

**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

**PHASE II—CRITERIA POLLUTANTS
REPLY BRIEF**

of

CLEAN ENERGY ORGANIZATIONS

APRIL 15, 2016

TABLE OF CONTENTS

INTRODUCTION 1

I. RESPONSE TO XCEL ENERGY. 2

 A. Xcel Has Failed To Support Its Artificial Geographic Scope..... 3

 1. Xcel’s attempt to inject policy considerations into a quantification exercise is inappropriate. 4

 2. Xcel has not provided evidence that uncertainty increases with distance or as predicted changes in concentration become smaller. 6

 3. Xcel has not provided any evidence that the majority of impacts or damages are in the box..... 9

 B. Xcel Has Failed To Prove That CAMx Is The Proper Tool For This Job..... 10

 1. CAMx is unable to account for geographic variability..... 11

 2. Geographic Domain has a greater influence over results than model choice. 13

 3. Xcel failed to prove that InMAP is inaccurate..... 13

 C. Xcel Uses Inconsistent Arguments To Support Its Manufactured Method Of Incorporating Concentration Response Functions And VSLs. 17

II. RESPONSE TO MINNESOTA LARGE INDUSTRIAL GROUP..... 19

 A. MLIG Fails To Disprove The Linear Relationship Between Changes In Concentrations And Health Impacts At Concentration Levels Below 12 Micrograms Per Cubic Meter..... 19

 B. MLIG Fails To Demonstrate The Relevancy Of The NAAQS To The Question Before The Commission..... 21

 C. MLIG’s Focus On Causation Is Misplaced. 22

III. USE OF EXTERNALITY VALUES IN RESOURCE PLANNING..... 23

 A. Externality Values Are Only One Factor That The Commission Considers. 24

 B. Resource Planning Considers Location-Specific Resources. 25

CONCLUSION..... 26

INTRODUCTION

Despite sometimes complex and technical testimony offered in this proceeding, the decision is straightforward. Three parties have offered updated environmental cost values for consideration by the Commission. Two of these three parties have independently offered remarkably similar paths to calculate these values. This shared path is based on objective and independent reviews of the best science available to address the question asked. The scientists retained by the Clean Energy Organizations (CEOs) and the Department of Commerce and Pollution Control Agency (the Agencies) were not asked to develop the highest—or lowest—possible environmental cost values; they were asked to use their best judgment and develop the most accurate values possible. And they independently followed the established science down very similar paths.

The outlier in this group is Xcel Energy (Xcel). The record is clear that the values being proposed by Xcel do not represent the best available science and would not be reasonable values for the Commission to adopt on this record. Xcel does not dispute that its values are inaccurate due to the truncated geographic domain Dr. Desvousges forced the model to use. In addition, the values Xcel proposes are based on the subjective judgment of one expert's views of the relevant academic literature. This judgment was not used to choose peer-reviewed inputs from the relevant academic literature, but was instead used to manipulate results into an unrecognizable form. The contrast presented by the record makes the decision simple.

The Administrative Law Judge is tasked with recommending a path forward to the Commission. Based on a preponderance of the evidence the path must include: (1) choosing a model that can account for geographic variability; (2) using a geographic scope that results in estimations of actual damages; (3) using concentration response functions from the best available

epidemiological studies; and (4) using a Value of Statistical Life recommended by the Environmental Protection Agency (EPA).

In this Reply Brief, CEOs respond to arguments presented in the Initial Briefs of Xcel, Otter Tail Power (OTP), and the Minnesota Large Industrial Group (MLIG) suggesting that it would be reasonable for the Commission to stray from the obvious path, and CEOs also provide a response to all of these Parties' claims about how these values will be used in Commission proceedings.

I. RESPONSE TO XCEL ENERGY.

Xcel's arguments in support of its proposed damages are inconsistent and misleading. Xcel's approach does not supply the Commission with estimated damages that are as accurate as possible using the best tools available today, but rather supplies the Commission with estimated damages that are artificially low. Xcel fails to support its artificial geographic domain with any scientific evidence, instead admitting that it is a policy choice. To distract from the overwhelming scientific evidence in the record supporting values based on actual damages, Xcel focuses inordinate attention on the capabilities of the model it chose to use—CAMx. But despite this attention, Xcel fails to prove that reduced-form models like InMAP are unable to estimate damages as accurately as CAMx. Xcel's inconsistent, and at times hypocritical, approach to estimating damages extends to its arguments in support of its unnecessary and subjective approach to incorporating the concentration-response functions and VSL values into the modeling exercise.

Ultimately, the Commission should rely on the best available models and science supported by this record. The best available models—including Xcel's model—all show that

damages occur on a national scale. The best available science leads to values vetted by the EPA and the Science Advisory Board rather than values created by one Party's witness.

A. Xcel Has Failed To Support Its Artificial Geographic Scope.

Xcel admits that its decision to truncate the geographic scope of damages is not based on the best available science, but instead is a policy decision. Xcel Initial Brief at 8. CEOs agree that there is no scientific basis for Xcel's geographic domain, but disagree that the statutory language gives the Commission the authority to truncate the domain for policy reasons. The statutory language is not ambiguous. *See* Minn. Stat. § 216B.2422 subd. 3(a). The statute does not limit damages to Minnesota—the only limitation is practicability.¹

As discussed in CEOs' Initial Brief, estimating actual damages beyond Minnesota is practicable and therefore required by the statutory language. CEOs Initial Brief at 17–31. And as the Agencies have correctly explained, “the decision needs to be supported by the evidentiary record . . . [and] the current record demonstrates that it is practicable to set an estimate of the range of damage values for the emissions at issue in this proceeding that is not constrained to impacts in Minnesota.” Agencies Initial Brief at 56–57. The statute does not give the Commission discretion to limit an “environmental cost” to something not supported by the record, and this record shows “there is no scientific basis not to count damages that occur beyond the boundary of Minnesota.” *Id.* at 57.

¹ Contrary to Xcel's claim that practicability means the proposed values “provide useful information and can in fact be applied for their intended purpose,” (Xcel brief at 1), the word means “‘feasible,’ or capable of being accomplished.” *See* CEO brief at 18 (quoting *Findings of Fact, Conclusion, Recommendation and Memorandum*, Docket no. E-999/CI-93-583 at 10 (Mar. 22, 1996) (quoting Webster's New Universal Unabridged Dictionary (2d Ed. 1983))); *see also Findings of Fact, Conclusions, and Recommendations: Carbon Dioxide Values*, Docket No. E-999/CI-93-583 at 125 (Apr. 15, 2016).

Xcel claims that its decision is supportable for policy reasons, but injecting policy decisions into a scientific exercise is inappropriate and should be rejected. Xcel additionally attempts to justify its artificial domain by claiming that damages “far away from the source” or based on small changes in concentration are too uncertain, that the “majority” of impacts occur within its box, and that precedent supports its truncated domain. Xcel Initial Brief at 70–71. But Xcel fails to support these assertions with any evidence.

1. Xcel’s attempt to inject policy considerations into a quantification exercise is inappropriate.

Xcel states that the environmental values should be based on “credible and accurate estimates, which means that the models and methods must rely on sound science and economics,” (Xcel Initial Brief at 7), but then proceeds to propose the opposite. The company claims that it is using “policy decisions” from the last proceeding as the basis for its decision to only offer three different values based on emission location (i.e. urban, rural, and metro fringe) and to ignore damages outside of its Minnesota Domain. *Id.* at 10–11. But even assuming that all of the “policy decisions” made in the 1990s should be followed today,² Xcel’s argument falls apart because the 1996 ALJ Report³ and 1997 Commission Order⁴ are clear that these decisions were based on practicability not policy.

² Xcel makes the point that the last ALJ found Minnesota-only damages acceptable, and encourages this proceeding to remain hidebound to that decision. Xcel Initial Brief at 10–11. But even taking that position at face value, Xcel has not proposed Minnesota-only damages and instead created a grid box that includes approximately 100 extra miles of damages in three directions. *Id.* at 11. The proposed values coming from CAMx do not comport with the geographic limitation to Minnesota from the previous proceeding that Xcel suggests is a key policy decision that should not be disturbed.

³ Findings of Fact, Conclusion, Recommendation and Memorandum, Docket no. E-999/CI-93-583 (Mar. 22, 1996) (referred to herein as 1996 ALJ Report).

⁴ Order Establishing Environmental Cost Values, Docket No. 93-538 (Jan. 3, 1997) (Ex. 306, herein referred to as “1997 Commission Order”).

The decisions in the 1990s were based on the best available data in the record at the time, which did not include more geographically sensitive values or actual damages beyond Minnesota. 1996 ALJ Report at 20, 28–29. But making these same decisions today to limit the information made available to the Commission would not reflect either sound science or economics since they do not reflect data in the record or the best available scientific information. This proceeding is charged with updating the values based on current science, not holding them as they were based on a sparser record when “the quantification of environmental costs [was] still in its infancy.” 1996 ALJ Report at 17. The last ALJ addressing this issue made it clear that his values “err[ed] on the side of conservatism,” but he proposed that later proceedings “increase the values gradually if better information in the future confirms the need for higher values.” *Id.* at 18. Better information has led to the reopening of this inquiry, and it is our charge today to use this better information to set the best values according to today’s scientific and economic knowledge.

This proceeding is a quantification exercise. The only limitation in the statute and the only limitation that should be considered as part of these proceedings is what is practicable. We have data from three separate models showing that pollution travels outside of Minnesota—sometimes to distant locations. There is no longer a practicability-based reason to exclude damages occurring outside of Xcel’s Minnesota Domain—all three models predicted the increases in concentration in these areas due to Minnesota emissions. And Xcel admits as much—it acknowledges that this is a policy choice. Policy choices like those that Xcel are trying to impose are not appropriate for the task at hand. It would be arbitrary and capricious to set deliberately inaccurate cost values. There are no data in the record showing that the predictions

of the model are too uncertain beyond the Minnesota Domain to be useful or that pollution stays within Xcel's artificial domain.

2. Xcel has not provided evidence that uncertainty increases with distance or as predicted changes in concentration become smaller.

Xcel asserts that “from a scientific perspective, there is more uncertainty when air quality changes are modeled far away from the source and when the predicted concentration changes are very small.” Xcel Initial Brief at 71. This assertion is not supported by any scientific evidence. There has been no evidence provided that uncertainty increases with distance. The parties have all agreed that there is some inherent uncertainty in air modeling, but none have shown that the uncertainty is correlated with distance. Asserting a relationship between two things, even from a “scientific perspective,” with no evidentiary support does not make it true.

Assuming national damages are zero makes Xcel's damages more uncertain, not less. *See* CEOs' Initial Brief at 25 (citing 1996 ALJ Report at 28). Matter does not disappear, it cannot be destroyed, and once a criteria pollutant has been emitted it goes somewhere. (Tr. Vol. 8 at 25:14–19.) The models in this record predict that these pollutants spread out at least as far as the contiguous United States. The record is clear that actual damages occur throughout the United States from emissions from facilities inside Minnesota. The effect of the grid box is that “Xcel proposed a known inaccurate damage value for the Commission to use in its proceedings.” (Agencies' Initial Brief at 8). In contrast, experts for CEOs and the Agencies calculated *all* damages as is called for by the law at issue and the best available science. *See id.* at 23–25 (discussing Dr. Muller's calculation of “all damages” across the appropriate geographic range). Omitting actual damages caused by Minnesota emissions makes Xcel's values more uncertain, not less.

Small changes in concentration, whether in Minnesota or outside of the state, are expected when modeling changes due to small marginal increases in emissions. Specifically, AP2 modeled one ton of each pollutant (ex. 808 at 20:13–14), InMAP modeled 1,000 tons of each pollutant (ex. 119, schedule 3), and CAMx modeled emissions equivalent to those from one coal unit (for NO_x and SO₂) alongside emissions of one natural gas plant (9.4 tons of PM_{2.5}) (ex. 608 at 3). These relatively small amounts⁵ will inevitably lead to small modeled changes in concentrations. But all three models can calculate damages based on these small changes—CAMx modeling and Dr. Desvousges’s analyses are no different here. Dr. Desvousges admitted that he used small changes to calculate damages—possibly using changes smaller than the changes CAMx was predicting outside of the Minnesota Domain. (Tr. Vol. 7 at 141–43.) Despite using small changes to calculate damages, Xcel attempts to put the basis of its estimates in doubt stating “very small concentration changes . . . may or may not cause human health effects, and may or may not cause health effects in a linear manner.” Xcel Initial Brief at 57. To the extent that Xcel is no longer confident that its modeling choices were correct, the Commission should give Xcel’s overall figures less weight.

Xcel also attempts to put all of the models’ results in question by comparing computed changes of 0.00001 µg/m³ to background long-term baseline values on the order of 8–23 µg/m³:

Every Party that conducted modeling, treated the results of health studies linearly, meaning that the relationship between mortality risk and PM_{2.5} concentration change are considered the same whether the concentration change is 10 µg/m³ or 0.00001 µg/m³. However, this linear relationship has been established based on correlations seen at the 8–23 µg/m³ range and has not been evaluated at very low concentration levels. Similarly, there is no existing health research that supports an association between very small PM_{2.5} concentration levels and premature mortality; all

⁵ Compare these incremental emissions to annual PM_{2.5} emissions from Sherco alone of 1,044 tons of PM_{2.5}. (Ex. 608, schedule 2 at 8.)

epidemiological studies have focused on much higher levels of concentrations that can be observed and measured. Again, every Party that conducted modeling assumed that the very small changes in PM_{2.5} ambient concentrations are statistically different than zero, although there is no existing research to support that conclusion.

Xcel Initial Brief at 67.

The above paragraph is misleading at best and disingenuous at worst. It discusses both the linear relationship between PM_{2.5} exposure (meaning there is a corresponding change in mortality regardless of how small the change in concentration is) and the ambient concentrations that have been studied by epidemiologists (the evidence shows a linear relationship at observed levels between 8 and 23 ug/m³). This paragraph implies that Parties are suggesting health impacts at “very small PM_{2.5} concentration levels,” i.e. at concentrations below those observed. That simply is not true. All of the models apply a change to a baseline. For example, if one air model calculated a change of .01 ug/m³ in an area with a baseline of 10 ug/m³, the damage value would be calculated from the difference in deaths between ambient levels of 10 ug/m³ and 10.01 ug/m³, not the damages of a hypothetical place where pollution values went from 0 ug/m³ to 0.01 ug/m³. Focusing on the small calculated changes ignores the fact that they are changes to baseline concentrations in line with those observed in epidemiological literature. CEOs Initial Brief at 48 (citing ex. 443). This is a separate issue from the fact that large cohort studies demonstrate that as particulate matter increases, deaths increase in a linear fashion. (Ex. 117, schedule 3 at 967–68; ex. 809 attachment 2 at 6; ex. 811 at 33:6–13.) The assertion that “there is no existing health research that supports an association between very small PM_{2.5} concentration levels and premature mortality” (Xcel Initial Brief at 67) conflates these two concepts. Small changes are to be expected when modeling incremental increases in emissions. The fact that

changes are small does not increase uncertainty; Xcel's Minnesota Domain is a policy choice to keep values low—nothing more.

3. Xcel has not provided any evidence that the majority of impacts or damages are in the box.

Dr. Desvousges was clear in his testimony that Xcel “did not calculate impacts beyond the box.” (Tr. Vol. 7 at 61:10.) Despite the fact that Xcel never calculated impacts (or damages) outside the arbitrary grid box, the company continues to assert that the majority of impacts fall within its box. Xcel Initial Brief at 60. This baseless assertion has been rebutted by both of the experts who have provided modeling data for the contiguous United States and vetted Dr. Desvousges's assertions. (*See, e.g.*, ex. 119 at 9:10–15:19; ex. 811 at 12:5–15:20.) Since there is no evidentiary basis for this geographic scope, it would be arbitrary and capricious to follow Xcel's reasoning on the grid box. The record has not been sufficiently developed to support Xcel's position.

Rather, the record shows that a large proportion of damages from Minnesota emissions occur when those emissions travel out of state. Moreover, most of the population of the United States is outside of Xcel's artificial grid box. One of the largest American cities is Chicago, located to the Southeast of Minnesota. In addition, high population density cities like Chicago have elevated ambient pollution levels. As MLIG pointed out, Chicago regularly experiences elevated particulate matter compared with Minnesota's ambient levels. MLIG Initial Brief at 10. As Dr. McClellan made clear, “it is apparent that, when used in company with standard baseline data for specific cities with populations measured in the millions, the calculated number of excess deaths is large.” (Exhibit 441, App. at 78.)

The Agencies agree that some of the largest damages attributable to Minnesota emissions occur in Chicago, entirely outside of Xcel's arbitrary grid box. *Id.* at 50 (Figure 4 and discussion

in text). “Chicago is farther away so it incurs a lower change in air quality, but its large population renders it relatively more susceptible to exposures and impacts.” *Id.*

It is hard to understand how Xcel could still not acknowledge a large share of the damages caused by Minnesota emissions occur in populations outside of its arbitrary grid box. Even MLIg’s expert makes cogent arguments for why Chicago and other more distant cities experience high damages. Nevertheless, Xcel’s expert continues to assert that impacts are “mostly” within the box. Nobody disputes that emissions disperse from the initial source. But the record contains no evidence that the majority of either “impacts” or “damages” occur within the Minnesota Domain.

B. Xcel Has Failed To Prove That CAMx Is The Proper Tool For This Job.

Rather than provide scientific support for its artificial geographic scope, Xcel spends an inordinate amount of its brief discussing the attributes of CAMx and the alleged shortcomings of InMAP. Despite this effort, Xcel fails to prove that CAMx can adequately account for geographic variability. Xcel ignores the evidence that the geographic scope of damages has a greater influence over results than model choice and fails to show by a preponderance of the evidence that InMAP’s results are less accurate than those provided by CAMx.

Photo-chemical models such as CAMx are not the best tools to set values in these proceedings because they are not made to handle hundreds or thousands of marginal-ton runs of individual facilities. Although photochemical models can be the appropriate tool for certain tasks, CAMx is not the best model for this task. Even Dr. Desvousges agrees that how one uses a model affects whether the results are considered accurate for that purpose. When asked why he chose not to use CAMx to model national changes in ambient air concentrations when EPA uses CAMx on a national scale, Dr. Desvousges explained that “just because one thing is accepted for

one objective, doesn't necessarily mean that it's equally well suited for the other objective." (Tr. Vol. 7 at 62:6–9.) This same reasoning applies to using CAMx for a purpose for which it was not designed and for which it is ill-suited.

1. CAMx is unable to account for geographic variability.

CEOs agree with the Agencies that “[r]educed-form modeling, with its relative simplicity makes an accurate analysis practicable, while reliance *solely* on a photochemical process model does not.” Agencies Brief at 15. Reduced form models allow for accuracy because “the scientific literature on air-pollution damage assessments shows that the impacts of emissions vary significantly according to the location of the emission source.” *Id.* at 14. Geographic variability based on emission location is not the opinion of two experts; it is a consensus finding of the entire field. And in order to account for the geographic variability of the potential sources of emissions in and around Minnesota, both Drs. Marshall and Muller used counties as appropriate hypothetical sites for new generating units.

It follows that “with approximately 500 sources and source locations, iterating through even a small number of alternative parameter values requires a very large number of executions of the model.” *Id.* at 49. In the instant proceeding, two of the experts have calculated roughly 500 county-level damages values for three different criteria pollutants. Thus, for marginal-ton calculations this requires approximately 1,500 model runs. Moreover, modeling different stack heights for the different marginal tons could multiply the number of required runs still further. As a result, 1,500 model runs seems to be a bare minimum in order to set county-level damage values for three pollutants. Photochemical models are simply not made to handle this many runs.

Moreover, should the Commission want to adopt values that could be updated based on newer science, it is imperative that the model can be run again—perhaps thousands of times—to

change the results based on a new parameter. Both Dr. Marshall and Dr. Muller have given parameters that can be updated easily as the science improves, and the models that they use are superior because they can handle the number of computations necessary to arrive at new results based on new parameters. In contrast, since Dr. Desvousges's VSL and concentration-response functions are based on his subjective opinions and unique statistical analyses, one could not update his findings without again hiring Dr. Desvousges.

There is no evidence in the record that CAMx can provide adjusted and reliable cost values in a reasonable timeline. Environ stated that CAMx takes three weeks to do one model run (Ex. 604, schedule 3 at 24.) By extrapolation, it would take 13,500 weeks⁶ to perform the 4,500 model runs that Dr. Muller deemed necessary to create credible damage values. *See* Agencies Initial Brief at 15 (“Dr. Muller explained, any reasonable implementation of any IAM is accompanied by an assessment of the ‘sensitivity’ of the results to different parameter values . . . the 1,500 model runs are increased to 3,000 or 4,500 runs if two or three different parameters are tested.” (citation and footnote omitted)).

It is apparent that the flexibility of reduced-form models allows them to be more useful in this proceeding than a photochemical model. Despite the obvious advantages of reduced-form models in a proceeding like this, Xcel spends the majority of its brief attempting to convince the reader that CAMx is in fact the best tool for the job.⁷ This strategy distracts from the most important difference between the parties' positions—the need to consider nationwide damages. Moreover, Xcel's efforts to prove that CAMx is the best tool failed.

⁶ This is approximately 259 years. This does not include the time before/between runs where the modeler has to set up the scenarios for CAMx to then process.

⁷ CEOs disagree that CAMx is the proper tool for the job. But in the event the Commission disagrees, we would support using CAMx to calculate damages as long as the geographic scope of damages is national, the concentration response functions and VSLs are based on the best available science, and results can be calculated in a reasonable amount of time.

2. Geographic Domain has a greater influence over results than model choice.

Other decisions before the ALJ have a larger impact on externalities values than model choice. (*See* ex. 119 at 3.) If the model inputs are standardized, the results calculated by InMAP and CAMx differ, at most, by a factor of 3.6. (Ex. 119 at 3:14–15.) Excluding less reliable results,⁸ the biggest difference between CAMx and InMAP is that CAMx-predicted damages for SO₂ emissions from Sherco, Black Dog, and Marshall are 3.6, 2.7, and 1.2 times higher than those predicted by InMAP. But by truncating the geographic domain, CAMx under-predicts SO₂ damages from emissions at Sherco, Black Dog, and Marshall by factors of 4.3, 3.6, and 5.1, respectively. (Ex. 119 at 14.) Clearly the geographic scope of damages has a significant influence over damage values. This influence is also depicted graphically in Dr. Muller’s chart reproduced in Xcel’s Initial Brief at page 21.

But to distract from the fact that the weight of Xcel’s damages rests not in its model choice but instead in its geographic domain, Xcel claims that InMAP and AP2 are less accurate than CAMx.

3. Xcel failed to prove that InMAP is inaccurate.

Xcel claims that there is “no question” that it has used the “best model.” (Xcel Initial Brief at 70.) Otter Tail Power, which submitted an *amicus* type brief in support of Xcel’s methodology, claims that Dr. Marshall does not deny that CAMx is “more accurate” than InMAP. (OTP Initial Brief at 10.) But these claims misread Dr. Marshall’s explanation of the distinction between “accuracy” and “realism.” In his surrebuttal testimony, Dr. Marshall said: “‘Realistic representation’ is different than ‘accurate results.’ Concentration estimates by AP2,

⁸ As described in Dr. Marshall’s testimony, using CAMx data to predict damages from emissions at the Black Dog Generator at a national scale may substantially underpredict impacts of PM_{2.5}.

InMAP, and CAMx may or may not be equally accurate, but there is no dispute that CAMx is a more realistic[] representation than InMAP or AP2 of meteorology and atmospheric chemistry.” (Ex. 119 at 19 n.16.) InMAP remains accurate, and it is specifically created to do the type of modeling necessary in this proceeding. (*Id.* at 23:16–24:4.) No model is as realistic as the atmosphere of Earth, nor should it be. “By definition, models are simplistic approximations of complex phenomena.” (Ex. 604, Schedule 3 at 32.) Absolute realism slows models down and makes their processing time impracticable, and therefore the most realistic model can still be the worst choice if it is cumbersome to use.

Dr. Marshall’s model evaluations in his testimony demonstrate that InMAP is accurate and reliable for its intended purpose. InMAP performs well for its intended purpose: modeling criteria pollutant changes throughout the United States from marginal changes in emissions at one location. Dr. Marshall has shown this in his testimony. (Ex. 119 Schedule 1, at 9295–9302.) Xcel nevertheless claims that InMAP’s results are inaccurate based, essentially, on the fact that it is a reduced-form model:

Since AP2 and InMAP are reduced-form models, they use simplified air dispersion and chemistry algorithms; rely on annual average meteorological data; model an equal amount of each pollutant; and do not account for any chemical interaction among the emitted pollutants to resemble a point source plume. We believe that all these factors together contributed to the inaccurate AP2 and InMAP air quality modeling results.

Xcel Initial Brief at 72. But Xcel has not provided evidence that any of these attributes of reduced-form models generally, or InMAP in particular, have led to inaccurate results.

Xcel claims that InMAP “consistently and grossly over-estimates potential externality values for PM_{2.5} compared to CAMx and AP2.” Xcel Brief at 46. This is demonstrably untrue. AP2’s PM_{2.5} values are higher for both the hypothetical rural and metro fringe scenarios. *Id.* at

45. Xcel also ignores the fact that InMAP is the only model of the three offered in this proceeding that uses grid cells as small as 1-km² in urban areas. This precision accounts for population density more accurately than either AP2 or CAMx and will therefore lead to more accurate and, in this case higher, damage values for exposure in urban areas.

Xcel also makes much of the fact that CAMx incorporates “hourly wind speed and direction” and claims that InMAP only uses “annual average data.” Xcel Brief at 2. Again, this is simply not true. As explained many times in this proceeding, InMAP uses the output from a full photochemical model similar to CAMx, WRF-Chem, to calculate ambient air concentration changes. (Ex. 115 at 13:3–9; ex. 119, schedule 1 at 9282, 9284, 9287, Tr. Vol. 6 at 139:3–5, 140:1–3.) WRF-Chem uses hour to hour variability, just like CAMx, and that output is used to inform the annual averages that are used in InMAP, just like CAMx. Using a photochemical model in this matter—to generate the annual averages for use in a reduced form model—is a proper use of these models. Ultimately, all of the models, whether reduced-form or photochemical models such as WRF-Chem or CAMx, use annual averages to calculate damages. Dr. Marshall, who is an air modeling expert and is familiar with CAMx, explained on the stand:

[CAMx] uses the hourly data, and then also uses an annual average. . . . CAMx is used for many things, and actually some of the uses that the company runs at Environ, they need that hourly data . . . but for the calculations done here, the main driver, the vast majority of the impacts comes from annual average. So after looking at the hourly variability, you don’t actually save any information, you go to the annual average. And that representation is what goes into the calculations. . . . Because all of the calculations, the calculations from Dr. Desvousges and from Dr. Muller and myself focus primarily on the annual average.

(Tr. Vol. 7 at 20:7–8, 21:6–8, 21:10–16, 140:9–12.)

The evidence available in this record demonstrates that while CAMx does perform hourly calculations, as Dr. Marshall explained, the model produces and uses annual average data. There

is no need to perform the hourly calculations for each model run. CAMx's computational intensity does not necessarily lead to any additional precision over the reduced-form models used by Drs. Marshall and Muller.

Lastly, Xcel suggests that its graphic representations of CAMx results are "as expected" and that InMAP's results must be inaccurate because they show a bias to the east. (Xcel Brief at 31–36.) Xcel has it backward. InMAP's results with an eastwardly trend are "as expected" and CAMx's concentric circles cast doubt on those results. In Minnesota, our prevailing winds travel from west to east, and when this trend is averaged over the year it is clear that pollutants emitted from Minnesota will head east more often than west. This is evidenced by U.S. government meteorological data, as explained by the Agencies and their expert, Dr. Muller. Agencies Brief at 39 (showing and explaining data from NOAA demonstrating that wind from due west "is the most frequent wind direction"). It is also corroborated by the modeling of AP2. Agencies Brief at 38, 50 figs. 2 & 4. It is further corroborated by the EPA's modeling for the Cross State Air Pollution Rule, done with CAMx. (Ex. 607 at 12 (fig. 3, showing CSPAR-controlled states cluster in the east of the continental U.S. and states are controlled more stringently to the east of Minnesota).) The fact that InMAP shows pollution damages to the east is a reflection of the best available science and modeling, as well as common-knowledge weather phenomena. It is not a "bias" that somehow negates the model's results.

A preponderance of the evidence shows that InMAP is made for proceedings exactly like this environmental cost contested case. "InMAP is designed to provide estimates of air pollution health impacts resulting from marginal changes in pollutant emissions. . ." (Ex. 119 at Schedule 1, 9284.) Unlike CAMx, InMAP is intended for the task at hand, and is nimble enough to do the necessary model runs to calculate credible and useful damage values.

C. Xcel Uses Inconsistent Arguments To Support Its Manufactured Method Of Incorporating Concentration Response Functions And VSLs.

Xcel uses inconsistent arguments throughout its brief. As discussed, Xcel supports its geographic domain by claiming it is based on precedent and yet does not use the same domain it used in the previous proceeding. Xcel Initial Brief at 70. And Xcel calculated its proposed damages using very small changes in concentration and then claims small changes are too uncertain to support damage estimates. Xcel Initial Brief at 57, Tr. Vol. 7 at 141–43. Xcel claims InMAP needs to be more sufficiently vetted by peer review (Xcel Initial Brief at 29), and yet Xcel is now asking the Commission to use a methodology created just for this proceeding (Xcel Initial Brief at 64); a methodology roundly criticized by almost all of the other experts in this proceeding. (Ex. 116 at 14:10–18:5; ex. 117 at 8:7–14:14; ex. 118 at 10:1–14:5; ex. 810 at 18:2–19:7.) These same inconsistencies flow to how Xcel incorporates the concentration response functions and VSL values into its damage calculations.

With respect to both concentration response functions and VSL, Xcel claims that we should eschew EPA recommendations in favor of its newly created product (VSL multiplied by risk).⁹ Despite recommending following irrelevant EPA guidance in other parts of this proceeding, Xcel would have the Commission reject EPA’s best estimate of VSL based on a suggestion that EPA could update the value in the future. Xcel Initial Brief at 69 n.192. Should the EPA update its VSL in the future, CEOs’ proposed values could easily be updated to reflect the new value, but until then the currently-in-force EPA value is the best VSL available. Xcel

⁹ Xcel makes the recommendation to eschew EPA recommendations in this instance despite the fact that Xcel continues to claim that EPA’s guidance related to NAAQS standards should be followed. *See* Xcel Initial Brief at 26 nn.72-73, 49 n.124. This inconsistency is especially confounding given that EPA’s guidance related to the NAAQS is not relevant to how models should be used to calculate marginal damages whereas EPA guidance related to the appropriate concentration response functions and VSL is directly relevant.

also ignores EPA's recommendation to use the Lepeule and Krewski concentration response functions to the exclusion of others. (*See* ex. 116 at 15:19–16:2.) Xcel's rejection of this expression of EPA expertise is inconsistent with its position on following EPA guidance, whether relevant or not, elsewhere in its argument. It is unreasonable to reject the EPA VSL value for no other reason than the fact that it has been used and useful for a long time.¹⁰ EPA's VSL, when adjusted for income and inflation, is the best available central-tendency VSL.

None of Dr. Desvousges's adjustments to the VSL or concentration-response figures have undergone peer review,¹¹ and the experts who have addressed his choices in testimony have found them wholly unreasonable. As one example, Dr. Polasky, who is a sitting member of the EPA Clean Air Scientific Advisory Committee, (ex.122 at 1), pointed out that key choices made by Dr. Desvousges pushed his VSL estimate down artificially. (Ex. 118 at 10:1–7.) He found these decisions, such as including negative VSL values that were excluded from the studies used and putting the study results through an unnecessary and arbitrarily-weighted Monte Carlo analysis, wholly unreasonable. (Ex. 122 at 2.)

Xcel seeks to discredit the other experts offering externality values in this proceeding by emphasizing that, while Dr. Desvousges devised his statistical analysis specifically for this proceeding, they relied on the EPA's expertise. Xcel has failed to rebut the testimony of four experts¹² who found Dr. Desvousges's statistical analyses and other bespoke science questionable and unreasonable. Adopting Xcel's brand new values and brand new analyses,

¹⁰ Xcel and other Parties have failed to explain why an individual's valuation of dangers to his or her own life would change significantly since the 1990s, which is the only way that EPA's value would change significantly.

¹¹ Despite this, one of Xcel's primary criticisms of InMAP is that it is too new and has not been sufficiently tested.

¹² Drs. Marshall, Muller, Jacobs, and Polasky all found significant faults with Dr. Desvousges's methods regarding modeling choices, economic statistics, statistics as applied to epidemiology, altered VSL values, and other positions he took in testimony.

created for this proceeding by Dr. Desvousges, would be significantly more risky than following the best estimates found in leading epidemiological studies and produced by the EPA itself.

II. RESPONSE TO MINNESOTA LARGE INDUSTRIAL GROUP.

MLIG claims that Dr. McClellan’s “epidemiological”¹³ opinion that there is no relationship between health effects and baseline air concentrations of PM_{2.5} below 12 µg/m³ is supported by a lack of contrary evidence and by EPA’s NAAQS. MLIG Initial Brief at 39. MLIG also attempts to superimpose an inapplicable legal standard—proximate cause—onto this case. *Id.* at 25. But the evidence clearly shows a linear relationship between an increased risk of premature mortality and PM_{2.5} concentrations well below the NAAQS. Indeed, the existence and level of the NAAQS are irrelevant to this proceeding. And MLIG’s attempt to create a new legal standard does not change these facts.

A. MLIG Fails To Disprove The Linear Relationship Between Changes In Concentrations And Health Impacts At Concentration Levels Below 12 Micrograms Per Cubic Meter.

The testimony of the experts in this proceeding shows a consensus on the linear relationship between changes in concentration and health impacts below concentrations of 12 µg/m³. In order to dispute this, MLIG distorts and obscures the meaning of scientific evidence in the record.

¹³ Only one epidemiologist provided testimony in this proceeding—Dr. David Jacobs. Dr. Jacobs testified that he agreed with the approach used by Drs. Marshall and Muller. “They chose to use the two studies recommended by the Environmental Protection Agency’s Scientific Advisory Board that analyze the two most widely studies cohorts and that reach different results. By retaining both studies and high- and low-end representations of damages, the Minnesota Public Utilities Commission can understand the variation in study results and make policy decisions accordingly.” (Ex. 117 at 13:1–6.) To be clear, Dr. McClellan is not an epidemiologist or a medical doctor. He is a veterinarian.

To support its claim, MLIG relies on discredited claims from Dr. McClellan. MLIG attempts to resurrect arguments that Dr. McClellan repudiated during cross examination and said were incorrect in his testimony. MLIG states in its Initial Brief that “[i]n other words, there is no statistical or medical evidence of an association between exposure to PM_{2.5} and adverse health effects in the Greven study at the local level.” MLIG Initial Brief at 38. But when questioned about this same conclusion in his testimony, Dr. McClellan said that his testimony was incorrect and that there “certainly is statistically significant medical evidence of an association between exposure to PM_{2.5} and adverse health effects.” (Tr. Vol. 7 at 179:2–9.) Nonetheless, MLIG spends three pages of its brief re-presenting a sensitivity analysis from one epidemiological study to try to make the same repudiated conclusion.

Moreover, MLIG asks the ALJ to rely on evidence that is not in the record. The Greven Study, on which MLIG relies so heavily, is not part of the record. And given Dr. McClellan’s inconsistent testimony, Dr. McClellan’s unilateral interpretation of one sensitivity analysis from that study cannot provide a basis on which to determine that there is no relationship between PM_{2.5} exposure and an increased risk of premature mortality. Such a determination runs contrary to all of the epidemiological studies that are in the record. The “observed concentrations” in both Lepeule and Krewski went well below the NAAQS. (Ex. 117, schedule 3 at 967-68; ex. 117, schedule 2 at 119.) There is nothing in the record that supports MLIG’s assertion of a lack of relationship between increased risk of mortality and exposure to PM_{2.5} at levels below the NAAQS.

B. MLIG Fails To Demonstrate The Relevancy Of The NAAQS To The Question Before The Commission.

EPA's NAAQS are irrelevant to this proceeding. This proceeding is charged with valuing the harm that is not controlled by the existing regulatory schemes. This includes both the harm associated with pollution in excess of federal standards as well as harm due to pollution in compliance those standards. The federal Clean Air Act standards are not designed to eliminate all risk. They affirmatively include such risks, and the EPA Administrator balances policy to determine how much potential damage is acceptable. Quantifying the damages associated with criteria pollutants is both possible and required under Minnesota law regardless of other regulatory decisions.

The Clean Air Act requires EPA to create scientific criteria documents that “inform[] the policy judgments leading to the EPA Administrator’s promulgation of NAAQS.” MLIG Initial Brief at 30. The Administrator’s role is to set a threshold that, informed by the criteria document, does not “pose an *unacceptable* risk of harm.” *Id.* at 42 (quoting the EPA Administrator regarding her role)(emphasis added). Therefore, consistent with all the evidence MLIG put forward on this issue, it is evident that the EPA administrator identifies an acceptable level of harm, consistent with the Clean Air Act’s command. 42 U.S.C. §7409(b)(1) (devoting the standards to “the judgment of the Administrator, based on [] criteria and allowing an adequate margin of safety”). Dr. McClellan confirmed on the stand that, consistent with his writings and testimony, he believes the NAAQS standards include an “acceptable level of risk” to human health. (Tr. Vol.7 at 183:15–24 (discussing Hazard and Risk: Assessment and Management book chapter included with McClellan rebuttal testimony).)

When the Commission determined that “[t]he scientific evidentiary support for the existing values has been reasonably called into question” and reopened the investigation of the

cost values of carbon dioxide and the three criteria pollutants, it was aware of the NAAQS standards. *See* Order Reopening Investigation and Convening Stakeholder Group to Provide Recommendations for Contested Case Proceeding, Docket No. E-999/CI-00-1636 at 5 (February 10, 2014). This amounts to an implicit acknowledgement that existing regulations do not reduce environmental costs to zero. MLIG's attempt to invoke the NAAQS as a way of discounting quantifiable environmental and public health costs should be rejected.

C. MLIG's Focus On Causation Is Misplaced.

MLIG seems to be arguing that the Commission must determine a causal link between particulate matter exposure and deaths within a particular population. MLIG makes this argument despite agreement among the epidemiological studies in the record that PM_{2.5} exposure increases one's risk of premature mortality. MLIG tries to obscure this relationship by claiming that "for downwind areas that may exceed that exposure level, any calculated increase in mortality attributable will be extraordinarily small related to the baseline mortality." MLIG Brief at 24. But the fact that other causes of death may exceed deaths from exposure to particulate matter does not eliminate particulate matter's effect on health. The statute requires the Commission to set externality values, not to disregard them simply because other factors may contribute more to mortality rates.

While MLIG might want to raise the bar on evidence to be presented in this proceeding, it cites no authority for trying to apply a proximate cause standard to the quantification of environmental costs. This standard is used in tort and similar cases assigning significant liability to defendants. *See Staub v. Proctor Hosp.*, 562 U.S. 411 (2011) (regarding proximate cause in federal tort law); *Holmes v. Securities Investor Protection Corporation*, 503 U.S. 258 (1992) (regarding proximate cause under the Racketeer Influenced and Corrupt Organizations Act).

A proximate cause standard is not required here. But even if it were, there is sufficient evidence of the link between PM_{2.5} exposure and an increased risk of premature mortality in this case. “Proximate cause requires only ‘some direct relation between the injury asserted and the injurious conduct alleged,’ and excludes only those ‘link[s] that are too remote, purely contingent, or indirect.’” *Staub*, 562 U.S. at 419 (quoting *Hemi Group, LLC v. City of New York*, 599 U.S. 1, 9 (2010)). The modeling has proven proximate cause of damages on a large population scale consistent with epidemiological effects. But as there are no plaintiffs seeking to recover for harms caused by specific emissions by specific emissions sources, the proximate cause standard elucidated in tort law is not applicable in the way presented by MLIG.

The standard here is whether it is practicable to quantify damages incurred by society from pollution released in Minnesota. The purpose of this proceeding is to set cost values, not to award large sums of money to injured parties. MLIG’s proposed causation standard is inapplicable in this proceeding.

III. USE OF EXTERNALITY VALUES IN RESOURCE PLANNING.

Xcel and OTP both offer opinions about how these values are currently used by the Commission in Resource Planning (IRP) Proceedings, and MLIG tries to connect these values to utility rates. There are two distortions contained in these descriptions. First, these values are only one piece of information used by the Commission. The Commission is free to use this information to make decisions based not only on the damages caused by emissions of pollutants, but on all other policy considerations raised by Parties in IRP proceedings. Second, location-specific values are practicable and useful in many types of proceedings in front of the Commission. This is evidenced by both OTP’s and Xcel’s currently pending Resource Plans.

A. Externality Values Are Only One Factor That The Commission Considers.

MLIG states that it is “troubled by what appears to be a disconnect between the Department’s position in this docket and the ultimate rate impact that position could have if adopted by the Commission.” MLIG Brief at 2 n. 3. MLIG is trying to create an issue where none exists. While environmental cost values must be used in all Commission proceedings, they are *not* used to set rates. They are not assessed to utilities or to ratepayers. MLIG is fully aware of this and yet implies that there is a direct connection between externality values and the “ultimate rate impact.” This is a baseless claim.

The relevant statute requires utilities to use environmental cost values “*in conjunction with other external factors*, including socioeconomic costs, when evaluating and selecting resource options in all proceedings before the commission.” (emphasis added). Minn. Stat. § 216B.2422, subd. 3(a). As Nicholas Martin (Xcel’s witness in the first phase of these proceedings) explained, these externality values are only one factor among many that utilities and the Commission consider in complex resource planning processes:

The externality value that’s adopted here will not be the sole determinant of any decision. . . . I am not prepared to say that would necessarily translate into higher cost. We’ve been acquiring renewable energy at quite a competitive cost. . . . I also want to say that [Present Value of Societal Costs] is not the only thing the Commission considers. . . . They consider reliability, affordability, fuel diversity. They consider a broad range of different things.

(Tr. Vol. 3B at 156–58.) MLIG’s concern is misplaced. The point of this proceeding is to update the values considered by the Commission to reflect the best available science; it is then up to the Commission to consider that information in conjunction with all of the other considerations in front of it. The most useful information for Integrated Resource Planning and other proceedings

will be the most accurate information—and that includes the most geographically sensitive damages available in the record.

B. Resource Planning Considers Location-Specific Resources.

Xcel and OTP both claim that county values are not practical or necessary for use in Resource Planning proceedings. Xcel Initial Brief at 63–64, OTP Initial Brief at 10–12. CEOs disagree. County-level values can be very helpful to utilities, the Commission, and the public in resource planning proceedings.

Xcel’s position that county-level values are somehow impracticable or useless ignores more than half of the resource planning puzzle because it overlooks planning of existing generation (which might be retired or kept in service) as well as future generation that has a proposed site or sites. As Xcel concedes in its brief: “Resource planning determines the size, type, and timing of resource additions or reductions—what amount and type of resources will be *added or retired* during the planning period.” Xcel Initial Brief at 63 (emphasis added). To suggest that investor-owned utilities only plan for amorphous future plants without considering location is to forget that determining when to retire old units is a central part of utilities’ use of these values. Maintaining and managing the company’s existing fleet is central to its planning work; existing generation sources can be long-lived and all of them have county-specific locations.

Even future generation sources can be location-specific. For example, Xcel has asked for a new location-specific resource in the current IRP. Xcel states that a “locational analysis [is] imperative to ensuring continued reliability and maximizing customer benefits.” January 29 Supplement in Docket No. 15-21 at 3. Having a county-specific externality value to use for these proposed resources will assist Xcel and other utilities to make informed decisions and resource

plans. For plants with no proposed location more generic values can be appropriate—this is why CEO proposed both county-specific and generic values in direct testimony.

OTP also has new location-specific generation proposed in its most-recent IRP. OTP states that “in its 2013 Resource Plan, Otter Tail Power evaluated several resource options. Out of six new natural gas resources considered, only one of these . . . was location specific.” OTP Brief at 11. This means that in one sixth of OTP’s proposed resources location-specific environmental cost values would be useful. In the remaining five proposed sites OTP could use generic cost values as proposed by Dr. Marshall, but the added precision of the location-specific value for that sixth proposal would have added more relevant information to OTP’s 2013 Resource Plan, and the company makes no argument that it would have any difficulty applying the specific values to that proposal. Even if it were true that the “vast majority” of proposed generation sources were not envisioned at a single location, (*id.* at 12), OTP’s anecdotal example demonstrates that it would have a use for county-specific damage values under normal utility planning already undertaken.

A preponderance of the evidence shows that county values are practicable and would be useful to the Commission as part of its consideration.

CONCLUSION

It is up to each Party to support its proposed values or proposed inputs by a preponderance of the evidence. CEOs have calculated proposed values using a methodology that follows the path of science and is supported by a preponderance of the evidence. Choosing an alternate path would admittedly be based on policy not science. But this proceeding seeks to develop the best estimate of actual values based on the best available science. Now is not the time to weigh pollution damages against all of the other considerations the Commission must

weigh when making decisions about Minnesota's energy future. There will be an opportunity to consider policy arguments; now is the time to establish accurate, science-based values to inform those policy decisions. CEOs' values are based on the best available science and represent the most accurate estimate of actual damages in the record.

CEOs, therefore, respectfully request that the ALJ recommend that the Commission adopt these values as the Commission's environmental cost values for PM_{2.5}, SO₂, and NO_x under Minn. Stat. § 216B.2422, subd. 3(a).

Dated: April 15, 2016

/s/ Leigh Currie
Leigh K. Currie
Christine B. Hottinger
Hudson B. Kingston
Minnesota Center for Environmental Advocacy
26 East Exchange Street, Suite 206
St. Paul, MN 55101
Phone: (651) 223-5969
lcurrie@mncenter.org

Attorneys for Clean Energy Organizations