Minnesota Center for Environmental Advocacy

Using law, science, and research to protect Minnesota's environment, its natural resources, and the health of its people.

26 East Exchange Street - Suite 206
Saint Paul, MN 55101-1667

651.223.5969
651.223.5967 fax

info@mncenter.org
www.mncenter.org

July 15, 2016

Daniel P. Wolf
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101-2147

VIA ELECTRONIC SERVICE

Re: In the Matter of the Further Investigation into Environmental and Socioeconomic Costs Under Minnesota Statute 216B.2422, Subd. 3
PUC Docket No. E-999/CI-14-643
OAH Docket No. 80-2500-31888

Dear Mr. Wolf:

In connection to Phase II or the Criteria Pollutants portion of the above-referenced docket, please find enclosed Clean Energy Organizations' Exceptions to the Administrative Law Judge's Findings of Fact, Conclusions, and Recommendations filed on June 15, 2016. Also attached is an Affidavit of Service.

Please do not hesitate to contact me should you have any questions or concerns.

Sincerely,

/s/ Hudson Kingston
Hudson B. Kingston
Staff Attorney

HK/em

Enclosure

cc: Attached service list

STATE OF MINNESOTA
OFFICE OF ADMINISTRATIVE HEARINGS
FOR THE MINNESOTA PUBLIC UTILITIES COMMISSION

In the Matter of the Investigation into the Environmental and Socioeconomic Costs Under Minn. Stat. § 216B.2422, Subd. 3

MPUC Docket No. E-999/CI-14-643, E-999/CI-00-1636
OAH Docket No. 80-2500-31888

EXCEPTIONS TO FINDINGS OF FACT, CONCLUSIONS, AND RECOMMENDATIONS: CRITERIA POLLUTANTS

Of

CLEAN ENERGY ORGANIZATIONS

July 15, 2016

TABLE OF CONTENTS

INTRODUCTION

Minnesota Center for Environmental Advocacy, Fresh Energy, and Sierra Club (collectively, "Clean Energy Organizations" or "CEOs") respectfully submit these exceptions to the Public Utilities Commission in regards to errors contained in an Administrative Law Judge Findings of Fact, Conclusions, and Recommendations: Criteria Pollutants[1] (ALJ Report) on setting the appropriate environmental cost values under Minn. Stat. § 216B.2422, subd. 3.[2] That statute states that the Commission "shall, to the extent practicable, quantify and establish a range of environmental costs associated with each method of electricity generation," and the Commission has ordered this proceeding in order to update the values based on what the best available science shows are the actual damages of fine particulate matter ($PM_{2.5}$), sulfur dioxide (SO_2), and nitrogen oxides (NO_x) (collectively "the criteria pollutants").[3] The ALJ Report failed to follow the best science in the record and consequently requires amendment by the Commission before it can be adopted to set the new environmental cost values for the criteria pollutants.

In order to set the most practicable values consistent with the scientific record, the Commission should: (1) order the calculation of a national geographic scope for damages, to follow standard practice in modern modeling of air pollution; (2) order the concentration-response function be set directly from the best available science, i.e. the two studies relied upon by CEOs and the Minnesota Pollution Control Agency and Department of Commerce (Agencies)

[1] Findings of Fact, Conclusions, and Recommendations: Criteria Pollutants. Pub. Util. Comm'n Docket No. E-999/CI-14-643, OAH Docket No. 80-2500-31888 (June 15, 2016).
[2] This proceeding follows the Commission's first such full proceeding to set environmental cost values, which was completed in 1997. Order Establishing Environmental Cost Values, Docket No. 93-538 (Jan. 3, 1997) (Ex. 306, herein referred to as "1997 Commission Order").
[3] Notice and Order for Hearing, Pub. Util. Comm'n Dockets No. E-999/CI-00-1636 & E-999/CI-14-643 at 8 (Oct. 15, 2014).

as well as the entire academic epidemiological community; (3) order that the modeling adopt the VSL that has been created, vetted, and used by the Environmental Protection Agency (EPA) for numerous relevant regulatory processes—the VSL best supported in the record; (4) order modeling that produces the most accurate and useful results, reflecting geographic and source-type diversity, for the various planning dockets that incorporate these values. Without these adjustments to the ALJ Report, the Commission risks setting inaccurate and confusing values that will not comport with the legislature's intent and the statute's command.

The ALJ Report does not satisfy the objective of updating the values to reflect the best available science. While the ALJ made many useful findings and conclusions, the Report also: (1) made no recommendation on the most important issue—what is the proper geographic scope of modeling damages from emissions; (2) contained severe errors in extrapolating a concentration-response function that does not reflect either the evidence in the record or the Report's own findings; (3) selected a Value of a Statistical Life (VSL) that falls short of the EPA's best standard for VSL, and cannot be updated easily if the EPA updates its value; and (4) proposed unworkable modeling scenarios, not advocated by any party, that would not provide usable values in Commission planning.

The Clean Energy Organizations consequently ask the Commission to fix these errors. Moreover, these exceptions lay out why accepting some of the ALJ Report recommendations unchanged would be arbitrary and capricious.

ARGUMENT

As the Commission has established in past precedent, and the courts have confirmed, the appropriate measure for whether a Commission decision on each issue is valid is whether it is

supported by a preponderance of the evidence.[4] The ALJ Report recommended that the Commission use a frame of four questions to set environmental cost values for the criteria pollutants.[5] The questions are:

- What is the proper geographic scope of damages?
- What is the most appropriate concentration-response function?
- What is the most appropriate value for the VSL?
- What sources and source locations should be included?[6]

This framing is both useful and logical, and these exceptions address each question—arranged based on the amount of information the ALJ Report gave the Commission to weigh on each topic. By viewing the environmental cost issues through the lens of these four questions, the Commission will see both how the ALJ Report made some errors that do not follow the record in this contested case, and how to correct those errors to set environmental cost values that reflect the actual damages caused by the criteria pollutants.

I. THE PROPER GEOGRAPHIC SCOPE OF DAMAGES IS A NATIONAL SCOPE, REFLECTING THE ACTUAL DAMAGES CAUSED BY CRITERIA POLLUTANTS EMITTED FROM MINNESOTA AND NEIGHBORING STATES

Ordering a national geographic scope of modeling is essential to having credible environmental cost values at the end of this proceeding. This question is more straightforward than the others addressed in these exceptions and the ALJ Report. The geographic scope issue is not arguably a matter of accounting for uncertainty between studies or setting policy related to the values' uses, as the other questions might be viewed. If the Commission sets a geographic

[4] *Matter of Quantification of Environmental Costs*, 578 N.W.2d 794, 801 (1998) (finding Commission's position on the preponderance standard reasonable).
[5] ALJ Report ¶ 1 at 103–04.
[6] *Id.*

scope that is too small, it will do so knowing that the environmental cost values will therefore be inaccurate across the board, because they grossly underestimate the total damages caused by the criteria pollutants. For these reasons this is the most important issue for the Commission to get right.

The ALJ Report gave the Commission no guidance on how to resolve the fundamental question of how far damages should be modeled in evaluating environmental costs, i.e. "What is the proper geographic scope of damages?" The relevant ALJ recommendation said only that "the Administrative Law Judge concludes that the question of geographic scope of damages is a policy matter to be decided by the Commission" and left the ultimate resolution to the Commission.[7] This determination fails to follow the Commission's precedent, and the Commission's order to the ALJ to set values based on actual damages, which requires a national geographic scope of modeling.

Though the ALJ Report sidestepped this question, the answer is easily found in the evidentiary record: the state of the art in calculating air pollution damages for criteria pollutants is a national—continental U.S.—geographic scope.[8] To set a smaller geographic scope based on the limitations of past air modeling in the last environmental costs proceeding would fail to apply the clear wording of Minn. Stat. § 216B.2422, subd. 3(a), which calls for the Commission to quantify costs "to the extent practicable" using today's science. A national scope of damages is practicable and common in the science available today; a smaller scope would be an arbitrary limitation that is not in accordance with Minnesota law.

[7] ALJ Report ¶ 5 at 105.
[8] *See* CEOs' Initial Brief at 20–26 (discussing how all three models show calculating national damages is practicable).

The record establishes that determining the impacts on a national geographic scope is practicable. The language of the statute, "to the extent practicable," is the touchstone for this question of geographic scope. "The common and approved usage of 'practicability' is 'feasible,' or capable of being accomplished. *See* Webster's New Universal Unabridged Dictionary (2d Ed. 1983)."[9] This is a scientific standard, requiring the Commission to set values based on the state of the science at the time of this proceeding. Because a national scope is now feasible and capable of being accomplished in modern science, that is the appropriate basis for current environmental cost values. By contrast, a smaller geographic scope based on nonscientific "policy" would not reflect what is practicable.

Using scientific evidence, both the ALJ and the Commission have already determined that the criteria pollutants travel far outside the borders of Minnesota. In this proceeding "the CEOs and the Agencies demonstrated by a preponderance of the evidence that emissions from Minnesota EGUs travel beyond Minnesota boundaries."[10] The ALJ Report additionally found that modeling in the record accurately demonstrates that there are measurable damages from the criteria pollutants "including states at least as distant from one another as Minnesota is to Florida."[11] This information is not at all a surprise. As the Commission explained in 1994: "Air emissions from utility plants can travel great distances and do not recognize state borders. Acid rain, in particular, is widely recognized as the byproduct of sulfur dioxide emissions hundreds or

[9] *Findings of Fact, Conclusion, Recommendation and Memorandum*, Docket no. E-999/CI-93-583 at 10 (Mar. 22, 1996).
[10] ALJ Report ¶ 40 at 100.
[11] ALJ Report ¶ 25 at 97. Although it is not explicitly discussed in the evidentiary record, Florida is further away from Minnesota than the vast majority of the continental U.S. The Commission should take administrative notice of the distance from Minnesota to Miami, Florida, to the extent that this would help affirm the distance that these pollutants can travel and cause damages.

even thousands of miles away."[12] The ALJ Report's conclusions in this case further support this scientific truism, concluding "SO_2, and NO_x can travel significant distances, forming secondary $PM_{2.5}$ hundreds of miles from the source from which they were emitted."[13]

Nonetheless, the ALJ Report incorrectly concluded geographic scope was a policy matter, despite the fact that the Commission established this contested case as a quantification proceeding, and past Commission precedent shows it is inappropriate to insert nonscientific policy judgments into such quantification. According to the Commission, the quantification of these values should not incorporate policy judgments until a later stage in other proceedings:

> [T]he Environmental Externalities Statute (Minn. Stat. § 216B.2422, subd. 3(a)) prescribes a two-stage process: Stage 1—quantification and establishment of a range of environmental costs to the extent practicable and Stage 2—use or application of the values in conjunction with other external factors (including socioeconomic costs) when evaluating and selecting resource options in all proceedings before the Commission. The current Order addresses Stage 1. Reasonable application of the range of environmental costs set in this Order will be addressed in future proceedings that address resource options. In those proceedings, the parties will address and the Commission will determine the reasonableness or practicality of applying environmental costs in the circumstances of those cases.[14]

Further, the Commission ordered in this proceeding that the quantification "focus[] on *actual damages* from uncontrolled emissions."[15] This calls for an accurate quantification reflecting the full scientific assessment of *actual damages*, which is shown in this record to be damages across

---

[12] Order Establishing Interim Environmental Cost Values for Air Emissions Associated with Electric Generation, Docket No. E-999/CI-93-583 at 5 (March 1, 1994). This Commission Order is available on e-dockets using Document ID 182860.
[13] ALJ Report ¶ 37 at 99–100. Stated another way, "Xcel failed to demonstrate by a preponderance of the evidence that Minnesota's compliance with the standards established by CSAPR reduces cross-border [criteria pollutant] damages to zero." ALJ Report ¶ 47 at 102.
[14] 1997 Commission Order at 11, n. 4.
[15] Notice and Order for Hearing, Pub. Util. Comm'n Dockets No. E-999/CI-00-1636 & E-999/CI-14-643 at 8 (Oct. 15, 2014) (emphasis added).

the continental U.S. Although presented with a straightforward directive by the Commission (and reminded of these duties by CEOs in briefing)[16] the ALJ Report failed to follow these orders and instead left this "policy matter" to the Commission to decide.

For the Commission to order a national geographic scope for modeling, it need not find that any particular percentage of damages occurs outside of Minnesota. The ALJ Report demonstrated some confusion on this point in concluding that the Agencies had failed to show the percentage of damages criteria pollutant cause outside of Minnesota, and also that "$PM_{2.5}$ causes damages which are mostly local and regional."[17] Not only is there no indication of what "local and regional" means in the realm of air modeling (and the normal meaning of "regional" is an area beyond just one state, which would mean that particulate pollution was "mostly" causing damages both inside and outside of Minnesota)[18] there is no legal requirement that a majority of damages occur somewhere in order to be calculated. If the Commission sets a national geographic scope and the final values are calculated it will be possible to say where 51 percent of the damages fall, but before modeling has been completed under the Commission's order in this proceeding that proportion is unknown, and remains irrelevant to the legal issue of what is "practicable" and what reflects the "actual damages" of each ton of pollutant emitted.

[16] CEOs' Initial Brief at 28.
[17] ALJ Report ¶ 37 at 99–100.
[18] Furthermore, as touched on in CEOs briefing, one need only to look at a possible emissions source in Winona County (in the southeast corner of Minnesota, whose emissions would travel further southeast out of Minnesota) to see how "local and regional" damages are different for different counties, and will often include large amounts of damages outside of Minnesota. *See* CEOs' Initial Brief at 37, 37 n.9.

While it is unfortunate that the ALJ Report's recommendation ¶ 5 gave the Commission no guidance in how to decide the geographic scope issue,[19] we need look no further than the 1997 Commission Order precedent on "Step 1" quantification and the ample modeling in the instant record to see that the only way to model *actual damages* is to do so at a continental U.S. scope. Modeling a national scope of damages is practicable with today's scientific advancements. To set a lesser geographic scope would go against the Commission's precedent of accounting for all actual damages in the quantification phase, and would arbitrarily undercut the statute that requires environmental costs to be accurately assessed. A stunted geographic scope would greatly undervalue the externalities at issue here. Unlike the other questions discussed below, determining the geographic scope of damages is neither a policy question nor a way of dealing with uncertainty. Setting an arbitrary geographic scope would be contrary to the statute. The resolution of this question is also the single biggest determinant of the size of the overall values that will ultimately be adopted by the Commission. For these reasons, the Commission's choice to set a national scope is the most important decision in this proceeding.

[19] This is apparently due to the conclusion ¶ 46 that "Minn. Stat. § 216B.2422, subd. 3, is silent as to whether or not the legislature expected the Commission to include damages outside of Minnesota." ALJ Report ¶ 46 at 102. While this conclusion ignores that the legislature commanded that environmental cost values be set "to the extent practicable" and that this means that the quantification of values should not include arbitrary limits like state borders, this issue of legislative intent on this point is somewhat mooted by the fact that the geographic scope issue is now before the Commission regardless of whether intent were absolutely clear from the wording of the statute. Since the Commission is going to decide the issue rather than remanding it for further deliberations, it is not immediately important that conclusion ¶ 46 be corrected for its misapplication of policy adjustments to a scientific quantification exercise. The Commission could correct conclusion ¶ 46 if it wanted to assure a more rational quantification process in any future proceeding to update the values.

II. THE MOST APPROPRIATE CONCENTRATION-RESPONSE FUNCTION FOR THIS PROCEEDING SHOULD BE BASED ON THE BEST SCIENCE IN THE RECORD

The CEOs recommend concentration-response values of 7.8 and 14 percent, values that are supported by the record and the science. While the record contains much discussion of the question "What is the most appropriate concentration-response function?" the ALJ Report does not follow this record closely. Instead of adopting values from the best studies available, the Report attempts to estimate a range that would be acceptable to all parties but reflect the views of none of them. Since the ALJ Report erroneously proposes values that are not acceptable to the parties, and are not reasonable according to the Report's conclusions, the Commission should instead follow the science in the record and choose concentration-response values of 7.8 and 14 percent.

A. The ALJ Report's Recommendation For Concentration-Response Appears To Be Based On A Mistaken Conclusion That Contradicts Both The ALJ Report's Findings And The Evidentiary Record.

The ALJ Report contains drafting errors that affect the proposed range for concentration-response functions and do not follow the evidentiary record. The three errors are that the ALJ Report: (1) misstates CEOs' position as only including one of the two studies CEOs relied upon and offered; (2) is based on finding an overlap between the three parties' positions that never existed; and (3) furthers a recommendation that deviates from the Report's conclusions without explanation. As a result the Commission should correct conclusions ¶ 48 and ¶ 50, and recommendation ¶ 3 from the ALJ Report.

First, there is a disconnect between the ALJ Report's conclusions and findings regarding CEOs' position on the concentration-response value. CEOs offered two concentration-response values based on the leading cohort studies in the epidemiological literature, referred to by the

names of their lead authors, Lepeule and Krewski.[20] Regarding these studies, the ALJ Report found:

> For the high end of the dose-response function, the CEOs and the Agencies use the same value taken from the *Lepeule* study, 14% increased mortality risk per 10 μg/m3 increase in $PM_{2.5}$ concentrations. While both the CEOs and the Agencies derive their low-end values from the *Krewski* study, the CEOs criticized the Agencies' low-end value of a 6% concentration response, as opposed to the CEOs' low-end value of 7.8% concentration response.[21]

Therefore, the CEOs expert's professional judgment was to use the 14 and 7.8 percent values, rejecting 6 percent as a worse interpretation of Krewski. But the ALJ Report's conclusion ¶ 48 gives CEOs' position as "7.8% (6% not unreasonable)."[22] Conclusion ¶ 48 erroneously reset CEOs' position to be an either/or between 6 and 7.8 percent and omitted the Lepeule 14 percent value entirely. Dropping the Lepeule value that both the CEOs and Agencies argued for resulted in an error in the ALJ Report's attempt to average the parties' positions—based on the erroneous conclusion the Report's recommendations went on to propose a range far below the 14 percent value favored by two parties, and below even the lowest value CEOs offered, 7.8 percent.

Second, the ALJ Report concluded that "the parties [sic] ranges of acceptable values overlapped,"[23] even though it is evident in the findings and conclusions that CEOs and Xcel did not suggest overlapping values, and both the CEOs and Agencies proposed significantly higher values than Xcel did. While CEOs and Agencies offered values from 14 percent to either 7.8 or 6 percent, Xcel offered a range from 5.3 to 7.3 percent.[24] The ALJ Report concluded "that 6.8% - 7.3% is both reasonable, and an acceptable dose-concentration response function range for Xcel,

[20] ALJ Report ¶ 104 at 39.
[21] ALJ Report ¶ 219 at 70.
[22] ALJ Report ¶ 105 at 39.
[23] ALJ Report ¶ 48 at 102.
[24] ALJ Report ¶ 48 at 102.

the Agencies and the CEOs."[25] That range, 6.8 percent to 7.3 percent, is entirely outside the values offered by CEOs—7.8 percent and 14 percent. The 6.8 to 7.3 percent range is in no way supported by CEOs' expert testimony.[26]

Finally, the numbers the ALJ Report found reasonable in conclusions were adjusted downward in the ALJ Report recommendations without explanation. Only two pages after stating that the ALJ "concludes that 6.8% - 7.3% is both reasonable, and . . . acceptable" to all three parties,[27] the Report recommended that the Commission "adopt a concentration-response function of 6.8 percent, or if the Commission prefers to adopt a concentration-response range to reflect uncertainty, a range of 6 percent to 7.3 percent."[28] That range is not reasonable, even according to the ALJ Report's own conclusion, because the "reasonable" range in the Report's conclusions began at 6.8 percent, not 6 percent. There is no reasoning offered in the Report for why the Commission should use 6.8 percent value as a single point when in conclusions it was only reasonable as a low end of a range. Moreover, the recommendations again incorrectly state that these values are "consistent with the parties' various recommendations."[29] This recommendation *is not consistent* with either the CEOs' position *or the ALJ Report's own conclusions*. It is also less than half the 14 percent value offered by two out of three parties. Because of these inconsistencies with the record and lack of justification, to adopt this recommendation rather than a concentration-response function based on actual epidemiological science in the record would be arbitrary and capricious.

[25] ALJ Report at 50.
[26] While it is true that the CEOs expert also described the interpretation of Krewski's value as either 6 or 7.8 percent being a matter of professional judgment, it is inaccurate to suggest—as the ALJ Report did—that the CEOs ultimate position is that the concentration-response function should be an either/or between those two values. CEOs never furthered a 6 percent value.
[27] ALJ Report ¶ 50 at 102,
[28] ALJ Report ¶ 3 at 104.
[29] *Id.*

Because the ALJ Report also conceded that "she made few conclusions regarding the parties' arguments about the correct values for the VSL and the concentration-response function,"[30] the fact that the only conclusions on this issue contained errors leaves the Commission no reasoning that supports to the ultimate recommendation in the Report. The only support for the numbers furthered was a perceived consensus,[31] which demonstrably never existed among the parties. The Commission must consequently modify and correct conclusions ¶ 48 and ¶ 50 and recommendation ¶ 3 whose current form is based on errors and not supported by the record.

B. The ALJ Report And Recommendation Gives Insufficient Weight To The Leading Scientific Studies On Concentration-Response Functions.

In regards to both the concentration-response function and the Value of a Statistical Life study, discussed below, "The Administrative Law Judge concludes that the CEOs and the Agencies demonstrated, by a preponderance of the evidence, why they chose the studies they relied upon for their damage cost analyses."[32] The Commission should follow these studies as they demonstrate the best science available.

There is not sufficient evidence to support the ALJ Report's proposed artificially-low range for the concentration-response function. The only party that offered such low values, Xcel, attempted to further its own invented values based on its expert's manipulation of statistical methods and less accepted studies, but no other party agreed with Xcel's methods.[33] The only

[30] ALJ Report 107–08.
[31] *See* ALJ Report at 108.
[32] ALJ Report ¶ 42 at 101.
[33] The ALJ acknowledged this in her memorandum, noting "neither party dropped their strong criticisms of Xcel's method of reaching its values." ALJ Report at 108.

epidemiologist to testify in this proceeding, and a leading scientist in the field, David Jacobs of the University of Minnesota, criticized Xcel's methods, explaining:

> There is no empirical basis for assigning the weights that Dr. Desvousges assigned, that is, the weights are not based on precision of the estimates being pooled. . . . I have considerable experience in the field of epidemiology, and this is not an accepted methodology I have ever encountered. It interjects one researcher's bias into the results and undermines the purpose of including different studies—to acknowledge and account for the heterogeneity in results.[34]

While Xcel may have begun with credible studies, it subjected these to unreasonable statistical methods, representing no peer-reviewed study and nowhere found in epidemiological literature.[35] Moreover, the ALJ Report did not explicitly follow Xcel's proposal over the others, and suggested a range higher than the 5.3 to 7.3 percent values that Xcel proposed. A rough estimate that does not find support in any party's testimony cannot be said to be based on the record evidence.

By contrast, the record evidence strongly supports following the leading studies instead of a low estimate based on no party's express position in this proceeding. The studies that CEOs and the Agencies both used are based on large cohorts of people and numerous decades of data collection and analysis.[36] These are widely accepted as the leading studies in the field. Supporting this, MLIG's expert testified that these two studies are "the two the most important studies that we have" in epidemiological science.[37] This means that all experts in this proceeding except for Xcel's viewed the Lepeule and Krewski studies as the best estimates of concentration-

[34] Ex. 117 at 12:3–4, 12:14–17.
[35] Ex. 117 at 14:9–12.
[36] *See* Ex. 117, Schedules 2 and 3 (copies of the Lepeule and Krewski studies).
[37] Hearing Trans. vol. 7 at 181; 12–13.

response function. The Commission should heed the experts and adopt the values in these two reports.

As a result of drafting errors, the ALJ Report left the Commission with a recommendation for a concentration-response range that is not based in the record evidence that demonstrates the state of the epidemiological science. Instead of approving the ALJ Report's recommended range, the Commission should return to the record itself and set values based on the best science available. Both the CEOs and Agencies have made clear that the correct values to use in modeling for concentration-response are those found in Lepeule and Krewski. The Commission should adopt the 14 and 7.8 percent values in order to accurately model the actual damages related to emissions of the criteria pollutants.

III. THE MOST APPROPRIATE VALUE FOR THE VALUE OF A STATISTICAL LIFE IS THE ENVIRONMENTAL PROTECTION AGENCY'S META-ANALYSIS VALUE

The Commission should adopt the EPA's Value of a Statistical Life (VSL) meta-analysis as the best VSL available, and as the VSL best supported by the record. The ALJ Report took a passing comment in rebuttal testimony and used that as the basis for its recommended VSL—while that passing comment was not incorrect as stated, it is clear on this record that the Commission should instead adopt EPA's VSL as the best scientific standard.

The question to resolve in this section is: "What is the most appropriate value for the VSL?" The ALJ Report recommended a VSL of $7.7 million. While CEOs support a single point estimate for VSL, the EPA's VSL is better supported in the record than the value the ALJ

selected. The EPA's VSL, adjusted for current value, is around $10 million according to the ALJ Report's findings and conclusions.[38]

The Commission has several good reasons to follow the EPA's judgment rather than adopt the ALJ Report's recommendation. The ALJ Report's findings and conclusions do not offer a compelling rationale to support a value of $7.7 million, and the record does not adequately assess or support the value of $7.7 million. By contrast, the EPA value is well-supported in the record and recommended by both the Agencies and the CEOs. The Commission should not adopt a less-well-supported value when a better-supported one is available.

A. The ALJ Report's Findings And Conclusion Do Not Offer A Sufficient Rationale To Adopt A $7.7 Million VSL.

There is little in the ALJ Report to support the VSL in its recommendations. Much like the concentration-response, discussed above, the Report merely tried to split the difference between parties' positions, without discussion of credibility. The ALJ Report "conclude[d] that . . . the parties [sic] ranges of acceptable values overlapped."[39] The ALJ Report goes further with this reasoning by claiming that "[d]espite some differences regarding the best way to determine those values, the Agencies and the CEOs ultimately compromised and agreed on [VSL] numbers acceptable to each."[40] This is not an accurate statement.

---

[38] ALJ Report ¶ 48, at 102 (stating CEOs' estimate at $9.8 million and the Agencies' estimate of the EPA value at 9.5 million (2011$)). As the ALJ Report found, different experts calculated the 2015 value of the EPA VSL slightly differently, with CEOs setting it at 9.8 million and the Agencies setting it at 10.1 million in 2015 dollars. ALJ Report ¶ 267 at 84. Elsewhere in the report it is noted that the Agencies set the EPA value at 9.5 million in 2011 dollars. ALJ Report ¶ 217 at 70. Dr. Polasky's expert testimony on this issue demonstrates that adjusting the EPA VSL for inflation and income adjustment to 2014 dollars puts it at 10.1 million. Ex. 118 at 5:13. All of these estimates are based on the same EPA value, and the Commission can choose the best adjustment criteria when adopting the EPA value.

[39] ALJ Report ¶ 48 at 102.

[40] ALJ Report at 107.

CEOs did not offer a VSL value other than the EPA VSL that forms the basis of Dr. Marhsall's recommended values. In support of the statement that the CEOs supported $7.7 million, the ALJ Report cited to this testimony: "If a central estimate is to be used, I believe either the EPA recommended value, i.e., $10.1 million, or the Kochi et al. combined estimate (adjusted for income growth), i.e. $7.7 million, would be appropriate."[41] The context shows this reference to a $7.7 million value was offered for the sake of discussion, as CEOs expert witness Dr. Polasky went on to say: "it would be appropriate to use a central meta-analysis estimate *such as the EPA VSL as Dr. Marshall did*. There are other reasonable approaches that *none of the experts used in this proceeding*, such as using the central tendency estimate of the Kochi et al. (2006) study, or creating a range . . ."[42] Hence, Dr. Polasky supported the use of the EPA value at $10.1 million reasonable, and would not have quibbled with any expert who had furthered $7.7 million based on Kochi et al. (Kochi study). But importantly, none of the three modeling experts did propose using the Kochi study in this way. As a result Dr. Polasky merely talked about a $7.7 million VSL in passing, as a value that no party supported. In all rounds of testimony CEOs' expert modeler, Dr. Marshall, continued to support the EPA VSL as the best value available, with the full support of Dr. Polasky's rebuttal testimony. No other party adopted this Kochi study value in response to Dr. Polasky's rebuttal testimony. It is simply not the case that CEOs offered the $7.7 million value instead of EPA's.

Additionally, CEOs never agreed to compromise on VSL numbers, or furthered $7.7 million as a mutually-acceptable number with the Agencies. CEOs maintained throughout their testimony that the Agencies' high-end VSL—the EPA value—was reasonable, but that their range was unreasonable, as discussed further below. If anything, Agencies and CEOs agreed that

[41] Ex. 118 at 8:11–13.
[42] *Id.* at 13:18–21 (emphasis added).

the EPA value was reasonable, as both used it.[43] The Agencies never proffered a value of $7.7 million either.

CEOs believe that the EPA value remains the best value for the Commission to adopt, and that compromise among VSL proposals only should happen if all parties' proposed VSLs are reasonable. In this proceeding they are not. Both the Agencies and Xcel based their ranges on flawed applications of the available studies.

The Agencies' VSL range used EPA's VSL but put it at the top end of a range weighed against a different type of value. Dr. Muller, the Agencies' expert, paired the EPA value as a high-end value with a stated-preference-only value as a low-end value.[44] It is inappropriate to use EPA's "measure of central tendency, or the mean of a probability distribution using both hedonic wage and stated preference studies," as the high end of a range.[45] Because the EPA central tendency value incorporates *both* hedonic and stated preference studies, it should be considered a mid-range estimate, not a high- or low-end estimate.[46] Dr. Muller's range "compares apples and oranges."[47] The Agencies' VSL range skewed low as a result. This ultimately produced an unreasonable proposal which the ALJ Report combined with other parties' positions.

Xcel established its VSL range by manipulating studies in two unreasonable ways. First, Xcel used the results of a sensitivity (i.e. bias) analysis of the Kochi study meta-analysis that included the re-incorporation of negative VSL values into studies that had removed them.[48] These negative VSL inputs would indicate that some individuals *pay* to increase risk to their

[43] Ex. 118 at 5, n.3.
[44] Ex. 808 at 41:24-42:3.
[45] Ex. 118 at 8:5–8; Ex. 115 at 25:11–15.
[46] Ex. 118 at 8:5–8; Ex. 116 at 2:10–18.
[47] Ex. 118 at 8:19-21.
[48] Ex. 118 at 10–13.

life.[49] That is, Xcel selected a value that incorporated irrational inputs into Kochi study. Xcel also calculated the percent impact these negative values would have on the central tendency and used that percentage to adjust lower the VSL values from other data sets in the Kochi study.[50] It applied this percentage to decrease values of two other Kochi study sensitivity analyses.[51] Furthermore, Xcel then put these and other studies thorough an arbitrary statistical process that amplified the irrational inputs:

> By giving the Kochi et al. (2006) (plus negative values rejected by the study authors) data set a weight of 35 percent (more than double the weight of any other study included), Dr. Desvousges was incorporating his own subjective preference. (Ex. 118 at 9–10, Table 2.) Dr. Desvousges gave the three Kochi et al. values a combined weight of 55 percent, preferring further his unreasonable manipulations of that study.
>
> Moreover, the inclusion and weighting of Kniesner et al., a single study estimate in the Monte Carlo exercise, was inappropriate. Every other study included in the Monte Carlo exercise was a meta-analysis, yet Kniesner et al. was given equal weight (15 percent probability) as the Viscusi and Aldy (2003) and Mrozek and Taylor (2002) meta-analyses. (Ex. 118 at 9, 13, T. 2.) Because meta-analyses cover a range of studies and thus reduce the overall effect of errors contained in a single study, affording a single study the same weight as meta-analyses will give that single study's errors undue weight. As with Dr. Desvousges's concentration-response function, a general appeal to his professional judgment does not explain how he assigned weights (*See* ex. 117 at 12:11-13).[52]

Xcel's expert manipulated VSL data irrationally and arbitrarily, resulting in questionable VSL values. The fact of $7.7 million falling within Xcel's VSL range does not provide an adequate rationale to adopt a VSL of $7.7 million. The ALJ Report should not have tried to reconcile a leading proven VSL with Xcel's uniquely unreasonable position on VSL.

[49] *Id.*
[50] *Id.*
[51] *Id.*
[52] CEOs' Initial Brief at 57–58.

Parties did not agree on a VSL value, and splitting the difference between unreasonable VSL proposals and reasonable ones produces an unreasonable result. Thus, the ALJ Report's rationales for its proposed VSL are not something the Commission should adopt.

B. The Evidentiary Record Demonstrates That The EPA VSL Is Reasonable And The Best Available Value.

The CEOs and Agencies both agreed that the EPA central value is a reasonable VSL. Both parties used the EPA value, CEOs adjusting it for income growth and using it as a central tendency point value, and the Agencies for the high end of their range.[53] As the ALJ Report found, the Agencies supported the EPA number with "the fact that [it] has been used many times in air pollution-related policy analyses . . . [as well as] a recent meta-analysis of revealed preference studies[.]"[54] As CEOs explained in briefing:

> [T]he EPA number draws from strong studies and reasonably summarizes them with a central tendency value or mean. EPA established its value based on twenty-six studies, [including both] stated preference . . . [and] hedonic wage studies. . . . It selected these studies using explicit criteria, "and then fit the values to a probability distribution, giving each study equal weight." (Ex. 118 at 4:15–18.)[55]

In order to represent it accurately in current dollars, Dr. Marshall also adjusted the number to account for changes in currency value and real income.[56] As can be seen from its use by both CEOs and Agencies, as well as the federal government over the span of decades, the EPA VSL is

[53] Ex. 118 at 7:12–8:1. Dr. Polasky discussed $10.1 million as the EPA central value tendency in 2015 dollars, but explained that the difference between this and the $9.8 million value Dr. Marshall used "can likely be attributed to differing methods of adjusting the VSL for income growth. Regardless, the difference is small and likely makes Dr. Marshall's value slightly more conservative." Ex. 118 at 5, n.3.
[54] ALJ Report ¶ 40 at 19–20.
[55] CEOs' Initial Brief at 51.
[56] Ex. 115 at 25:13–14.

a reasonable value well-supported in the record and the overall scientific field. The ALJ Report concluded that both parties satisfied the preponderance standard for this study.[57]

There is an additional utility in using this generally-accepted and vetted number from the federal agency with the most expertise on this topic. The EPA may also update the value over time,[58] and if it did, the Commission could choose to update the cost estimates based on that new information. In contrast, $7.7 million is a figure pulled from one meta-study, Kochi et al., and adjusted by Dr. Polasky.[59] Since it is not furthered by any agency and there is no indication it will be revisited, this value does not give the Commission an easy way to update its values should the scientific consensus change. Rejecting the judgment of the EPA in favor of a value that is poorly supported in the record would not be in line with the Commission's duty to make rational choices within its statutory duties. The better approach is to order that environmental cost values be set using EPA's VSL, adjusted for current value.

IV. GEOGRAPHICALLY DIVERSE SOURCE LOCATIONS AND SOURCES OF DIFFERENT EFFECTIVE HEIGHTS SHOULD BE MODELED IN ORDER TO HAVE A USEFUL DATA SET FOR PLANNING PURPOSES

CEOs ask the Commission to order the geographic diversity of source locations and variation of source stack height that would give the Commission the most complete set of values to apply in planning dockets. Based on the record, the Commission should require county-level values like the ones modeled by the Agencies and CEOs' experts.

The ALJ Report offered the most complex, and difficult to parse, answer to the final question addressed in these exceptions: "What sources and source locations should be included?"

[57] ALJ Report ¶ 42 at 101.
[58] Hearing Trans. vol. 6 at 170:24–171:1.
[59] Ex. 118 at 8:11–13.

Recommendation ¶ 4 sets out two suggested answers in the alternative, based on whether the Commission favors averaged/generic source locations or whether the Commission would prefer to have values for each county where an electric generating unit providing energy to Minnesota is located or could be located.

In order to make sense of recommendation ¶ 4, this section first addresses faulty conclusions that complicate recommendation ¶ 4, and then it addresses both of the alternatives suggested by the ALJ Report.

A. Several Conclusions In The ALJ Report Must Be Rejected In Order To Guide The Commission's Decision On Source Locations.

The ALJ Report contains conclusions about source locations that are irrelevant to the resolution of this question and do not follow from Minn. Stat. § 216B.2422, subd. 3's charge. These conclusions are ¶ 31–33 and ¶ 45. These four conclusions should be rejected because they diverge from the record evidence and have rendered the ALJ Report recommendations less useful to the Commission.

In the first of these conclusions, ¶ 31, the ALJ Report asserts that some plants within 200 miles of Minnesota might be "less likely" to "impact Minnesota locations" than other plants within 200 miles of Minnesota.[60] Whether a plant to the southeast of Minnesota is "less likely" to impact Minnesota with air pollution than a plant to the west of this state is irrelevant and not supported by the evidence that the ALJ Report presented in findings.

First of all, it is irrelevant because the Commission's task in this proceeding is to quantify the actual damages of emissions generated to produce electricity in Minnesota. The impacts need not be in Minnesota so long as the power is generated for use here. As a result the distinction

[60] ALJ Report ¶ 31 at 98.

between more likely/less likely that the ALJ Report makes is irrelevant to quantifying the actual damages related to the pollution.

Second, the ALJ Report does not provide record support for conclusion ¶ 31. It cites to Finding ¶ 43, which copies an illustrative map that the Agencies provided in testimony showing projected impacts from emissions emanating from Sherburne County, Minnesota.[61] Not only does this map not show the impacts of emissions from a source outside of Minnesota, it demonstrates that impacts from emissions from Sherburne County occur in all directions from the source, not just to the southeast of the source. The ALJ Report reproduces another finding and map submitted by the agencies that further rebuts conclusion ¶ 31. Finding ¶ 32 reproduces the Agencies illustrative map showing the increased $PM_{2.5}$ concentration around the Sherburne County source, demarcating a zone of increased pollution that stretches from Wyoming to Texas on its west edge.[62] This shows that a source to the southeast of Minnesota, providing Minnesota with electricity, would increase pollution levels in all directions, including in Minnesota. To omit sources to the southeast of Minnesota based on conclusion ¶ 31 would be inconsistent with the record.

The next two conclusions note that the Commission has not *required* modeling of source locations outside of Minnesota where there is not currently a plant,[63] and that the Agencies "have not demonstrated how damages in a Chicago receptor location attributed to a source location in Wisconsin will not be included in Minnesota [criteria pollutant] externalities numbers."[64] Conclusions ¶ 32 and ¶ 33 are flawed because they answer questions the Commission never asked this proceeding to answer. The assertion that the Commission did not "require" the

[61] ALJ Report ¶ 43 at 20–21.
[62] ALJ Report ¶ 32 at 16–17.
[63] ALJ Report ¶ 32 at 98.
[64] ALJ Report ¶ 33 at 98–99.

modeling of emissions from out-of-state sources that do not currently exist ignores the fact that the Commission did not require the modeling of emissions from any particular source. Rather, the task at hand is to provide useful environmental cost values based on what is practicable to model today—two parties have proven in their testimony that modeling emissions from the counties inside Minnesota and within 200 miles of the Minnesota border is both practicable and the most useful way to generate these values.[65] Conclusion ¶ 33 is a similarly unnecessary conclusion based on a question the Commission did not pose. Indeed, in order to have an accurate accounting of the actual damages caused by a generating unit in Wisconsin that provides electricity to Minnesota, the Agencies were required to prove that emissions from that plant *do* have an impact in Chicago—causing the premature deaths of millions over the lifetime of that facility. Both conclusions ¶ 32 and ¶ 33 should be rejected as answers to irrelevant questions that complicate the Commission's decisionmaking.

Finally, conclusion ¶ 45 must be struck, both because it seems to be based on a misunderstanding of atmospheric science and because it calls for the Commission to require impracticable modeling. The ALJ Report conflates the ideas of baseline concentrations and marginal damage in this conclusion, and illustrates this with the example:

> if a power plant in Wisconsin injects significant amounts of O_3 or NO_x into the Chicago area, and the Sherco plant contributes a small additional amount of NO_x to the Chicago area, the Sherco plant is not increasing the ambient concentration of $PM_{2.5}$ in Chicago to the same extent it is likely increasing the ambient $PM_{2.5}$ in Chicago.[66]

The example is intended to demonstrate that if a plant makes a "small additional" contribution to pollution levels, it is not contributing to increased pollution levels. This is categorically false. All

[65] Ex. 115 at 17:2–17:18; ex. 119 at 20:3–22:2; ex. 808 at 18:10–20:2; ex. 811 at 25:7–27:17.
[66] ALJ Report ¶ 45 at 101.

of the modeling in the record demonstrates that additional amounts of the criteria pollutants increase $PM_{2.5}$ levels in downwind locations, due either to direct $PM_{2.5}$ emissions or through the transformation of the other two criteria pollutants into $PM_{2.5}$. To say that a plant is making a small additional increase in Chicago's ambient criteria pollutant levels is the same as saying it is increasing the ambient concentration of $PM_{2.5}$ in Chicago.

Other pollutants coming from other sources (including considerable amounts of pollution from outside the energy sector, such as tailpipe emissions) combine with a modeled marginal increase from a particular source to form the total ambient concentration. Each small addition to the baseline combines with other emissions to create the larger whole. But conclusion ¶ 45 states the above Sherco example and ultimately concludes: "if damages are based on ambient concentrations at receptor sites outside of Minnesota based on Minnesota sources and source locations, then any out-of-state sources of pollution must be excluded from the Minnesota damage costs."[67] This is tantamount to rejecting all air modeling in the record and requiring all of the models to be redesigned from the ground up to exclude almost all sources of pollution, be they other energy units in other states, other industrial sources of pollution such as smelters and refineries, or cars and trucks causing pollution in urban areas. There is no evidence in the record that suggests any of the three models used by the experts could exclude all out-of-state sources of pollution, because the baseline ambient levels that all three models use necessarily include data that reflects emissions from many millions of known and unknown pollution sources. It is utterly impracticable to follow conclusion ¶ 45's recommendation about how the modeling should be conducted to set environmental cost values.

[67] ALJ Report ¶ 45 at 101.

B. County-Level Sources At Different Stack Heights Produces The Most Useful Data Set For Planning Purposes.

It is evident from the parties' testimony and the ALJ Report's remaining conclusions that the answer to "What sources and source locations should be included?" is: the Minnesota counties and counties within 200 miles of Minnesota that both CEOs and the Agencies offered in direct testimony.[68]

Where pollution is coming from creates the most variation in environmental cost values among model parameters, and even more variation in results than model choice itself. Differences in emissions locations modeled by Dr. Marshall showed differences in modeled damages that vary by up to a factor of 100.[69] By contrast, when controlling for modeling parameters, the difference between the models used by the three experts only diverged at the most by a factor of 3.6.[70] Therefore, knowing where emissions are coming from is significantly more important than which of the three models the Commission ultimately chooses to use. Any lack of precision in this location modeling parameter ordered by the Commission will likely produce inaccurate values in subsequent planning dockets.

The ALJ Report does not take a position on whether county-level source locations up to 200 miles from the Minnesota border would be useful, but it notes correctly that the Commission has already decided that this range of source locations is appropriate. In conclusion ¶ 38, the ALJ Report asserts that whether county-level values would be useful "is a policy decision most

[68] While this section refers to these data sets as being county-level, both the CEOs and Agencies did model some of the generating units in Minnesota to provide exact figures for these units. For the sake of this source location discussion it should be assumed that the Commission can order the modeling of any specific plants it deems useful in addition to all the county-level sources. This additional information is not difficult for a modeler to generate using reduced-form models.
[69] Ex. 116 at 5:12–13 *accord* Ex. 119 at 3:14–15.
[70] Ex. 119 at 3:14–15, *see also* CEOs' Initial Brief at 33 (discussing how source locations produce larger differences in damage results than model choice).

appropriately made by the Commission" and that ordering such values to improve its decisionmaking is therefore up to the Commission's discretion.[71] The testimony of two experts in the record demonstrates that, using reduced-form modeling, generating specific county-level environmental cost values is now practicable using today's science. "As the parties have demonstrated in this proceeding, the science and the modeling capabilities have matured significantly since the First Externalities proceeding."[72] This advancement in scientific knowledge pairs well with the ALJ Report's conclusion "that the Commission's decision in the First Externalities case to establish [values applicable to] all locations within Minnesota as well as to locations within 200 miles of the Minnesota border was made as the most reasonable, practicable decision at the time."[73] The usefulness and reasonableness of having values that can be used across Minnesota and for sources within 200 miles of Minnesota has not changed, but the ability to calculate values specific to every county has reached a point that the Commission can now order a full data set that does not only include generic estimates[74] based on rough geographic categories. The Commission should therefore follow what it deemed useful in the last environmental costs proceeding and order scientifically-practicable precise county-level source location modeling across Minnesota and nearby counties.

There is no reason to exclude some counties within 200 miles of Minnesota. The ALJ Report recommends "a model configuration that includes all 87 counties in Minnesota, but only out-of-state sources that reflect active EGUs in the out-of-state locations."[75] However, if the

[71] ALJ Report ¶ 38 at 100.
[72] *Id.*
[73] ALJ Report ¶ 34 at 99.
[74] As Dr. Marshall's direct testimony (Ex. 115) makes clear, the Commission can order generic values to be used when a new generating source is not yet sited, but these generic values can be generated to supplement, not replace, the more precise county-by-county values.
[75] ALJ Report ¶ 4.b. at 104.

Commission opts to have a data set of county-level values there is no reason to distinguish between existing and future emissions from out-of-state counties within 200 miles of Minnesota—both reduced-form models used by experts in this proceeding could just as easily calculate 87 county values as the several hundred values comprising all counties. There is no practicability issue about getting a full data set, and as discussed above the Commission should reject conclusion ¶ 32 that emphasized the Commission did not "require" calculation of potential emissions sources outside Minnesota. The Commission should require comprehensive modeling now, including all relevant county locations.

Also, the Commission should reject the part of recommendation ¶ 4.b. "that the Commission exclude out-of-state sources located in eastern Wisconsin, Michigan, and Illinois."[76] As discussed above, omitting wide swaths of pollution sources from the current models is not something contemplated in the instant record's models and there is no evidence that such a modification to the models would be possible or would yield scientifically-defensible results. It is not clear from this recommendation whether the proposed exclusion is based on conclusions ¶ 31, ¶ 33, or ¶ 45, but the Commission should reject all three of these conclusions for reasons stated above, and this part of the recommendations should be deleted as well.

The Commission should also order modeling based on different stack heights. As calculated by Dr. Marshall and reproduced in the ALJ Report: "The CEOs used effective stack heights of 29m, 310m, and 880m, which are meant to represent the vertical centers of the InMAP grid cell layers. The heights are based on the effective stack heights for small (25th percentile),

[76] ALJ Report ¶ 4.b. at 104. It is unclear what part of eastern Michigan would be within 200 miles of Minnesota, but since this language should be stricken as a whole it is not material exactly what was the intended exclusion.

medium (75th percentile) and large power plant stack heights in Minnesota."[77] If the Commission orders the modeling of these stack heights then the appropriate stack height can be applied later to the planning dockets at hand, creating even more specificity regarding the type of plant being planned.

Source locations and stack heights both have a large impact on the range of modeled damage values. Using a reduced-form model allows for a sufficient number of model runs to be done reliably at various locations and heights in order to have a full data set for all potential utility planning purposes. Both InMAP and AP2 models were designed for the purpose at issue here, calculating changes in ambient pollution levels based on small marginal changes at different source locations, and it is reasonable to rely on them for this proceeding. Despite the ALJ Report assertion "that neither the CEOs nor the Agencies have proved by a preponderance of the evidence that their respective InMAP or AP2 models can reliably predict [criteria pollutant] externality values across the contiguous U.S.,"[78] both Drs. Marshall and Muller offered ample record evidence to show that their models are accurate and useful for the task at hand.[79] Based on the record evidence from both of these experts, the Commission should either order the use of one of these reduced-form models, or both of them in order to generate what Dr.

[77] ALJ Report ¶ 91 at 36; *see also* Ex. 115 at 17–20.
[78] ALJ Report ¶ 43 at 101.
[79] Ex. 119, Schedule 1; ex. 808 at 23:1–32:12; ex. 810 at 39:2–46:7. The ALJ Report concluded that "The model should produce accurate results, regardless of the use to which the data will be put." ALJ Report ¶ 21 at 96. But this is a versatility standard we as a society do not hold our tack hammers and sledgehammers to, let alone complex computer models that are designed for a specific use. To say that a computer program made for one thing should be able to do another different thing is to misunderstand the precision of the instruments involved, and as a result it is an error in the ALJ Report conclusions to hold reduced-form models meant for calculating marginal-ton damages to EPA standards intended for compliance with the State Implementation Plan modeling standards under the Clean Air Act as the ALJ Report concluded.

Marshall described as "a scientific approach called ensemble prediction,"[80] to further decrease uncertainty in the results of these two proven and useful tools.

In order to produce useful and accurate results the commission should order the modeling of county-level environmental cost values at several different stack heights. The record demonstrates that generating such values is practicable and the modeled results are sufficiently reliable.

C. The Record Contains Evidence Sufficient To Support More Geographic Diversity And Varied Stack Heights Even If The Commission Prefers Using CAMx.

Even if the Commission decides to order modeling with the more complex and resource-intensive model offered by Xcel, CAMx, there is sufficient record support to retain some geographic variability in source locations. Paired with modeling of sources at different effective stack heights, this adjusted modeling using CAMx would be a great improvement on recommendation ¶ 4.a. in the ALJ Report.

The ALJ Report's recommendation ¶ 4.a. as-written amplifies the source-location faults in Xcel's proposal, and would lead to confusing environmental cost values that would be unnecessarily difficult to apply in planning dockets. The ALJ Report describes "a five- or six-tiered version of Xcel's three-tiered proposed sources and source locations. The Administrative Law Judge recommends that the additional tiers incorporate factors such as nearby topography, vegetation, buildings, etc. . . ."[81] but there is no further explanation of how a generic value—meant to be applied to sources across Minnesota's many different ecological regions and with totally different downwind communities—could incorporate variables such as "buildings" in a

[80] Ex. 119 at 7.
[81] ALJ Report ¶ 4.a. at 104.

meaningful way that would aid in grouping source locations. While the ALJ Report suggests a potential additional "small town" tier to supplement Xcel's "rural" value, this is already part and parcel of Xcel's three values because its modeled "rural" location is located in the town of Marshall, Minnesota, a community in Lyon County with roughly 13,000 residents. To apply the Marshall value to another "small town" or similarly-sized small city, like Grand Rapids in Itasca County (population approximately 10,000), would be to ignore the fact that these locations are in different parts of the state with totally different downwind populations. While both of these source locations will have some impact on some cities, the impacts will be remarkably different, as demonstrated by ample modeling evidence in the record regarding the different county-level damage calculations.[82] The additional categories of "isolated" rural and "less so" rural proposed in this recommendation,[83] would be even harder to apply in planning dockets. The three designations in existing values, i.e. rural/metro-fringe/urban, are not defined and already lead to planning that does not adequately assess the geographic differences between source locations—adding two or three more difficult-to-define categories would only make the values less easy to apply confidently.

Instead of using or expanding upon Xcel's undefined categories, the Commission could use evidence in the record to order modeling at geographically-diverse source locations. For example, the Agencies' expert Dr. Muller modeled six existing plants that provide more geographic diversity than the Xcel categories, namely: Black Dog, Clay Boswell, Sherburne County, A.S. King, Riverside, and High Bridge.[84] The Commission could order the modeling of

[82] *See* Ex. 115, Schedule 3 (complete list of county-level values offered by CEOs' expert).
[83] *See* ALJ Report ¶ 4.a. at 104.
[84] Ex. 808, Schedule 3.

emissions from these six plants, or even supplement this list with a few more plant locations[85] in order to give a fuller geographic range for source locations than is represented in Xcel's testimony or the ALJ Report's recommendation ¶ 4.a. Such plant-based values would not be as specific and useful as county-based values, but at least these values could be applied because they would cover existing generation and, in the case of new generating units, it would be straightforward to triangulate the nearest source location to a proposed plant.[86]

Furthermore, if the Commission decides to order modeling using CAMx at specific plant locations, it would also be logical for the Commission to call for modeling at different stack heights, to account for different potential types of plants. Dr. Marshall described the merits of having data at different stack heights, and the impact that height has on damage results.[87] Moreover, as the Commission already knows, existing coal plants have high stack heights, but newer gas plants often are designed to emit their pollutions from a lower stack. As a result, the Commission should order modeling that reflects both current stack heights at these plants, and also a likely lower stack height for new generation at the same locations. Testimony submitted by Xcel provides sufficient stack height data to calculate the average stack height of gas plants in Minnesota.[88] The table that Xcel provided in its testimony gives the Commission applicable data to make informed averages for effective stack height within the CAMx modeling parameters.

[85] The Commission could either use Xcel's list of plants in the record, Desvouges Direct Schedule 3, pages 22 and 23, to supplement Dr. Marshall's examples, or take administrative notice of other plants not owned by Xcel but within the Commission's purview that give greater geographic coverage.
[86] This suggestion on triangulation is not found in the evidentiary record, but since it bears on how the values are used and not on how they are calculated it is a matter for the Commission to determine outside of this particular quantification docket.
[87] Ex. 115 at 20.
[88] *See* Ex. 604, Schedule 3 at 22 and 23.

While it would be much more useful to the Commission's planning dockets to have specific county-level results, should the Commission order modeling using CAMx, the suggested changes here would allow for no more than a few dozen model runs that would provide better geographic scope and source height parameters than suggested by recommendation ¶ 4.a. As discussed in the previous section, reduced-form models are more appropriate for this proceeding and would produce more useful results, but the Commission could choose any of the three models used in this proceeding and—with carefully chosen parameters—produce better values than simply falling back on "rural, metro-fringe, and urban" values that do not reflect real-world source locations and types.

RECOMMENDATION

In light of the above arguments the CEOs recommend that the Commission order modeling with the following specific changes to the ALJ Report's recommendations:

- Amend recommendation ¶ 5 to require modeling at a national—continental U.S.—scope, consistent with the legal requirement to model actual damages to society and the practicability of modeling nationally using current science.
- Amend recommendation ¶ 3 and order modeling using the actual concentration-response function values given by Krewski and Lepeule, 7.8 and 14 percent.
- Amend recommendation ¶ 2 and order modeling using the EPA's VSL, adjusted to current value based on changes in income levels and inflation.
- Amend recommendation ¶ 4 to either require the modeling of county-level emissions in all Minnesota counties and all counties within 200 miles of Minnesota, or to at least require modeling at diverse geographic source locations based on current generating units, and incorporating several different stack heights to account for the

differences between the average height of existing coal units and the likely average height of any future natural gas units.

These amendments to the ALJ Report, and the rejection of conclusions ¶ 31 through ¶ 33 and ¶ 45, will lead to the most practicable and accurate environmental cost values for the criteria pollutants, resulting in improved Commission planning and decisionmaking in the future.

Dated: July 15, 2016

/s/ Hudson Kingston

Hudson B. Kingston
Minnesota Center for Environmental Advocacy
26 East Exchange Street, Suite 206
St. Paul, MN 55101
Phone: (651) 287-4880
hkingston@mncenter.org

Attorney for Clean Energy Organizations

STATE OF MINNESOTA
FOR THE PUBLIC UTILITIES COMMISSION

In the Matter of the Investigation into
Environmental and Socioeconomic Costs
Under Minn. Stat. § 216B.2422, Subd. 3

AFFIDAVIT OF SERVICE

PUC Docket No. E-999/CI-14-643
OAH Docket No. 80-2500-31888

STATE OF MINNESOTA)
)ss.
COUNTY OF RAMSEY)

Erin Mittag being duly sworn says that on the 15th day of July, 2016, she served via electronic service the following:

- Clean Energy Organizations Exceptions to Findings of Fact, Conclusions, and Recommendations

on the following persons, in this action, by filing through e-dockets:

Attached Service List

/s/ Erin Mittag
Erin M. Mittag
Legal Assistant

Subscribed and sworn to before me
this 15th day of July, 2016

/s/ Leigh Currie
Notary Public
My Commission Expires January 31, 2017

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
David	Aafedt	daafedt@winthrop.com	Winthrop & Weinstine, P.A.	Suite 3500, 225 South Sixth Street Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Michael	Ahern	ahern.michael@dorsey.com	Dorsey & Whitney, LLP	50 S 6th St Ste 1500 Minneapolis, MN 554021498	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Marc	Al	marc.al@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
B. Andrew	Brown	brown.andrew@dorsey.com	Dorsey & Whitney LLP	Suite 1500 50 South Sixth Street Minneapolis, MN 554021498	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Hugh	Brown	brown.hugh@dorsey.com	Dorsey & Whitney LLP	Suite 1500 50 South Sixth Street Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Carl	Cronin	carl.cronin@xcelenergy.com	Xcel Energy	414 Nicollet Mall Minneapolis, Minnesota 55401	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Leigh	Currie	lcurrie@mncenter.org	Minnesota Center for Environmental Advocacy	26 E. Exchange St., Suite 206 St. Paul, Minnesota 55101	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Patricia	DeBleeckere	tricia.debleeckere@state.mn.us	Public Utilities Commission	Suite 350 121 Seventh Place East St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, Fifth Floor Minneapolis, MN 55401	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Jessica	Dexter	jdexter@elpc.org	Environmental Law & Policy Center	394 Lake Avenue, Ste. 309 Duluth, MN 55802	Electronic Service	No	OFF_SL_14-643_Official CC Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Brian	Draxten	bhdraxten@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380498	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Tristan	Duncan	tlduncan@shb.com	Shook Hardy & Bacon, L.L.P.	2555 Grand Blvd. Kansas City, MO 64108	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Bret	Eknes	bret.eknes@state.mn.us	Public Utilities Commission	Suite 350 121 7th Place East St. Paul, MN 551012147	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Jim	Erickson	jim.g.erickson@xcelenergy.com	Xcel Energy	414 Nicollet mall 7th Flr Minneapolis, MN 55401	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Bruce	Gerhardson	bgerhardson@otpco.com	Otter Tail Power Company	PO Box 496 215 S Cascade St Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Emerald	Gratz	emerald.gratz@state.mn.us	Office of Administrative Hearings	PO Box 64620 Saint Paul, Minnesota 55164-0620	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Thomas J.	Grever	tgrever@shb.com	Shook, Hardy &Bacon L.L.P.	2555 Grand Blvd. Kansas City, MO 64108	Electronic Service	No	OFF_SL_14-643_Official CC Service List
J Drake	Hamilton	hamilton@fresh-energy.org	Fresh Energy	408 St Peter St Saint Paul, MN 55101	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Linda	Jensen	linda.s.jensen@ag.state.mn.us	Office of the Attorney General-DOC	1800 BRM Tower 445 Minnesota Street St. Paul, MN 551012134	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Kevin D.	Johnson	kdjohnson@stoel.com	Stoel Rives LLP	Suite 4200 33 South Sixth Street Minneapolis, MN 55402	Electronic Service	No	OFF_SL_14-643_Official CC Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Sarah	Johnson Phillips	sjphillips@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Hudson	Kingston	hkingston@mncenter.org	MN Center for Environmental Advocacy	26 East Exchange Street, Suite 206 St. Paul, Minnesota 55101	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Brad	Klein	bklein@elpc.org	Environmental Law & Policy Center	35 E. Wacker Drive, Suite 1600 Suite 1600 Chicago, IL 60601	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Kevin	Lee	kevin@kevinleelaw.com		400 S. 4th St. Suite 401-111 Minneapolis, MN 55415	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Jonathan	Massey	jmassey@masseygail.com	Massey & Gail LLP	1325 G Street NW Washington, DC 20005	Electronic Service	No	OFF_SL_14-643_Official CC Service List
David	Moeller	dmoeller@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022093	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Andrew	Moratzka	apmoratzka@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Jeff	Oxley	jeff.oxley@state.mn.us	Office of Administrative Hearings	600 North Robert Street St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Michelle	Rebholz	michelle.rebholz@state.mn.us	Public Utilities Commission	Suite 350121 Seventh Place East St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Kevin	Reuther	kreuther@mncenter.org	MN Center for Environmental Advocacy	26 E Exchange St, Ste 206 St. Paul, MN 551011667	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Laureen	Ross McCalib	lrossmccalib@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 55369-4718	Electronic Service	No	OFF_SL_14-643_Official CC Service List
LauraSue	Schlatter	LauraSue.Schlatter@state.mn.us	Office of Administrative Hearings	PO Box 64620 St. Paul, MN 55164-0620	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Janet	Shaddix Elling	jshaddix@janetshaddix.com	Shaddix And Associates	Ste 122 9100 W Bloomington Frwy Bloomington, MN 55431	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Sean	Stalpes	sean.stalpes@state.mn.us	Public Utilities Commission	121 E. 7th Place, Suite 350 Saint Paul, MN 55101-2147	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Donna	Stephenson	dstephenson@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 55369	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Eric	Swanson	eswanson@winthrop.com	Winthrop Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_14-643_Official CC Service List
SaGonna	Thompson	Regulatory.records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Erin	Vaughn	evaughn@shb.com	Shook, Hardy &Bacon L.L.P.	2555 Grand Blvd. Kansas City, MO 64108	Electronic Service	No	OFF_SL_14-643_Official CC Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Colin	Wicker	wicker.colin@dorsey.com	Dorsey & Whitney LLP	50 6th Street South Suite 1500 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Alexis	Williams	williams@fresh-energy.org	Fresh Energy	408 St. Peter St Suite 220 St. Paul, MN 55102	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Cam	Winton	cwinton@mnchamber.com	Minnesota Chamber of Commerce	400 Robert Street North Suite 1500 St. Paul, Minnesota 55101	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Daniel P	Wolf	dan.wolf@state.mn.us	Public Utilities Commission	121 7th Place East Suite 350 St. Paul, MN 551012147	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List