. in Mankato, MN; and U.S. Steel Corp – Minntac in Mountain Iron, MN. From this, EPA Region 5 air monitoring and modeling staff provided comments to MPCA staff, regarding the air dispersion modeling conducted for the U.S. Steel Corp. – Minntac facility in Mountain Iron, MN.

As described in the 2009 document, MPCA staff modeled the Minntac facility and found that lead (Pb) concentrations from the source were below the monitoring threshold level of 0.075 µg/m^3, which would qualify for a monitoring waiver as allowed under 40 CFR part 58 Appendix D, paragraph 4.5(a)(ii). In August of 2011, MPCA staff were asked to resubmit air dispersion modeling for the U.S. Steel – Minntac facility in order to qualify for a monitoring waiver renewal, or else a site-specific monitor would need to be in operation on January 1, 2012. Comments on the 2009 modeling analysis for Minntac and the areas that needed to be addressed in the remodeling were: include buildings and building downwash in the analysis; use actual stack locations instead of a representative merged stack; switch to a Cartesian grid from a polar grid; and include fugitive emissions of Pb from the source, if such emissions existed at the Minntac facility. Updated modeling files were completed in October 2011, sent to EPA in November 2011, and received waiver approval on December 21, 2011.

In December of 2016 the MPCA reviewed all submitted modeling files to determine if the monitoring waiver, as allowed under 40 CFR part 58 Appendix D, paragraph 4.5(a)(ii), was still applicable for the U.S. Steel Corp.-Minntac facility. During the review of modeling files, one item was identified as needing re-evaluation to determine waiver applicability; several buildings on the property were not included in the October 2011 analysis and were subsequently included. Additionally, the model was re-run using updated AERMOD software, meteorological data, and terrain data. Upon completion of the review and incorporation of the model updates, the MPCA applied for a renewal from EPA in January 2017 and received EPA approval.

In April of 2023, and finalized in February of 2024, the MPCA reviewed the modeling files submitted for the 2017 waiver application to determine if the monitoring waiver, as allowed under 40 CFR part 58 Appendix D, paragraph 4.5(a)(ii), was still applicable for the U.S. Steel Corp.-Minntac facility. During the review of modeling files, one item was identified as needing re-evaluation to determine waiver applicability; emission rates for several units were adjusted based on stack testing that had been conducted at the facility (see Attachment A). Additionally, the model was re-run using updated AERMOD software, meteorological data, and terrain data. A denser receptor was also implemented upon EPA

request. Upon completion of the review and incorporation of the model updates, the MPCA has determined that the U.S. Steel Corp.- Minntac facility remains qualified for a lead monitoring waiver.

Model selection and inputs

The modeling review and analysis was performed using the U.S. EPA's AMS/EPA Regulatory Model AERMOD, version 22112. While AERMOD version 23132 has since become available, from reviewing the model change bulletin, no change in estimated impacts would be expected. Due to no change being anticipated the model was not re-run with version 23132. AERMOD is the EPA recommended regulatory air dispersion model (see 40 CFR Part 51, Appendix W). AERMOD's regulatory default settings were used in the analysis. The versions of the regulatory pre-processors, as follows, were used: AERMAP (version 18081), AERMET (version 21112), AERMINUTE (version 15272), and AERSURFACE (version 13016). The Building Profile Input Program for PRIME (BPIPPRM version 04274), was used to calculate building downwash values for the facility.

Minntac facility modeling was reevaluated using the same default settings used in the October 2017 analysis. The "MONTH" averaging time option was selected for the five-year period of 2016-2020 and rural classification was confirmed for the facility. To calculate the maximum rolling 3-month average, post files were generated from AERMOD and then read into EPA's post-processor, LEADPOST version 11237. LEADPOST is an EPA program designed to calculate a rolling 3-month average and is used exclusively for the Pb NAAQS.

Meteorological inputs and surface characteristics

As mentioned above, the modeling analysis was conducted using five consecutive years of meteorological data. The current MPCA pre-processed meteorological data sets were developed with AERMET version 21112, as well as the EPA pre-processor AERMINUTE version 15272 with the use of EPA's surface characteristics tool, AERSURFACE version 13016. Surface meteorological data was obtained from the National Climatic Data Center's (NCDC) Integrated Surface Database (ISD). This database is also referred to as the Integrated Surface Hourly Database (ISHD or ISH) or TD-3505. ISHD and TD-3280 are currently the only active formats after 1995 for National Weather Service (NWS) files. Additionally, most ASOS stations also have 1-minute average wind speed and direction data available to supplement the ISHD data, by using the pre-processing program AERMINUTE. This data set, referred to as DSI-6405, consists of a running 2-minute average wind speed reported for every minute. This data is then used in Stage 2 of AERMET to either substitute missing on-site winds or replace standard winds from the ISHD file(s).

Upper air data (also known as radiosondes or soundings) was obtained from the National Oceanic and Atmospheric Administration (NOAA) and Earth System Research Laboratory (ESRL)'s Radiosonde Database. Data was collected for each individual year, for all sounding times and data levels, with wind units selected as tenths of meters/second.

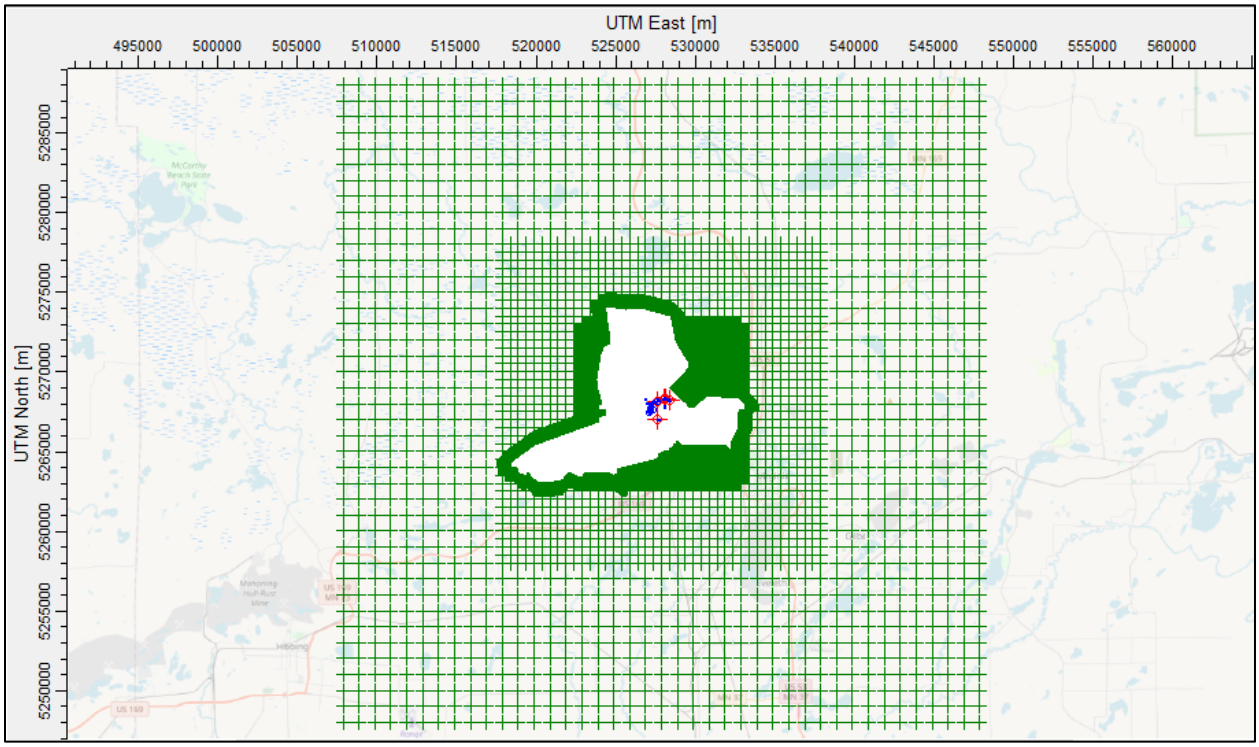
The meteorological surface station of Hibbing, MN (HIB) and upper air station of International Falls, MN (INL) for the years of 2016 – 2020 were selected as the most representative for the analysis. The Hibbing, MN meteorological tower was the most representative surface station, in regard to surrounding land use, to the Minntac facility. Proximity to the surface meteorological tower and similar wind patterns were also factors in selecting the Hibbing, MN data set.

Terrain, ambient air Boundaries, and ambient air receptors

This modeling review and analysis for Minntac used 1/3 arc-second National Elevation Dataset (NED) data in GeoTIFF format for processing with the latest version of AERMAP (version 18081). This was then used to determine elevations for the model inputs, such as the sources, receptors, and buildings.

The receptor grid was altered from the last waiver request to incorporate a denser layout near the facility boundary. Due to the large footprint of the facility, the tier spacing nearest the boundary was shortened to 50m out to a distance of 5 km, from a previous distance of 1 km. The receptor heights were re-processed with AERMAP. Figure 1 displays receptor locations and the ambient air boundary utilized in this analysis.

Figure 1 – Receptor grid and modeling domain for the U.S. Steel Corp. – Minntac facility in Mountain Iron, MN.



Emission sources and characterizations

US Steel Corp. owns the Minntac facility and operates it as a taconite mine and pellet processing facility. The modeled emission rates were based on Minntac's actual 2022 pellet production for each line and actual gas usage for each boiler.

For the five pellet production lines, the modeled emission rates were based on:

- The annual production for each line (based on 2022 emission inventory data) averaged across 8760 hours; and
- Emission factors from lead emission testing conducted by U.S Steel on two different waste gas stacks in 2022.

The MPCA believes this approach to creating the modeled emission rates based on actual emissions is reasonable because U.S Steel operates the Minntac pellet production lines 24 hours/day year-round, except for occasional downtime for maintenance.

For the seven gas boilers, the modeled emission rates were based on:

- The annual fuel use for each boiler, averaged across 8760 hours; and
- The lead emission factor from AP-42, Table 1.4-2 for natural gas combustion.

Stack locations were obtained from the facility for the October 2011 analysis and subsequent 2017 analysis. U.S Steel submitted updated calculations in 2022 as requested by the MPCA for work on the ongoing Part 70 permit reissuance. The most recent air permit confirmed a total of 12 emission units, consisting of boilers and gas stacks, emitting lead to 12 stacks. These stack parameters are listed in Attachment A. Permitting records for Minntac were also reviewed to confirm the facility did not have on record any fugitive emission sources emitting lead.

Background concentrations for this review and analysis were obtained from the MPCA's Criteria Pollutant Data Explorer. Maximum 3-month rolling averages from 2021 were relied upon, as data from 2020 and 2019 were limited. Excluding source-oriented monitors directly at Gopher Resources (MN State Highway 149 & Yankee Doodle Road in Eagan, MN, located in the southeastern Twin Cities metro area), which are not representative of background concentrations, monitors around the state showed quarterly average values between 0.00 and 0.03 µg/m^3. The majority of values equaled 0.01 µg/m^3. Therefore, the background concentration value of 0.01 µg/m^3 was confirmed to be representative of the state's background lead levels.

The MPCA staff also reviewed Minntac's annual lead emissions estimates since 2011 to evaluate whether emissions rates had changed since the last waiver submittal. As demonstrated in Table 1 below, emissions per year did not significantly change since the last waiver submittal. Emission changes between 2014 and 2015 are from updated stack test emission factor values for the induration lines along with the cessation of coal usage for induration lines 6 and 7.
https://www.pca.state.mn.us/sites/default/files/aq10-04.pdf

As mentioned above, U.S Steel conducted lead emission testing on two furnace stacks most recently in 2022.These revised emission factors were used in the modeled emission rates based on 2022 production but were not used by Minntac in their 2022 emissions inventory. Therefore, the modeled lead emission rates in Attachment A are slightly lower (0.488 tpy) than what was reported by Minntac (0.508 tpy).

Table 1. U.S. Steel Corp. – Minntac annual lead emission estimates (tpy)

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
0.8	0.8	0.9	0.9	0.4	0.5	0.6	0.6	0.5	0.5	0.6	0.5

Modeling results

As described in the Modeling Inputs section above, the maximum monthly average was determined from the AERMOD run and then the associated post file (*.POS) was read into LEADPOST. LEADPOST then calculated the rolling 3-month averages from the modeled period of 2016-2020 and found the maximum rolling 3-month average. Table 2 provides results for all previously submitted analyses for comparison; results demonstrate that the Minntac facility remains below 50% of the new NAAQS of 0.15 μg/m^3, or 0.075 μg/m^3.

Table 2 – Pb air dispersion modeling results for U.S. Steel Corp. – Minntac

U.S. Steel Corp. – Minntac Analysis	Maximum Rolling 3-Month Average Concentrations (μg/m^3)	Background Concentrations (μg/m^3)	Total Impact for Lead (μg/m^3)	Is Total Impact > 50% of NAAQS (0.075 μg/m^3)?
July 2009	0.000230	0.01	0.010230	No
October 2011	0.000212	0.01	0.010212	No
January 2017	0.000244	0.01	0.010244	No
February 2024	0.000580	0.01	0.010580	No

The maximum modeled, plus background, concentration remains below the Pb source-oriented air monitoring threshold at the Minntac facility. Figure 2 below shows where the maximum concentration occurred in the 2017 review and analysis; for comparison Figure 3 shows the maximum concentration location as identified in the 2024 analysis. The MPCA respectfully requests EPA to renew the ambient air monitoring waiver for this facility.

Figure 2 – Total maximum rolling 3-month average concentrations for U.S. Steel Corp. – Minntac, January 2017 review/analysis.

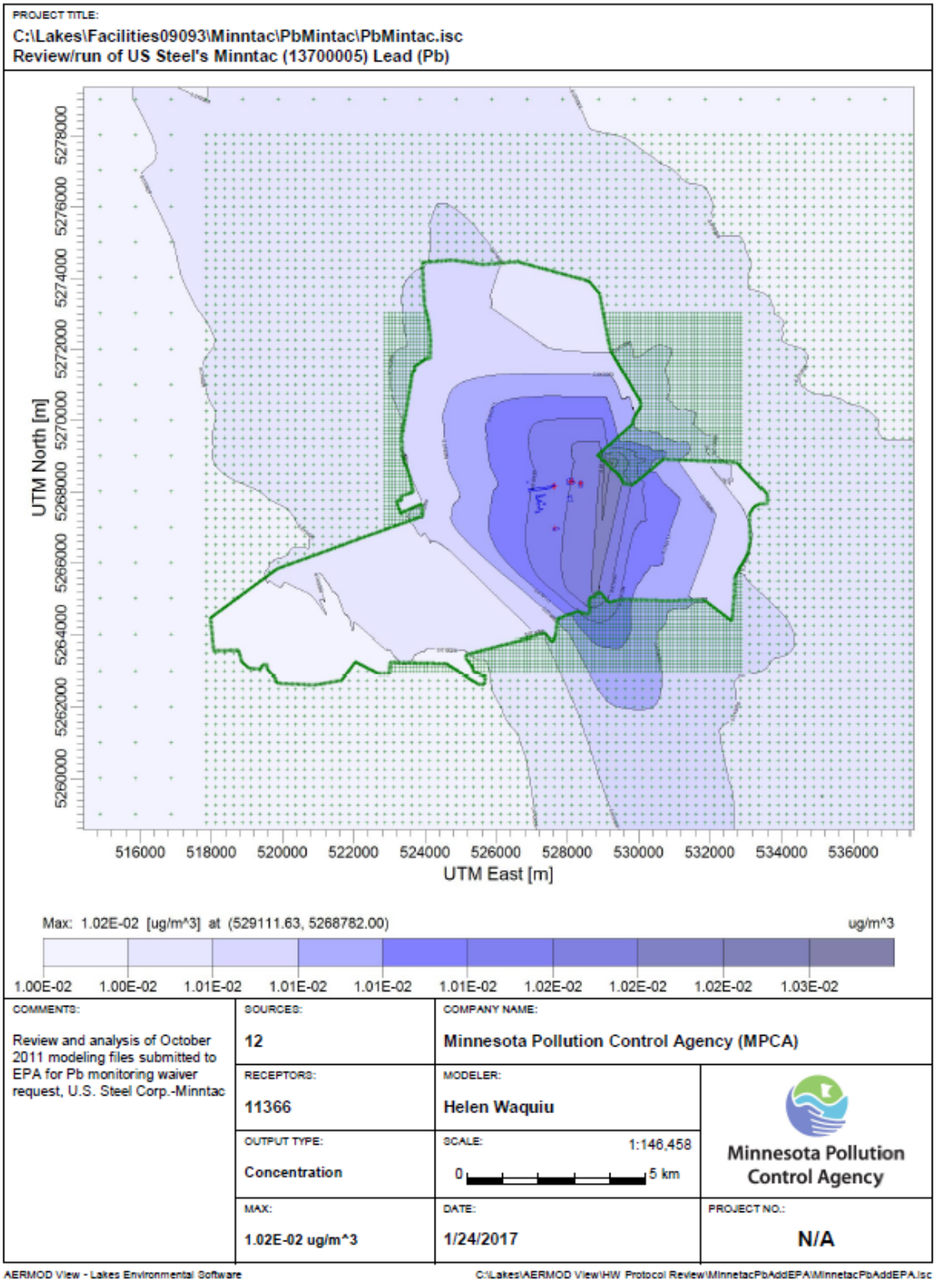
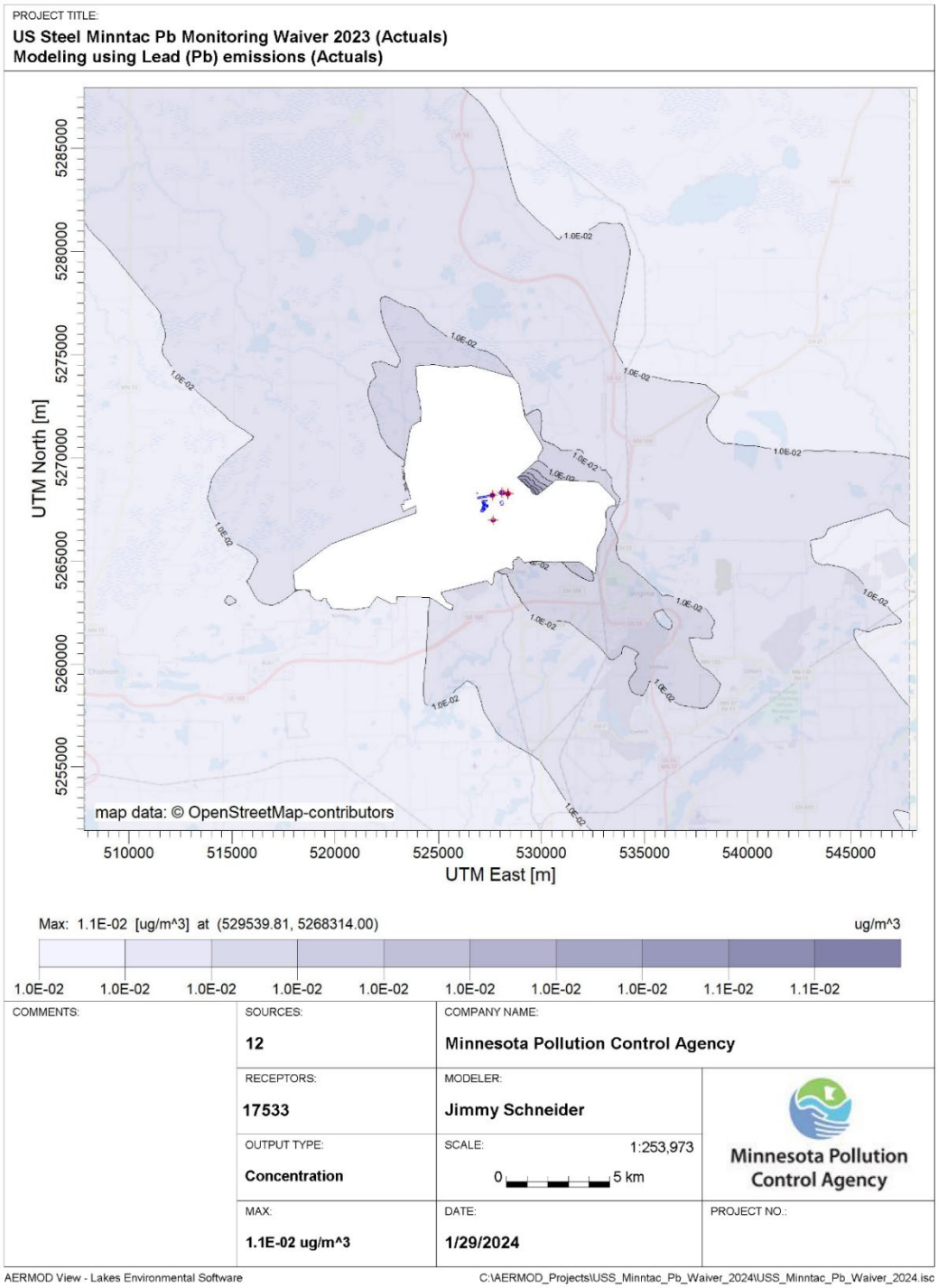


Figure 3 – Total maximum rolling 3-month average concentrations for U.S. Steel Corp. – Minntac, February 2024 analysis.



Attachment A

Source Pathway - Source Inputs

AERMOD

Point Sources

Source Type	Source ID	X Coordinate [m]	Y Coordinate [m]	Base Elevation (Optional)	Release Height [m]	Emission Rate [g/s]	Gas Exit Temp. [K]	Gas Exit Velocity [m/s]	Stack Inside Diameter [m]
POINT	SV001	527605.44	5268166.23	512.99	20.50	9.24E-7	466.48	5.43	1.37
		EU001, SI 104 MMBtu Boiler							
POINT	SV002	527612.14	5268167.19	513.08	20.50	8.62E-7	466.48	5.43	1.37
		EU002, SI104 MMBtu Boiler							
POINT	SV003	527619.14	5268168.20	513.07	20.50	4.29E-7	466.48	6.64	1.37
		EU003, SII 125 MMBtu Boiler							
POINT	SV004	527627.00	5268169.38	513.00	20.91	1.07E-6	466.48	8.14	1.37
		EU004, SIII 153 MMBtu Boiler							
POINT	SV005	527633.90	5268170.38	513.01	20.91	1.20E-6	466.48	8.14	1.37
		EU005, SIII 153 MMBtu Boiler							
POINT	SV010	527646.16	5266984.45	493.68	17.93	1.32E-7	466.48	4.24	0.76
		EU010, 24.6 MMBtu Boiler							
POINT	SV011	527650.71	5266985.14	493.69	17.93	1.54E-7	466.48	4.24	0.76
		EU011, 24.6 MMBtu Boiler							
POINT	SV103	528069.94	5268291.29	518.94	35.36	0.00191	385.93	20.83	3.05
		EU223 EU225 EU226, L3 Waste Gas Stack							
POINT	SV118	528116.58	5268294.62	519.03	42.55	0.00215	319.26	21.45	4.27
		EU261, L4 Waste Gas Stack							
POINT	SV127	528130.92	5268296.41	518.97	42.55	0.00216	319.26	21.45	4.27
		EU282, L5 Waste Gas Stack							
POINT	SV144	528362.95	5268243.39	520.43	42.67	0.00358	315.93	14.04	4.88
		EU315, L6 Waste Gas Stack							
POINT	SV151	528377.69	5268245.79	519.83	42.67	0.00346	315.93	15.16	4.88
		EU334, L7 Waste Gas Stack							

Project File: C:\AERMOD_Projects\USS_Minntac_Pb_Waiver_2024\USS_Minntac_Pb_Waiver_2024.isc
AERMOD View by Lakes Environmental Software SO1 - 1 1/29/2024