

Proposed Revisions to Minnesota Rules, chapter 7023, Adopting Vehicle Greenhouse Gas Emissions Standards (Clean Cars Minnesota)

Addendum to Statement of Need and Reasonableness, February 2021

Introduction

The MPCA has confirmed a transcription error in its analysis of particulate matter (PM) in the agency’s Statement of Need and Reasonableness (SONAR) and related Technical Support Document (TSD) for the Clean Cars Minnesota rulemaking. This error does not impact the overall need for and reasonableness of the rule, nor does it affect the proposed rule itself. It affects the degree, but not the direction of a portion of the PM-related benefits we calculated.

The MPCA notified Administrative Law Judge Palmer-Denig and the public of this error during the public hearing on February 23, 2021. At the hearing, the MPCA committed to publishing this addendum to the rulemaking record in order to describe the error and correct the parts of the analysis that were affected. This addendum will be filed to the record as Exhibit O and it will be posted on the eComments site and the MPCA’s Clean Cars rulemaking website. The MPCA will also send a GovDelivery notification to interested members of the public once the exhibit is published.

This addendum is organized into two sections. Section 1 provides an overview, including a description of the error and the impact of the error on the MPCA’s analysis. Section 2 provides detailed revisions to the agency’s SONAR and TSD text, tables, and figures.

Section 1: Overview

The MPCA made an error transcribing the PM standard in the agency’s emissions analysis. Table 1 shows the grams-per-mile tailpipe emission rates used in the SONAR and TSD for both the “Reference scenario” and the “Clean Cars scenario” alongside the corrected rates.

Table 1: PM emission rates as shown in the SONAR and TSD as well as the corrected PM emission rates

Model year	PM emission rates in SONAR and TSD		Corrected PM emission rates	
	Reference scenario	Clean Cars scenario	Reference scenario	Clean Cars scenario
2025	0.03	0.025	0.003	0.0025
2026	0.03	0.02	0.003	0.0020
2027	0.03	0.015	0.003	0.0015
2028+	0.03	0.01	0.003	0.0010

This transcription error affects part of the MPCA’s particulate matter, health, and equity analyses found in the SONAR and TSD. It does not change any of the other analyses supporting the SONAR: it does not affect the analysis supporting the primary goal of the rule, which is to reduce greenhouse gas (GHG) emissions in Minnesota in order to address climate change, and it does not affect the analysis of the cost of manufacturer compliance or the analysis of costs and benefits for consumers. Finally, the error does not impact the agency’s overall analytical methodology or data sources.

The transcription error impacts the scale of the PM benefits estimated in the MPCA’s analysis and the related health and equity benefits. The corrected emissions rates do not impact the agency’s estimates of upstream PM emissions associated with electricity generation or fuel extraction, processing, and transportation. The MPCA had estimated in the SONAR and TSD that the proposed Clean Cars Minnesota rule would reduce tailpipe emissions of

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PM by 3,032 tons in the first 10 years of implementation. With the corrected emission rates identified in Table 1 above, the MPCA now estimates the proposed rule would reduce tailpipe emissions of PM by 339 tons over this timeframe. This correction also reduces the estimated health and equity benefits of the proposed rule, but does not impact the overall conclusions that the proposed rule would reduce negative health impacts of vehicle pollution and reduce, but not eliminate, disparities in air pollution exposure.

The PM emission rates were used in the following parts of the MPCA's analyses:

- 1) PM tailpipe emissions rates (TSD section 2.B.i, pages 21-22)
- 2) Emissions benefits of other pollutants (TSD section 2.C.iii, pages 27-30 and SONAR, pages 9 and 79-81)
- 3) Sensitivity analysis: Marginal fuel mix (TSD pages 31-34)
- 4) Health benefits analysis results (TSD section 4.A.ii, pages 74-77 and SONAR, page 81)
- 5) Equity analysis, Increasing benefits over time (TSD section 4.B.iv, pages 82-83 and SONAR, pages 88-89)
- 6) Equity analysis, Sensitive land uses (TSD section 4.B.v, pages 83-86 and SONAR, pages 89-91)
- 7) Economic slowdown sensitivity analysis, Emissions benefits results (TSD section 5.A, page 89)

Section 2 of this addendum identifies and corrects all of the locations in the SONAR and TSD impacted by the transcription error.

Section 2: Corrections to the SONAR and TSD

This section of the addendum identifies locations in the SONAR and TSD where the transcription error impacts the analysis or agency conclusions from the analysis. At each location, the original, incorrect figures are struck through (example of ~~strike through text~~) and the corrected figures are bold and underlined (example of **bold and underlined text**).

PM tailpipe emissions rates (TSD section 2.B.i, pages 21-22)

Pages 21-22 of the TSD identify the PM tailpipe emission rates used in the MPCA's PM emissions analysis. The following includes excerpts from pages 21-22 of the TSD that correct the transcription error for the PM tailpipe emission rates:

"Tailpipe PM emissions rates in the Reference scenario were held at ~~0.03~~ **0.003** grams/mile for all model years, since this is the federal particulate emissions standard. Comparatively, LEV particulate emissions standards require manufacturers to certify 100% of their fleet to the same ~~0.03~~ **0.003** grams/mile in MY 2024, but from MYs 2025 to 2028, require manufacturers to certify increasing percentages of their light-duty fleet to ~~0.01~~ **0.001** grams/mile. In the analysis, we treated the LEV PM standards like a fleet-average standard for MYs 2024-2027, while the phase-in is taking place. In MY 2028, LEV requires 100% of a manufacturer's fleet to meet the ~~0.01~~ **0.001** grams/mile standard.¹ PM emissions benefits for model year vehicles 2028-2034 were therefore evaluated on a per-vehicle basis, rather than as a fleet-average. Tailpipe particulate emissions rates inputs for the Clean Cars scenario are listed in Table 4, which were based on LEV's required fleet percentages certified to the ~~0.03~~ **0.003** and ~~0.01~~ **0.001** grams/mile standard.

¹ California LEV Regulations, section 1961.2(a)(2)(A), "Particulate Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles".

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Table 4: PM emission rates

Model year	Reference scenario	Clean Cars scenario
2025	-.03 0.003	-.025 0.0025
2026	-.03 0.003	-.02 0.002
2027	-.03 0.003	-.015 0.0015
2028+	-.03 0.003	-.01 0.001

Federal PM emission standards remain at 3 milligrams per mile, while LEV standards become more stringent over time.”

Emissions benefits of other pollutants (TSD section 2.C.iii, pages 27-30; SONAR, pages 9 and 79-81)

Pages 27-30 of the TSD describe emissions benefits from PM and other pollutants that are not GHGs. These same results are reported on pages 9 and 79-81 of the SONAR. The transcription error only impacts the estimates of PM tailpipe emissions benefits and does not impact the methodology, estimates of upstream emissions, or the estimates of emissions benefits from other pollutants.

Below is an excerpt from pages 27-28 of the TSD with corrections:

“MPCA’s analysis indicates that implementation of the proposed rules together would result in an annual well-to-wheel emission reduction of 998 tons of NMOG + NO_x and ~~637~~ **106** tons of PM in 2034. These well-to-wheel emissions reductions equate to 6,059 tons of NMOG + NO_x and ~~3,245~~ **552** tons of PM reduced over the first 10 years of the rule. Over the first 10 years, our analysis estimates the proposed rules would reduce PM tailpipe emissions by ~~3,032~~ **339** tons.”

These same corrections occur on page 79 of the SONAR:

“The MPCA’s analysis indicates that the proposed rule would result in an annual emission reduction of 998 tons of NMOG + NO_x and ~~637~~ **106** tons of PM in 2034 (Figures 11 and 12). These emissions reductions equate to 6,059 tons of NMOG + NO_x and ~~3,245~~ **552** tons of PM reduced over the first 10 years of implementation. Of these estimates, ~~3,032~~ **339** tons of PM reductions would occur from the tailpipe of the vehicles.”

Similar information is presented in the SONAR Introduction on page 9, and corrected as follows:

“Additionally, the MPCA estimates that the proposed rule would reduce other pollutants that directly affect the health of Minnesotans. We estimate the proposed rule would annually reduce ~~635~~ **106** tons of particulate matter (PM) and 998 tons of nitrogen oxides (NO_x) and non-methane organic gases (NMOG) in 2034. We estimate the proposed rule would reduce ~~3,232~~ **552** tons of PM and 6,059 tons of NMOG + NO_x over the first 10 year of implementation.”

The MPCA presented the same figure in both the SONAR and TSD of the PM emissions costs and benefits over time from the proposed rule (Figure 10 on page 29 of the TSD and Figure 12 on page 80 of the SONAR). Below is the corrected version of that figure, including a corrected value in the figure’s description.

PM emissions costs and benefits from the proposed rules over time (corrected)

*PM emissions benefits from the proposed rules accumulate over time, since each year old vehicles with higher emissions are replaced by either lower-emitting LEV-certified ICE vehicles, BEVs, or PHEVs. Even with an estimated increase in PM emissions from electricity generation for additional EVs required by the rules, emissions benefits from tailpipe emissions and a reduction in gasoline production vastly exceed those emissions costs. The net cumulative well-to-wheel PM emissions benefit of the rules is estimated to be ~~3,245~~ **552** tons reduced over the first 10*

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years of implementation. ****Note that the following is the corrected figure. To see the original figure, see page 29 of the TSD or page 80 of the SONAR.**

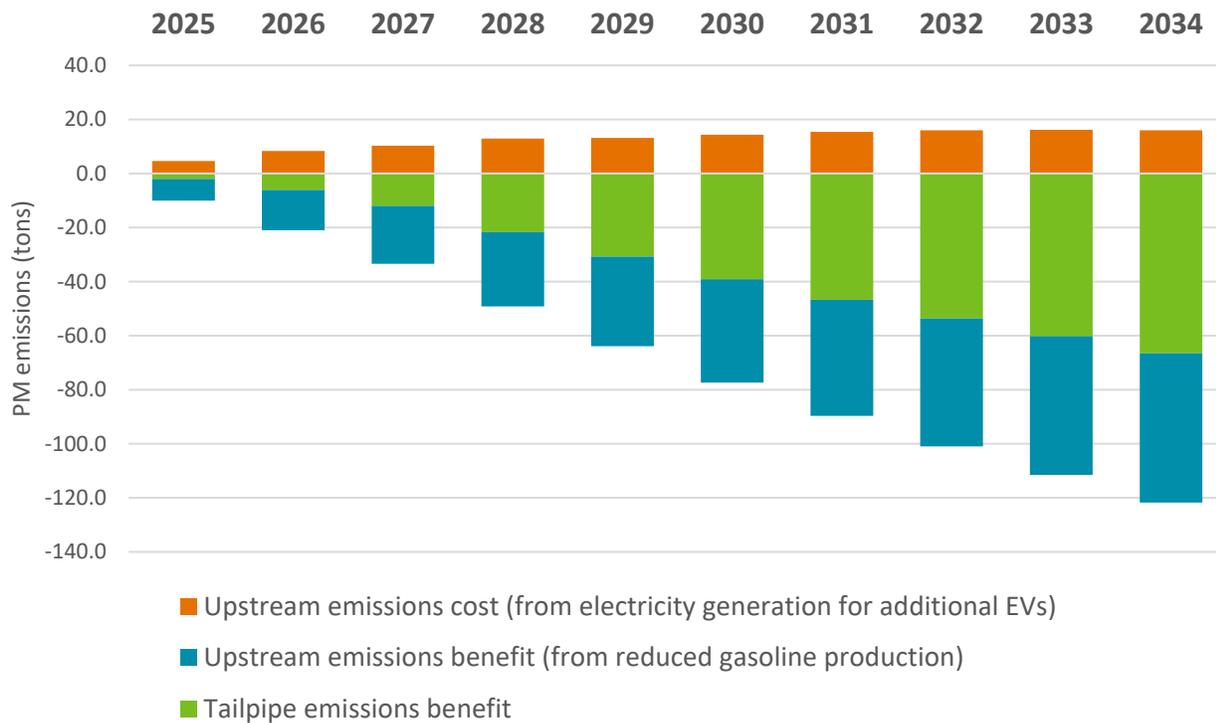


Table 8 in the TSD (page 29) accompanies the above figure. Below is the corrected version of this table.

Table 8: PM emissions costs and benefits from the proposed rules over time (with average electricity generation mix) in tons

Model year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Tailpipe emissions benefit	-20.6	-60.9	-120.1	-198.7	-273.3	-343.6	-409.8	-472.9	-534.8	-597.7
Upstream emissions benefit (from reduced gasoline production)	-8.0	-14.9	-21.4	-27.5	-33.1	-38.3	-43.0	-47.3	-51.3	-55.2
Upstream emissions cost (from electricity generation for additional EVs)	4.6	8.4	10.3	12.9	13.1	14.3	15.4	16.0	16.2	16.0

Sensitivity analysis: Marginal fuel mix (TSD section 2.C.iv, pages 31-34)

Pages 31-34 of the TSD describe a sensitivity analysis the MPCA conducted to understand a possible worst-case for upstream power sector emissions. The transcription error only impacts the estimates of tailpipe PM emissions and therefore does not impact the conclusions of this sensitivity analysis, which focuses on upstream power sector emissions.

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The net emissions values in Figure 13 and Table 11 of the TSD (both on page 34), which include both upstream and tailpipe emissions, are affected by the transcription error. Below are corrected versions of this figure and this table, including a corrected value in the figure’s description.

Figure 13: PM emissions costs and benefits from the proposed rules over time (with marginal electricity generation mix) (corrected)

Using a worst-case marginal fuel mix (instead of an average) of 50% coal and 50% natural gas to estimate the upstream emissions costs from electricity generation reduces the overall 10-year well-to-wheel PM emissions benefit from ~~3,245~~ **552** to ~~3,238~~ **545** tons. ****Note that the following is the corrected figure. To see the original figure, see page 34 of the TSD.**

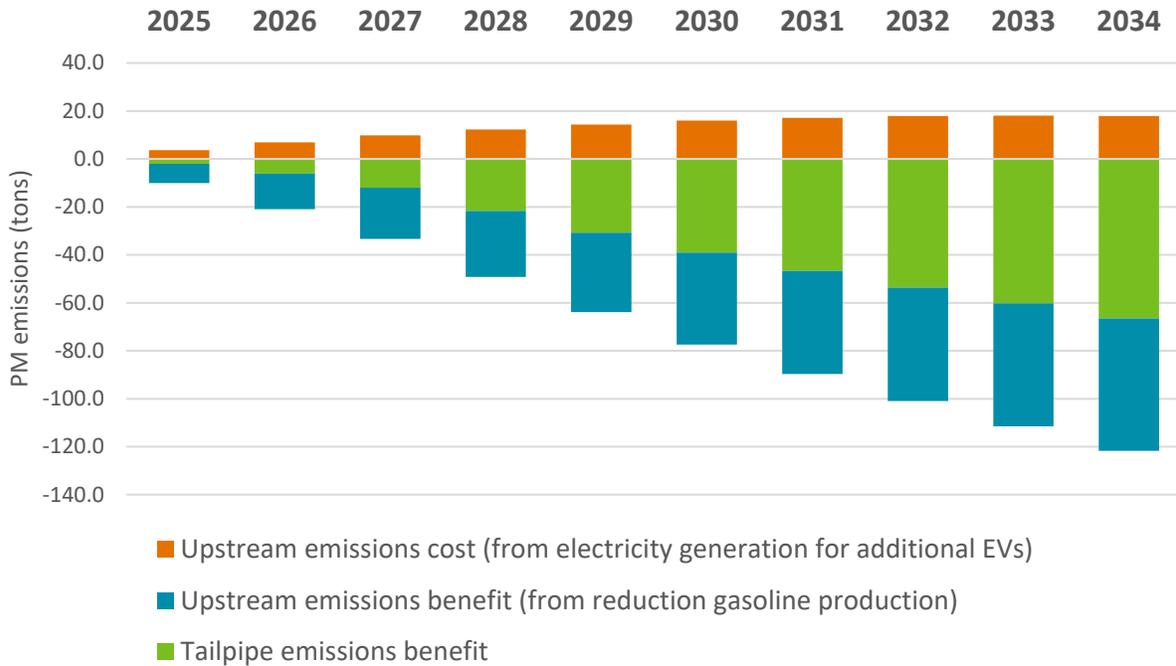


Table 11: PM emissions costs and benefits from the proposed rules over time (with marginal electricity generation mix) in tons

Model year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Tailpipe emissions benefit	-20.6	-60.9	-120.1	-198.7	-273.3	-343.6	-409.8	-472.9	-534.8	-597.7
Upstream emissions benefit (from reduced gasoline production)	-8.0	-14.9	-21.4	-27.5	-33.1	-38.3	-43.0	-47.3	-51.3	-55.2
Upstream emissions cost (from electricity generation for additional EVs)	3.6	6.9	9.8	12.3	14.4	16.0	17.2	17.8	18.1	17.8

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Health benefits analysis results (TSD section 4.A.ii, pages 74-77; SONAR, page 81)

Pages 81 of the SONAR and 74-77 of the TSD describe the MPCA’s analysis of the health benefits of the proposed rule. PM tailpipe emissions benefits of the rule factored into MPCA’s health benefits analysis. The correction impacts the scale of the estimated benefits, but not the overall conclusion that there would be health benefits associated with the air pollution reductions from this proposed rule.

The correction changes the estimated health benefits of the rule in Table 44 of the TSD (page 75) and the economic value of these health benefits in Table 45 of the TSD (page 75). Since the MPCA also used a second methodology to estimate health benefits and the economic value of those benefits, Tables 46-48 of the TSD (pages 76-77) are also changed. Below are corrected versions of these five tables.

Table 44: Estimated health benefits of the proposed rule over first 10 years of implementation based on EPA’s Benefit per Ton values

Avoided health outcome	Estimate
Premature deaths	149 - 348 28 - 65
Respiratory emergency room visits	82 15
Acute bronchitis	214 41
Lower respiratory symptoms	2,724 526
Upper respiratory symptoms	3,812 740
Minor restricted activity days	108,438 20,651
Work loss days	18,453 3,555
Asthma exacerbation	4,405 857
Cardiovascular hospitalizations	41 8
Respiratory hospitalizations	38 7
Non-fatal heart attacks	17 - 157 3 - 29

*The proposed rule could prevent ~~149-348~~ **28-65** early deaths from air pollution relative to the business-as-usual reference scenario. Additionally, many less severe health outcomes would also be avoided. These are estimated benefits throughout the U.S. resulting from the change in emissions in Minnesota, but given the local and regional qualities of these pollutants, the majority of these benefits would occur in Minnesota.*

Table 45: Estimated economic value of health benefits of the proposed rule over first 10 years of implementation based on EPA’s Benefit per Ton values

Economic benefit	Estimate
3% discount rate	\$1.46 billion - \$3.21 billion \$275 million - \$615 million
7% discount rate	\$1.31 billion - \$2.92 billion \$248 million - \$556 million

*Depending on the choice of discount rate, the economic value of the health benefits of this rule could be between ~~\$1.3 billion~~ **\$248 million** and ~~\$3.2 billion~~ **\$615 million**.*

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Table 46: Estimated health benefits from reduced tailpipe emissions resulting from the proposed rule over first 10 years of implementation based on EPA’s COBRA model

Avoided health outcome	Nationwide	Minnesota
Premature deaths	50 <u>113</u> 6 - 13	39 <u>87</u> 4 - 10
Respiratory emergency room visits	23 <u>3</u>	18 <u>2</u>
Acute bronchitis	88 <u>10</u>	71 <u>8</u>
Lower respiratory symptoms	1,120 <u>127</u>	909 <u>103</u>
Upper respiratory symptoms	1,599 <u>182</u>	1,297 <u>148</u>
Minor restricted activity days	43,181 <u>4,913</u>	35,213 <u>4,006</u>
Work loss days	7,323 <u>833</u>	5,981 <u>680</u>
Asthma exacerbation	1,649 <u>188</u>	1,336 <u>152</u>
Cardiovascular hospitalizations	16 <u>2</u>	12 <u>1</u>
Respiratory hospitalizations	13 <u>2</u>	10 <u>1</u>
Non-fatal heart attacks	6 <u>54</u> 1 - 6	4 <u>41</u> 1 - 5

Nationwide, from tailpipe emissions reductions alone, Clean Cars Minnesota is estimated to prevent ~~50~~ 6 to ~~113~~ 13 early deaths as well as numerous less severe health outcomes.

Table 47: Estimated health benefits from tailpipe and upstream emissions changes resulting from the proposed rule over first 10 years of implementation based on combination of EPA’s Benefit per Ton values and COBRA model

Avoided health outcome	Estimate
Premature deaths	62 <u>141</u> 18 - 41
Respiratory emergency room visits	30 <u>9</u>
Acute bronchitis	107 <u>29</u>
Lower respiratory symptoms	1,358 <u>368</u>
Upper respiratory symptoms	1,936 <u>523</u>
Minor restricted activity days	52,843 <u>14,255</u>
Work loss days	8,887 <u>2,464</u>
Asthma exacerbation	2,042 <u>585</u>
Cardiovascular hospitalizations	19 <u>5</u>
Respiratory hospitalizations	16 <u>5</u>
Non-fatal heart attacks	18 <u>56</u> 8 - 13

These are nationwide health benefits. Benefits from reduced tailpipe emissions were estimated with EPA’s COBRA model, taking into account geographic locations of emissions, while benefits from upstream emissions changes were estimated with EPA’s Benefit per Ton values.

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Table 48: Estimated economic value of health benefits of the proposed rule over first 10 years of implementation based on combination of EPA’s COBRA model and Benefit per Ton values

Economic benefit	Estimate
3% discount rate	\$626 million – \$1.42 billion \$179 million - \$408 million
7% discount rate	\$560 million – \$1.26 billion \$161 million - \$289 billion

The economic value of health benefits from reduced tailpipe emissions were estimated using COBRA while the economic value of health impacts from changes in upstream emissions were estimated using EPA’s Benefit per Ton values.

There are also some corrections to the concluding paragraph of the section of the TSD describing health benefits (page 77):

“It could prevent ~~62~~ **18** to ~~348~~ **65** early deaths plus many more avoided less severe health outcomes. While this analysis cannot pinpoint the exact economic value of these benefits, both the Benefit per Ton and COBRA methods show that it is likely to be ~~at least several~~ **two to six** hundreds of million dollars.”

Equity analysis, Increasing benefits over time (TSD section 4.B.iv, pages 82-83; SONAR, pages 88-89)

The MPCA analyzed the distribution of emissions benefits from the proposed rule in an equity analysis on pages 88-89 of the SONAR and 82-83 of the TSD. PM tailpipe emissions benefits of the rule also factored into portions of this equity analysis. The correction reduces the estimated tailpipe emissions benefits of the rule, but does not impact the overall conclusions of the analysis that communities of concern for environmental justice are anticipated to experience the largest air quality benefits. Again, the correction impacts the scale of the benefits, but not the overall conclusion that the proposed rule will help address, but not eliminate, existing inequitable exposures to air pollution from vehicles.

There is identical language in the TSD and in the SONAR describing increasing benefits of the estimated PM reductions over time that needs to be corrected. The following excerpt from both the TSD (page 82) and the SONAR (page 88) includes these corrections:

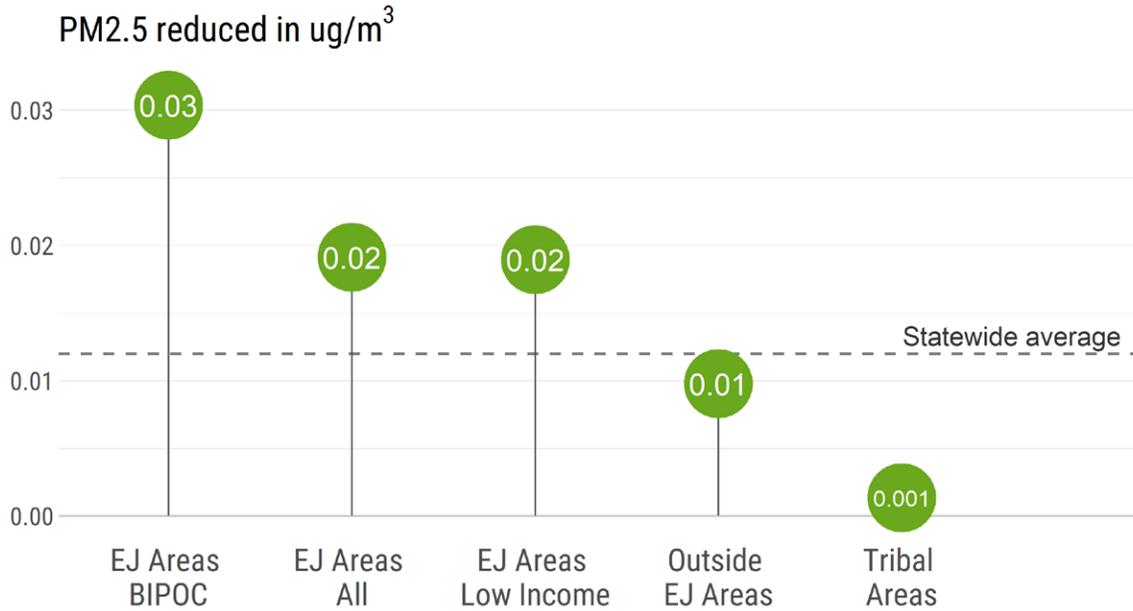
“By 2034, MPCA’s analysis estimates the proposed rule would result in an annual reduction of ~~530~~ **60** tons of PM_{2.5} emissions compared to the reference (business as usual) scenario. Based on current light-duty vehicle traffic, this reduction is equivalent to ~~25~~ **3**% of the total PM_{2.5} emitted in one year from light-duty vehicles. Depending on an area’s light-duty vehicle traffic density, the improvement in air pollution from cleaner vehicles will result in a range of pollution benefits. In remote low-traffic areas with less light-duty vehicle traffic-related air pollution, the decrease in PM_{2.5} may be less than ~~0.01~~ **0.001** µg/m³, while reductions in areas with higher traffic density are expected to approach ~~1.0~~ **0.1** µg/m³.”

The same figure presenting pollution benefits for areas of concern for environmental justice based on PM_{2.5} reduced in 2034 appears in both the TSD and the SONAR (Figure 20 on page 83 of the TSD; Figure 15 on page 89 of the SONAR). The figure is also affected by the corrected estimates of PM_{2.5} emissions benefits resulting from the rule. The corrected version of this figure is below.

Greater pollution benefits for areas of concern for environmental justice, PM2.5 reduced in 2034. (corrected)
This figure shows the average annual PM2.5 air concentration reductions in units of µg/m³ that are estimated to result from the proposed rule in year 2034. The air quality benefits are higher for areas of concern for environmental justice (referred to as “EJ Areas” in the graphic) in general, and even more so for areas with higher proportions of Black, Indigenous and People of Color (note that the figure uses the abbreviation “BIPOC” to

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identify these populations). Areas of the state, including Tribal lands, with lower light-duty vehicle traffic volumes and therefore lower light-duty vehicle traffic-related PM2.5 concentrations are anticipated to experience smaller reductions in PM2.5 from vehicles. **Note that the following is the corrected figure. To see the original figure, see page 83 of the TSD or page 89 of the SONAR.



Ref: MNDOT 2014 traffic data; EPA's AERMOD model

Equity analysis, Sensitive land uses (TSD section 4.B.v, pages 83-86; SONAR, pages 89-91)

As part of the MPCA’s equity analysis, the agency examined the distribution of air pollution benefits for sensitive land uses that concentrate people who are more vulnerable to the harmful effects of air pollution. This part of the equity analysis is also impacted by the correction. As with other parts of the analysis, the correction reduces the estimated benefit, but does not change the overall conclusion that sensitive land uses in areas of concern for environmental justice would see the greatest benefit from the proposed rule.

There are further revisions required to a table in both the TSD and the SONAR that presents estimated PM_{2.5} reductions for sensitive land uses in 2034 (Table 51 on page 86 of the TSD; Table 10 on page 91 of the SONAR). The corrected version of this table is below.

Estimated PM_{2.5} reduction benefits of Clean Cars Minnesota for sensitive land uses in 2034.

Land Use	Outside EJ Areas	EJ Areas: Low Income	EJ Areas: BIPOC	Tribal Areas
Licensed Hospitals	0.13 0.014	0.18 0.02	0.28 0.032	0.03 0.003
Elem. Schools	0.08 0.009	0.15 0.017	0.25 0.029	0.01 0.001
Daycares	0.08 0.009	0.18 0.02	0.25 0.029	0.03 0.003
Nursing Homes	0.1 0.011	0.18 0.02	0.3 0.034	0.01 0.001

The table shows the average modeled PM_{2.5} air concentration reduction in ug/m³. The air quality benefits are higher for the services near areas of concern for environmental justice in general, and more so for areas having higher proportions of Black, Indigenous, and people of color.

Economic slowdown sensitivity analysis, Emissions benefits results (TSD section 5.A, page 89)

The MPCA estimated the potential impacts of a possible long-term economic slowdown that could result from the current pandemic to the estimated costs and benefits of the proposed rule. The correction reduces the

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estimated benefits of the proposed rule identified in this analysis, but does not change the overall conclusion that there would still be net benefits of the proposed rule even in the case of a long-term economic downturn.

The estimated PM emissions benefits under the Economic slowdown sensitivity analysis scenario are also affected by this error. Specifically, one paragraph of the TSD (page 89) requires corrections, as follows:

“MPCA’s analysis indicates that implementation of the proposed rules together under a low economic growth scenario would result in an annual well-to-wheel emission reduction of 920 tons of NMOG + NO_x (down from 998) and ~~579~~ **95** tons of PM (down from ~~637~~ **106**) in 2034. These well-to-wheel emissions reductions equate to 5,658 tons of NMOG + NO_x and ~~2,979~~ **497** tons of PM reduced over the first 10 years of the rule (down from 6,059 and ~~3,245~~ **552**, respectively). Over the first 10 years, our analysis estimates the proposed rules would reduce PM tailpipe emissions by ~~2,785~~ **303** tons (down from ~~3,032~~ **339**).”

Summary

The transcription error detailed by this addendum does not affect the overall need for or reasonableness of the proposed rule. It also does not affect the GHG emissions analysis that supports adoption of this rule. As this addendum shows, the transcription error affects the degree to which PM emissions-related benefits are affected, but it does not affect the direction of those benefits.