PERMIT APPLICATION

Moses Lake Industries, Inc. > Moses Lake, WA

Notice of Construction
TMAC Line #3 Expansion Project
and Copper Purification Facility Upgrade

Prepared By:

Maren Seibold – Managing Consultant, Trinity Consultants
Pat Blau – EHS Manager, Moses Lake Industries

TRINITY CONSULTANTS
20819 72nd Avenue South
Suite 610
Kent, WA 98032
(253) 867-5600

November 2018

Project 184801.0052

Environmental solutions delivered uncommonly well

TABLE OF CONTENTS

LIST OF TABLES

1. EXECUTIVE SUMMARY

Moses Lake Industries, Inc. (MLI) operates a tetramethyl ammonium carbonate (TMAC) production facility in Moses Lake, Washington. This facility is currently subject to Approval Order No. 18AQ-E042, which was recently issued by the Department of Ecology – Eastern Regional Office (Ecology) on September 12, 2018. This approval order accommodated MLI's TMAC Product Quality and Emissions Upgrade Project, which included the installation of a new boiler (Boiler #2) with enhanced emission control features to provide additional utility steam for TMAC and other MLI production requirements as characterized by MLI's August 2, 2018 Notice of Construction (NOC) application. This approval order also identifies MLI's Copper Purification Facility, but characterizes this process as "exempt from New Source Review (NSR)".

In this NOC application, MLI is proposing to make further upgrades to its existing TMAC production facility via the installation of Line #3 to increase the facility's TMAC production capacity. The proposed new line will incorporate similar improved air emission control design features to those described for the TMAC Product Quality and Emissions Upgrade Project. Furthermore, MLI is proposing to implement additional emissions control strategies and production enhancements for the Copper Purification Facility, where MLI produces ultra-high purity copper sulfate electrolyte materials for the semi-conductor industry. Additional steam needs for these upgrades will be supported by Boiler #2.

Based on its potential to emit (PTE), MLI's TMAC production facility is currently considered a minor source with respect to the Prevention of Significant Deterioration (PSD) permitting program, a minor source with respect to the Title V operating permit program, and an area source of Hazardous Air Pollutant (HAP) emissions. Emission calculations for the proposed project are presented in Section 3 of this application. As described in Section 4, the proposed Line #3 expansion project will not affect these minor and area source designations. Therefore, this project does not require a PSD permit application or trigger the applicability of the Title V permitting program. Furthermore, as part of the emissions evaluation for the Line #3 expansion project, a conservatively higher fuel-bound NO_X emissions factor is utilized to estimate NO_X emissions resulting from the combustion of trimethylamine (which contains a nitrogen molecule) at the existing flare. Although a majority of these calculated NO_X emission increases are due to the revised calculation methodology rather than the increased venting rate to the flare associated with the operation of Line #3, the resulting increased NO_X emissions estimates are conservatively considered throughout this application.

As provided in Washington Administrative Code (WAC) 173-400-110, an NOC application, often referred to as minor New Source Review (NSR), is still required. Given the timing and association between the previous TMAC Product Quality and Emissions Upgrade Project, the proposed installation of TMAC Line #3, and the planned Copper Purification Facility upgrades, this application conservatively satisfies the NOC application requirements and assesses the regulatory applicability of these projects in aggregate. In addition to the general application requirements, the proposed TMAC Line #3 installation project will be subject to certain federal and state regulations including New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), and the Washington Toxic Air Pollutant (TAP) rules. These regulations are addressed in Section 4 of this report. There are no applicable NESHAP or NSPS requirements for Copper Purification Facility portion of the project.

As part of the NOC application, a Best Available Control Technology (BACT) analysis is conducted for criteria pollutant emissions from new and modified equipment associated with the proposed TMAC project in accordance with WAC 173-400-141. Pollutants with TMAC project-related increases that exceed the NSR exemption thresholds established by WAC 173-400-110(5) are addressed by the BACT evaluation. Emissions of criteria pollutants from the upgraded Copper Manufacturing Facility will remain below NSR thresholds and consequently will not trigger BACT requirements. Additionally, in accordance with WAC 173-460-060, a similar BACT evaluation is required for TAP emissions from both the TMAC projects and the Copper Purification Facility project that exceed the pollutant-specific de minimis thresholds established by WAC 173-460-150. Section 5 of this application presents the BACT determinations for relevant criteria pollutants and the TAP BACT (tBACT) determinations for relevant TAPs.

As a requirement for new sources of TAPs under WAC 173-460, a TAP screening analysis is performed in accordance with the methodology established by WAC 173-460-080. As presented in Section 2 of this application, the results of the analysis demonstrate that emissions of each TAP are below the corresponding Small Quantity Emission Rate (SQER), with the exception of formaldehyde and NO_2. Accordingly, cumulative project-related emissions of formaldehyde and NO_2 are modeled using AERSCREEN and the results of this dispersion modeling analysis are presented in Section 6. Furthermore, as requested by Ecology for the previous NOC application for the TMAC facility upgrades, Section 6 of this application also compares the results of the AERSCREEN modeling evaluation for the proposed project to the relevant National Ambient Air Quality Standards (NAAQS) for NO_2 and $PM_{2.5}$.

The final section of this application, Section 7, identifies MLI's requested changes to the existing permit limits established by Approval Order No. 18AQ-E042.

In summary, the NOC application contains the following elements:

- Section 2. Project Description
- Section 3. Emission Calculations
- Section 4. Regulatory Applicability
- Section 5. BACT/tBACT Evaluation
- Section 6. Dispersion Modeling Analysis
- Section 7. Requested Permit Changes
- Appendix A: Application Forms
- Appendix B: Site Plan
- Appendix C: Emission Calculations
- Appendix D: BACT Cost Calculations
- Appendix E: Modeling Files and Results
- Appendix F: Revised Permit Table
- Appendix G: SEPA checklist

2. PROJECT DESCRIPTION

MLI is proposing to expand its existing TMAC production facility in Moses Lake, Washington via the installation of a new Line #3 to increase TMAC production capacity. Furthermore, MLI is proposing to implement production and emissions control upgrades for the Copper Facility. The following sections provide detailed project descriptions and identify equipment affected by the proposed projects.[1]

2.1. PROJECT DESCRIPTION – TMAC LINE #3

2.1.1. Project Impact on Facility's TMAC Production Rate

The current facility is permitted to produce 2,207 kg/hour (30-day average) of pure TMAC, with no single day production to exceed 128,520 lb/day (58,312 kg/day). To accommodate the addition of Line #3, MLI is requesting that permitted production capacity be increased by 1,017 kg/hour of pure TMAC. As a result, the overall Line #1, #2 and #3 combined permitted capacity would be 3,224 kg/hour (30-day average) of pure TMAC, with no single day production to exceed 187,590 lb/day (85,113 kg/day). This represents a 46% increase in the permitted production rate.

2.1.2. TMAC Line #3 Equipment Description and Operating Strategy

The following changes are proposed as part of the Line #3 installation at the Moses Lake facility:

1. A new set of raw material bulk storage tanks (one each for methanol, trimethylamine, and dimethylcarbonate) will be installed adjacent to the existing off-load area/bulk storage tanks. The tanks will be of similar size and design as the existing bulk storage tanks.
2. Line #3 will include an upgraded purification/mix section designed to minimize the potential for off-specification material. This feature will minimize potential waste generation and support improved environmental sustainability goals.
3. Vent gas flows from Line #3 will be combined with existing Line #1 and #2 vents in a common header and treated in the existing flare system.
4. The reaction section of Line #3 will consist of two small and two large reactors. This configuration will increase overall residence time of the reactants relative to the existing production lines, which will mitigate the potential for unreacted material to exit the reaction section of the new production line. By improving the conversion efficiency of Line #3, the operation of the new production line will reduce both loading to the reactor vent condenser and venting to the flare. Consequently, this design strategy will minimize potential emissions from the existing flare associated with Line #3's operations.
5. The distillation section of Line #3 will include an upsized distillation column for improved separation efficiency. By enhancing the separation efficiency of the distillation portion of Line #3, MLI will minimize venting to the flare. Consequently, this design strategy will minimize potential emissions to the existing flare associated with Line #3's operations.
6. Line #3 will share a new upgraded -15 Deg C utility chiller utilizing an ethylene glycol/water solution to support increased cooling capacity for all three TMAC production lines. Relative to the existing lower capacity methanol/water chiller, this proposed upgrade will increase the efficiency of the vent condensers

[1] A detailed project description and affected equipment list for the related TMAC Product Quality and Emissions Upgrade Project was addressed by the August 2, 2018 NOC application and is not re-characterized in this application.

thereby minimizing emissions from the flare. Furthermore, the transition from a HAP-based utility chiller will reduce fugitive HAP (methanol) emissions.

7. To maximize operational flexibility and reliability, the steam demand for Line #3's operation can be supplied by either Boiler #1 or Boiler #2.
8. Similar to Line #1 and #2, clean burning co-product methanol generated by Line #3 will be utilized as fuel for either Boiler #1 or #2. This on-site energy recovery strategy reduces the facility's demand for off-site natural gas, minimizes potential fugitive emissions and the potential for spills associated with truck loading and the transportation of the methanol co-product stream, and also avoids off-site emissions that would be generated by alternative strategies associated with managing the methanol stream.
9. As a result of the increased recovery of co-product methanol from the existing process lines and the increased production of co-product methanol resulting from the operation of Line #3, it is estimated that Boiler #2 could utilize the methanol fuel stream to supply up to 100% of its firing capacity; however, MLI requests the flexibility to supplement Boiler #2's fuel supply with natural gas depending on process needs and available methanol supplies.

From a project timing standpoint, MLI anticipates that the installation of Line #3 will occur in spring 2019. Commissioning the new process line is tentatively scheduled for the July to August 2019 timeframe.

2.2. PROJECT DESCRIPTION – COPPER PURIFICATION FACILITY UPGRADES

2.2.1. Project Impact on Copper Purification Facility Production Rate

MLI is proposing upgrades to its Copper Purification Facility to increase potential production of ultra-high purity copper electrolyte and to improve emissions control. As a result of these upgrades, as well as increased steam utility availability along with chiller/water heating capacity and improved crystal separation efficiency, the Copper Purification Facility's operating rate will increase from a current nominal rate of 17 or 18 reaction cycles per week to an anticipated nominal rate of 58 reaction cycles per week (monthly average). MLI anticipates that no single week will exceed 64 reaction cycles.

2.2.2. Production Operation and Emission Control Upgrades

The existing approval order identifies 8 reactors, 19 crystallizers and 7 evaporators. Following the proposed upgrades, the Copper Purification Facility will consist of 6 reactors supported by 30 crystallizers and 8 evaporators. Emissions generated from the copper purification operations are collected by two sets of duct-work, each of which is directed to a dedicated scrubber. Specifically, emissions from the purification reactors are directed to the AAT Model 8V-ME-PP Orion scrubber located inside of building PB-97, while emissions from the evaporators are directed to the upgraded Harrington Model ECV 3 3-5 LV scrubber located outside of building PB-97.

Control efficiencies associated with the scrubber systems are enhanced by the operation of a chevron-style pre-mist eliminator unit prior to each scrubber, which decreases the inlet loading to the control devices. The pre-mist eliminators remove droplets and entrained liquid condensate that otherwise would be carried along the ductwork with the exhaust flow. Due to the nature of the process operations, the exhaust flows are saturated from a moisture standpoint when exiting from the reactor and evaporator units. Additionally, due to the physical properties of copper sulfate and trace copper bisulfate solutions, constituents are in a dissolved liquid solution state and do not exhibit appreciable vapor pressure. As the exhaust flows cool with distance from the reactors and evaporators, additional water vapor condenses increasing droplet size thereby enhancing overall removal efficiency. Liquid condensate removed prior to the scrubbers is collected in totes thereby minimizing the concentration and loading of fluid collected and recirculated through the scrubbers further improving overall control efficiency.

The beneficial combination of maintaining emissions in a more concentrated state due to more efficiently utilizing the reactor and evaporator units, pre-mist elimination removal prior to the scrubbers, and scrubber upgrades are expected to reduce emissions on a per unit production basis. Project emissions from the copper purification reactor and evaporator scrubbers are anticipated to be well below the corresponding SQERs established under WAC 173-460-150.

3. PROJECT EMISSION CALCULATIONS

This section describes each source of emissions increases associated with the TMAC Line #3 expansion project and the Copper Purification Facility upgrades, as well as the methodologies used to calculate criteria pollutant, HAP, and TAP emissions from each affected source. Detailed supporting calculations can be found in Appendix C. A detailed description of emissions increases associated with the TMAC Product Quality and Emissions Upgrade Project was addressed by the August 2, 2018 NOC application and is not re-characterized in this application; however, the emission estimates presented in Table 3-1 of this application account for the combined emissions from both TMAC-area projects as well as the Copper Purification Facility upgrade project.

3.1. PROJECT-RELATED EMISSIONS SOURCES

3.1.1. Flare

Line #3 will include vent condensers to process flows from the reactor and distillation sections of the line. The vent condensers will be robustly sized and supported by the upsized -15 Deg C chiller system to minimize emissions. Flows will be individually monitored from each of the Line #3 vent condensers as well the combined flow in the Line #3 vent header prior to its combination with vent flows from existing Lines #1 and #2. The combined condenser flows from all three lines will be processed in the existing flare, which is of sufficient capacity to process these combined vent streams while maintaining compliance with good operating practices for the flare.

Emission calculations for the flare primarily rely on the results of the 2013 flare inlet testing conducted by MLI, scaled to account for proposed production increases, and using the flare control efficiencies provided by the Texas Natural Resource Conservation Commission's (TNRCC's) guidance document (RG-109, October 2000). In accordance with this guidance, a 99% control efficiency is applied to methanol and propane emissions, while a 98% control efficiency is applied to miscellaneous VOC emissions. Although MLI will be primarily using natural gas as auxiliary fuel to the flare, MLI wishes to retain the ability to use propane as a backup fuel. Accordingly, the worst-case emission estimates detailed in Section C4 of Appendix C account for the use of propane at the flare.[2] Miscellaneous criteria emissions associated with combustion are calculated using standard emissions factors from AP-42. Similarly, HAP/TAP emissions associated with combustion are calculated using the standard flare emission factors obtained from the Ventura County Air Pollution Control District's (APCD's) AB 2588 Combustion Emission Factors document.[3]

A conservatively higher fuel-bound NO_X emissions factor is utilized to estimate NO_X emissions resulting from the combustion of trimethylamine (which contains a nitrogen atom) at the existing flare. Although a majority of these calculated NO_X emission increases are due to the revised calculation methodology (rather than the potentially increased venting rate to the flare associated with the operation of Line #3), the resulting NO_X emission estimates are conservatively treated as project-related increases throughout this application.

[2] The 2013 inlet test data accounts for the use of propane as supplemental fuel to the flare. Propane is regulated as a VOC. Since this testing, MLI has transitioned to primarily using natural gas as supplemental fuel to the flare. The primary constituents of natural gas are methane and ethane, which are not regulated as VOC according to 40 CFR 51.100(s). Accordingly, the worst-case emission estimates for the flare presented in Appendix C correspond to the use of propane rather than natural gas.

[3] In response to MLI's recent NOC application, Ecology requested that MLI revise the TAP/HAP calculations for the new boiler to be based on the Ventura County APCD's emission factors rather than AP-42 factors. Accordingly, MLI has used the Ventura County factors to estimate emissions from the flare as well as the boiler.

Additional details and the results of these calculations are presented in Section C4 of Appendix C.

3.1.2. Boiler #2

Approval Order No. 18AQ-E042 currently establishes a methanol usage limit for Boiler #2 of 1,201,000 gallons per rolling 12-month period. The proposed operation of Line #3 will lead to increases in available clean burning co-product methanol fuel. To allow increased operational flexibility, MLI requests the removal of the current Boiler #2 methanol usage limit such that Boiler #2 could theoretically use the co-product methanol fuel to supply 100% of its annual heat input.

The calculations presented in Appendix C evaluate emissions from both natural gas combustion and methanol combustion in Boiler #2 and present the maximum emission rate for each pollutant considering these two potential operating scenarios. Other than removing the methanol usage limit for Boiler #2, the emission calculations presented in Appendix C for the boiler use the same methodologies presented in the August 2, 2018 NOC application.

In summary, these emission calculations are based on guarantees from Cole Industrial (the boiler vendor) for CO and NO_x emissions, which vary by fuel type. Emissions of other criteria pollutants associated with natural gas combustion are calculated using the appropriate sections of EPA's AP-42. Filterable PM emissions from methanol combustion are based on the regulatory limit for new boilers combusting liquid fuels under 40 CFR 63 Subpart JJJJJJ. With the exception of VOC, emissions of other criteria pollutants during methanol combustion are assumed to be equivalent to natural gas emissions. The VOC emission rate associated with methanol combustion accounts for estimated TMA emissions, estimated methanol emissions, and estimated miscellaneous VOC emissions (using the AP-42 emission factor for natural gas).

Per Ecology's request, TAP and HAP emissions from natural gas combustion are calculated using emission factors obtained from the Ventura County APCD's AB 2588 Combustion Emission Factors document.

Additional details and the results of these calculations are presented in Section C2 of Appendix C.

3.1.3. Additional Fugitive Components

Project-related fugitive emissions associated with leaks from piping components are calculated using past actual monitoring data and very conservative assumptions for the TMAC Product Quality and Emissions Upgrade Project. Specifically, MLI determined the maximum actual piping fugitive emission rates for VOC and methanol reported by the Moses Lake facility between 2012 and 2017. As discussed with Ecology, MLI's actual reported fugitive emissions during this time period rely on overly conservative assumptions (e.g., using 10 ppm in the screening value equation to account for emissions from non-leaking components instead of EPA's non-leaker factors, assuming connectors are leaking at the average rate for other components, etc.).

This maximum actual annual emission rate reported for VOC and methanol between 2012 and 2017 was then scaled by 345% to account for maximum post-project VOC emissions and by 500% to account for maximum post-project methanol emissions. Considering the conservatism in the actual reported emissions and the magnitude of the aforementioned scaling factors applied to calculate post-project emissions (when compared to the relatively modest increase in component counts associated with the project), this calculation methodology very conservatively characterizes worst-case post-project fugitive emissions.

Additional details and the results of these calculations are presented in Section C3 of Appendix C.

3.1.4. Copper Purification Facility Upgrades

For the purpose of this evaluation, emissions from the existing Copper Purification Facility are conservatively estimated to equal the de minimis thresholds for the following TAPs: (1) Copper and Compounds and (2) Sulfuric Acid. This basis yields a conservative estimate for copper/copper compound emissions, based on the results of the 2017 engineering level air testing conducted on the exhaust stacks from the Copper Purification Facility's reactor and evaporator units, which indicated that emissions of copper compounds were well below the corresponding de minimis emission rate established by WAC 173-460-150. While this 2017 test data indicated that the sulfuric acid emissions from the Copper Purification Facility equipment may approach the corresponding de minimis threshold, the implementation of the pH adjustment strategy and the pre-mist eliminators addressed a majority of sulfuric acid emissions detected by this recent testing, such that the de minimis emission rate for sulfuric acid conservatively represents pre-project emissions.

Project-related emissions increases are estimated to be in proportion to the increase in the maximum number of weekly copper purification reactions (i.e., 58 reaction cycles vs. 17 reaction cycles = 3.4 project multiplier). Specifically, this project multiplier (3.4) is applied to pre-project emission estimates of each pollutant to account for maximum post-project emissions. For conservatism, an additional scaling factor of 3 is applied to post-project sulfuric acid emissions from the reactors to account for potential process variability.

The measurement and quantification of these components at such low levels in a saturated wet exhaust matrix is particularly challenging, especially for the standard sulfuric acid test method which also quantifies other non-TAP metal sulfates (including sodium and copper) and neutralized bisulfate content. In any case, project-related emissions of copper/copper compounds are estimated to be less than a quarter of the corresponding SQER, -- while project-related emissions of sulfuric acid are estimated to be approximately two-thirds of the corresponding SQER. Given the nature of the Copper Purification Facility processes, improvements to maintain emissions in a more concentrated state for improved removal efficiency, and improvements in the emissions control scrubbing processes, actual emissions of these TAPs may be substantially lower than these estimates and may not exceed de minimis thresholds.

Due the nature of the processes there are no other potentially significant TAP emission components and no significant criteria emission components. Additional details and the results of these calculations are presented in Section C5 of Appendix C.

3.2. POTENTIAL TO EMIT FOR PROJECT

Table 3-1 identifies project-related potential emission increases for the proposed TMAC Line #3 upgrade portion of the project and the recently approved TMAC Product Quality and Emissions Upgrade Project. The sum total of these emissions is compared to the NSR exemption thresholds. Because the Copper Purification Facility project will be limited to TAPs increases only, these project emissions are not identified in Table 3-1.

Table 3-1. TMAC-Area Project Emissions

Source	PM (filterable) (tpy)	$PM_{10}/PM_{2.5}$ (tpy)	SO_2 (tpy)	NO_x (tpy)	VOC (tpy)	CO (tpy)	CO_2e (tpy)	Methanol (tpy)
Line #3 Upgrade Project								
Boiler #2 Increased Methanol Combustion	1.03	--	--	3.57	0.30	1.33	--	0.25
Additional Fugitive Components	--	--	--	--	-2.86[4]	--	--	1.54
Increased Flare Emissions	0.01	0.05	0.004	15.82[5]	1.92	5.90	776	0.74
TMAC Product Quality and Emissions Upgrade Project								
Boiler #2	1.16	0.54	0.04	6.17	0.94	3.97	8,563	0.50
Additional Fugitive Components	--	--	--	--	0.97	--	--	0.81
Combined Projects Impacts								
Combined Project Totals	***2.21***	***0.59***	***0.05***	***25.56***	***1.27***	***11.19***	***9,339***	***3.84***
NSR Exemption Thresholds[6]	1.25	0.75/0.5	2.0	2.0	2.0	5.0	--	See Table 3-2
Project Emissions Above Thresholds?	Yes	Yes (for $PM_{2.5}$)	No	Yes	No	Yes	--	See Table 3-2

3.3. TOXIC AIR POLLUTANT ANALYSIS

Ecology regulates the emissions of TAPs through the provisions of WAC 173-460. TAPs are listed in WAC 173-460-150 with a SQER, acceptable source impact level (ASIL), and de minimis threshold for each pollutant, which are used to demonstrate compliance with WAC 173-460. For the proposed TMAC Line #3 upgrade portion of the project, the only sources of TAP emissions are increased methanol combustion in Boiler #2, increased flaring, and additional fugitive components. However, for conservatism, these emission increases are added to the impacts of the Copper Purification Facility upgrade project and the recently approved TMAC Product Quality and Emissions Upgrade Project to determine applicable requirements under WAC 173-460. Furthermore, as discussed elsewhere in this NOC application, MLI is proposing to redistribute the annual emission limits for existing sources such that the expanded TMAC facility and facility-wide permitted methanol emissions remain at minor source levels.

Table 3-2 shows the aggregated emissions increases of each TAP, which are compared to the de minimis threshold and/or SQER for each respective pollutant. For conservatism, the emissions increases account for the following:

[4] The negative VOC emissions change for fugitive components indicates that MLI is requesting an overall decrease in the permitted VOC emission limit for this source category for the Line #3 implementation.
[5] The majority of this NO_x emissions increase is associated with the revised accounting method for fuel-bound NO_x emissions from the flare (assuming 10% of the nitrogen in TMA forms NO_x instead of the previous 0.5% assumption).
[6] NSR exemption thresholds are established by WAC 173-400-110(5). For TAP emissions such as methanol, the de minimis emission rates specified in WAC 173-460-150 represent the NSR exemption thresholds.

- The greater emission rates from the combustion of either natural gas or co-product methanol in Boiler #2 (without restricting the amount of methanol used in the boiler);
- Total post-project flare emissions from the TMAC facility (while the TAPs screening is typically based on project-related emission increases, this evaluation considers total post-project emissions for conservatism);
- Total post-project fugitive emissions from the TMAC facility (while the TAPs screening is typically based on project-related emission increases, this evaluation considers total post-project emissions for conservatism); and
- Project-related emission increases from the Copper Purification Facility upgrade project.

Even with these conservative assumptions, Table 3-2 shows that all TAPs emitted from the project are below their respective SQERs with the exception of NO_2 and formaldehyde. A dispersion modeling evaluation for project emissions of NO_2 and formaldehyde is presented in Section 6 of this application. Additional details regarding this TAPs screening evaluation is presented in Section C6 of Appendix C.

Table 3-2. Project-Related TAP Emissions

Pollutant	CAS Number	Emissions		Averaging Period	ASIL (µg/m³)	SQER (lb/avg. period)	De Minimis (lb/avg. period)	Modeling Required?
		Maximum Hourly TAPs (lb/hr)	Maximum Annual TAPs (tpy)					
Benzene	71-43-2	6.06E-04	2.65E-03	year	0.0345	6.62	0.331	No
Formaldehyde	50-00-0	3.96E-03	0.02	year	0.167	32	1.6	**Yes**
Naphthalene	91-20-3	4.03E-05	1.76E-04	year	0.0294	5.64	0.282	No
Acetaldehyde	75-07-0	1.89E-04	8.26E-04	year	0.37	71	3.55	De Minimis
Acrolein	107-02-8	7.59E-05	3.33E-04	24-hr	0.06	0.00789	0.000394	No
Propylene	115-07-1	0.02	0.07	24-hr	3000	394	19.7	De Minimis
Toluene	108-88-3	6.16E-04	2.70E-03	24-hr	5000	657	32.9	De Minimis
Xylene	108-38-3	4.13E-04	1.81E-03	24-hr	221	29	1.45	De Minimis
Ethylbenzene	100-41-4	4.76E-03	0.02	year	0.4	76.8	3.84	No
Hexane	110-54-3	1.68E-04	7.35E-04	24-hr	700	92	4.6	De Minimis
n,n-Dimethylformamide	68-12-2	9.23E-04	4.04E-03	24-hr	80	10.5	0.526	De Minimis
Methanol	67-56-1	1.96	8.59	24-hr	4000	526	26.3	No
SO_2	7446-09-05	1.16E-02	0.05	1-hr	660	1.45	0.457	De Minimis
NO_2	10102-44-0	7.43	32.55	1-hr	470	1.03	0.457	**Yes**
CO	630-08-0	3.01	13.19	1-hr	23000	50.4	1.14	No
Copper and compounds	--	0.05	0.23	1-hr	100	0.219	0.011	No
Sulfuric acid	7664-93-9	3.66E-03	0.016	24-hr	1	0.131	0.00657	No

MLI's TMAC production facility is located in Moses Lake, Grant County, Washington, which is in attainment for all criteria pollutants. The following sections evaluate the air quality-related regulatory requirements potentially applicable to the proposed TMAC Line #3 expansion project and the Copper Purification Facility upgrades. A detailed regulatory applicability evaluation for the TMAC Product Quality and Emissions Upgrade Project was addressed by the August 2, 2018 NOC application and is not re-characterized in this application. However, for regulatory programs that are based on project-related emissions increases, these sections assess the cumulative total of project emissions from (1) the permitted TMAC Product Quality and Emissions Upgrade Project, (2) the proposed TMAC Line #3 expansion project, and (3) the proposed Copper Purification Facility upgrade project.

4.1. FEDERAL NEW SOURCE REVIEW

A project in an attainment area is subject to the Prevention of Significant Deterioration (PSD) permitting program under Washington Administrative Code (WAC) 173-400-700 if the project is either a "major modification" to an existing "major source," or is a new major source itself. MLI's existing TMAC production facility falls below the threshold criteria for classification as a major PSD source. As such, PSD applicability is triggered only if the proposed project would constitute a major stationary source by itself. In other words, the upgrade project must increase emissions of a regulated air pollutant by 100 tons per year (tpy) or more to trigger PSD review.[7] Therefore, potential emission increases of each criteria air pollutant must be compared to the PSD major source thresholds.

Table 4-1 compares the aggregated potential emission increases from the recently permitted and proposed projects to the applicable PSD thresholds. The results of this evaluation demonstrate that PSD permitting (i.e., federal NSR) is not triggered for the recent projects, even when cumulative emissions are conservatively considered.

Table 4-1. PSD Major Source Threshold Comparison

Source	PM (filterable) (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_2 (tpy)	NO_x (tpy)	CO (tpy)	VOC (tpy)
Project Emissions	2.21	0.59	0.59	0.05	25.56	11.19	1.27
PSD Emission Thresholds	100	100	100	100	100	100	100
Subject to PSD?	No	No	No	No	No	No	No

4.2. TITLE V OPERATING PERMITS

If the Potential to Emit (PTE) of the post-project facility exceeds the Title V major source threshold for any criteria pollutant, Hazardous Air Pollutant (HAP), or combination of HAPs, then Title V permitting requirements are triggered for the entire facility. Table 4-2 presents post-project potential facility emissions relative to the Title V major source thresholds. As demonstrated by this table, the post-project Moses Lake facility will not trigger Title V permitting requirements. The emission limits proposed by MLI in Section 7 of this application will ensure that the Moses Lake facility remains a minor source under the Title V program.

[7] As a chemical process plant, MLI's Moses Lake facility is subject to a PSD major source threshold of 100 tons per year, as opposed to the general PSD major source threshold of 250 tons per year.

Table 4-2. Title V Major Source Threshold Comparison

Source	PM (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_2 (tpy)	NO_x (tpy)	CO (tpy)	VOC (tpy)	Combined HAP (tpy)	Individual HAP-Methanol (tpy)
Facility-Wide PTE	<10	<10	<10	<10	40.1	15.2	21.1	<15	9.46
Title V Thresholds	100	100	100	100	100	100	100	25	10
Subject to Title V?	No	No	No	No	No	No	No	No	No

4.3. NOC APPLICABILITY

WAC 173-400-110 establishes requirements for a project that increases emissions of regulated air pollutants by at least a threshold quantity but does not trigger federal NSR permitting. This state-level permitting requirement is often referred to as minor NSR. If subject to minor NSR, a facility must submit a NOC application and obtain a corresponding order of approval before constructing a new source. A new source, as defined in WAC 173-400-030, is "the construction or modification of a stationary source that increases the amount of any air contaminant emitted by such source or that results in the emission of any air contaminant not previously emitted…"

Detailed project-related emission increases associated with the approved TMAC Product Quality and Emissions Upgrade Project were presented in the August 2, 2018 NOC application and are not re-characterized by this application. As described in Sections 3.1.1 through 3.1.3, further emission increases associated with the proposed installation of TMAC Line #3 will result from increased venting to the existing flare, fugitive emissions from new piping components, and the removal of the annual methanol usage limit for Boiler #2. Section 3.1.4 discusses the emission impacts of the Copper Purification Facility upgrades.

Given the timing and association between the previous TMAC Product Quality and Emissions Upgrade Project, the proposed installation of TMAC Line #3, and the planned Copper Purification Facility upgrades, the cumulative emissions of these three (3) projects are compared to the NSR exemption thresholds. As demonstrated by Table 3-1, aggregate emissions increases exceed the criteria pollutant NSR exemption thresholds for NO_x, CO, PM, and $PM_{2.5}$ emissions. Consequently, the projects are classified as a "new source" that triggers the requirements of WAC 173-400-110 and a NOC application is required. The requisite NOC application forms are presented in Appendix A.

Additionally, project-related emissions of TAPs trigger requirements under WAC 173-460. Specifically, emissions increases of NO_x and formaldehyde from the TMAC process exceed the SQER established by WAC 173-460-150 and trigger dispersion modeling requirements. Furthermore, emissions increases of combustion by-products from the TMAC process and emissions of copper/copper compounds and sulfuric acid from the Copper Purification Facility exceed the corresponding de minimis thresholds established by WAC 173-460-150 and trigger tBACT requirements.

4.4. BEST AVAILABLE CONTROL TECHNOLOGY

Under WAC 173-400-110, each new and/or modified source must employ BACT for all pollutants not previously emitted, or any pollutants for which emissions will increase as a result of the new source or modification. The proposed TMAC projects will potentially increase process emissions of VOC and TAPs from new fugitive piping components, and will increase criteria pollutant and TAP emissions from the flare and Boiler #2. Furthermore, the proposed Copper Purification Facility upgrades may increase potential emissions of selected TAPs as described in Section 3.1.4.

As shown in Table 3-1 of this application, project-related emissions of NO_x, CO, and PM/$PM_{2.5}$ exceed the corresponding pollutant-specific NSR exemption thresholds established by WAC 173-400-110(5) and are subject to BACT requirements. Furthermore, as depicted in Table 3-2, project-related emissions of various combustion by-products from the TMAC area and emissions of copper/copper compounds and sulfuric acid from the Copper Purification Facility exceed the de minimis thresholds established by 173-460-150 and are subject to tBACT requirements. The BACT and tBACT evaluation for these emissions is presented in Section 5.

4.5. NEW SOURCE PERFORMANCE STANDARDS

WAC 173-400-115 adopts federal NSPS by reference. The NSPS rules, which are located in Title 40 of the Code of Federal Regulations Part 60 (40 CFR 60), require new, modified, or reconstructed sources to control emissions to the level achievable by the best-demonstrated technology as specified in the applicable provisions. The following is an evaluation of potentially applicable NSPS regulations for new and modified equipment associated with the proposed project.

4.5.1. 40 CFR Part 60 Subpart A, General Provisions

NSPS Subpart A, 40 CFR 60.18 (General Control Device Requirements) contains requirements for control devices used to comply with applicable NSPS subparts. As described in Sections 4.5.4 and 4.5.5, MLI's TMAC production facility uses a process flare as a control device for compliance with NSPS Subparts NNN and RRR. Accordingly, the flare must adhere to applicable provisions of 40 CFR 60.18. The proposed installation of TMAC Line #3 will involve new equipment that vents to the existing flare; however, this change will not affect the applicability of NSPS Subparts A, NNN, and RRR, as these subparts already apply to MLI's process equipment.

With respect to NSPS Subpart A requirements, the flare is designed to comply with all relevant requirements of 40 CFR 60.18, including visible emission limits, continuous flame requirements, minimum vapor heat content thresholds, and maximum exit velocity limits. These requirements are established by the current air permit for MLI's Moses Lake facility and will continue to apply following the upgrade project. MLI will ensure that post-project operations of the existing flare continue to meet applicable requirements.

4.5.2. 40 CFR Part 60 Subpart Dc, New Source Performance Standards (NSPS) for Small Industrial-Commercial-Institutional Steam Generating Units

NSPS Subpart Dc applies to steam generating units constructed, modified, or reconstructed after June 9, 1989 with a maximum design heat input capacity between 10 million British thermal units per hour (MMBtu/hr) and 100 MMBtu/hr (inclusive). The August 2, 2018 NOC application presented a full NSPS Subpart Dc applicability evaluation for Boiler #2. This evaluation identified that, apart from notification and recordkeeping requirements, only the SO_2-related requirements of NSPS Subpart Dc apply to Boiler #2. Associated permit conditions for Boiler #2 are established in Approval Order No. 18AQ-E042.

This NOC application for the installation of Line #3 in the TMAC production area proposes to remove the annual methanol usage limit established for Boiler #2 in the current permit; however, this proposal will not impact the regulatory applicability of NSPS Subpart Dc to the boiler.

4.5.3. 40 CFR Part 60 Subpart VVa, Standards of Performance for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry for Which Construction, Reconstruction, or Modification Commenced After November 7, 2006

NSPS Subpart VVa provides standards for equipment leaks of VOC from process units that produce, as an intermediate or final product, any of the Synthetic Organic Chemical Manufacturing Industry (SOCMI) chemicals listed in 40 CFR 60.489. NSPS Subpart VVa applies to the specific component types specified in the rule (e.g., valves, pumps, agitators). In addition, the process unit is subject to NSPS Subpart VVa requirements only if it is considered to be new, modified, or reconstructed after November 7, 2006.

As a result of the August 2, 2018 NOC application, fugitive piping components at the current TMAC production facility are subject to NSPS Subpart VVa requirements. The additional piping components installed as part of the Line #3 installation will also be subject to NSPS Subpart VVa.

4.5.4. 40 CFR Part 60 Subpart NNN, Standards of Performance for Volatile Organic Compound Emissions from SOCMI Distillation Processes

NSPS Subpart NNN (Standards of Performance for Volatile Organic Compound Emissions from SOCMI Distillation Operations) applies to SOCMI facilities that produce, as intermediates or final products, any chemical included in 40 CFR 60.667. As methanol is included in 40 CFR 60.667 and is the major co-product produced in the synthesis of TMAC, the distillation section of MLI's new Line #3 will be subject to the requirements of this subpart. Like the compliance strategy for Lines #1 and #2, MLI will meet the Subpart NNN standard in 40 CFR 60.662(b) by controlling distillation process vent emissions from Line #3 by a closed-vent system routed to a condenser recovery system, which discharges to the existing process flare.

As described in Section 4.5.1, the process flare will continue to comply with all applicable requirements of 40 CFR 60.18, as required by 40 CFR 60.662(b). This control system also complies with the applicable monitoring requirements of 40 CFR 60.663(b). Furthermore, MLI will continue to comply with all relevant reporting and recordkeeping requirements established by 40 CFR 60.665. These relevant requirements are established by MLI's current air permit.

4.5.5. 40 CFR Part 60 Subpart RRR, Standards of Performance for Volatile Organic Compound Emissions from SOCMI Reactor Processes

NSPS Subpart RRR (Standards of Performance for Volatile Organic Compound Emissions from SOCMI Reactor Processes) applies to SOCMI facilities that produce, as intermediates or final products, any chemical included in 40 CFR 60.707. As methanol is included in 40 CFR 60.707 and is the major co-product produced in the synthesis of TMAC, the reaction section of MLI's new Line #3 will be subject to the requirements of this subpart. Like the compliance strategy for Lines #1 and #2, MLI will meet the Subpart RRR standards in 40 CFR 60.702(b) by controlling reaction process venting emissions by a closed-vent system routed to a condenser recovery system, which discharges to the existing process flare.

As described in Section 4.5.1, the process flare will continue to comply with all applicable requirements of 40 CFR 60.18, as required by 40 CFR 60.702(b). This control system also complies with the applicable monitoring requirements of 40 CFR 60.703(b). Furthermore, MLI will continue to comply with all relevant reporting and recordkeeping requirements established by 40 CFR 60.705. These relevant requirements are established by MLI's current air permit.

4.6. NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

The NESHAP rules, which are located in 40 CFR Part 61 and Part 63, require major sources of HAP emissions to control their HAP emissions. The standards established under 40 CFR 63 specifically establish Maximum Achievable Control Technology (MACT) requirements for specific source categories. As presented in Section 4.2 of this application, the Moses Lake facility is not a major source of HAPs and is therefore only potentially subject to "Area Source" NESHAP regulations. The following sections evaluate potentially applicable NESHAP regulations.

4.6.1. 40 CFR Part 61 Subpart V, Standards for Equipment Leaks (Fugitive Emission Sources)

40 CFR 61 Subpart V, National Emission Standard for Equipment Leaks (Fugitive Emission Sources), regulates fugitive equipment leaks for facilities processing certain chemicals that meet the regulatory definition of volatile hazardous air pollutants (VHAPs). According to the definitions for this subpart established by 40 CFR 61.241, the VHAP category is limited to benzene and vinyl chloride. As MLI's TMAC production facility does not operate any pumps, pressure relief devices, valves, or connectors in VHAP service, 40 CFR 61 Subpart V is not applicable to the Moses Lake facility.

4.6.2. 40 CFR Part 63 Subparts F and G, National Emission Standards for Organic HAPs from the SOCMI Industry

40 CFR 63 Subparts F (National Emission Standards for Organic Hazardous Air Pollutants from the SOCMI) and G (National Emission Standards for Organic Hazardous Air Pollutants From the Synthetic Organic Chemical Manufacturing Industry for Process Vents, Storage Vessels, Transfer Operations, and Wastewater) regulate emissions of hazardous chemicals from SOCMI facilities that are classified as major sources of HAPs. Under Section 112(a) of the Clean Air Act, the term "major source" is defined as any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit considering controls, in the aggregate, 10 tpy or more of any HAP or 25 tpy or more of any combination of HAPs. Because MLI's post-project TMAC production facility will not be classified as a major source of hazardous air pollutants, 40 CFR 63 Subparts F and G are not applicable.

4.6.3. 40 CFR Part 63 Subpart JJJJJJ, National Emission Standards for HAPs for Area Sources: Industrial, Commercial, and Institutional Boilers

40 CFR 63 Subpart JJJJJJ (National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers) applies to industrial, commercial, and institutional boilers within the coal, biomass, or oil subcategory that are located at, or are part of, an area source of HAP, as defined in 40 CFR 63.2, except as specified in 40 CFR 63.11195.[8] 40 CFR 63.11237 specifies that the "*oil subcategory* includes any boiler that burns any liquid fuel and is not in either the biomass or coal subcategories…" Furthermore, "*liquid fuel* includes, but is not limited to, distillate oil, residual oil, any form of liquid fuel derived from petroleum, used oil meeting the specification in 40 CFR 279.11, liquid biofuels, biodiesel, and vegetable oil." Considering this broad definition of the term *liquid fuel*, the liquid methanol co-product stream produced by MLI would constitute a liquid fuel for the purposes of 40 CFR 63 Subpart JJJJJJ.

The August 2, 2018 application characterized the applicability of Subpart JJJJJJ for Boiler #2 and these requirements were incorporated into Approval Order No. 18AQ-E042. MLI's proposed removal of the annual methanol operating limit will not impact the applicability of this regulation; therefore, the current permit already addresses these requirements.

[8] 40 CFR 63.11193 and 63.11194.

4.7. STATE REGULATORY APPLICABILITY

4.7.1. Washington Toxic Air Pollutant Regulations

In Washington, all new sources emitting TAPs (and modified sources with increased TAP emissions) are required to demonstrate compliance with the Washington TAP program pursuant to WAC 173-460. Ecology has established a de minimis threshold, SQER, and ASIL for each listed TAP. If the total project-related TAP emissions increase exceeds its respective SQER, further determination of compliance with the ASIL (i.e., dispersion modeling) is required. TAP emission calculations for the projects are described in Section 3 of this application. Specifically, Table 3-2 compares project-related increases of each TAP to the corresponding de minimis threshold and SQER. This table accounts for emissions increases of sulfuric acid and copper (and copper compounds) associated with the Copper Purification Facility upgrade project. As demonstrated by this table, only NO_2 and formaldehyde emissions from the project exceed the SQER and trigger dispersion modeling requirements.

MLI prepared a modeling analysis using AERSCREEN to demonstrate that project impacts of NO_2 and formaldehyde do not exceed the ASIL. The modeling methodology and detailed results are presented in Section 6 of this application. Detailed emission calculations are included in Appendix C and modeling files are included as Appendix E.

Furthermore, project-related emissions of various combustion by-products from the TMAC process and project-related emissions of copper/copper compounds and sulfuric acid from the Copper Purification Facility exceed the TAP-specific de minimis thresholds and trigger tBACT requirements. A qualitative discussion of tBACT is provided in Section 5 of this application.

4.7.2. Other Washington Regulatory Requirements

The proposed Line #3 installation and Copper Purification Facility project are also subject to various regulations established by WAC 173-400-040 (General Standards for Maximum Emissions), WAC 173-400-050 (Emission Standards for Combustion and Incineration Units), and WAC 173-400-060 (Emission Standards for General Process Units). Emission units associated with the proposed projects will satisfy all applicable regulations established by the WAC. Furthermore, the post-project facility will comply with all relevant standards of the WAC.

Under WAC 173-400-113, Ecology requires new and modified sources to implement BACT for all pollutants not previously emitted or for those emissions that are projected to increase as a result of the new source or modification. Similarly, WAC 173-460-060 requires new and modified sources to install and operate tBACT for project-related emissions of TAPs that exceed the de minimis thresholds.

As shown in Table 3-1 of this application, aggregated project-related emissions of NO_x, CO, and PM/$PM_{2.5}$ exceed the corresponding pollutant-specific NSR exemption thresholds established by WAC 173-400-110(5). The August 2, 2018 NOC application presented a BACT evaluation for NO_x and $PM_{2.5}$ emissions from Boiler #2. Given the relationship between CO and NO_x emissions, the BACT evaluation presented for NO_x is also considered relevant for CO emissions from Boiler #2. While this BACT evaluation remains generally applicable, MLI reassessed control costs based on the increased emissions associated with the proposed elimination of the annual methanol usage limit for Boiler #2. These revised control costs and the associated BACT implications are presented in Section 5.3.

Table 3-2 identifies aggregated project-related TAP emissions that exceed the corresponding de minimis thresholds. The August 2, 2018 NOC application presented a tBACT evaluation for these organic TAP emissions from Boiler #2. The findings and conclusions of this tBACT evaluation remain applicable, in spite of the proposed elimination of the annual methanol usage limit for Boiler #2, and are not reproduced in this application. Section 5.4 evaluates tBACT for the control of process vents from the new Line #3, Section 5.5 evaluates tBACT requirements for fugitive methanol emissions from piping components, and Section 5.6 evaluates tBACT requirements for emissions increases from the Copper Purification Facility upgrade project.

5.1. INTRODUCTION TO BACT/TBACT METHODOLOGY

Although MLI's project does not trigger the federal BACT requirement established by 40 CFR 52.21 for PSD permitting actions, the general methodology used for a PSD BACT evaluation is generally applied to the minor NSR BACT/tBACT required for MLI's project. Unless otherwise noted, the following methodology is used as a guide for determining BACT/tBACT for project-related emissions increases.

In accordance with EPA's guidance, BACT/tBACT is determined on a pollutant-by-pollutant basis and covers new or modified emission units associated with a project that have net emission increases of the pollutants for which there is a project-wide significant net emission increase.[9] Consistent with the approach used by EPA and Ecology for other permitted projects, a "top-down" BACT/tBACT analysis organized by pollutant and by emissions source category is presented in the following sections of the application.

Although inherently lower emitting processes should be considered in a BACT/tBACT analysis, applicants are not required to alter the design of the main production processes at the proposed source based on BACT/tBACT requirements. Lower-emitting processes are only considered to be available if they are designed to manufacture identical or similar products from identical or similar raw materials or fuels. The applicant describes the inherent aspects of the proposed design that define the "source," and given these design constraints (e.g., the use of both natural gas and the co-product methanol stream as fuel for Boiler #2), BACT/tBACT is determined for the source in question on a case-by-case basis.

[9] For MLI's upgrade project, which triggers minor NSR permitting requirements, the NSR exemption thresholds established by WAC 173-400-110(5) and the de minimis TAP thresholds established by WAC 173-460-150 are used in lieu of the PSD Significant Emission Rates (SERs) to determine the scope of the required BACT/tBACT evaluation.

5.2. OVERVIEW OF 5-STEP BACT/TBACT EVALUATION PROCESS

Consistent with EPA's BACT guidance, BACT/tBACT for the proposed upgrade project has been evaluated via a "top-down" approach. Under this identified top-down approach, the most stringent control available for a similar or identical source or source category is identified. This control option is used to establish the BACT/tBACT emission limitation unless the applicant can demonstrate (and the permitting authority agrees) that it is not "achievable" due to technical infeasibility or cost-ineffectiveness or other adverse environmental or energy consequences of implementing the technology. If the top control alternative is eliminated, then the next most stringent level of control is evaluated. This process continues until the control option under consideration cannot be eliminated by any source specific adverse environmental, energy, or economic impacts.

5.2.1. BACT/tBACT Step 1 - Identify All Control Technologies

Available control technologies with the practical potential for application to the emission unit and regulated air pollutant in question are identified. Available control options include the application of alternate production processes and control methods, systems, and techniques including fuel cleaning and innovative fuel combustion, when applicable. The application of demonstrated control technologies in other similar source categories to the emission unit in question can also be considered. While identified technologies may be eliminated in subsequent steps in the analysis based on technical infeasibility and cost-ineffectiveness, or environmental and energy impacts, all control technologies with potential application to the emission unit under review should be identified.

5.2.2. BACT/tBACT Step 2 - Eliminate Technically Infeasible Options

After the available control technologies have been identified, each technology is evaluated with respect to its technical feasibility in controlling pollutant emissions from the source in question. An undemonstrated technology is only technically feasible if it is "available" and "applicable." A control technology is only considered available if it has reached the licensing and commercial sales phase of development. Control technologies in the R&D and pilot scale phases are not considered available. An available control technology is considered applicable if it has been permitted or actually implemented by a similar source. Decisions about technical feasibility of a control option consider the physical or chemical properties of the emissions stream in comparison to emissions streams from similar sources successfully implementing the control alternative.

5.2.3. BACT/tBACT Step 3 - Rank Remaining Control Technologies by Control Effectiveness

All remaining technically feasible control options are ranked based on their overall control effectiveness for the pollutant under review.

5.2.4. BACT/tBACT Step 4 - Evaluate Most Effective Controls and Document Results

After identifying available and technically feasible control technologies, the economic, environmental, and energy impacts are evaluated to select the best control option. If adverse collateral impacts do not disqualify the top-ranked option from consideration, then it is selected as BACT/tBACT. Alternatively, if adverse economic, environmental, or energy impacts are associated with the top control option, the next most stringent option is evaluated. This process continues until an achievable control technology is identified.

5.2.5. BACT/tBACT Step 5 - Select BACT

In the final step, one pollutant specific control option establishes BACT/tBACT for each source of emissions under review based on evaluations from the previous step.

Although the first four steps of the top-down BACT/tBACT process involve technical and economic evaluations of potential control options (i.e., defining the appropriate technology), the selection of BACT/tBACT in the fifth step involves an evaluation of emission rates achievable with the selected control technology. BACT/tBACT is an emission limit unless technological or economic limitations of the measurement methodology would make the imposition of an emissions standard infeasible, in which case a work practice or operating standard can be imposed.

5.3. BOILER #2 BACT/TBACT EVALUATION FOR NO_X/NO_2 EMISSIONS[10]

Based on the removal of the methanol usage limit for Boiler #2 and the resulting increase in potential NO_x emissions, the SCR cost evaluation presented in the August 2, 2018 NOC application is no longer valid. The revised SCR cost evaluation, which is presented in Appendix D, demonstrates that the cost of implementing SCR control technology is over $10,200 per ton removed even when accounting for these emission increases. Accordingly, SCR technology is not considered cost effective for the control of these NO_x emissions.

Boiler #2 is subject to NSPS Subpart Dc and NESHAP Subpart JJJJJJ; however, these regulations do not establish limits for NO_x emissions. Therefore, MLI's proposed BACT determinations are based on the Cole Industrial guarantees for the base case identified in this BACT evaluation. As described previously, these NO_x guarantees are intrinsically linked to CO emissions. Therefore, MLI proposes the following fuel-specific BACT limits for both NO_x and CO emissions:

- Methanol co-product combustion: 112 ppmvd NO_x @ 3% O_2 and 100 ppmvd CO @ 3% O_2 (i.e., 0.133 lb/MMBtu NO_x and 0.072 lb/MMBtu CO)
- Natural gas combustion: 30 ppmvd NO_x @ 3% O_2 and 50 ppmvd CO @ 3% O_2 (i.e., 0.036 lb/MMBtu NO_x and 0.036 lb/MMBtu CO)

In order to satisfy these limits, MLI will operate the unit in accordance with good combustion and operating practices including following manufacturer recommendations for operating and maintaining the boiler.

5.4. LINE #3 PROCESS VENT TBACT EVALUATION FOR METHANOL EMISSIONS

After condensing methanol in process vents from the TMAC process, MLI uses a flare to control the remaining methanol emissions from TMAC process vents. According to standard references, the flare is 99% efficient for the destruction of methanol. A thermal oxidizer, which would achieve a comparable control efficiency, is not feasible for these vents due to their highly variable nature. A flare system is a commonly utilized and integral safety component utilized at chemical manufacturing and refinery operations. Flares are inherently suited to passively manage large scale emergency situations, operate with a low pressure drop and continue operation in adverse situations, including during electrical power loss where a thermal oxidizer would not function.. The nature of VOC vent components from the MLI TMAC plant also consist of readily combustible low molecular

---

[10] Section 5.4 documents the BACT evaluation for both NO_x emissions, which are regulated under WAC 173-400, and NO_2 emissions, which are regulated under WAC 173-460. Since the evaluations are identical, and associated cost calculations assume that 100% of NO_x from Boiler #2 is in the form of NO_2 for conservatism, the remainder of this section refers only to NO_x for the sake of simplicity. This BACT evaluation is also considered relevant for emissions of CO.

weight materials such as methanol that are well suited to high efficiency destruction in a flare. As such, the condenser/flare system for process vents of methanol represents tBACT.

5.5. PIPING COMPONENT TBACT EVALUATION FOR FUGITIVE METHANOL EMISSIONS

MLI will be subject to NSPS VVa requirements, including associated piping component monitoring and Leak Detection and Repair (LDAR) provisions. Based on monitoring data collected for the existing TMAC process, fugitive leaks from the TMAC system do not cause significant emissions. Therefore, the implementation of this LDAR program is considered tBACT for these methanol emissions.

5.6. COPPER PURIFICATION AREA TBACT EVALUATION FOR TAP EMISSIONS

Based on MLI's conservative emission estimates for the Copper Purification Facility discussed in Section 3, copper/copper compound and sulfuric acid emissions may exceed the corresponding de minimis thresholds. MLI already implements essentially Top-Down tBACT-level controls on ventilation exhausts from the reactor and evaporator sections of the process. These controls are appropriately suited to manage the low volatility and low concentrations of emission constituents observed in this process, as well as the temperature and moisture profiles of the exhaust process streams. Based on the 2017 engineering test data collected by MLI, and assuming the copper sulfate in the exhaust stream is emitted as PM, the average grain-loading of the scrubber systems' exhaust streams is expected to be less than 0.01 grains/dscf.

However, as described below, MLI is proposing to fine-tune the existing control strategy to ensure efficient control of the process vents associated with the increased reactor cycles facilitated by this project. The additional flows from increased reactor operations paired with the improved emissions control strategy is expected to further reduce grain-loading from the scrubbers relative to the 2017 data. Considering this grain-loading estimate and the low levels of emissions generated by the Copper Purification Facility (project-related emissions increases will not exceed the SQER for either copper/copper compounds or sulfuric acid), this control strategy represents tBACT for the copper purification process.

In evaluating tBACT, some background discussion of the nature of the emissions streams, the generating processes and how the generated emissions are minimized and processed through the down-stream emissions control equipment is appropriate. The reactor process involves the batch dissolution of high purity solid copper with sulfuric acid in an ultra-pure water solution. The evaporator process involves the evaporation of water from copper sulfate solutions that are only mildly acidic. In both cases the exhaust emissions consist of physically entrained water mist droplets containing relatively low concentrations of dissolved/dissociated copper sulfate ions. The nature of copper sulfate chemistry including the relatively higher hydrolysis rates for the copper 2+ ions versus sulfate or bisulfate ions is such that a neutral solution may exhibit a slightly acidic pH. At this pH, the sulfate ion is in a partially neutralized bisulfate form versus a sulfuric acid form. At such conditions, there is expected to be no measurable sulfuric acid vapor pressure. Similarly, copper does not have an appreciable vapor pressure at these conditions. Due to the nature of the reactor process, the exhaust stream is at a relatively mild (i.e., near ambient) temperature.

From a standpoint of emissions control, the existing process exhaust treatment for both the reactors and evaporators has been upgraded with the installation of chevron-style pre-mist eliminators (upstream of the scrubbers) to remove larger droplets as well as any liquid that is carried along the walls of the ductwork. This reduces the loading and concentration of the liquid in the scrubber reservoirs recirculated to the top of the scrubber packing thereby increasing the concentration driving force for removal.

In the case of the reactor scrubber, a manual sodium hydroxide addition system to adjust pH and neutralize sulfuric acid is implemented. MLI plans to upgrade the reactor dosing to an automated system to improve sulfuric acid neutralization efficiency. The proposed upgrades are anticipated to maintain the emissions in a more concentrated form that will further increase removal efficiency as well as potentially reducing mechanisms that generate entrained droplets in the reaction process.

In the case of the evaporator scrubber, substantial additional removal efficiency is inherently achieved due to the higher water vapor content/temperature and the cooling/condensing processes as the exhaust leaves the evaporators and passes through the scrubber. The indirect steam driven evaporator process is implemented to evaporate water from dissolved copper sulfate solutions, which are only mildly acidic from a pH standpoint. Physically entrained water droplets contain low concentrations of dissociated copper sulfate ions. Tempering air introduced to the process, as well as natural cooling through the ductwork, reduces the temperatures to a typical range of 170-180 Deg. F. The cooling process condenses water vapor to form additional liquid droplets. The condensing water also increases the size of original fine entrained water droplets, which act as nucleation sites for condensation thereby increasing the droplet removal efficiency in the down-stream emission control systems.

Given the low-level but potentially variable emissions from this process, MLI requests that limits be set for the entire Copper Purification Facility rather than individual stacks. MLI proposes to demonstrate compliance with these limits via one-time engineering testing, the results of which will be communicated to Ecology.

This section discusses MLI's dispersion modeling analysis methodology and results to demonstrate compliance with relevant standards.

6.1. SCREENING METHODOLOGY

6.1.1. Model Selection

This analysis uses the U.S. EPA preferred model for screening assessments, AERSCREEN, for evaluating ambient air impacts from potential emission increases associated with the proposed project. The result from an AERSCREEN model is a predicted ambient concentration that represents a conservative estimate of the maximum post-project ambient concentration at the modeled (maximum) emission rate.

6.1.2. Modeling Parameters

NO_2 and formaldehyde emissions from Boiler #2 will be routed through a new stack to be constructed at the Moses Lake facility as part of the project originally proposed by the August 2, 2018 NOC application. The modeling parameters are determined based on the design of the boiler and associated stack.

Project-related NO_2 and formaldehyde emissions from the flare will be routed through the existing flare stack. For conservatism, emissions from each stack are modeled separately, and maximum impacts are combined for comparison to the corresponding ASIL. Table 6-1 summarizes the model input parameters for the exhaust stream. A nominal emission rate of 1 gram per second (g/s) is entered as the AERSCEEN input value for each stack. The model result is then scaled by the maximum NO_2 emission rate from the corresponding emission unit to determine the maximum ambient impact of the project.

Table 6-1. Source Parameters

Source ID	Modeled Emission Rate (g/s)	Source Elevation [a] (m)	Stack Height [b] (m)	Stack Diameter [b] (m)	Exhaust Temperature [c] (K)	Exhaust Velocity [d] (m/s)	Distance to Fenceline [e] (m)
Boiler	1	352.04	18.90	0.71	487.04	4.78	62
Flare	1	352.04	22.86	0.25	922.04	--	1.5

[a] Approximate source elevation of 1155 ft from MLI's site plan.

[b] MLI's design for the Boiler #2 stack corresponds to a stack height of 62 feet and a stack diameter of 28 inches. The existing flare is 75 feet tall with an nominal descriptive tip dimension of 10 inches, although the actual tip ID is approximately 8 inches.

[c] The boiler stack temperature is estimated based on the average result of the 2017 source test for Boiler #1. Since Boiler #2 will be equipped with a FGR system, which will reduce the combustion temperature relative to Boiler #1, this exhaust temperature is conservative. The temperature for the flare is lower end of the range provided by John Zink.

[d] The boiler stack flow rate is based on the heat input capacity of Boiler #2 at 100% firing rate (16.7 MMBtu/hr), as provided by Cole Industrial (the boiler vendor). This heat input capacity is scaled by the F-factor for natural gas from EPA Method 19 (8,710 dscf/MMBtu) and converted to acfm based on the anticipated stack temperature. This calculation assumes the exhaust is at ambient pressure and at 0% O_2 for conservatism. The resulting volumetric flow rate is then divided by the stack diameter to determine the exit velocity. Rather than calculating an exit velocity for the flare, the flare's heat release rate (875,812 cal/s) and radiative heat loss fraction (55%) were used to model its emissions.

[e] The 'distance to fenceline' refers to the shortest distance from each stack location to the Moses Lake facility's fenceline, as depicted by the site plan presented in Appendix B of this application.

6.1.3. Meteorological Data

The MAKEMET processor in AERSCREEN generates meteorological conditions based on user-specified surface characteristics, ambient extreme temperatures, minimum wind speed, and anemometer height. For this project, the suggested default values of MAKEMET are used for the minimum wind speed (0.5 m/s) and the anemometer height (10 meters). The maximum and minimum ambient temperatures are set to the daily extremes based on 2016 observations at Moses Lake (station name KMWH). Rural land use option and average climate profile for cultivated land are used for MLI's facility.

6.1.4. Building Downwash

The purpose of a building downwash analysis is to determine whether the plume discharged from a stack will become caught in the turbulent wake of a building (or other structure). Wind blowing near a building creates zones of turbulence that are greater than in open air, resulting in plume downwash, which can result in elevated ground-level concentrations. Building downwash is considered for screening analyses of point sources to accurately represent the dispersion of emissions from the modeled stack.

The AERSCREEN program can compute downwash effects for one or multiple buildings. The Boiler #2 stack will be located nearly equidistant to a number of facility buildings. Each of the buildings are of similar structural size, making it difficult to establish which structure will be dominant in a downwash analysis. As a refined approach, the nearby buildings and boiler stack location were compiled into a BPIPPRM input file to allow BPIPPRM to determine the dominant structure directly. As indicated by the AERSCREEN output file, the nearby structures were of insufficient size and not in close enough proximity to the new boiler stack to cause downwash effects. A similar evaluation was performed for the flare stack, and it indicated that some downwash would occur. The building dimensions were determined based on MLI's site plan, which is provided as Appendix B. Electronic versions of the modeling files, including the BPIP input and setup files, are included as Appendix F.

6.2. TAP SCREENING RESULTS

As demonstrated by Table 3-2, with the exception of NO_2 and formaldehyde emissions, project-related emission increases of TAPs subject to regulation under WAC 173-460 are below the corresponding SQERs. Therefore, only NO_2 and formaldehyde emissions trigger dispersion modeling requirements to demonstrate compliance with the ASIL. Project-related increases of both pollutants are associated with the operation of Boiler #2 and the flare. Details regarding the model selection, inputs, and results are provided in the following sections.

The concentration output from AERSCREEN is the maximum concentration from modeling the unit emission rate of 1 g/s. The maximum concentration is then multiplied by the maximum expected emission rate from the source to compare with the corresponding ASIL. Electronic copies of all AERSCREEN inputs and outputs are provided in Appendix E.

Table 6-2 demonstrates that the result of the screening model is below the ASIL for NO_2 and formaldehyde. Therefore, the ambient TAP concentrations resulting from the proposed project are considered acceptable under WAC 173-460 and no further analysis is required.

Table 6-2. Screening Result for NO_2 and Formaldehyde Emissions

Pollutant	Model Averaging Period	Scaled Concentration (μg/m³)	ASIL (μg/m³)	ASIL Averaging period	Compliance with ASIL?
NO_2	1-hr	28.11	470	1-hr	Yes
Formaldehyde	annual	0.0013	0.167	annual	Yes

[a] As detailed in Appendix E, the maximum modeled impact for each source (Boiler #2 and flare) was aggregated for comparison to the ASIL.

6.3. NAAQS SCREENING RESULTS

As requested by Ecology for the August 2018 NOC application, the following table compares the results of the AERSCREEN modeling evaluation for the proposed project to the relevant National Ambient Air Quality Standards (NAAQS) for NO_2 and $PM_{2.5}$. This evaluation assesses the project's compliance with the NAAQS by assuming that project-related impacts coupled with a representative background concentration for the area yield a reasonable estimate of total post-project pollutant concentrations in the area around MLI's facility. Per Ecology's guidance, ambient pollutant concentration data published by Washington State University's Northwest International Air Quality Environmental Science and Technology Consortium (NW AIRQUEST) was used to determine representative background concentrations for NO_2 and $PM_{2.5}$ (based on data collected for 2009 through 2011).

As discussed in Section 6.2, the output from AERSCREEN represents the maximum concentrations from modeling the unit emission rate of 1 g/s at various averaging periods. The maximum concentration for a given averaging period is then multiplied by the maximum expected NO_2 or $PM_{2.5}$ emission rate from Boiler #2 and the flare to estimate project-related impacts. The resulting source-specific modeled impacts are aggregated for comparison to the NAAQS. By adding a representative background concentration to these scaled modeled concentrations, compliance with each NAAQS for NO_2 and $PM_{2.5}$ is demonstrated. Electronic copies of all AERSCREEN inputs and outputs are provided in Appendix E.

Table 6-3 demonstrates that post-project impacts from the Moses Lake facility will maintain compliance with the NAAQS for NO_2 and $PM_{2.5}$. Therefore, the ambient NO_2 and $PM_{2.5}$ concentrations resulting from the proposed project demonstrate compliance with the ambient air quality standards established under WAC 173-476 and no further analysis is required.

Table 6-3. Simplified NAAQS Compliance Demonstration for Project Emissions

Pollutant	Modeled Averaging Period	Cumulative Modeled Concentration[a] (µg/m³)	Representative Background[b] (µg/m³)	Total Impact (µg/m³)	NAAQS (µg/m³)	In Compliance with NAAQS?
NO_2	1-hour	28.11	16.00	44.11	188	Yes
	annual	2.81	2.82	5.63	100	Yes
$PM_{2.5}$	24-hour	0.44	14	14.44	35	Yes
	annual	0.07	5.3	5.37	12	Yes

[a] The modeled results for the unit emission rate (1 g/s) were scaled by the appropriate projected emission rate for the boiler and flare to assess compliance with the NAAQS.

[b] Per Ecology's suggestion, as communicated in a July 26, 2018 email from Jenny Filipy (Ecology) to Pat Blau (MLI), the following website was used to determine representative background concentrations for NO_2 and $PM_{2.5}$: http://lar.wsu.edu/nw-airquest/lookup.html
These results are based on the following facility location, expressed in latitude/longitude: 47.2051947, -119.2909225
Background values expressed in ppb were converted to ug/m3 by multiplying the concentration in ppb by the molecular weight and then dividing the result by (0.02447*1000).

7. REQUESTED PERMIT CHANGES

This section identifies MLI's requested changes to the existing Approval Order (Approval Order No. 18AQ-E042) for the Moses Lake facility.

- Appendix F identifies MLI's requested changes to facility permit limits.
- MLI requests that the natural gas usage limit for the flare be revised from 7.86 MMscf/yr to 17.69 MMscf/yr.
- MLI requests that the methanol usage limit for Boiler #2 of 1,201,000 gallons be eliminated from the permit.
- If Ecology decides to establish an emission limit for the Copper Purification Facility, MLI requests that this limit be established for the entire copper area, rather than individual stacks. Given the low-level of emissions from this process (e.g., pre-project TAP emissions are below the corresponding de minimis thresholds, while project-related increases of TAPs will be less than the corresponding SQERs), MLI proposes to demonstrate compliance with these limits via one-time engineering testing, the results of which will be communicated to Ecology.

APPENDIX A: APPLICATION FORMS

Notice of Construction Application

A notice of construction permit is required before installing a new source of air pollution or modifying an existing source of air pollution. This application applies to facilities in Ecology's jurisdiction. Submit this application for review of your project. For general information about completing the application, refer to Ecology Forms ECY 070-410a-g, "Instructions for Ecology's Notice of Construction Application."

Ecology offers up to 2 hours of free pre-application help. We encourage you to schedule a pre-application meeting with the contact person specified for the location of your proposal (see below). For more help than the initial 2 free hours, submit Part 1 of the application and the application fee. You may schedule a meeting with us at any point in the process.

Completing the application, enclose it with a check for the initial fee and mail to:

WA Department of Ecology
Cashiering Unit
P.O. Box 47611
Olympia, WA 98504-7611

For Fiscal Office Use Only:
001-NSR-216-0299-000404

Check the box for the location of your proposal. For help, call the contact listed below.		
	Ecology Permitting Office	**Contact**
☐ **CRO**	**Chelan, Douglas, Kittitas, Klickitat, or Okanogan County** Ecology Central Regional Office – Air Quality Program	Lynnette Haller (509) 457-7126 lynnette.haller@ecy.wa.gov
☒ **ERO**	**Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla, or Whitman County** Ecology Eastern Regional Office – Air Quality Program	Jolaine Johnson (509) 329-3452 jolaine.johnson@ecy.wa.gov
☐ **NWRO**	**San Juan County** Ecology Northwest Regional Office – Air Quality Program	Dave Adler (425) 649-7267 david.adler@ecy.wa.gov
☐ **IND**	**Kraft and Sulfite Paper Mills and Aluminum Smelters** Ecology Industrial Section – Waste 2 Resources Program Permit manager: ______________________________	James DeMay (360) 407-6868 james.demay@ecy.wa.gov
☐ **NWP**	**U.S. Department of Energy Hanford Reservation** Ecology Nuclear Waste Program	Phil Gent (509) 372-7983 phil.gent@ecy.wa.gov

To request ADA accommodation, call (360) 407-6800, 711 (relay service), or 877-833-6341 (TTY).

Notice of Construction Application

Check the box for the fee that applies to your application.

New project or equipment

☒	**$1,500: Basic project** initial fee covers up to 16 hours of review
☐	**$10,000: Complex project** initial fee covers up to 106 hours of review

Change to an existing permit or equipment

☐	**$200: Administrative or simple change** initial fee covers up to 3 hours of review Ecology may determine your change is complex during completeness review of your application. If your project is complex, you must pay the additional $675 before we will continue working on your application.
☒	**$875: Complex change** initial fee covers up to 10 hours of review
☐	**$350** flat fee: **Replace or alter control technology equipment** (WAC 173-400-114) Ecology will contact you if we determine your change belongs in another fee category. You must pay the fee associated with that category before we will continue working on your application.

Read each statement, then check the box next to it to acknowledge that you agree.	
☒	The initial fee you submitted may not cover the cost of processing your application. Ecology will track the number of hours spent on your project. If the number of hours Ecology spends exceeds the hours included in your initial fee, Ecology will charge you $95 per hour for the extra time.
☒	You must include all information in this application. Ecology may not process your application if it does not include all the information requested.
☒	Submittal of this application allows Ecology staff to inspect your facility.

Notice of Construction Application

Part 1: General Information

I. Project, Facility, and Company Information

1. Project Name TMAC Line #3 Expansion Project and Copper Purification Facility Upgrade
2. Facility Name Moses Lake Industries
3. Facility Street Address 8248 Randolph Road NE
4. Facility Legal Description Section 27, Range 28E, Township 20N, Grant County, State of Washington
5. Company Legal Name (if different than Facility Name)
6. Company Mailing Address (street, city, state, zip) 8248 Randolph Road NE

II. Contact Information and Certification

1. Facility Contact Name (who will be on-site) Patrick Blau	
2. Facility Contact Mailing Address (if different than Company Mailing Address)	
3. Facility Contact Phone Number 509-762-5336 x 236	4. Facility Contact Email pblau@mlindustries.com
5. Billing Contact Name (who should receive billing information) Patrick Blau	
6. Billing Contact Mailing Address (if different than Company Mailing Address)	
7. Billing Contact Phone Number	8. Billing Contact Email
9. Consultant Name (optional – if 3rd party hired to complete application) Back-up contact ONLY after first checking with Pat Blau: Maren Seibold	
10. Consultant Organization/Company Trinity Consultants	
11. Consultant Mailing Address (street, city, state, zip)	
12. Consultant Phone Number 859-341-8100 x 104	13.Consultant Email MSeibold@Trinityconsultants.com
14. Responsible Official Name and Title (person responsible for project policy or decision-making) Mike Tiffany, VP Operations Manager	
15. Responsible Official Mailing Address 8248 Randolph Road NE	
16. Responsible Official Phone 509-762-5336	17. Responsible Official Email mtiffany@mlindustries.com
18. Responsible Official Certification and Signature I certify that the information on this application is accurate and complete. Signature ______________________________ Date____________	

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Construction Application

Part 2: Technical Information

The Technical Information may be sent with this application to the Ecology Cashiering Unit, or may be sent directly to the appropriate Ecology office along with a copy of this application.

For all sections, check the box next to each item as you complete it.

III. Project Description

Attach the following to your application:

- ☒ Description of your proposed project (See Section 2 of NOC Application)
- ☒ Projected construction start and completion dates (See Section 2 of NOC Application)
- ☒ Operating schedule and production rates (See Section 2 of NOC Application)
- ☒ List of all major process equipment with manufacturer and maximum rated capacity (See Section 2 of Application)
- ☐ Process flow diagram with all emission points identified (No new emission points, Boiler #2 addressed in August NOC)
- ☒ Plan view site map (See Appendix B of NOC Application)
- ☐ Manufacturer specification sheets for major process equipment components (August NOC has Boiler #2 info)
- ☐ Manufacturer specification sheets for pollution control equipment (No new control equipment)
- ☒ Fuel specifications, including type, consumption (per hour and per year), and percent sulfur (See Appendix C of NOC Application)

IV. State Environmental Policy Act (SEPA) Compliance

Check the appropriate box below.

☐ SEPA review is complete.
Include a copy of the final SEPA checklist and SEPA determination (e.g., DNS, MDNS, EIS) with your application.

☒ SEPA review has not been conducted.

☒ If SEPA review will be conducted by another agency, list the agency. You must provide a copy of the final SEPA checklist and SEPA determination before Ecology will issue your permit.

Agency Reviewing SEPA:
Lead agency unclear; if not Ecology, would be Grant County

☒ If SEPA review will be conducted by Ecology, fill out a SEPA checklist and submit it with your application. You can find a SEPA checklist online at http://www.ecy.wa.gov/programs/sea/sepa/forms.htm.

Notice of Construction Application

V. Emissions Estimations of Criteria Pollutants

(See Appendix C of NOC Application)

Does your project generate air pollutant emissions? ☒ Yes ☐ No

If yes, provide the following information about your air pollutant emissions:

☒ Air pollutants emitted, such as carbon monoxide (CO_2), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), and volatile organic compounds (VOC), particulate matter ($PM_{2.5}$, PM_{10}, TSP), sulfur dioxide (SO_2)

☒ Potential emissions of criteria air pollutants in tons per hour, tons per day, and tons per year (include calculations)

☒ Fugitive air pollutant emissions – pollutant and quantity

VI. Emissions Estimations of Toxic Air Pollutants

(See Appendix C of NOC Application)

Does your project generate toxic air pollutant emissions? ☒ Yes ☐ No

If yes, provide the following information about your toxic air pollutant emissions:

☒ Toxic air pollutants emitted (specified in WAC 173-460-150[1])

☒ Potential emissions of toxic air pollutants in pounds per hour, pounds per day, and pounds per year (include calculations)

☒ Fugitive toxic air pollutant emissions - pollutant and quantity

VII. Emission Standard Compliance

(See Section 4 of NOC Application)

Does your project comply with all applicable standards identified? ☒ Yes ☐ No

☒ Provide a list of all applicable new source performance standards, national emission standards for hazardous air pollutants, national emission standards for hazardous air pollutants for source categories, and emission standards adopted under the Washington Clean Air Act, Chapter 70.94 RCW.

VIII. Best Available Control Technology

(See Section 5 of NOC Application)

☒ Provide a complete evaluation of Best Available Control Technology (BACT) for your proposal.

[1] http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460-150

DEPARTMENT OF ECOLOGY State of Washington

Notice of Construction Application

IX. Ambient Air Impacts Analyses

(See Section 6 of NOC Application)

Does your project cause or contribute to a violation of any ambient air quality standard or acceptable source impact level? ☐ Yes ☒ No

Provide the following:

☒ Ambient air impacts analyses for criteria air pollutants (including fugitive emissions)

☒ Ambient air impacts analyses for toxic air pollutants (including fugitive emissions)

☒ Discharge point data for each point included in ambient air impacts analyses (include only if modeling is required)

- ☒ Exhaust height
- ☒ Exhaust inside dimensions (diameter or length and width)
- ☒ Exhaust gas velocity or volumetric flow rate
- ☒ Exhaust gas exit temperature
- ☒ Volumetric flow rate
- ☒ Discharge description (i.e., vertically or horizontally) and if there are any obstructions (e.g., raincap)
- ☒ Emission unit(s) discharging from the point
- ☒ Distance from the stack to the nearest property line
- ☒ Emission unit building height, width, and length
- ☒ Height of tallest building on-site or in the vicinity, and the nearest distance of that building to the exhaust
- ☒ Facility location (urban or rural)

APPENDIX B: SITE PLAN

APPENDIX C: EMISSION CALCULATIONS

Section C1. Project Impacts on TMAC Production Rate

Part A. Proposed TMAC Production Limit Increase (Based on Line 3 Installation)

> As part of MLI's proposed project to install a third TMAC production line to the Moses Lake facility, MLI will be increasing the permitted production rate of the TMAC facility. The current production limit established by Approval Condition 2.a of Approval Order No. 18AQ-E042 restricts TMAC production to 2,207 kg/hr pure TMAC product. MLI requests that this production limit be increased to 3,224 kg/hr pure TMAC product. This equates to a 46% production increase relative to the current permit limit.

> This section identifies the maximum anticipated production level for the post-project TMAC facility at the current product quality. Part B of this section identifies slightly different pure TMAC production rates (5-6% lower than Part A). The differences in these production rates are based on slightly reduced production levels associated with anticipated product quality improvements. However, for conservatism, MLI requests that the permitted production limit be based on the higher production rate identified in this section.

Current TMAC Production Limit (pre-Line 3 installation):	2,207	kg/hr
Proposed TMAC Production Limit (including Line 3):	3,224	kg/hr
Proposed Increase to Production Limit:	***46%***	

Part B. Project Impacts on Maximum TMAC Production Rate

> Ecology recently approved MLI's TMAC Product Quality/Emissions Upgrade project for the Moses Lake facility by issuing Approval Order No. 18AQ-E042. This project included upgrades to TMAC Lines 1 and 2, which would enable those lines to operate at higher TMAC production rates that previously achieved. Due to the contemporaneous nature of the previously approved project and the currently proposed project involving the additional of TMAC Line 3, MLI is including combined emissions from both projects in the NOC application.

> In order to accurately quantify emission increases based on production increases, this section assesses the cumulative total production increases facilitated by (1) the permitted TMAC Product Quality and Emissions Upgrade Project and (2) the proposed TMAC Line 3 expansion project.

Product Parameters/Constants:

Density:	9.20	lb/gal
TMAC Concentration:	65%	
	24	hr/day
	2.204	lb/kg

Pre-TMAC Product Quality/Emissions Upgrade Project Production Levels:

Line 1:	5,400	gal/day TMAC product
Line 2:	6,600	gal/day TMAC product
Line 3:	0	gal/day TMAC product
Total:	12,000	gal/day TMAC product
Equivalent Total:	***1,356***	***kg/hr pure TMAC***

Post-TMAC Product Quality/Emissions Upgrade Project Production Levels:

Line 1:	9,000	gal/day TMAC product
Line 2:	9,000	gal/day TMAC product
Line 3:	0	gal/day TMAC product
Total:	18,000	gal/day TMAC product
Equivalent Total:	***2,034***	***kg/hr pure TMAC***

Post-TMAC Line 3 Expansion Project Production Levels:

Line 1:	9,000	gal/day TMAC product
Line 2:	9,000	gal/day TMAC product
Line 3:	9,000	gal/day TMAC product
Total:	27,000	gal/day TMAC product
Equivalent Total:	***3,052***	***kg/hr pure TMAC***

Total Increase to Production Rates:	***125%***

Section C2. Boiler #2 Emission Calculations

> As part of MLI's proposed TMAC Product Quality/Emissions Upgrade project for the Moses Lake facility, which was recently approved by Ecology, MLI will be installing a second boiler (Boiler #2). This boiler was characterized in MLI's August 2, 2018 NOC application. MLI is currently proposing to further expand its existing TMAC production facility via the installation of a new Line #3 and to implement production and emissions control upgrades for the Copper Purification Facility. Due to the contemporaneous nature of the previously approved project and the currently proposed project, MLI is including emissions from both projects in this new NOC application.

> In the updated approval order for the Moses Lake facility, which was issued by Ecology on September 12, 2018 (Approval Order No. 18AQ-E042), Operational Requirement 2.k establishes a methanol usage limit for Boiler #2 of 1,201,000 gallons per year. This limit assumes that a maximum of 50% of the annual heat input capacity for Boiler #2 is supplied by the methanol co-product stream. As part of this new NOC application, MLI is requesting that Ecology removal the current methanol usage limit. The emission calculations and associated analyses presented in this application assume that methanol can be used to supply up to 100% of Boiler #2's annual heat input capacity; therefore, a methanol usage limit is no longer necessary.

> Because MLI is treating Boiler #2 as a "new unit" for the purposes of this NOC application, potential emissions from Boiler #2 must demonstrate compliance with the Washington New Source Review (NSR) requirements under WAC 173-400-110 for criteria pollutants and WAC 173-460-040 for TAPs.

> Boiler #2 will combust either pipeline quality natural gas or methanol co-product generated by the Moses Lake facility. As presented in Table C2-5, the worst-case emission rates for Boiler #2 are the greater emission rates from firing natural gas only or methanol only at the boiler's maximum capacity.

Table C2-1. New 400 HP Boiler Parameters and Constants

Maximum Operating Hours	8,760	hr/year
Maximum Boiler Capacity [a]	16.70	MMBtu/hr
F-Factor [b]	8,710	dscf/MMBtu
Exhaust Flow Rate (0% O_2) [c]	2,424	dscf/min
Exhaust Flow Rate (3% O_2) [c]	2,772	dscf/min
Standard Pressure	1	atm
Standard Temperature	68	^oF
	528	^oR
Ideal Gas Constant (R)	1	scf-atm/(^{o}R-lbmol)
Molecular Weight of NO_2	46.01	lb/lbmol
Molecular Weight of CO	28.01	lb/lbmol

[a] The maximum heat input capacity is based on the Cole Industrial quoted capacity for the 30 ppm NOx boiler. This corresponds to a boiler output rating of 400 hp and an efficiency of 80.2% at this maximum firing scenario.

[b] The F-factor for natural gas firing is from EPA Method 19. This F-factor is assumed to be representative of methanol as well; both methane (primary constituent in natural gas) and methanol contain a single carbon atom, so the stoichiometric ratios to complete the combustion reaction are similar. This assumption is supported by the results of MLI's recent source testing on its existing boiler, which show close agreement between the boiler exhaust rate when firing methanol and natural gas at similar heat input rates.

[c] The exhaust flow rate is calculated as the product of the boiler's rated heat input capacity and the F-factor. This flow rate is assumed to represent both natural gas and methanol combustion, and corresponds to 0% O2. For the purpose of calculating emissions using the vendor-supplied emission guarantees, which are expressed on a 3% O2 basis, these flow rates were converted to a 3% O2 basis.

Table C2-2. Methanol Co-Product Fuel Stream Specifications and Proposed Usage Limit

Maximum Heat Input from Methanol Fuel Stream [a]	146,261	MMBtu/year
Methanol Density [b]	6.61	lb/gal
Methanol Higher Heating Value [c]	9,212	Btu/lb
	0.0609	MMBtu/gal
Proposed Methanol Usage Limit (Boiler #2)	2,402,000	gal/year

[a] The maximum annual heat input from methanol fuel combustion in Boiler #2 assumes that methanol is fired for up to 100% of the unit's annual rated heat input capacity.

[b] The density of the methanol co-product stream is based on sampling conducted by MLI.

[c] The Higher Heating Value (HHV) of the methanol co-product produced by the MLI facility was determined as part of the 2017 source test on Boiler #1.

Table C2-3. Potential Emissions from the New 400 HP Boiler - Natural Gas Combustion

Operating Hours on Natural Gas	8,760	hr/year
Natural Gas Heating Value [a]	1,030	Btu/scf
Vendor Guarantee for NO_x [b]	30	ppmvd @ 3% O_2
	0.036	lb/MMBtu
Vendor Guarantee for CO [b]	50	ppmvd @ 3% O_2
	0.036	lb/MMBtu

		Emission Factor	Emission Factor	Emission Rate	
Pollutant		**(lb/MMscf)**	**(lb/MMBtu)**	**(lb/hr)**	**(tpy)**
PM (filterable only)	c	1.9	0.002	0.03	0.13
PM_{10}	c	7.6	0.007	0.12	0.54
$PM_{2.5}$	c	7.6	0.007	0.12	0.54
SO_2	c	0.6	0.001	9.73E-03	0.04
NO_x	b	--	0.036	0.60	2.61
VOC	c	5.5	0.005	0.09	0.39
CO	b	--	0.036	0.60	2.65
TAPs					
Benzene	d	5.80E-03	5.63E-06	9.40E-05	4.12E-04
Formaldehyde	d	1.23E-02	1.19E-05	1.99E-04	8.73E-04
Naphthalene	d	3.00E-04	2.91E-07	4.86E-06	2.13E-05
Acetaldehyde	d	3.10E-03	3.01E-06	5.03E-05	2.20E-04
Acrolein	d	2.70E-03	2.62E-06	4.38E-05	1.92E-04
Propylene	d	5.30E-01	5.15E-04	8.59E-03	3.76E-02
Toluene	d	2.65E-02	2.57E-05	4.30E-04	1.88E-03
Xylene	d	1.97E-02	1.91E-05	3.19E-04	1.40E-03
Ethylbenzene	d	6.90E-03	6.70E-06	1.12E-04	4.90E-04
Hexane	d	4.60E-03	4.47E-06	7.46E-05	3.27E-04
GHGs (as CO_2e)	e		--	1,955	8,563
CO_2	f	--	116.98	1,953	8,555
N_2O	f	--	2.20E-04	3.68E-03	0.02
CH_4	f	--	2.20E-03	0.04	0.16

[a] The natural gas heating value corresponds to the default heating value for pipeline quality natural gas that is used as the basis for EPA's SCR cost calculations template.

[b] The emissions guarantees for NOx and CO exhaust concentrations were provided by Cole Industrial, the vendor for the proposed boiler. These were converted from a ppmvd @ 3% O2 basis to a lb/MMBtu basis using these vendor guaranteed concentrations, the exhaust flowrate and heat input capacity of the proposed boiler, and the ideal gas law.

[c] Emission factors for small boilers (<100 MMBtu/hr) are obtained from Table 1.4.1 and Table 1.4.2, AP-42 Chapter 1.4, Natural Gas Combustion. These factors are converted from a lb/MMscf basis to a lb/MMBtu basis using the heating value of natural gas. PM emissions represent filterable PM only, while PM10 and PM2.5 emissions include both filterable and condensable PM emissions of the associated size.

[d] Natural gas emission factors are obtained from the Ventura County Air Pollution Control District's AB 2588 Combustion Emission Factors document, dated May 17, 2001. Based on the size of the proposed boiler, the factors for 10-100 MMBtu/hr units are used.

[e] The GHGs emissions are calculated based on the Global Warming Potentials (GWP) provided in Table A-1 of 40 CFR 98.

CO_2	1
N_2O	298
CH_4	25

[f] The emission factors are obtained from 40 CFR 98 Subpart C, Tables C-1 and C-2, and converted to values in lb/MMBtu.

Table C2-4. Potential Emissions from the New 400 HP Boiler - Methanol Combustion

Maximum Methanol Usage [a]	146,261	MMBtu/year
	2,402,000	gal/year
Vendor Guarantee for NOx [b]	112	ppmvd @ 3% O2
	0.133	lb/MMBtu
Vendor Guarantee for CO [b]	100	ppmvd @ 3% O2
	0.072	lb/MMBtu

	Emission Factor	Emission Factor	Emission Rate	
Pollutant [c]	**(lb/MMscf)**	**(lb/MMBtu)**	**(lb/hr)**	**(tpy)**
PM (filterable only) [d]	--	0.03	0.50	2.19
NO_x [b]	--	0.133	2.22	9.74
CO [b]	--	0.072	1.21	5.30
VOC [e]	--	--	0.28	1.24
Non-TAPs	--			
TMA [f]	--	--	0.02	0.10
TAPs				
Methanol [f]	--	--	0.17	0.75

[a] The maximum usage rate for methanol fuel combustion in Boiler #2 assumes that methanol is used to supply 100% of the unit's maximum annual capacity.

[b] The emissions guarantees for NOx and CO exhaust concentrations were provided by Cole Industrial, the vendor for the proposed boiler. These were converted from a ppmvd @ 3% O2 basis to a lb/MMBtu basis using these vendor guaranteed concentrations, the exhaust flowrate and heat input capacity of the proposed boiler, and the ideal gas law. The NOx emission factor accounts for thermal NOx from pure methanol combustion and NOx from fuel-bound nitrogen.

[c] For all other pollutants not represented in this table, hourly emissions from methanol combustion are assumed to be equivalent to hourly emissions from natural gas combustion.

[d] The PM (filterable) emission factor for methanol combustion corresponds to the limit established by 40 CFR 63 Subpart JJJJJJ for new boilers firing liquid fuels.

[e] The VOC emission rate associated with methanol fuel combustion corresponds to the sum of (1) estimated TMA emissions (see footnote f), (2) estimated methanol emissions (see footnote f), and (3) estimated miscellaneous VOC emissions (calculated using the AP-42 factor from Table 1.4-2, scaled by the unit's heat input capacity).

[f] The projected methanol and TMA emission rates from Boiler #2 (1,500 lb/yr and 200 lb/yr, respectively) are based on MLI's operating experience (and based on a TMA concentration in the methanol co-product stream of approximately 3,300 ppmw, per MLI's sampling results). The 2017 source test results for Boiler #1, which showed that the exhaust concentrations of both TMA and methanol were less than the associated method detection limits (MDLs), verify that these estimates are conservative. However, because Boiler #2 will implement a Flue Gas Recirculation (FGR) system, which will reduce the operating temperature of the new system and potentially increase VOC emissions relative to Boiler #1, MLI does not wish to use the Boiler #1 source test results to estimate methanol and TMAC emissions from the proposed boiler.

Table C2-5. Potential Emissions from the New 400HP Boiler - Worst Case [a]

Pollutant	Hourly Emission Rate (lb/hr)	Annual Emission Rate (tpy)
Criteria		
PM (filterable only)	0.50	2.19
PM_{10}	0.12	0.54
$PM_{2.5}$	0.12	0.54
SO_2	0.01	0.04
NO_x	2.22	9.74
VOC	0.28	1.24
CO	1.21	5.30
TAPs		
Benzene	9.40E-05	4.12E-04
Formaldehyde	1.99E-04	8.73E-04
Naphthalene	4.86E-06	2.13E-05
Acetaldehyde	5.03E-05	2.20E-04
Acrolein	4.38E-05	1.92E-04
Propylene	8.59E-03	3.76E-02
Toluene	4.30E-04	1.88E-03
Xylene	3.19E-04	1.40E-03
Ethylbenzene	1.12E-04	4.90E-04
Hexane	7.46E-05	3.27E-04
Methanol	1.71E-01	7.50E-01
GHGs (as CO_2e)	1,955	8,563

[a] The worst-case emission rates for Boiler #2 are the greater emission rates from firing natural gas only or methanol only at the boiler's maximum capacity for the entire year.

Section C3. Fugitive Emissions from Piping Components

> As part of MLI's approved TMAC Product Quality/Emissions Upgrade project and proposed TMAC Line 3 Addition to the Moses Lake facility, MLI will be adding and upgrading various valves, connectors, pumps, and related piping components.

> Post-project fugitive methanol emissions are calculated based on past actual reported emissions for piping leaks adjusted by a conservative scaling factor to account for annual variability in actual emissions, fugitive sources other than piping component leaks, and the additional equipment associated with the TMAC Product Quality/Emissions Upgrade project and TMAC Line 3 Addition.

> Post-project fugitive VOC emissions are calculated based on past actual reported emissions for piping leaks adjusted by a conservative scaling factor to account for annual variability in actual emissions, fugitive sources other than piping component leaks, and the additional equipment associated with the TMAC Product Quality/Emissions Upgrade project and TMAC Line 3 Addition.

Table C3-1. Currently Permitted Fugitive Emissions[a]

Pollutant	Permitted Emission Rate (tpy)
Methanol	4.05
VOC (as emitted)	12.52

[a] The annual fugitive emission limits are established by Condition 4.f of Approval Order No. 18AQ-E042.

Table C3-2. Recently Reported Fugitive Emissionsa

Reporting Year	Methanol (lbs/yr)	Methanol (tpy)	Total VOC (lbs)	Total VOC (tpy)
2012	2,262.4	1.1	2,615.9	1.3
2013	3,238.0	1.6	3,862.5	1.9
2014	2,885.3	1.4	3,359.4	1.7
2015	2,518.8	1.3	2,980.8	1.5
2016	2,295.7	1.1	2,936.6	1.5
2017	2,013.2	1.0	2,486.5	1.2
Maximum	***3,238.0***	***1.6***	***3,862.5***	***1.9***

[a] The annual fugitive emission rates from piping components in Table C3-2 represent the results of LDAR-related monitoring, converted to emission rates in accordance with the methodology prescribed by EPA's Protocol for Equipment Leak Emission Estimates (EPA 453/R-95-017). These estimates serve as the basis for the actual annual emissions reported each year to Ecology, and do not account for either the TMAC Product Quality/Emissions Upgrade project or the TMAC Line 3 Addition.

Table C3-3. Proposed Post-Project Fugitive Emissions

Pollutant	Proposed Emission Rate (tpy)
Methanol[a]	5.59
VOC (as emitted)[b]	9.66

[a] Fugitive methanol emissions are calculated based on past actual reported emissions for piping leaks adjusted by a conservative scaling factor (345%) to account for annual variability in actual emissions, fugitive methanol sources other than piping component leaks, and the additional equipment associated with the TMAC Product Quality/Emissions Upgrade project and TMAC Line 3 Addition. Note that actual reported emissions from 2017 and earlier do not account for the impacts of the approved TMAC Product Quality/Emissions Upgrade project.

[b] Fugitive VOC emissions are calculated based on past actual reported emissions for piping leaks adjusted by a conservative scaling factor (500%) to account for annual variability in actual emissions, fugitive sources other than piping component leaks, and the additional equipment associated with the TMAC Product Quality/Emissions Upgrade project and TMAC Line 3 Addition. Note that actual reported emissions from 2017 and earlier do not account for the impacts of the approved TMAC Product Quality/Emissions Upgrade project.

Section C4. Flare Emissions

> The new Line 3 will include vent condensers to process flows from the reactor and distillation sections of the TMAC production line. The vent condensers will be sized and supported by an upsized chiller system to minimize emissions. Flows will be individually monitored from each vent condenser.

> The combined condenser flows from all three TMAC production lines will be routed to the existing flare for emissions control. The existing flare is of sufficient capacity to process these combined vent streams.

> Emission calculations for the post-project flare rely on engineering estimates, existing emission limits adjusted to account for operating increases associated with the recent and proposed projects, and representative emission factors.

NOx Emission Calculations:

> The following calculation of NOx emissions from the flare accounts for both:

1. Thermal NOx (formed when nitrogen in combustion air is sufficiently heated in the presence of oxygen to produce NOx); and
2. Fuel-bound NOx (formed when the organic material being controlled by the flare contains nitrogen, which forms NOx when combusted).

Fuel-Bound NOx Calculations:

> The calculation of fuel-bound NOx is based on the projected maximum quantity of TMA that reaches the flare. This projection is based on the previously permitted TMA emission rate, scaled to account for project-related increases. Because this previously permitted emission rate did not consider the emission increases associated with the recently approved TMAC Product Quality/Emissions Upgrade project, the calculation of post-project emissions accounts for the production increases of both the approved TMAC Product Quality/Emissions Upgrade project and the proposed TMAC Line 3 Addition project.

> The following process is used to calculate fuel-bound NOx emissions:

1. The flare's control efficiency is applied to the previously permitted TMA limit to determine of the quantity of TMA routed to the flare for control prior to the upgrade project.
2. The resulting uncontrolled TMA venting rate is scaled by the projected TMAC production increase of both the recently approved and proposed projects to determine the maximum post-project quantity of TMA that will be routed to the flare.
3. The results of internal testing conducted by MLI are used to conservatively estimate the fraction of TMA that produces NOx in a typical combustion reaction.
4. This fraction is applied to the uncontrolled post-project quantity of TMA routed to the flare to determine fuel-bound NOx emissions.

Table C4-1. Fuel-Bound NOx Emissions from Flare

Parameter	**Value**
Controlled Previously Permitted TMA Emissions (lb/yr) [a]	5,000
TMA Control Efficiency of Flare	98%
Uncontrolled Previously Permitted TMA Emissions (lb/yr) [b]	250,000
Uncontrolled Post-Project TMA Emissions (lb/yr) [c]	562,500
Portion of TMA that converts to NOx [d]	10%
NO_x Emissions from TMA Combustion at Flare (lb/yr) [e]	43,778
NO_x Emissions from TMA Combustion at Flare (tpy) [e]	**21.89**

[a] Although there is no limit in Approval Order No. 18AQ-E042 for TMA emissions from the flare (as TMA is no longer a TAP under WAC 173-460), the previous limit from Approval Order No. 16AQ-E022 (5,000 lbs/yr) is used as the basis for determining past maximum operating levels.

[b] Uncontrolled emissions are calculated assuming that controlled emissions account for the flare's projected 98% control efficiency for TMA (control efficiency based on TNRCC October 2000 guidance document).

[c] Uncontrolled pre-project TMA emissions are scaled by the anticipated production increase to calculate maximum uncontrolled post-project TMA vents to the flare. See Section C1 for details re: this production increase.

[d] The results of internal testing conducted by MLI indicate that an average of 7% of TMA feed forms NOx in a typical combustion reaction. For conservatism, MLI has assumed that 10% of the TMA routed to the flare will form NOx.

[e] This 10% factor is applied to calculate fuel-bound NOx formed from TMA combustion at the flare. The resulting value is scaled by the ratio of molecular weights (NO_2 to TMA) to quantify potential NOx emissions at the flare associated with TMA conversion.

Thermal NOx Calculations:

> The calculation of thermal NOx is based on the projected maximum quantities of natural gas, methanol, and TMA that will reach the flare following the approved upgrade project and proposed Line 3 addition. Each of these vents is scaled by an appropriate heating value to determine the total heat input to the flare.

> The following process is used to calculate thermal NOx emissions from the flare:

1. The current permit limit for natural gas usage at the flare represents the starting point for this calculation.
2. This limit is scaled by the production increases associated with both the Line 1/2 upgrades and the proposed Line 3 addition to represent a post-project maximum natural gas usage rate for the flare.
3. The resulting natural gas usage rate is converted from a volumetric basis to a heat input-based rate using a typical heating value for pipeline quality natural gas.
4. The maximum quantity of methanol vented to the flare is estimated using MLI's proposed permit limit for post-project methanol emissions from the flare, along with the assumed control efficiency for the flare.
5. The resulting methanol venting rate is converted from a volumetric basis to a heat input-based rate using a typical heating value for methanol.
6. The maximum quantity of TMA vented to the flare is estimated using MLI's previous permit limit for the flare (Approval Order 16AQ-E022), the proposed TMAC production increase associated with the projects, and the assumed TMA control efficiency for the flare.
7. The resulting TMA venting rate is converted from a volumetric basis to a heat input-based rate using a typical heating value for TMA.
8. An appropriate thermal NOx emission factor for the flare is applied to the combined heat input from natural gas, methanol, and TMA combustion to quantify thermal NOx emissions.

Table C4-2. Thermal NOx Emissions from Flare

Parameter	Value
Current Natural Gas Usage Limit for Flare (MMscf/yr)	7.86
Post-Project Maximum Natural Gas Usage at Flare (MMscf/yr) [a]	17.69
Post-Project Heat Input from Natural Gas Usage at Flare (MMBtu/yr) [b]	18,216
Post-Project Methanol Vented to Flare (lb/yr) [c]	466,000
Post-Project Methanol Vented to Flare (MMBtu/yr) [d]	4,567
Post-Project TMA Vented to Flare (lb/yr) [e]	365,202
Post-Project TMA Vented to Flare (MMBtu/yr) [f]	5,963
Total Heat Input to Flare (MMBtu/yr) [i]	28,746
Emission Factor for Thermal NO_x Emissions from Flare (lb/MMBtu) [j]	0.0641
Thermal NO_x Emissions from Flare (lb/yr)	1,843
Thermal NO_x Emissions from Flare	**0.92**

[a] Post-project maximum natural gas usage at the flare is calculated by assuming that the project will increase flare operation and associated gas usage by 125%. See Section C1 for the derivation of this production increase.

[b] Natural gas usage is converted from a volumetric basis to a heat input basis using a typical HHV of 1,030 Btu/scf.

[c] The post-project quantity of methanol controlled by the flare is based on the proposed methanol emission limit for the flare (2.33 tons/yr) and an assumed 99% control efficiency for methanol, per TNRCC's guidance document (RG-109, October 2000) for compounds containing no more than 3 carbons including methanol).

[d] The quantity of methanol controlled by the flare is converted from a mass basis to a heat input basis using a typical HHV for methanol (9,800 Btu/lb).

[e] The post-project quantity of TMA controlled by the flare is based on the previous permit limit for TMA emissions from the flare, adjusted to account for the proposed increase in TMAC production, and using an assumed 98% control efficiency for TMA per TNRCC's guidance document (RG-109, October 2000).

[f] The quantity of TMA controlled by the flare is converted from a mass basis to a heat input basis using a representative heating value for TMA from Yaws' Critical Property Data for Chemical Engineers and Chemists (16,329 Btu/lb).

[i] The total heat input to the flare accounts for the combined impacts of natural gas, vented methanol, and vented TMA. Other organic compounds are assumed to have a negligible impact on emissions.

[j] The vent gas routed to MLI's flare has a typical heating value of approximately 350 Btu/scf (2013 flare inlet testing showed a heating value of 371 Btu/scf). According to TNRCC's flare guidance (RG-109, October 2000), the threshold for low Btu/high Btu vents is 1,000 Btu/scf. Therefore, it is appropriate to use the low Btu emission factors to represent emissions from MLI's existing flare. Specifically, the thermal NOx emission factor from TNRCC's guidance document for a "low Btu" vent stream combusted in a non-steam-assisted flare is used.

VOC and Methanol Emission Calculations:

> The proposed VOC and methanol limits for the flare are based on the results of flare inlet testing conducted in 2013. These results are adjusted based on the flare's estimated control efficiency for various compounds and scaled to account for process variability and project-related production increases.

> The 2013 inlet test data corresponds to the use of propane as supplemental fuel to the flare. Propane is regulated as a VOC. Since this testing, MLI has transitioned to primarily using natural gas as supplemental fuel to the flare. The primary constituents of natural gas are methane and ethane, which are not regulated as VOC according to 40 CFR 51.100(s). However, MLI wishes to retain the ability to use propane at the flare as a back-up to the primary fuel. As such, worst-case emissions of propane based on the 2013 flare inlet testing have been included in the following emission projections.

Table C4-3. VOC and Methanol Emissions from Flare

Parameter	Value
Misc. VOC Inlet to Flare (no methanol or propane), 2013 Test Data (lb/hr) [a]	12.13
Flare Control Efficiency for Misc. VOC [b]	98%
Controlled Misc. VOC Emissions from Flare, 2013 Test Data (lb/hr)	0.24
Methanol Inlet to Flare, 2013 Test Data (lb/hr) [c]	7.35
Flare Control Efficiency for Methanol [d]	99%
Controlled Methanol Emissions from Flare, Adjusted 2013 Test Data (lb/hr)	0.07
Propane Inlet to Flare, 2013 Test Data (lb/hr) [e]	9.22
Flare Control Efficiency for Propane [f]	99%
Controlled Propane Emissions from Flare, 2013 Test Data (lb/hr)	0.09
Controlled VOC Emissions from Flare, Adjusted 2013 Test Data (lb/hr) [g]	0.41
TMAC Production Rate, 2013 Test Data (kg/hr) [h]	1,383.6
Multiplier to Adjust 2013 Test Data to Post-Project Production Rate [i]	2.33
Safety Factor to Account for Process Variability - Methanol Vents [j]	300%
Post-Project Controlled Methanol Emissions from Flare (tpy) [k]	**2.25**
Safety Factor to Account for Process Variability - VOC Vents [l]	200%
VOC Emission Factor for Natural Gas Combustion at Flare (lb/MMBtu) [m]	0.0054
Post-Project Controlled VOC Emissions from Flare (tpy) [n]	**8.41**

[a] The quantity of VOC routed to the flare for emissions control is based on the results of flare inlet testing conducted by Horizon Engineering (test report dated April 16, 2013). This quantity represents the sum of speciated VOCs, not including methanol or propane. Methanol and propane are each presented as a distinct line item in this analysis, as the estimated flare control efficiency differs for methanol/propane and other miscellaneous VOC.

[b] According to Table 4 of TNRCC's flare guidance (RG-109, October 2000), the estimated generic DRE for miscellaneous organic compounds is 98%.

[c] This value is based on the results of flare inlet testing conducted by Horizon Engineering (test report dated April 16, 2013).

[d] According to Table 4 of TNRCC's flare guidance (RG-109, October 2000), the estimated destruction/removal efficiency (DRE) for compounds such as methanol is 99%. This represents an adjustment from the 2013 test report, which applied a control efficiency of 98% to calculate post-flare methanol emissions.

[e] This value is based on the results of flare inlet testing conducted by Horizon Engineering (test report dated April 16, 2013).

[f] According to Table 4 of TNRCC's flare guidance (RG-109, October 2000), the estimated destruction/removal efficiency (DRE) for compounds such as propane is 99%.

[g] The controlled VOC emission rate represents the sum of controlled misc. VOC, controlled methanol, and controlled propane. This emission rate corresponds to the TMAC production rate associated with the 2013 flare inlet testing.

[h] This represents the TMAC production rate associated with flare inlet testing conducted by Horizon Engineering (test report dated April 16, 2013).

[i] The multiplier represents the difference between the proposed post-project TMAC production rate (3,224 kg/hr) and the production rate associated with the 2013 flare inlet testing.

[j] This safety factor is applied to the calculation of post-project emissions to account for variability in the methanol content and venting rate of the vent stream.

[k] Post-project methanol emissions apply a 99% DRE to the 2013 flare inlet testing, scale the resulting emissions by the proposed production rate, and apply a safety factor to account for variability in the methanol venting rate/concentration from the TMAC process.

[l] This safety factor is applied to the calculation of post-project emissions to account for variability in the VOC content and venting rate of the vent stream.

[m] In addition to VOC vents that pass through the flare (2% of misc. VOC, 1% of methanol and propane), the combustion of natural gas at the flare may generate VOC emissions. These emissions are estimated using the AP-42 for natural gas combustion (Table 1.4-2).

[n] Post-project VOC emissions apply a representative DRE to the 2013 flare inlet test data, scale the resulting emissions by the proposed production rate, and apply a safety factor to account for variability in the VOC venting rate/concentration from the TMAC process. This emission rate also accounts for VOC generated by the combustion of hydrocarbons at the flare.

Other Criteria Pollutant and TAP Emission Calculations:

> Emissions of other criteria pollutants and TAPs from the flare associated with combustion are estimated using the total heat input to the flare (see Table C4-2) and appropriate emission factors.

Table C4-4. Other Pollutant Emissions from Flare

Pollutant	Emission Factor (lb/MMBtu)	Annual Emission Rate (tpy) [f]
Criteria [a]		
PM (filterable)	0.0018	0.027
PM_{10}	0.0074	0.106
$PM_{2.5}$	0.0074	0.106
SO_2	0.0006	0.008
CO [b]	0.5496	7.899
TAPs [c]		
Benzene	1.56E-04	2.24E-03
Formaldehyde	1.15E-03	1.65E-02
Naphthalene	1.08E-05	1.55E-04
Acetaldehyde	4.22E-05	6.06E-04
Acrolein	9.80E-06	1.41E-04
Propylene	2.39E-03	3.44E-02
Toluene	5.69E-05	8.17E-04
Xylene	2.84E-05	4.09E-04
Ethylbenzene	1.42E-03	2.03E-02
Hexane	2.84E-05	4.09E-04
n,n-Dimethylformamide [d]	--	4.04E-03
GHGs (as CO_2e) [e]	--	1,683

CO_2	1.17E+02	1,681
N_2O	2.20E-04	0.003
CH_4	2.20E-03	0.032

[a] Unless otherwise noted, criteria pollutant emission factors for natural gas combustion are obtained from Tables 1.4-1 and 1.4-2, AP-42 Chapter 1.4, Natural Gas Combustion. These factors are converted from a lb/MMscf basis to a lb/MMBtu basis using the heating value of natural gas (1,020 Btu/scf). PM emissions represent filterable PM only, while PM10 and PM2.5 emissions include both filterable and condensable PM emissions of the associated size.

[b] The CO emission factor from TNRCC's flare guidance (RG-109, October 2000) for a "low Btu" vent stream combusted in a non-steam-assisted flare is used.

[c] Unless otherwise noted, TAP emissions are based on the flare emission factors obtained from the Ventura County Air Pollution Control District's AB 2588 Combustion Emission Factors document, dated May 17, 2001. These factors are adjusted from a lb/MMscf basis to a lb/MMBtu basis using an assumed HHV for natural gas of 1,020 Btu/scf.

[d] The calculation of n,n-Dimethylformamide emissions is based on the 2013 flare inlet testing average result (0.0099 lb/hr), adjusted by the assumed flare control efficiency for miscellaneous VOC (98%), scaled to account for the proposed production increase (2.33x), further scaled to account for vent stream variability (450%), and annualized assuming continuous operations.

[e] The GHG emission factors are obtained from 40 CFR 98 Subpart C, Tables C-1 and C-2, and converted to values in lb/MMBtu. The CO2 equivalent (CO2e) emission rate is calculated using the Global Warming Potentials (GWP) provided in Table A-1 of 40 CFR 98.

[f] Annual emissions are estimated by scaling the pollutant-specific emission factor (in terms of lb/MMBtu) by the total annual heat input to the flare, as calculated in Table C4-2.

Flare Emissions Summary:

> The following table summarizes the emission calculations presented in Tables C4-1 through C4-4.

Table C4-5. Flare Emissions Summary

Pollutant	Short-Term Emissions (lb/hr) [a]	Annual Emissions (tpy) [b]
Criteria		
PM (filterable)	0.006	0.027
PM_{10}	0.024	0.106
$PM_{2.5}$	0.024	0.106
SO_2	0.002	0.008
NO_x [c]	5.208	22.81
VOC	1.920	8.41
CO	1.803	7.899
TAPs		
Benzene	5.12E-04	2.24E-03
Formaldehyde	3.76E-03	1.65E-02
Naphthalene	3.54E-05	1.55E-04
Acetaldehyde	1.38E-04	6.06E-04
Acrolein	3.22E-05	1.41E-04
Propylene	7.85E-03	3.44E-02
Toluene	1.87E-04	8.17E-04
Xylene	9.33E-05	4.09E-04
Ethylbenzene	4.65E-03	2.03E-02
Hexane	9.33E-05	4.09E-04
n,n-Dimethylformamide	9.23E-04	4.04E-03
Methanol	0.514	2.25
GHGs (as CO_2e)	384.3	1,683
CO_2	383.9	1,681
N_2O	0.001	0.003
CH_4	0.007	0.032

[a] Short-term (hourly) emission rates are calculated from the flare's annual emission rates and assuming the flare operates 8,760 hours per year.

[b] Detailed calculations for the annual emission rates are presented in Tables C4-1 through C4-4, and summarized in this table.

[c] Total NOx emissions from flare accounts for both thermal NOx formation and the NOx forming from the nitrogen molecule in TMA (i.e., "fuel-bound NOx").

Section C5. Emissions Increases from Copper Purification Facility Upgrade

> MLI is proposing upgrades to its Copper Purification Facility to increase potential production of the copper electrolyte and to improve emissions control.

> The existing approval order identifies 8 reactors, 19 crystallizers and 7 evaporators. Following the proposed upgrades, the Copper Manufacturing Facility will consist of 6 reactors supported by 30 crystallizers and 8 evaporators. The reactors and evaporators generate air emissions from the copper purification process, but the crystallizers do not represent sources of air emissions.

> Emissions generated from the copper purification operations are collected by two sets of duct-work, each of which is directed to a dedicated scrubber. Specifically, emissions from the purification reactors are directed to the AAT Model 8V-ME-PP Orion scrubber located inside of building PB-97, while emissions from the evaporators are directed to the upgraded Harrington Model ECV 3 3-5 LV scrubber located outside of building PB-97. Control efficiencies associated with the scrubber systems are enhanced by the operation of a chevron-style pre-mist eliminator unit prior to each scrubber. Further detail on the operation of these scrubbers is provided in the NOC application.

> Approval Order No. 18AQ-E042 specifies that the Copper Purification Facility is exempt from NSR. As such, controlled pre-project emissions of TAPs from each area scrubber are conservatively assumed to be equal to the corresponding de minimis thresholds established by WAC 173-460-150. To calculate emissions following the upgrade project, MLI is scaling the controlled pre-project emissions for each TAP by the project-related production multiplier, which is calculated as follows.

> Improved steam utility availability and chiller capacity will allow an increase in the potential number of reactions per week from a current nominal rate of 17 or 18 to an anticipated nominal rate of 58. This nominal rate of 58 reaction cycles per week represents a monthly average. MLI anticipates that no single week will exceed 64 reaction cycles. For conservatism, these project-related emissions increase calculations assume that the current nominal rate is 17 reactions per week, which corresponds to a production multiplier of 3.4 for the planned upgrade project: 58 reactions per week (monthly average)/17 reactions per week = 3.4 multiplier.

Production Multiplier:

Pre-Project Reaction Cycles per Week:	*17*
Post-Project Reaction Cycles per Week:	*58*
Project-Related Production Multiplier	*3.4*

> The following calculations estimate copper sulfate and sulfuric acid emissions from the copper purification process. In the copper purification facility environment, MLI expects these compounds to be present as ions in solution, rather than as molecules in the exhaust. Furthermore, given the pH of the process, MLI does not anticipate that vents from the associated scrubbers will contain appreciable quantities of sodium hydroxide or sodium sulfate. In fact, non-copper sulfates present in this process would likely be in the form of sodium bisulfate, which is not regulated as a TAP under WAC 173-460.

Table C5-1. Copper Compound Emissions from Copper Purification Area

Emission Point	Pre-Project Hourly Emissions[a]		Post-Project Hourly Emissions[b]		Post-Project Annual Emissions[c]		Project-Related Emission Increases[d]	
	Rate	Units	Rate	Units	Rate	Units	Rate	Units
Reactor Scrubber	0.011	lb $CuSO_4$/hr	0.038	lb $CuSO_4$/hr	328.8	lb $CuSO_4$/yr	232.4	lb $CuSO_4$/yr
Evaporator Scrubber	0.011	lb $CuSO_4$/hr	0.038	lb $CuSO_4$/hr	328.8	lb $CuSO_4$/yr	232.4	lb $CuSO_4$/yr
Totals	***0.022***	***lb $CuSO_4$/hr***	***0.075***	***lb $CuSO_4$/hr***	***657.5***	***lb $CuSO_4$/yr***	***464.8***	***lb $CuSO_4$/yr***

[a] Based on the Copper Purification Area's current designation as an NSR-exempt process area, MLI is conservatively using the de minimis threshold for each TAP to represent pre-project emissions from each scrubber in this area. Copper sulfate emissions from the Copper Purification Area are subject to the TAP thresholds for "Copper & Compounds". These emissions are expressed on an "as emitted" basis for conservatism.

[b] Post-project hourly emissions are calculated by scaling pre-project emissions by the production multiplier.

[c] Post-project annual emissions are calculated from post-project hourly emissions assuming 8,760 hours per year of operation.

[d] Project-related emission increases represent the difference between pre- and post-project emissions on an annual basis.

Table C5-2. Sulfuric Acid Emissions from Copper Purification Area[a]

Emission Point	Pre-Project Hourly Emissions		Post-Project Hourly Emissions		Post-Project Annual Emissions		Project-Related Emission Increases	
	Rate	Units	Rate	Units	Rate	Units	Rate	Units
Reactor Scrubber	0.0003	lb H_2SO_4/hr	0.0028	lb H_2SO_4/hr	24.54	lb H_2SO_4/yr	22.15	lb H_2SO_4/yr
Evaporator Scrubber	0.0003	lb H_2SO_4/hr	0.0014	lb H_2SO_4/hr	12.27	lb H_2SO_4/yr	9.87	lb H_2SO_4/yr
Totals	***0.0005***	***lb H_2SO_4/hr***	***0.0042***	***lb H_2SO_4/hr***	***36.82***	***lb H_2SO_4/yr***	***32.02***	***lb H_2SO_4/yr***

[a] The same methodology described in the footnotes to Table C5-1 is also used to estimate sulfuric acid emissions increases in this table; however, based on internal sampling data, MLI has scaled the resulting estimates by an additional factor of 3 to account for potential process variability.

Section C6. TAPs Screening

> WAC 173-460-070 requires a NOC application to demonstrate that project-related increases in TAP emissions "are sufficiently low to protect human health and safety from potential carcinogenic and/or other toxic effects." MLI is satisfying this requirement by completing a First Tier Review of TAP emissions in accordance with WAC 173-460-080.

> According to WAC 173-460-080, a NOC application must include an Acceptable Source Impact Level (ASIL) analysis for each TAP emitted by the new or modified emission units with an emission increase greater than the de minimis emission level. The ASIL requirement can be satisfied for any TAP using either dispersion modeling (i.e., by demonstrating that the modeled ambient impact of the aggregate emissions increase of each TAP does not exceed the corresponding ASIL) or a Small Quantity Emission Rate (SQER) evaluation (i.e., by showing that the proposed increase in emissions of a TAP is less than the corresponding SQER).

> Project-related emission increases associated with both the TMAC Product Quality/Emissions Upgrade project (accounted for in Approval No. 18AQ-E042) as well as the currently proposed TMAC Line #3 Expansion Project and Copper Purification Facility Upgrade are evaluated in this TAPs screening.

> The following table compares project emissions increases to the corresponding TAP thresholds established by WAC 173-460-150. As demonstrated by this table, only project-related NO_2 emissions exceed the SQER and trigger dispersion modeling requirements.

Table C6-1. HAPs/TAPs Emission Summary

				Emissions[a]						
Pollutant	CAS Number	HAP?	TAP?	Maximum Hourly TAPs (lb/hr)	Annual TAPs (tpy)	Averaging Period	ASIL ($\mu g/m^3$)	SQER (lb/avg. period)	De Minimis (lb/avg. period)	Modeling Required?
Benzene	71-43-2	Yes	Yes	6.06E-04	2.65E-03	year	0.0345	6.62	0.331	No
Formaldehyde	50-00-0	Yes	Yes	3.96E-03	0.02	year	0.167	32	1.6	**Yes**
Naphthalene	91-20-3	Yes	Yes	4.03E-05	1.76E-04	year	0.0294	5.64	0.282	No
Acetaldehyde	75-07-0	Yes	Yes	1.89E-04	8.26E-04	year	0.37	71	3.55	De Minimis
Acrolein	107-02-8	Yes	Yes	7.59E-05	3.33E-04	24-hr	0.06	0.00789	0.000394	No
Propylene	115-07-1	No	Yes	0.02	0.07	24-hr	3000	394	19.7	De Minimis
Toluene	108-88-3	Yes	Yes	6.16E-04	2.70E-03	24-hr	5000	657	32.9	De Minimis
Xylene[b]	108-38-3	Yes	Yes	4.13E-04	1.81E-03	24-hr	221	29	1.45	De Minimis
Ethylbenzene	100-41-4	Yes	Yes	4.76E-03	0.02	year	0.4	76.8	3.84	No
Hexane[c]	110-54-3	Yes	Yes	1.68E-04	7.35E-04	24-hr	700	92	4.6	De Minimis
n,n-Dimethylformamide	68-12-2	Yes	Yes	9.23E-04	4.04E-03	24-hr	80	10.5	0.526	De Minimis
Methanol	67-56-1	Yes	Yes	1.96	8.59	24-hr	4000	526	26.3	No
SO_2	7446-09-05	No	Yes	1.16E-02	0.05	1-hr	660	1.45	0.457	De Minimis
NO_2[d]	10102-44-0	No	Yes	7.43	32.55	1-hr	470	1.03	0.457	**Yes**
CO	630-08-0	No	Yes	3.01	13.19	1-hr	23000	50.4	1.14	No
Copper and Compounds[e]	--	No	Yes	0.05	0.23	1-hr	100	0.219	0.011	No
Sulfuric Acid	7664-93-9	No	Yes	3.66E-03	0.016	24-hr	1	0.131	0.00657	No

[a] The worst-case TAP emission rates used as the basis for this TAPs screening evaluation represent:
> The greater emission rates from the combustion of either natural gas or co-product methanol in Boiler #2 (without restricting the amount of methanol used in the boiler);
> Total post-project flare emissions from the TMAC facility (while the TAPs screening is typically based on project-related emission increases, this evaluation considers total post-project emissions for conservatism);
> Total post-project fugitive emissions from the TMAC facility (while the TAPs screening is typically based on project-related emission increases, this evaluation considers total post-project emissions for conservatism); and
> Project-related emission increases from the Copper Purification Facility upgrade project.

[b] For conservatism, it is assumed that all xylene is in the form of m-xylene (WAC 173-460 establishes identical thresholds for m-, o-, and p-xylene).

[c] For conservatism, it is assumed that all hexane is in the form of n-hexane.

[d] It is conservatively assumed that all NO_X is emitted in the form of NO_2.

APPENDIX D: BACT COST CALCULATIONS

Data Inputs

Enter the following data for your combustion unit:

Is the combustion unit a utility or industrial boiler? Industrial

Is the SCR for a new boiler or retrofit of an existing boiler? New Construction

What type of fuel does the unit burn? Natural Gas

Complete all of the highlighted data fields:

What is the maximum heat input rate (QB)?	16.70 MMBtu/hour
What is the higher heating value (HHV) of the fuel?	1,030 Btu/scf

*HHV value of 1030 Btu/scf is a default value. See below for data source. Enter actual HHV for fuel burned, if known.

What is the estimated actual annual fuel consumption?	142,000,757 scf/Year
Enter the net plant heat input rate (NPHR)	8.2 MMBtu/MW

If the NPHR is not known, use the default NPHR value:

Fuel Type	Default NPHR
Coal	10 MMBtu/MW
Fuel Oil	11 MMBtu/MW
Natural Gas	8.2 MMBtu/MW

Plant Elevation	1070 Feet above sea level

Not applicable to units burning fuel oil or natural gas

Type of coal burned: Not Applicable

Enter the sulfur content (%S) = percent by weight

Not applicable to units buring fuel oil or natural gas

Note: The table below is pre-populated with default values for HHV and %S. Please enter the actual values for these parameters in the table below. If the actual value for any parameter is not known, you may use the default values provided.

	Fraction in Coal Blend	%S	HHV (Btu/lb)
Bituminous	0	2.35	11,814
Sub-Bituminous	0	0.31	8,730
Lignite	0	0.91	6,534

Please click the calculate button to calculate weighted values based on the data in the table above.

For coal-fired boilers, you may use either Method 1 or Method 2 to calculate the catalyst replacement cost. The equations for both methods are shown on rows 85 and 86 on the ***Cost Estimate*** tab. Please select your preferred method:

- ○ Method 1
- ○ Method 2
- ● Not applicable

Enter the following design parameters for the proposed SCR:

Number of days the SCR operates (t_{SCR})	365 days
Number of days the boiler operates (t_{plant})	365 days
Number of SCR reactor chambers (n_{scr})	1
Number of catalyst layers (R_{layer})	3

Inlet NO_x Emissions (NOx_{in}) to SCR	0.13 lb/MMBtu
NOx Removal Efficiency (EF) provided by vendor	90 percent
Stoichiometric Ratio Factor (SRF)	0.525

*The SRF value of 0.525 is a default value. User should enter actual value, if known.

Number of empty catalyst layers (R_{empty})	1
Ammonia Slip (Slip) provided by vendor	2 ppm
Volume of the catalyst layers ($Vol_{catalyst}$) (Enter "UNK" if value is not known)	UNK Cubic feet
Flue gas flow rate ($Q_{fluegas}$) (Enter "UNK" if value is not known)	UNK acfm

Estimated operating life of the catalyst ($H_{catalyst}$)	24,000 hours
Estimated SCR equipment life	25 Years*

* For industrial boilers, the typical equipment life is between 20 and 25 years.

Gas temperature at the SCR inlet (T)	417 ^oF
Base case fuel gas volumetric flow rate factor (Q_{fuel})	484 ft^3/min-MMBtu/hour

Concentration of reagent as stored (C_{stored})	50 percent*
Density of reagent as stored (ρ_{stored})	71 lb/cubic feet*
Number of days reagent is stored ($t_{storage}$)	14 days

*The reagent concentration of 50% and density of 71 lbs/cft are default values for urea reagent. User should enter actual values for reagent, if different from the default values provided.

Densities of typical SCR reagents:	
50% urea solution	71 lbs/ft^3
29.4% aqueous NH_3	56 lbs/ft^3
19% aqueous NH_3	58 lbs/ft^3

Select the reagent used: Urea

Enter the cost data for the proposed SCR:

Desired dollar-year	2017		
CEPCI for 2017	567.5 Enter the CEPCI value for 2017	584.6 2012 CEPCI	CEPCI = Chemical Engineering Plant Cost Index
Annual Interest Rate (i)	7 Percent		
Reagent ($Cost_{reag}$)	1.62 $/gallon for a 50 percent solution of urea		
Electricity ($Cost_{elect}$)	0.0328 $/kWh		
Catalyst cost ($CC_{replace}$)	160.00 $/cubic foot (includes removal and disposal/regeneration of existing catalyst and installation of new catalyst*		* $160/cf is a default value for the catalyst cost. User should enter actual value, if known.
Operator Labor Rate	60.00 $/hour (including benefits)*		* $60/hour is a default value for the operator labor rate. User should enter actual value, if known.
Operator Hours/Day	4.00 hours/day*		* 4 hours/day is a default value for the operator labor. User should enter actual value, if known.

Note: The use of CEPCI in this spreadsheet is not an endorsement of the index, but is there merely to allow for availability of a well-known cost index to spreadsheet users. Use of other well-known cost indexes (e.g., M&S) is acceptable.

Maintenance and Administrative Charges Cost Factors:

Maintenance Cost Factor (MCF) =	0.005
Administrative Charges Factor (ACF) =	0.03

Data Sources for Default Values Used in Calculations:

Data Element	Default Value	Sources for Default Value	If you used your own site-specific values, please enter the value used and the reference source . . .
Reagent Cost ($/gallon)	1.62	Based on the average of vendor quotes from 2011 - 2013.	
Electricity Cost ($/kWh)	0.071	Average annual electricity cost for utilities is based on 2014 electricity production cost data for fossil-fuel plants compiled by the U.S. Energy Information (EIA). Available at http://www.eia.gov/tools/faqs/faq.cfm?id=19&t=3.	
Percent sulfur content for Coal (% weight)	2.35	Average sulfur content based on U.S. coal data for 2014 compiled by the U.S. Energy Information Administration (EIA) from data reported on EIA Form EIA-923, Power Plant Operations Report. Available at http://www.eia.gov/electricity/data/eia923/.	
Higher Heating Value (HHV) (Btu/lb)	1,030	2014 natural gas data compiled by the Office of Oil, Gas, and Coal Supply Statistics, U.S. Energy Information Administration (EIA) from data reported on EIA Form EIA-923, Power Plant Operations Report. Available at http://www.eia.gov/electricity/data/eia923/.	
Catalyst Cost ($/cubic foot)	160	Cichanowicz, J.E. "Current Capital Cost and Cost-Effectiveness of Power Plant Emissions Control Technologies", July 2013.	

Design Information and Assumptions for Heating Exhaust Stream to Required SCR Temperature

Boiler #2 (16.7 MMBtu/hr) - NOx Emissions Profile and Exhaust Gas Conditions

Parameter	Parameter Per Reheater	Units	Reference/Notes
Maximum Heat Input Capacity	16.7	MMBtu/hr	Heat input capacity from Cole Industrial quote dated 6/20/2018
Maximum Annual Gas Usage Rate	142.0	MMscf/yr	Proposed operating constraint
High Heating Value of Natural Gas at Plant	1,030	Btu/scf	Default value used by EPA's SCR cost template spreadsheet
Inlet Temperature	417	^oF	Average stack temperature for existing boiler firing methanol fuel stream (per 2017 source test)
Stack Gas Dry Standard Volumetric Flow Rate, at 68^oF	2,772	dscfm	The exhaust flow rate is calculated as the product of the boiler's rated heat input capacity and the applicable F-factor (8,710 dscf/MMBtu). This flow rate is assumed to represent both natural gas and methanol combustion, and corresponds to 0% O2. This flow rate is converted to a 3% O2 basis to better represent the stream that would be routed to a SCR system.
NOx Emission Factor (firing methanol)	0.133	lb/MMBtu	The emissions guarantee for NOx exhaust concentrations (112 ppmvd) from the methanol-fired boiler equipped with the base FGR system was provided by Cole Industrial, the vendor for the proposed boiler. This concentration was converted from a ppmvd @ 3% O2 basis to a lb/MMBtu basis using these vendor guaranteed concentrations, the exhaust flowrate and heat input capacity of the proposed boiler, and the ideal gas law.
Maximum Portion of Year Boiler Will Operate on Methanol Fuel Stream	100%	percent	MLI is proposing to revise the operational limit established by Approval Order No. 18AQ-E042, which currently corresponds to a 50% annual capacity factor for methanol. This application is requesting that the limit be updated to allow MLI to fire the boiler continuously on methanol throughout the year (or that the limit simply be removed from the permit)
NOx Emission Factor (firing natural gas)	0.036	lb/MMBtu	The emissions guarantee for NOx exhaust concentrations (30 ppmvd) from the natural gas-fired boiler equipped with the base FGR system was provided by Cole Industrial, the vendor for the proposed boiler. This concentration was converted from a ppmvd @ 3% O2 basis to a lb/MMBtu basis using these vendor guaranteed concentrations, the exhaust flowrate and heat input capacity of the proposed boiler, and the ideal gas law.
Maximum Annual NOx Emission Rate	9.74	tpy	Calculated using the NOx EFs and capacity of boiler; assuming continuous annual operations on methanol at the boiler's capacity.
Maximum Hourly NOx Emission Rate	2.22	lb/hr	Calculated from NOx EF for methanol combustion (for conservatism) and capacity of boiler.

Preheater Design Basis

Parameter	Parameter Per Reheater	Units	Reference/Notes
Exhaust Flow Rate, Mass Basis	12,473	lb/hr	Dry standard volumetric flow rate converted to mass basis using standard molar volume of an ideal gas and molecular weight of air
Desired Exhaust Stream Temperature (going to SCR)	700	^oF	Optimal Temperature for SCR Operation
Mean Heat Capacity of Exhaust Stream	0.255	Btu/(lb-^oF)	EPA's CCM Section 3.2 Chapter 2, page 2-26; represents the mean heat capacity of air between 77F and 1375F (the average temperature of the waste gas entering and leaving the preheater)
Heat Required to Increase Exhaust Temperature	72	Btu/lb	Calculation of heat required to raise one pound of exhaust gas from exhaust temperature (417 F) to desired temperature for SCR (700 F)
Preheater Size Requirement (No Energy Recovery)	0.90	MMBtu/hr	Calculation of heat required to increase exhaust gas temperature to desired level; no energy recovery
Energy Recovery Rate	0.70	--	EPA's CCM Section 3.2 Chapter 2, page 2-8; represents maximum energy recovery accomplished by recuperative incinerator
Preheater Size Requirement (with Energy Recovery)	0.27	MMBtu/hr	Calculation of preheater size required to increase exhaust gas temperature to desired level; accounting for maximum energy recovery rate
Natural Gas Usage (with Energy Recovery)	4.37	acfm	Calculation of natural gas usage to increase exhaust gas temperature to desired value for SCR reaction, based on Preheater size requirement and HHV of natural gas
Natural Gas Usage (Annual)	2.30	MMcf/yr	Calculation of annual natural gas usage required to increase exhaust gas temperature to desired level; accounting for maximum energy recovery rate
Natural Gas Cost for Preheating	$ 17,454	$	Cost estimate for natural gas required for preheating based on annual usage and natural gas cost per Mcf
NOx Emissions from Natural Gas Usage for Preheating	0.01	lb/hr	Calculation based on Preheater size requirement and NOx EF from AP-42 Chapter 1.4 for external combustion sources with low NOx burners

Constants and Unit Conversions

Constants	Value	Units	Reference/Notes
Standard Molar Volume	386	scf/lbmol	
Molecular Weight of Dry Air	28.95	lb/lbmol	Molecular weight calculated for dry air based on 77.9% N2, 20.9% O2, and 0.9% Ar
Conversions	**Value**	**Units**	**Reference/Notes**
Minutes per Hour	60	min/hr	
Hours per Year	8,760	hr/yr	
Days per Year	365	days/yr	
Utility Costs, Employee Wages			
Natural Gas Price	$7.6	per Mcf	Most recent natural gas pricing data available for WA (March 2018), per https://www.eia.gov/dnav/ng/hist/n3035wa3M.htm
Chemical Engineering Plant Cost Indices			
2017	567.5	--	2017 cost index used since 2018 annual index not yet available

SCR Design Parameters

The following design parameters for the SCR were calculated based on the values entered on the *Data Inputs* tab. These values were used to prepare the costs shown on the *Cost Estimate* tab.

Parameter	Equation	Calculated Value	Units	
Maximum Annual Heat Input Rate (Q_B) =	HHV x Max. Fuel Rate =	16.7	MMBtu/hour	
Maximum Annual fuel consumption (mfuel) =	(QB x 1.0E6 x 8760)/HHV =	142,000,757	scf/Year	
Actual Annual fuel consumption (Mactual) =		142,000,757	scf/Year	
Heat Rate Factor (HRF) =	NPHR/10 =	0.82		
Total System Capacity Factor (CF_{total}) =	(Mactual/Mfuel) x (tscr/tplant) =	1.00	fraction	
Total operating time for the SCR (t_{op}) =	CF_{total} x 8760 =	8760	hours	
NOx Removal Efficiency (EF) =	(NOxin- NOxout)/NOxin =	90.0	percent	
NOx removed per hour =	NOx_{in} x EF x Q_B =	2.00	lb/hour	
Total NO_x removed per year =	(NOx_{in} x EF x Q_B x t_{op})/2000 =	8.77	tons/year	
NOx removal factor (NRF) =	EF/80	1.13		
Volumetric flue gas flow rate ($q_{flue\ gas}$) =	Q_{fuel} x QB x (460 + T)/(460 + 700)n_{scr}	6,110	acfm	
Space velocity (V_{space}) =	$q_{flue\ gas}/Vol_{catalyst}$	29.69	/hour	
Residence Time	$1/V_{space}$	0.03	hour	
Coal Factor (CoalF) =	1 for oil and natural gas; 1 for bituminous; 1.05 for sub-bituminous; 1.07 for lignite (weighted average is used for coal blends)	1.00		
SO_2 Emission rate =	(%S/100)x(64/32)*1E6)/HHV =			Not applicable; factor applies only to coal-fired boilers
Elevation Factor (ELEVF) =	14.7 psia/P =	1.04		
Atmospheric pressure at sea level (P) =	2116x[(59-(0.00356xh)+459.7)/518.6]$^{5.256}$ x (1/144)* =	14.2	psia	
Retrofit Factor (RF)	New Construction	0.80		

* Equation is from the National Aeronautics and Space Administration (NASA), Earth Atmosphere Model. Available at https://spaceflightsystems.grc.nasa.gov/education/rocket/atmos.html.

Catalyst Data:

Parameter	Equation	Calculated Value	Units
Future worth factor (FWF) =	(interest rate)(1/((1+ interest rate)^Y -1) , where Y = $H_{catalyts}/(t_{SCR}$ x 24 hours) rounded to the nearest integer	0.311	Fraction
Catalyst volume ($Vol_{catalyst}$) =	2.81 x Q_B x EF $_{adj}$ x Slipadj x Noxadj x Sadj x (Tadj/Nscr)	205.78	Cubic feet

Cross sectional area of the catalyst ($A_{catalyst}$) =	$q_{flue\ gas}$ /(16ft/sec x 60 sec/min)	6	ft^2
Height of each catalyst layer (H_{layer}) =	$(Vol_{catalyst}/(R_{layer} \times A_{catalyst})) + 1$	12	feet

SCR Reactor Data:

Parameter	Equation	Calculated Value	Units
Cross sectional area of the reactor (A_{SCR}) =	1.15 x $A_{catalyst}$	7	ft^2
Reactor length and width dimentions for a square reactor =	$(A_{SCR})^{0.5}$	2.7	feet
Reactor height =	$(R_{layer} + R_{empty}) \times (7ft + h_{layer}) + 9ft$	84	feet

Reagent Data:

Type of reagent used	Urea	Molecular Weight of Reagent (MW) =	60.06 g/mole
		Density =	71 lb/ft^3

Parameter	Equation	Calculated Value	Units
Reagent consumption rate ($m_{reagent}$) =	$(NOx_{in} \times Q_B \times EF \times SFR \times MW_R)/MW_{NOx}$ =	1	lb/hour
Reagent Usage Rate (m_{sol}) =	$m_{reagent}$/Csol =	3	lb/hour
	(m_{sol} x 7.4805)/Reagent Density	0	gal/hour
Estimated tank volume for reagent storage =	(m_{sol} x 7.4805 x $t_{storage}$ x 24)/Reagent Density =	97	gallons (storage needed to store a 14 day reagent supply)

Capital Recovery Factor:

Parameter	Equation	Calculated Value
Capital Recovery Factor (CRF) =	$i (1+ i)^n/(1+ i)^n - 1$ = Where n = Equipment Life and i= Interest Rate	0.0858

Other parameters	Equation	Calculated Value	Units
Electricity Usage:			
Electricity Consumption (P) =	A x 1,000 x 0.0056 x $(CoalF \times HRF)^{0.43}$ = where A = (0.1 x QB) for industrial boilers.	8.59	kW

Cost Estimate

Total Capital Investment (TCI)

TCI for Oil and Natural Gas Boilers

For Oil and Natural Gas-Fired Utility Boilers between 25MW and 500 MW:

$$TCI = 80{,}000 \times (200/B_{MW})^{0.35} \times BMW \times ELEVF \times RF$$

For Oil and Natural Gas-Fired Utility Boilers >500 MW:

$$TCI = 60{,}670 \times B_{MW} \times ELEVF \times RF$$

For Oil-Fired Industrial Boilers between 275 and 5,500 MMBTU/hour :

$$TCI = 7{,}270 \times (2{,}200/Q_B)^{0.35} \times Q_B \times ELEVF \times RF$$

For Natural Gas-Fired Industrial Boilers between 205 and 4,100 MMBTU/hour :

$$TCI = 9{,}760 \times (1{,}640/Q_B)^{0.35} \times Q_B \times ELEVF \times RF$$

For Oil-Fired Industrial Boilers >5,500 MMBtu/hour:

$$TCI = 5{,}275 \times Q_B \times ELEVF \times RF$$

For Natural Gas-Fired Industrial Boilers >4,100 MMBtu/hour:

$$TCI = 7{,}082 \times Q_B \times ELEVF \times RF$$

Total Capital Investment (TCI) =	$654,782	in 2017 dollars

Annual Costs

Total Annual Cost (TAC)

TAC = Direct Annual Costs + Indirect Annual Costs

Direct Annual Costs (DAC) =	$13,256	in 2017 dollars
Indirect Annual Costs (IDAC) =	$58,854	in 2017 dollars
Total annual costs (TAC) = DAC + IDAC	$72,111	in 2017 dollars

Direct Annual Costs (DAC)

DAC = (Annual Maintenance Cost) + (Annual Reagent Cost) + (Annual Electricity Cost) + (Annual Catalyst Cost)

Annual Maintenance Cost =	0.005 x TCI =	$3,274	in 2017 dollars
Annual Reagent Cost =	$q_{sol} \times Cost_{reag} \times t_{op}$ =	$4,102	in 2017 dollars
Annual Electricity Cost =	$P \times Cost_{elect} \times t_{op}$ =	$2,467	in 2017 dollars
Annual Catalyst Replacement Cost =	$n_{scr} \times Vol_{cat} \times (CC_{replace}/R_{layer}) \times FWF$	$3,414	in 2017 dollars
Direct Annual Cost =		$13,256	in 2017 dollars

Indirect Annual Cost (IDAC)

IDAC = Administrative Charges + Capital Recovery Costs

Administrative Charges (AC) =	0.03 x (Operator Cost + 0.4 x Annual Maintenance Cost) =	$2,667	in 2017 dollars
Capital Recovery Costs (CR)=	CRF x TCI =	$56,187	in 2017 dollars
Indirect Annual Cost (IDAC) =	AC + CR =	$58,854	in 2017 dollars

Cost Effectiveness without Preheater

Cost Effectiveness (without Preheater) = Total Annual Cost (without Preheater)/ NOx Removed/year

Total Annual Cost (TAC) without preheater =	$72,111	per year in 2017 dollars
NOx Removed =	8.77	tons/year
Cost Effectiveness =	$8,226	per ton of NOx removed in 2017 dollars

Cost Effectiveness with Preheater

Cost Effectiveness (with Preheater) = Total Annual Cost (with Preheater)/ NOx Removed/year

Total Annual Cost (TAC) with preheater =	SCR TAC without preheater + Preheating Cost	$89,564	per year in 2017 dollars
NOx Removed =		8.77	tons/year
Cost Effectiveness =		$10,216	per ton of NOx removed in 2017 dollars

APPENDIX E: MODELING FILES AND RESULTS

Appendix E. AERSCREEN Inputs and Results

Table E-1. AERSCREEN Source Parameters

Source ID	Modeled Emission Rate (g/s)	Source Elevation [a] (m)	Stack Height [b] (m)	Stack Diameter [b] (m)	Exhaust Temperature [c] (K)	Exhaust Velocity (m/s)	Flow Rate [d] (dcfm)	Flow Rate [e] (acfm)	Distance to Fenceline [f] (m)	Heat Release Rate [g] cal/s	Radiative Heat Loss Fraction [h] (%)
Boiler	1	352.044	18.898	0.7112	487.04	4.78	2,424	4,027	62	--	--
Flare (Actual)	1	352.044	22.860	0.2540	922.04	--	561.7	1,767	105	--	--
Flare (Modeled)	1	352.044	22.860	--	--	--	--	--	105	875,812	55%

[a] Approximate source elevation of 1155 ft from Simplified Site Plan, 2017 Emissions Report, provided by MLI.

[b] Stack height and diameter for boiler provided by MLI on June 12, 2018 based on engineering design; parameters for flare based on current stack.

[c] Stack temperature for boiler based on average result for existing boiler while firing methanol (per 2017 source test); assumed to be conservative, given FGR design of new unit. Stack temperature for flare based on lower end of John Zink's estimate (1200F - 1500F).

[d] The boiler flow rate is based on the heat input capacity of the new 30 ppm NOx boiler at 100% firing rate, as provided in the Cole Industrial quote dated June 20, 2018. This heat input capacity is scaled by the F-factor for natural gas from EPA Method 19 (8,710 dscf/MMBtu) and converted to acfm based on the anticipated stack temperature. This calculation assumes the exhaust is at ambient pressure.
The flare flow rate is calculated using the 2013 inlet test data as a basis. The average inlet flow rate observed during the testing is scaled by its heating value, then the EPA Method 19 F-factor is applied to calculate the volumetric flow rate following combustion at the flare. For conservatism, this flow rate was not adjusted by moisture content or excess oxygen concentration.

[e] Assume dscfm is at: 68 F 20 C

[f] The shortest distance from the boiler stack to the fenceline was used, based on the two options provided by MLI on June 13, 2018. The distance from the flare to the property line is based on the current flare stack.

[g] The flare's heat release rate is calculated using the estimated flow rate and the heating value of the stream based on the 2013 inlet testing.

[h] The flare's radiative heat loss fraction is based on the conservative methodology prescribed by SCREEN3.

Table E-2. AERSCREEN Modeling Results - NO2 (TAP)

Source ID	Modeled Averaging Period	Modeled Concentration - Unit Emission Rate ($\mu g/m^3$)	Modeled Concentration - Scaled Emission Rate[a] ($\mu g/m^3$)	ASIL ($\mu g/m^3$)	In Compliance with ASIL?
Boiler	1-hour	42.75	11.98	470	Yes
Flare	1-hour	24.59	16.14	470	Yes
Total [b]	***1-hour***	**--**	***28.11***	***470***	***Yes***

[a] The modeled results for the unit emission rates (1 g/s) were scaled by the flare and new boiler's respective NO2 emission rates to assess compliance with the ASIL. For conservatism, all NOx is assumed to be NO2.

Boiler NO2 Emission Rate:	2.22	lb/hr
	0.28	g/s
Flare NO2 Emission Rate:	5.21	lb/hr
	0.66	g/s

[b] Total impacts conservatively sum the maximum impact from the flare and the maximum impact from the boiler for comparison to the ASIL.

Table E-3. AERSCREEN Modeling Results - Formaldehyde (TAP)

Source ID	Modeled Averaging Period	Modeled Concentration - Unit Emission Rate ($\mu g/m^3$)	Modeled Concentration - Scaled Emission Rate[a] ($\mu g/m^3$)	ASIL ($\mu g/m^3$)	In Compliance with ASIL?
Boiler	annual	4.275	0.0001	0.167	Yes
Flare	annual	2.459	0.0012	0.167	Yes
Total [b]	***annual***	**--**	***0.0013***	***0.167***	***Yes***

[a] The modeled results for the unit emission rates (1 g/s) were scaled by the flare and new boiler's respective formaldehyde emission rates to assess compliance with the ASIL.

Boiler Formaldehyde Emission Rate:	1.99E-04	lb/hr
	2.51E-05	g/s
Flare Formaldehyde Emission Rate:	3.76E-03	lb/hr
	4.74E-04	g/s

[b] Total impacts conservatively sum the maximum impact from the flare and the maximum impact from the boiler for comparison to the ASIL.

Pollutant	Modeled Averaging Period	Boiler Modeled Concentration - Unit Emission Rate (μg/m³)	Boiler Modeled Concentration - Scaled Emission Rate[a] (μg/m³)	Flare Modeled Concentration - Unit Emission Rate (μg/m³)	Flare Modeled Concentration - Scaled Emission Rate[b] (μg/m³)	Total Modeled Concentration[c] (μg/m³)	Representative Background[d] (μg/m³)	Total Impact (μg/m³)	NAAQS (μg/m³)	In Compliance with NAAQS?
NO2	1-hour	42.75	11.98	24.59	16.14	28.11	16.00	44.11	188	Yes
	annual	4.275	1.20	2.459	1.61	2.81	2.82	5.63	100	Yes
PM2.5	24-hour	25.65	0.40	14.76	0.05	0.44	14	14.44	35	Yes
	annual	4.275	0.07	2.459	0.01	0.07	5.3	5.37	12	Yes

[a] The boiler's modeled results for the unit emission rate (1 g/s) were scaled by the appropriate projected emission rate for the new boiler to assess compliance with the NAAQS.

NO2 Emission Rate:	2.22	lb/hr
	0.28	g/s
PM2.5 Emission Rate:	0.12	lb/hr
	0.02	g/s

[b] The flare's modeled results for the unit emission rate (1 g/s) were scaled by the appropriate projected emission rate for the post-project flare to assess compliance with the NAAQS.

NO2 Emission Rate:	5.21	lb/hr
	0.66	g/s
PM2.5 Emission Rate:	0.024	lb/hr
	0.003	g/s

[c] Total impacts conservatively sum the maximum impact from the flare and the maximum impact from the boiler for comparison to the corresponding NAAQS.

[d] Per Ecology's suggestion, as communicated in a July 26th email from Jenny Filipy (Ecology) to Pat Blau (MLI), the following website was used to determine representative background concentrations for NO2 and PM2.5: http://lar.wsu.edu/nw-airquest/lookup.html
These results are based on the following facility location, expressed in latitude/longitude: 47.2051947, -119.2909225
Background values expressed in ppb were converted to ug/m3 by multiplying the concentration in ppb by the molecular weight and then dividing the result by (0.02447*1000).

AERSCREEN 16216 / AERMOD 18081 06/21/18
15:47:43

TITLE: MLI BOILER

*************************** STACK PARAMETERS **************************

SOURCE EMISSION RATE:	1.0000 g/s	7.937 lb/hr
STACK HEIGHT:	18.90 meters	62.00 feet
STACK INNER DIAMETER:	0.711 meters	28.00 inches
PLUME EXIT TEMPERATURE:	487.0 K	417.0 Deg F
PLUME EXIT VELOCITY:	4.780 m/s	15.68 ft/s
STACK AIR FLOW RATE:	4024 ACFM	
RURAL OR URBAN:	RURAL	
INITIAL PROBE DISTANCE =	5000. meters	16404. feet

********************** BUILDING DOWNWASH PARAMETERS *********************

USER DEFINED BPIPPRM INPUT FILE: BPIP_INPUT_FILE.INP

MAXIMUM BUILDING HEIGHT:	0.0 meters	0.0 feet
MAXIMUM BUILDING LENGTH:	0.0 meters	0.0 feet
MINIMUM BUILDING WIDTH:	9999.9 meters	32808.1 feet

************************ FLOW SECTOR ANALYSIS *************************
25 meter receptor spacing: 98. meters - 5000. meters

FLOW SECTOR	BUILD WIDTH	BUILD LENGTH	XBADJ	YBADJ	MAX 1-HR CONC	DIST (m)	TEMPORAL PERIOD
10*	0.00	0.00	0.00	0.00	42.71	325.0	SPR
20	0.00	0.00	0.00	0.00	42.71	325.0	SPR
30	0.00	0.00	0.00	0.00	42.71	325.0	SPR
40	0.00	0.00	0.00	0.00	42.71	325.0	SPR
50	0.00	0.00	0.00	0.00	42.71	325.0	SPR
60	0.00	0.00	0.00	0.00	42.71	325.0	SPR
70	0.00	0.00	0.00	0.00	42.71	325.0	SPR
80	0.00	0.00	0.00	0.00	42.71	325.0	SPR
90	0.00	0.00	0.00	0.00	42.71	325.0	SPR
100	0.00	0.00	0.00	0.00	42.71	325.0	SPR
110	0.00	0.00	0.00	0.00	42.71	325.0	SPR
120	0.00	0.00	0.00	0.00	42.71	325.0	SPR
130	0.00	0.00	0.00	0.00	42.71	325.0	SPR
140	0.00	0.00	0.00	0.00	42.71	325.0	SPR

SRC00001

150	0.00	0.00	0.00	0.00	42.71	325.0	SPR
160	0.00	0.00	0.00	0.00	42.71	325.0	SPR
170	0.00	0.00	0.00	0.00	42.71	325.0	SPR
180	0.00	0.00	0.00	0.00	42.71	325.0	SPR
190	0.00	0.00	0.00	0.00	42.71	325.0	SPR
200	0.00	0.00	0.00	0.00	42.71	325.0	SPR
210	0.00	0.00	0.00	0.00	42.71	325.0	SPR
220	0.00	0.00	0.00	0.00	42.71	325.0	SPR
230	0.00	0.00	0.00	0.00	42.71	325.0	SPR
240	0.00	0.00	0.00	0.00	42.71	325.0	SPR
250	0.00	0.00	0.00	0.00	42.71	325.0	SPR
260	0.00	0.00	0.00	0.00	42.71	325.0	SPR
270	0.00	0.00	0.00	0.00	42.71	325.0	SPR
280	0.00	0.00	0.00	0.00	42.71	325.0	SPR
290	0.00	0.00	0.00	0.00	42.71	325.0	SPR
300	0.00	0.00	0.00	0.00	42.71	325.0	SPR
310	0.00	0.00	0.00	0.00	42.71	325.0	SPR
320	0.00	0.00	0.00	0.00	42.71	325.0	SPR
330	0.00	0.00	0.00	0.00	42.71	325.0	SPR
340	0.00	0.00	0.00	0.00	42.71	325.0	SPR
350	0.00	0.00	0.00	0.00	42.71	325.0	SPR
360	0.00	0.00	0.00	0.00	42.71	325.0	SPR

* = worst case flow sector

********************* MAKEMET METEOROLOGY PARAMETERS *********************

MIN/MAX TEMPERATURE: 251.0 / 312.0 (K)

MINIMUM WIND SPEED: 0.5 m/s

ANEMOMETER HEIGHT: 10.000 meters

SURFACE CHARACTERISTICS INPUT: AERMET SEASONAL TABLES

DOMINANT SURFACE PROFILE: Cultivated Land
DOMINANT CLIMATE TYPE: Average Moisture
DOMINANT SEASON: Spring

ALBEDO: 0.14
BOWEN RATIO: 0.30
ROUGHNESS LENGTH: 0.030 (meters)

SURFACE FRICTION VELOCITY (U*) ADJUSTED

METEOROLOGY CONDITIONS USED TO PREDICT OVERALL MAXIMUM IMPACT

YR	MO	DY	JDY	HR
10	01	05	5	12

H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS
22.82	0.060	0.300	0.020	49.	34.	-1.0	0.030	0.30	0.14	0.50

HT	REF TA	HT
10.0	312.0	2.0

WIND SPEED AT STACK HEIGHT (non-downwash): 0.5 m/s
STACK-TIP DOWNWASH ADJUSTED STACK HEIGHT: 18.9 meters
ESTIMATED FINAL PLUME RISE (non-downwash): 53.9 meters
ESTIMATED FINAL PLUME HEIGHT (non-downwash): 72.8 meters

METEOROLOGY CONDITIONS USED TO PREDICT AMBIENT BOUNDARY IMPACT

YR	MO	DY	JDY	HR
10	08	11	5	12

H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS
54.78	0.246	0.600	0.020	151.	281.	-26.0	0.200	0.50	0.20	2.00

HT	REF TA	HT
10.0	312.0	2.0

WIND SPEED AT STACK HEIGHT (non-downwash): 2.2 m/s
STACK-TIP DOWNWASH ADJUSTED STACK HEIGHT: 18.9 meters
ESTIMATED FINAL PLUME RISE (non-downwash): 17.4 meters
ESTIMATED FINAL PLUME HEIGHT (non-downwash): 36.3 meters

*********************** AERSCREEN AUTOMATED DISTANCES *********************

OVERALL MAXIMUM CONCENTRATIONS BY DISTANCE

DIST (m)	MAXIMUM 1-HR CONC (ug/m3)	DIST (m)	MAXIMUM 1-HR CONC (ug/m3)
98.00	40.92	2550.00	14.71
100.00	41.36	2575.00	14.61
125.00	42.65	2600.00	14.53
150.00	39.74	2625.00	14.46
175.00	38.37	2650.00	14.39
200.00	36.19	2675.00	14.32
225.00	36.89	2700.00	14.26
250.00	39.62	2725.00	14.19
275.00	41.35	2750.00	14.12
300.00	42.31	2775.00	14.06
325.00	42.71	2800.00	13.99
350.00	42.70	2825.00	13.92
375.00	42.39	2850.00	13.86
400.00	41.85	2875.00	13.79
425.00	41.12	2900.00	13.72
450.00	40.23	2925.00	13.66
475.00	39.20	2950.00	13.59
500.00	38.25	2975.00	13.53
525.00	37.31	3000.00	13.46
550.00	36.39	3025.00	13.40
575.00	35.48	3050.00	13.34
600.00	34.63	3075.00	13.27
625.00	33.79	3100.00	13.21
650.00	32.99	3125.00	13.15

675.00	32.21	3150.00	13.09
700.00	31.46	3175.00	13.02
725.00	30.74	3200.00	12.96
750.00	30.05	3225.00	12.90
775.00	29.38	3250.00	12.84
800.00	28.74	3275.00	12.78
825.00	28.13	3300.00	12.72
850.00	27.54	3325.00	12.66
875.00	26.98	3350.00	12.60
900.00	26.43	3375.00	12.54
925.00	25.91	3400.00	12.48
950.00	25.41	3425.00	12.42
975.00	24.93	3450.00	12.37
1000.00	24.47	3475.00	12.31
1025.00	24.02	3500.00	12.25
1050.00	23.59	3525.00	12.20
1075.00	23.18	3550.00	12.14
1100.00	22.78	3575.00	12.08
1125.00	22.39	3600.00	12.03
1150.00	22.11	3625.00	11.97
1175.00	21.85	3650.00	11.92
1200.00	21.60	3675.00	11.87
1225.00	21.35	3700.00	11.81
1250.00	21.11	3725.00	11.76
1275.00	20.86	3750.00	11.71
1300.00	20.63	3775.00	11.65
1325.00	20.40	3800.00	11.60
1350.00	20.17	3825.00	11.55
1375.00	19.95	3850.00	11.50
1400.00	19.73	3875.00	11.45
1425.00	19.52	3900.00	11.40
1450.00	19.31	3925.00	11.35
1475.00	19.10	3950.00	11.30
1500.00	18.90	3975.00	11.25
1525.00	18.70	4000.00	11.20
1550.00	18.51	4025.00	11.15
1575.00	18.32	4050.00	11.10
1600.00	18.25	4075.00	11.06
1625.00	18.20	4100.00	11.01
1650.00	18.14	4125.00	10.96
1675.00	18.08	4150.00	10.92
1700.00	18.02	4175.00	10.87
1725.00	17.95	4200.00	10.82
1750.00	17.88	4225.00	10.78
1775.00	17.80	4250.00	10.73
1800.00	17.72	4275.00	10.69
1825.00	17.64	4300.00	10.64
1850.00	17.55	4325.00	10.60
1875.00	17.46	4350.00	10.56
1900.00	17.37	4375.00	10.51
1925.00	17.28	4400.00	10.47
1950.00	17.18	4425.00	10.43
1975.00	17.09	4450.00	10.38
2000.00	16.99	4475.00	10.34
2025.00	16.89	4500.00	10.30
2050.00	16.79	4525.00	10.26
2075.00	16.69	4550.00	10.22
2100.00	16.59	4575.00	10.18
2125.00	16.49	4600.00	10.14
2150.00	16.38	4625.00	10.10
2175.00	16.28	4650.00	10.06
2200.00	16.17	4675.00	10.02
2225.00	16.07	4700.00	9.978

SRC00001

2250.00	15.96	4725.00	9.939
2275.00	15.86	4750.00	9.900
2300.00	15.75	4775.00	9.862
2325.00	15.65	4800.00	9.824
2350.00	15.54	4825.00	9.786
2375.00	15.44	4850.00	9.749
2400.00	15.33	4875.00	9.712
2425.00	15.23	4900.00	9.675
2450.00	15.13	4925.00	9.638
2475.00	15.02	4950.00	9.602
2500.00	14.92	4975.00	9.565
2525.00	14.82	5000.00	9.530

********************* AERSCREEN MAXIMUM IMPACT SUMMARY ********************

CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m3)	SCALED 3-HOUR CONC (ug/m3)	SCALED 8-HOUR CONC (ug/m3)	SCALED 24-HOUR CONC (ug/m3)	SCALED ANNUAL CONC (ug/m3)
FLAT TERRAIN	42.75	42.75	38.48	25.65	4.275

DISTANCE FROM SOURCE 337.00 meters directed toward 10 degrees

CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m3)	SCALED 3-HOUR CONC (ug/m3)	SCALED 8-HOUR CONC (ug/m3)	SCALED 24-HOUR CONC (ug/m3)	SCALED ANNUAL CONC (ug/m3)
IMPACT AT THE AMBIENT BOUNDARY	40.92	40.92	36.83	24.55	4.092

DISTANCE FROM SOURCE 98.00 meters directed toward 10 degrees

SRC00001

AERSCREEN 16216 / AERMOD 18081 11/14/18
11:36:10

TITLE: MLI FLARE

**************************** FLARE PARAMETERS ***************************

SOURCE EMISSION RATE:	1.0000 g/s	7.937 lb/hr
FLARE HEIGHT:	22.860 meters	75.00 feet
EFF RELEASE HEIGHT:	26.018 meters	85.36 feet
HEAT RELEASE RATE:	0.8758E+06 cal/sec	
HEAT LOSS FRACTION:	0.550	
EFF STACK DIAMETER:	0.620 meters	24.42 inches
EFF EXIT TEMPERATURE:	1273.0 K	1831.7 Deg F
EFF EXIT VELOCITY:	20.000 m/s	65.62 ft/s
RURAL OR URBAN:	RURAL	

INITIAL PROBE DISTANCE = 5000. meters 16404. feet

********************** BUILDING DOWNWASH PARAMETERS *********************

USER DEFINED BPIPPRM INPUT FILE: C:\1801\BPIP_INPUT_FILE.INP

MAXIMUM BUILDING HEIGHT:	9.1 meters	30.0 feet
MAXIMUM BUILDING LENGTH:	65.6 meters	215.3 feet
MINIMUM BUILDING WIDTH:	36.6 meters	120.1 feet

************************ FLOW SECTOR ANALYSIS *************************
25 meter receptor spacing: 105. meters - 5000. meters

FLOW SECTOR	BUILD WIDTH	BUILD LENGTH	XBADJ	YBADJ	MAX 1-HR CONC	DIST (m)	TEMPORAL PERIOD
10	42.06	54.87	9.39	17.32	15.12	625.0	WIN
20	45.72	58.18	4.20	21.75	15.12	625.0	WIN
30	51.50	59.71	-1.12	27.28	15.12	625.0	WIN
40	55.72	59.44	-6.40	31.98	15.12	625.0	WIN
50	58.49	55.95	-64.57	-29.56	15.82	300.0	WIN
60	62.10	65.61	6.95	-4.06	16.86	250.0	WIN
70	57.00	62.73	8.51	2.82	15.18	250.0	WIN
80	50.16	57.95	9.80	9.60	15.12	625.0	WIN
90	42.20	52.10	10.10	16.30	15.12	625.0	WIN
100	50.48	58.27	3.52	22.39	15.12	625.0	WIN
110	57.23	62.97	-3.16	27.80	18.54	225.0	WIN
120	59.71	51.50	-53.03	28.74	20.45	200.0	WIN

130	59.44	55.72	-59.84	23.32	20.19	275.0	WIN
140	57.35	58.25	-64.84	17.19	16.68	300.0	WIN
150	53.53	59.01	-67.86	10.53	15.88	300.0	WIN
160	46.00	58.31	11.23	-24.29	15.12	625.0	WIN
170	39.50	55.55	16.26	-17.26	15.12	625.0	WIN
180	37.30	50.70	-64.50	-12.45	15.12	625.0	WIN
190	42.06	54.87	-64.27	-17.32	21.34	225.0	AUT
200	45.72	58.18	-62.38	-21.75	23.35	200.0	AUT
210	51.50	59.71	-58.60	-27.28	22.78	125.0	SUM
220	55.72	59.44	-53.04	-31.98	23.44	125.0	SUM
230	58.49	55.95	8.62	29.56	15.12	625.0	WIN
240	62.10	65.61	-72.57	4.06	15.65	175.0	AUT
250	57.00	62.73	-71.24	-2.82	15.12	625.0	WIN
260	50.16	57.95	-67.75	-9.60	16.07	300.0	WIN
270	42.20	52.10	-62.20	-16.30	21.17	175.0	SUM
280	50.48	58.27	-61.79	-22.39	22.50	225.0	WIN
290*	57.23	62.97	-59.81	-27.80	24.58	150.0	WIN
300	59.71	51.50	1.53	-28.74	15.86	250.0	WIN
310	59.44	55.72	4.12	-23.32	15.73	250.0	WIN
320	57.35	58.25	6.59	-17.19	15.12	625.0	WIN
330	53.53	59.01	8.85	-10.53	15.12	625.0	WIN
340	46.00	58.31	-69.55	24.29	21.96	225.0	WIN
350	39.50	55.55	-71.81	17.26	21.97	225.0	WIN
360	36.60	51.10	-71.90	12.10	15.12	625.0	WIN

* = worst case flow sector

********************** MAKEMET METEOROLOGY PARAMETERS *********************

MIN/MAX TEMPERATURE: 251.0 / 312.0 (K)

MINIMUM WIND SPEED: 0.5 m/s

ANEMOMETER HEIGHT: 10.000 meters

SURFACE CHARACTERISTICS INPUT: AERMET SEASONAL TABLES

DOMINANT SURFACE PROFILE: Cultivated Land
DOMINANT CLIMATE TYPE: Average Moisture
DOMINANT SEASON: Winter

ALBEDO: 0.60
BOWEN RATIO: 1.50
ROUGHNESS LENGTH: 0.010 (meters)

SURFACE FRICTION VELOCITY (U*) ADJUSTED

METEOROLOGY CONDITIONS USED TO PREDICT OVERALL MAXIMUM IMPACT

YR	MO	DY	JDY	HR
10	10	17	17	12

H0	U*	W*	DT/DZ	ZICNV	ZIMCH	M-O LEN	Z0	BOWEN	ALBEDO	REF WS
143.47	0.219	1.200	0.020	371.	235.	-5.6	0.010	1.50	0.60	3.00

HT REF TA HT

```
- - - - - - - - - - -
  10.0   251.0    2.0

WIND SPEED AT STACK HEIGHT (non-downwash):        3.2 m/s
STACK-TIP DOWNWASH ADJUSTED STACK HEIGHT:        26.0 meters
ESTIMATED FINAL PLUME RISE (non-downwash):       51.1 meters
ESTIMATED FINAL PLUME HEIGHT (non-downwash):     77.1 meters


       METEOROLOGY CONDITIONS USED TO PREDICT AMBIENT BOUNDARY IMPACT
       --------------------------------------------------------------

 YR MO DY JDY HR
 -- -- -- --- --
 10 10 09  17 12

    H0     U*     W*  DT/DZ ZICNV ZIMCH  M-O LEN    Z0  BOWEN ALBEDO  REF WS
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
153.81  0.370  1.200  0.020  346.  517.    -25.3 0.200   0.50   0.20    3.00

    HT  REF TA     HT
- - - - - - - - - - -
  10.0   251.0    2.0

WIND SPEED AT STACK HEIGHT (non-downwash):        3.5 m/s
STACK-TIP DOWNWASH ADJUSTED STACK HEIGHT:        26.0 meters
ESTIMATED FINAL PLUME RISE (non-downwash):       47.8 meters
ESTIMATED FINAL PLUME HEIGHT (non-downwash):     73.8 meters


-----------------------------------------------------------------------------
*********************** AERSCREEN AUTOMATED DISTANCES *********************
                 OVERALL MAXIMUM CONCENTRATIONS BY DISTANCE
-----------------------------------------------------------------------------
```

DIST (m)	MAXIMUM 1-HR CONC (ug/m3)	DIST (m)	MAXIMUM 1-HR CONC (ug/m3)
105.00	21.96	2575.00	6.799
125.00	23.48	2600.00	6.748
150.00	24.58	2625.00	6.698
175.00	23.60	2650.00	6.649
200.00	23.35	2675.00	6.601
225.00	22.85	2700.00	6.553
250.00	21.90	2725.00	6.506
275.00	21.32	2750.00	6.460
300.00	20.42	2775.00	6.414
325.00	19.06	2800.00	6.369
350.00	17.49	2825.00	6.325
375.00	16.03	2850.00	6.281
400.00	14.76	2875.00	6.238
425.00	13.66	2900.00	6.196
450.00	13.94	2925.00	6.154
475.00	14.32	2950.00	6.113
500.00	14.61	2975.00	6.072
525.00	14.83	3000.00	6.032
550.00	14.97	3025.00	5.993
575.00	15.07	3050.00	5.954
600.00	15.11	3075.00	5.915
625.00	15.12	3100.00	5.877

650.00	15.09	3125.00	5.840
675.00	15.03	3150.00	5.804
700.00	14.95	3175.00	5.784
725.00	14.85	3200.00	5.764
750.00	14.74	3225.00	5.744
775.00	14.60	3250.00	5.724
800.00	14.46	3275.00	5.704
825.00	14.30	3300.00	5.684
850.00	14.14	3325.00	5.664
875.00	13.97	3350.00	5.646
900.00	13.78	3375.00	5.630
925.00	13.59	3400.00	5.614
950.00	13.39	3425.00	5.597
975.00	13.20	3450.00	5.581
1000.00	13.02	3475.00	5.564
1025.00	12.85	3500.00	5.547
1050.00	12.67	3525.00	5.530
1075.00	12.50	3550.00	5.514
1100.00	12.33	3575.00	5.497
1125.00	12.16	3600.00	5.480
1150.00	12.00	3625.00	5.463
1175.00	11.83	3650.00	5.446
1200.00	11.68	3675.00	5.429
1225.00	11.52	3700.00	5.412
1250.00	11.37	3725.00	5.395
1275.00	11.22	3750.00	5.378
1300.00	11.08	3775.00	5.361
1325.00	10.94	3800.00	5.344
1350.00	10.80	3825.00	5.327
1375.00	10.66	3850.00	5.310
1400.00	10.53	3875.00	5.293
1425.00	10.40	3900.00	5.276
1450.00	10.27	3925.00	5.259
1475.00	10.15	3950.00	5.242
1500.00	10.03	3975.00	5.226
1525.00	9.911	4000.00	5.209
1550.00	9.796	4025.00	5.192
1575.00	9.683	4050.00	5.175
1600.00	9.573	4075.00	5.158
1625.00	9.465	4100.00	5.141
1650.00	9.359	4125.00	5.125
1675.00	9.256	4150.00	5.108
1700.00	9.167	4175.00	5.091
1725.00	9.081	4200.00	5.074
1750.00	8.996	4225.00	5.058
1775.00	8.911	4250.00	5.041
1800.00	8.829	4275.00	5.025
1825.00	8.747	4300.00	5.008
1850.00	8.666	4325.00	4.992
1875.00	8.587	4350.00	4.975
1900.00	8.509	4375.00	4.959
1925.00	8.432	4400.00	4.943
1950.00	8.356	4425.00	4.926
1975.00	8.282	4450.00	4.910
2000.00	8.208	4475.00	4.894
2025.00	8.136	4500.00	4.878
2050.00	8.065	4525.00	4.862
2075.00	7.994	4550.00	4.846
2100.00	7.925	4575.00	4.830
2125.00	7.857	4600.00	4.814
2150.00	7.790	4625.00	4.800
2175.00	7.725	4650.00	4.787
2200.00	7.660	4675.00	4.775

2225.00	7.596	4700.00	4.762
2250.00	7.533	4725.00	4.750
2275.00	7.471	4750.00	4.737
2300.00	7.410	4775.00	4.725
2325.00	7.350	4800.00	4.712
2350.00	7.291	4825.00	4.700
2375.00	7.233	4850.00	4.687
2400.00	7.176	4875.00	4.675
2425.00	7.119	4900.00	4.662
2450.00	7.064	4925.00	4.650
2475.00	7.009	4950.00	4.637
2500.00	6.955	4975.00	4.625
2525.00	6.902	5000.00	4.612
2550.00	6.850		

********************* AERSCREEN MAXIMUM IMPACT SUMMARY ********************

CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m3)	SCALED 3-HOUR CONC (ug/m3)	SCALED 8-HOUR CONC (ug/m3)	SCALED 24-HOUR CONC (ug/m3)	SCALED ANNUAL CONC (ug/m3)
FLAT TERRAIN	24.59	24.59	22.13	14.76	2.459

DISTANCE FROM SOURCE 148.00 meters directed toward 290 degrees

IMPACT AT THE AMBIENT BOUNDARY	21.96	21.96	19.77	13.18	2.196

DISTANCE FROM SOURCE 105.00 meters directed toward 220 degrees

APPENDIX F: REVISED PERMIT TABLE

Section F. Requested Changes to Emission Limits

> Condition 4.f of Approval Order No. 18AQ-E042 establishes maximum annual emisssion limitations for the permitted sources at MLI's TMAC production facility.

> Table F-1 documents these currently applicable emission limits.
> Table F-2 identifies MLI's requested changes to these permit limits based on the proposed project.

Table F-1. Summary of Current Permit Limits

	Source Emissions (tpy)				
Pollutant	**Boiler #1**	**Boiler #2**	**Flare**	**Fugitive**	**Total**
NOx	7.5	6.17	6.99	--	20.66
CO	2.0	4.0	2.0	--	8.00
VOC (in actual weight)	1.79	0.94	6.49	12.52	21.74
Methanol	0.87	0.50	1.51	4.05	6.93

Table F-2. Proposed Permit Limits
Changes Denoted in Bold Italics

	Source Emissions (tpy)				
Pollutant	**Boiler #1**	**Boiler #2**	**Flare**	**Fugitive**	**Total**
NOx[a]	7.5	***9.74***	***22.81***	--	***40.05***
CO	2.0	***5.30***	***7.90***	--	***15.19***
VOC (in actual weight)	1.79	***1.24***	***8.41***	***9.66***	***21.10***
Methanol[b]	0.87	***0.75***	***2.25***	***5.59***	***9.46***

[a] The majority of the proposed NOx emissions increase for the flare is attributable to the alternative book-keeping procedures for TMA nitrogen conversion (previous estimate based on 0.5% conversion; new estimate based on 10% conversion). Under the previous methodology, the project-related NOx emissions increases from the flare would have only been approximately 1 tpy. The proposed increase in NOx emissions is based on an accounting consideration, rather than an actual project-related emissions increase.

[b] MLI proposes a facility-wide increase in methanol emissions of approximately 2.5 tpy. This corresponds to just over half of the SQER for methanol. Therefore, although methanol is the primary HAP/TAP emitted from the facility, the project did not trigger methanol modeling and does not result in the facility's designation as a major source of HAP. Notwithstanding this proposed methanol increase, facility-wide permitted VOC emissions will decrease as a result of this project

APPENDIX G: SEPA CHECKLIST

SEPA ENVIRONMENTAL CHECKLIST

Purpose of checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for Lead Agencies:

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of checklist for nonproject proposals:

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. Background [HELP]

1. Name of proposed project, if applicable:

   TMAC Line #3 Expansion Project and Copper Purification Facility Upgrade

Note: This is follow-on work and may be considered an expansion addendum to the previously submitted "TMAC Product Quality/Emission Upgrade and Boiler #2" project.

2. Name of applicant: **Moses Lake Industries**

3. Address and phone number of applicant and contact person:

Moses Lake Industries

8245 Randolph Road NE

Moses Lake, WA 98837

Attn: Pat Blau 509-762-5336 x 236

4. Date checklist prepared: **11/19/2018**

5. Agency requesting checklist: **Washington State Department of Ecology (WDOE)**

6. Proposed timing or schedule (including phasing, if applicable): **Early spring 2019 through fall 2019**

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain. **No.**

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

- This SEPA checklist and the WDOE Notice of Construction air permit application

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

No.

10. List any government approvals or permits that will be needed for your proposal, if known.
WDOE Notice of Construction and updated approval order. Buildling permits.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

- The project consists of:

1. The installation of a Line #3 to produce additional tetramethylammoniumcarbonate (TMAC) product adjacent to the existing Lines #1 and #2 at the MLI TMAC manufacturing operation.

2 Emission control and production enhancement upgrades to the existing copper purification facility where ultra high purity copper electrolyte products are manufactured.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

Moses Lake Industries
8245 Randolph Road NE
Moses Lake, WA 98837

B. Environmental Elements [HELP]

1. *Earth* [help]

a. General description of the site:

(circle one): Flat, rolling, hilly, steep slopes, mountainous, other _____________

Generally Flat, slight rolling slopes in some cases.

b. What is the steepest slope on the site (approximate percent slope)?

5%

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

Soils are a mixture of sandy, loam and gravel/cobbles in various layers.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe. **No.**

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill. **Minor amounts of grading of existing soils for the Line #3 expansion. This area is already an existing impervious flate paved flat parking area and there is no need for any significant re-grading. The process containment area is the range of 35 by 35 feet and the new tank containment area in the range of 50 by 40, both +- 20%.**

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

No.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

The project area is already covered in impervious asphalt. The project will have no impact to existing conditions.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:
No impacts are expected due to the minor amount of grading on a flat area of the plant.

2. Air [help]

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.
No significant emissions are expected during construction.

The upgrade associated with TMAC Line #3 will generate a minor amount of combustion emissions due to the need to generate additional process steam in the boiler plus minor amounts of VOCs. Emissions are are limited by the application of Best Available Control Technology (BACT) process and emission control equipment.

The upgrade to the copper purification process will generate minor amounts of copper sulfate and sulfuric acid emissions. The levels will be less than the applicable Small Quantity Emission Rate (SQER) and due to the upgrade and use of BACT scrubbing equipment may be below de minumus levels.

Moses Lake Industries will remain in total a minor source of air emissions.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.
None.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

The use of Best Avialable Control Technology (BACT) level equipment.

3. Water [help]

a. Surface Water: [help]

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

No. The closest surface water body is Crab Creek some 2 miles to the east.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

No

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

None. Does not apply.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No.

b. Ground Water: [help]

1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

No. Moses Lake Industries is already supplied with potable water supply from the City of Moses Lake.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

No waste material will be discharged into the ground from this project.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

No new water runoff will be generated from the project. Existing impervious asphalt area will be replaced by concrete impervious areas. Water will runoff to an adjacent gravel area.

2) Could waste materials enter ground or surface waters? If so, generally describe.

No.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

No.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

Secondary containment for chemicals.

4. Plants [help]

a. Check the types of vegetation found on the site:

____deciduous tree: alder, maple, aspen, other
____evergreen tree: fir, cedar, pine, other
____shrubs
_**X**__grass
____pasture
____crop or grain
____ Orchards, vineyards or other permanent crops.
____ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
____water plants: water lily, eelgrass, milfoil, other
____other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

None. The minor area to be disturbed is already a paved parking area.

c. List threatened and endangered species known to be on or near the site.

None.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

None – Does not apply.

e. List all noxious weeds and invasive species known to be on or near the site.

None.

5. Animals [help]

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site.

Examples include:

birds: hawk, heron, eagle, songbirds, other:
mammals: deer, bear, elk, beaver, other:
fish: bass, salmon, trout, herring, shellfish, other ________

Unknown quanties of birds and small mammals have been observed in outer areas of the plant site. None in the actual work area.

b. List any threatened and endangered species known to be on or near the site.
None.

c. Is the site part of a migration route? If so, explain.
Generally, the site is in the Pacific Flyway. However this site has not historically been a known landing site.

d. Proposed measures to preserve or enhance wildlife, if any:
N/A

e. List any invasive animal species known to be on or near the site.
None.

6. Energy and Natural Resources [help]

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

The project will use electricity for lighting and equipment operation and natural gas for heating.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.
No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

Does not apply.

7. Environmental Health [help]

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

1) Describe any known or possible contamination at the site from present or past uses.
None known.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.
The project is an upgrade to an existing chemical manufacturing operation and will add no new types of chemical hazards.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

There will be no new types of raw materials, process materials or products generated from existing conditions. A second similar set of raw material feed tanks with one each for methanol, trimethylamine and dimethylcarbonate (12,000, 18,000 and 18,000 gallons respectively) will be installed some 60 feet north of the existing raw material tanks. Materials are handled within secondary containment to prevent or collect any spill.

4) Describe special emergency services that might be required.
None. Existing emergency services currently available are adequate.

5) Proposed measures to reduce or control environmental health hazards, if any:
New equipment within the TMAC Plant Process area will be installed following Process Safety Management Guidelines. An update to the RMP plan will be conducted. Upgrades to the Copper Purification equipment will occur within the existing PB-97 building which is a containment area.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?
None. The existing manufacturing equipment noise will not appreciably change.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.
Minor amounts of noise onsite during construction will not appreciably change existing noise levels.

3) Proposed measures to reduce or control noise impacts, if any:
Does not apply.

8. Land and Shoreline Use [help]

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.
No.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?
N/A – The project site has not been used as working farmland or forest land.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

No.

c. Describe any structures on the site.
The Moses Lake Industries manufacturing site already has some 15 structions on-site.

d. Will any structures be demolished? If so, what?
No.

e. What is the current zoning classification of the site?
Heavy Industrial.

f. What is the current comprehensive plan designation of the site?
Industrial Use.

g. If applicable, what is the current shoreline master program designation of the site?
N/A

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.
No.

i. Approximately how many people would reside or work in the completed project?
None. The existing staffing levels for the TMAC and Copper Purification Department may increase modestly. For TMAC assume an additional 2-3 potential employees and for Copper Purification assume and additional 2-3 employees for the actual process areas. These numbers may vary somewhat based on the degree of future automation employed with a total for both areas possibly in the range of 5-6 additional employees.

j. Approximately how many people would the completed project displace?
None.

k. Proposed measures to avoid or reduce displacement impacts, if any:
N/A

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:
N/A

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:
N/A

9. Housing [help]

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None.

c. Proposed measures to reduce or control housing impacts, if any:

Does not apply.

10. Aesthetics [help]

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The TMAC Line #3 equipment will be of the same height and arrangement as the existing TMAC Line #1 and #2 equipment. The talled structure associated with the new equipment will be the new #2 Boiler stack which was included in the recent TMAC project and will be 62' tall and 28" diameter. This is shorter than the existing boiler stack which is 75' tall. The boiler building exterior will be painted metal.

b. What views in the immediate vicinity would be altered or obstructed?

None.

c. Proposed measures to reduce or control aesthetic impacts, if any:

N/A

11. Light and Glare [help]

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

No significant glare will be generated. The new TMAC Line #3 process equipment will have similar lighting to the existing structures.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No.

c. What existing off-site sources of light or glare may affect your proposal?

No.

d. Proposed measures to reduce or control light and glare impacts, if any:

Does not apply.

12. Recreation [help]

a. What designated and informal recreational opportunities are in the immediate vicinity?

None.

b. Would the proposed project displace any existing recreational uses? If so, describe.
No.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

Does not apply.

13. Historic and cultural preservation [help]

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers ? If so, specifically describe.

No.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.
No.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

Does not apply.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

Does not apply.

14. Transportation [help]

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.

Randalph Road provides service to the existing Moses Lake Industries site.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

No.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

None.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).
NO.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

Assume 10 trips per day in personal vehicles by employees, which will be spread out over a 24 hour work schedule. Assume approximately 5 truck loads per day associated with raw materials or product during day shift times. The above amount of traffic is not significant versus existing levels.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

No.

h. Proposed measures to reduce or control transportation impacts, if any:

Does not apply.

15. Public Services [help]

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

No.

b. Proposed measures to reduce or control direct impacts on public services, if any.

Does not apply.

16. Utilities [help]

a. Circle utilities currently available at the site:
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other ___________

All of the above, except septic sewer. MLI is connected to the City of Moses Lake sewage system.

d. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Existing utilities already available onsite at Moses Lake Industries will be adequate.

C. Signature [HELP]

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: ____________________

Name of signee ___Patrick J. Blau____________________

Position and Agency/Organization _____EHSS Manager____________________

Date Submitted: 11/20/18