

ISSUE DATE: January 3, 1997

DOCKET NO. E-999/CI-93-583

ORDER ESTABLISHING ENVIRONMENTAL COST VALUES

BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

Joel Jacobs  
Marshall Johnson  
Dee Knaak  
Mac McCollar  
Don Storm

Chair  
Commissioner  
Commissioner  
Commissioner  
Commissioner

In the Matter of the Quantification of  
Environmental Costs Pursuant to Laws of  
Minnesota 1993, Chapter 356, Section 3

ISSUE DATE: January 3, 1997

DOCKET NO. E-999/CI-93-583

ORDER ESTABLISHING  
ENVIRONMENTAL COST VALUES

**PROCEDURAL HISTORY**

On August 1, 1993, the Laws of Minnesota 1993, Chapter 356, Section 3 became effective. This law, codified as Minn. Stat. § 216B.2422, requires that the Commission "to the extent practicable, quantify and establish a range of environmental costs associated with each method of electricity generation." The law requires each utility to use the values in conjunction with other external factors when evaluating resource options in all proceedings before the Commission. In addition to requiring the development of environmental cost values, the statute required the Commission to develop interim values by March 1, 1994.

To address its obligation to establish interim environmental cost values by the March 1, 1994 statutory deadline, the Commission issued its ORDER ESTABLISHING PROCEDURE FOR ESTABLISHING INTERIM ENVIRONMENTAL COST VALUES on August 17, 1993. This Order contained a number of questions regarding environmental externalities, requested the parties address these questions, and set deadlines for interested parties to file comments and reply comments. The Commission encouraged interested parties to work together to reach a consensus on interim values.

After reviewing the written and oral comments by interested parties, the Commission issued its ORDER ESTABLISHING INTERIM ENVIRONMENTAL COST VALUES on March 1, 1994.

On March 3, 1994, the Commission issued a NOTICE AND ORDER FOR HEARING initiating formal evidentiary hearings to set the final environmental cost values. This Order also directed parties to address the following issues in the course of the contested case proceedings:

- (1) What range of environmental cost values should the Commission adopt for use in resource planning and other resource-selection proceedings as required by

Minn. Stat. § 216B.2422? Specifically, for which pollutants or externalities should the Commission establish a range of values, and what are the appropriate boundaries of each range? Should these values be geographically sensitive?

- (2) What methodology or methodologies should be used to establish these ranges of values (e.g., damage costs, control costs, other methodologies, or some combination of these)?
- (3) Is it practicable for the Commission to quantify and establish a range of environmental cost values for methods of electric generation that do not generate significant air emissions? If so, how should the Commission establish such values and what are the appropriate boundaries of any such range?
- (4) Is it practicable for the Commission to adopt environmental cost values which reflect the full cycle of electric generation, including both upstream and downstream costs? If so, how should the Commission establish such values and what are the appropriate boundaries of any such range?

On May 13, 1994, Administrative Law Judge (ALJ) Allan W. Klein issued his Third Prehearing Order in which he reinstated the scoping process with a modified schedule and named the following as parties: Northern States Power Company (NSP), Minnesota Power and Light Company (MP), Minnegasco, a Division of NorAm Energy Corporation, Otter Tail Power Company (OTP), Cooperative Power Association (CPA), United Power Association (UPA), other “jurisdictional utilities,” the Minnesota Department of Public Service (the Department), Residential and Small Business Utilities Division of the Office of the Attorney General (RUD-OAG), Minnesota Pollution Control Agency (MPCA), American Wind Energy Association (AWEA), Center for Energy and the Environment (CEE), District Energy of St. Paul (District Energy), Institute for Local Self Reliance (ILSR), Izaak Walton League of America (IWLA), Minnesotans for an Energy Efficient Economy (ME3), Western Fuels Association (Western Fuels), Lignite Energy Council (LEC), Center for Energy & Economic Development (CEED), Potlatch Corporation (Potlatch), Northern Municipal Power Agency (NMPA), Southern Minnesota Municipal Power Agency (SMMPA), Large Power Intervenor, and Boise Cascade Corporation (Boise).

On July 13, 1994, the ALJ issued his Fourth Prehearing Order which defined the scope of the proceeding and requested parties to submit memoranda on the question of whether evidence should be limited to environmental costs or whether it should also include socioeconomic and other factors.

On August 24, 1994, the ALJ issued his Fifth Prehearing Order which, among other things, limited the scope of this proceeding by excluding “testimony and arguments relating to non-environmental issues, such as socioeconomic costs and benefits . . . , {except} for the purposes of creating a record to support or defend constitutional challenges.”

On October 28, 1994, the Commission issued its ORDER MODIFYING ADMINISTRATIVE

LAW JUDGE'S FIFTH PREHEARING ORDER ON THE CONSIDERATION OF SOCIOECONOMIC FACTORS. In its Order, the Commission generally agreed with the ALJ's analysis but stated that it "does not construe the statute to exclude all socioeconomic evidence from consideration." The Commission modified the ALJ's order to "ensure that socioeconomic evidence is not excluded from consideration in this proceeding if it is relevant to quantifying the impact of electric generation on the natural environment ..." In its Order, the Commission also responded to parties' claims that the Commission should look at the possible social and economic consequences of applying environmental cost values in deciding what those values should be. Addressing this issue, the Commission stated:

The Commission does not, at this juncture, find this concern sufficiently compelling to justify departure from the two-stage process set forth in the statute, which clearly contemplates the Commission establishing environmental cost values independent from its consideration of the consequences of applying those values.

The parties filed direct testimony on November 29, 1994, rebuttal testimony on March 15, 1995, and surrebuttal testimony on April 28, 1995.

On April 26, 1995, the ALJ issued a Memorandum extending the filing date for surrebuttal testimony relating to mercury and all testimony relating to criteria pollutants except for the emissions trading aspects of SO<sub>2</sub> to May 29, 1995.

From April 18 to April 27, 1995, the ALJ held six public hearings throughout the state, including a three-city videoconference. Over 160 people presented testimony at the public hearings.

From May 8 to June 28, 1995, the ALJ conducted evidentiary hearings. Over 50 witnesses presented testimony during the course of the proceeding.

Between September 8, 1995 and October 24, 1995, many of the parties filed briefs and reply briefs regarding constitutional and evidentiary issues.

On November 16, 1995, the ALJ issued his Post-Hearing Ruling on Evidentiary Motions. On December 7, 1995, the ALJ issued an Order Clarifying Post-Hearing Ruling on Evidentiary Motions.

Between January 12, 1996 and February 21, 1996, the following parties filed briefs and reply briefs on substantive issues: Western Fuels; the Department; NSP; RUD-OAG; MPCA; Dairyland Power Cooperative (Dairyland); OTP; CEED; Minnegasco and Peoples Natural Gas Company (Peoples), (together the Natural Gas Utilities); CPA, Minnkota Power Cooperative (Minnkota), and UPA (together the Cooperatives); State of North Dakota; LEC; IWLA, ME3, AWEA, Clean Water Action, the American Lung Association, the Minnesota Center for Environmental Advocacy, and ILSR (together the Environmental Coalition); and MP.

On March 25, 1996, the ALJ issued his Findings of Fact, Conclusions, Recommendation and Memorandum in this matter.

Between April 15 and April 29, 1996, the parties filed their Exceptions to the ALJ's Recommendation and their Replies to Exceptions.

On May 8, 1996, Western Fuels, CEED, LEC, North Dakota, and OTP filed their joint opposition to the MPCA request to take official notice of an Intergovernmental Panel on Climate Change (IPCC) report.

On September 16, 1996, the Commission met to hear oral argument and deliberate upon several preliminary issues of this matter. On September 17, 1996, the Commission met to hear oral argument regarding the substantive issues in this matter. On September 19, 1996, the Commission met to deliberate upon those issues.

## **FINDINGS AND CONCLUSIONS**

### **I. INTRODUCTION**

In this Order, the Commission fulfills its obligation to quantify and establish a range of environmental costs associated with each method of electricity generation "to the extent practicable," as directed by Minnesota's externalities statute, Minn. Stat. § 216B.2422 (1994).

### **II. SUMMARY OF FINDINGS**

Based on the record established in this proceeding, the Commission finds it practicable to quantify and establish a range of environmental costs for specific pollutants as follows:<sup>1</sup>

|                  |        | Urban         | Metropolitan<br>Fringe | Rural       | Within 200<br>Miles of<br>Minnesota |
|------------------|--------|---------------|------------------------|-------------|-------------------------------------|
| SO <sub>2</sub>  | \$/ton | 112 - 189     | 46 - 110               | 10 - 25     | 10 - 25                             |
| PM <sub>10</sub> | \$/ton | 4,462 - 6,423 | 1,987 - 2,886          | 562 - 855   | 562 - 885                           |
| CO               | \$/ton | 1.06 - 2.27   | 0.76 - 1.34            | 0.21 - 0.41 | 0.21 - 0.41                         |
| NO <sub>x</sub>  | \$/ton | 371 - 978     | 140 - 266              | 18 - 102    | 18 - 102                            |
| Pb               | \$/ton | 3,131 - 3,875 | 1,652 - 1,995          | 402 - 448   | 402 - 448                           |

---

<sup>1</sup> The figures listed in this table are the values recommended by the ALJ, updated to 1995 dollars using a methodology proposed by the Department.

|                 |        |            |            |            |            |
|-----------------|--------|------------|------------|------------|------------|
| CO <sub>2</sub> | \$/ton | .30 - 3.10 | .30 - 3.10 | .30 - 3.10 | .30 - 3.10 |
|-----------------|--------|------------|------------|------------|------------|

### III. UTILIZATION OF THE RANGES ESTABLISHED IN THIS ORDER

The range of environmental costs adopted by the Commission in this Order will now be used by utilities, in conjunction with other external factors (including socioeconomic costs) when evaluating and selecting resource options in all proceedings before the Commission, including resource plan and certificate of need proceedings. Minn. Stat. § 216B.2422, subd. 3 (a). These values will not apply to decisions regarding the dispatch of electric power from existing facilities.

In their petitions in such matters, the utilities will be required to provide three cost analyses for each generation option provided: one using the values at the low end of the range established for the environmental externalities associated with the electric power generation option in question; one using values at the high end of the adopted range; and one using zero environmental externalities values, i.e. reflecting direct costs only. Ordering Paragraph 2.

In the context of particular petitions and based on the record developed in proceedings addressing those petitions, the Commission will evaluate the merits of the energy resource options proposed therein. In so doing, the Commission will consider not only the environmental externalities quantified in this proceeding, but any evidence of other relevant environmental externalities (costs) not specifically quantified in this proceeding (e.g. mercury), as well as other external factors, including socioeconomic costs that the record developed in that proceeding indicates is associated with the resource option in question.

### IV. COMMISSION ANALYSIS

In the course of this proceeding, various parties have 1) raised constitutional challenges to Minnesota's environmental externalities statute, 2) objected to the inclusion and exclusion of various elements of the record adopted by the Commission in deciding this matter, and 3) objected to specific values proposed by the ALJ and adopted by the Commission for various environmental impacts. In this part of the Order, the Commission will address the parties' objections.

#### A. Constitutional Challenges

##### 1. Facial Challenges

Several parties argued that the statute purporting to authorize the Commission to act on this subject is unconstitutional *on its face*, i.e. without need of any factual record to demonstrate its unconstitutionality. These parties argued the "facial" unconstitutionality of the statute on two grounds:

1) that the statute conflicts with the Supremacy Clause of the U.S. Constitution,

Article VI, Clause 2; and

2) that the statute constitutes an unconstitutional delegation of authority.

Minnesota law is clear, however, that neither an administrative body such as the Commission nor an Administrative Law Judge (ALJ) has the authority to declare that a statute is unconstitutional on its face. Neeland v. Clearwater Memorial Hospital, 257 N.W.2d 366, 368 (Minn. 1977); Holt v. Board of Medical Examiners, 431 N.W.2d 905, 906 (Minn. Ct. App. 1989). This is appropriate because, as a creature of the state, an agency has no authority to determine that the legislature lacked authority to delegate certain powers to it. Therefore, the Commission will not undertake to examine the grounds urged as the basis for finding the statute unconstitutional on its face.<sup>2</sup>

## **2. Unconstitutional “As Applied”**

The Commission, of course, is required to apply statutes in a manner consistent with the Constitution. In considering what is a constitutional application of the statute, the Commission considers relevant court decisions bearing on the constitutionality of the Commission’s application of the statute. The time for doing so, however, is not at hand. In this Order, the Commission is simply establishing externality values, as directed by the statute. While this action is not entirely academic, it does not act upon utilities in a manner that can be properly characterized as “applying” the statute to them.

In subsequent cases, when a utility brings forward specific energy choice proposals for review, the Commission will be “applying” the statute, deciding what weight should be given to the various economic analyses (one that used the high end of the range figure, one using the low end figure and one using a zero value) when considered together with other external factors, including socioeconomic costs.

Given the limited scope of this proceeding and a record molded to that purpose, the Commission finds that challenges that the statute is unconstitutional “as applied” are not ripe for consideration.

## **B. Content of the Record Issues**

---

<sup>2</sup> The Commission does not necessarily accept that the parties’ Supremacy Clause challenge is properly classified as a facial challenge. Until a resource planning decision or certificate of need is considered, it cannot be determined whether there is an actual conflict between state and federal law. Regardless of how the Supremacy Clause challenge is classified, the Commission does not accept it. If it is a facial challenge, it is clear that the Commission is without authority to determine its validity; in the more likely event that it is an “as applied” challenge, the Commission finds it is premature, as discussed in the next section regarding the “as applied” challenges.

The Commission has reviewed all of the ALJ's rulings in his November 16, 1995 Post-Hearing Ruling on Evidentiary Motions, finds them well-reasoned, and affirms them.

Subsequent to the ALJ's Ruling, two requests to add items to the record were received. For the reasons stated below, the Commission will reject both such requests.

These decisions leave the evidentiary record in this matter as it was at the end of the contested case hearing before the ALJ (June 28, 1995), except as modified by the ALJ's November 16, 1995 Ruling.

Several content-of-the-record issues deserve comment, as follows:

### **1. Request to Take Official Notice of an IPCC Report**

In its Reply to Exceptions filed April 26, 1996, the Environmental Coalition requested that the Commission take official notice of the IPCC's Second Assessment Report Synthesis "as an acknowledgment that the ALJ's findings are consistent with the IPCC's most recent conclusions regarding the increasingly certain link between anthropogenic carbon emissions and potentially catastrophic climate change." Reply Brief of the Environmental Coalition on Exceptions, page 4.

Western Fuels, CEED, LEC, the State of North Dakota, and Otter Tail opposed the Environmental Coalition's request. These parties stated:

The Environmental Coalition's use of the purported IPCC report in its Reply Brief on Exceptions demonstrates a cavalier disregard for the integrity of the administrative process. The contents of the report obviously are not subject to official notice by this Commission.

The objecting parties asserted that the facts within the IPCC report are neither judicially cognizable facts nor "general, technical, or scientific facts" within the specialized knowledge of this Commission. They further asserted that the state of the record with respect to the work of the IPCC is wholly objectionable from an evidentiary standpoint and to allow the new IPCC report to become part of the record through official notice would be a breach of due process. They further noted that under Minn. Stat. § 14.60, subd. 4, the Commission cannot take official notice of the IPCC report without affording the parties "an opportunity to contest the facts so noticed."

Requests that the Commission take administrative notice of general, technical, or scientific facts within its specialized knowledge pursuant to Minn. Stat. § 14.60, subd. 4 (1994) are directed to the sound discretion of the Commission. In this case, the Commission declines to take the requested notice for several practical reasons:

- first, some finality must be accorded an evidentiary record that has been established over an extensive period of time and has long been closed;



- second, the time involved in allowing parties to contest the facts to be noticed would interrupt the deliberation phase and would unnecessarily prolong an already extensive proceeding; and
- third, the information proposed is not necessary to the resolution of any issue before the Commission. As stated by the proponents of this information (the Environmental Coalition), the information merely corroborates the ALJ's findings regarding climate change issues. As indicated more fully below, the Commission finds that the current record adequately supports the ALJ's findings in this regard. The untimely-proffered additional evidence is simply offered for its "consistency" with the ALJ's conclusions, which in turn have been based upon the 1990 IPCC Report (Exhibit 72) and the 1992 IPCC Supplement (Exhibit 70). As such, the offered evidence is much akin to cumulative or repetitious evidence that the Commission is authorized to exclude under Minn. Stat. § 14.60, subd. 1 (1994).

## 2. Request to Take Official Notice of an EPA Report and Newsletter

In its Exceptions to the ALJ's Report filed April 15, 1996, the MPCA requested that the Commission take official notice of the following items:

**Regarding SO<sub>2</sub>:** the actual SO<sub>2</sub> emissions from phase I sources for 1995 as reported in an EPA March 26, 1996 press release, and the 1994 allowance auction average clearing price as reported in an article entitled "Utilities Well Below SO<sub>2</sub> Reduction Mandates, Prices Hit New Lows" from Inside EPA's Clean Air Report, v. 7, No. 7 at 18-19 (April 4, 1996); and

**Regarding mercury:** a letter from EPA Assistant Administrator Mary D. Nichols explaining that a “significant” delay is needed to allow completion of the EPA’s final report on mercury emissions, health effects, and control technologies and an associated article in a special edition of Inside EPA’s Clean Air Report, dated April 5, 1996.

The Commission will deny this request, for many of the same reasons cited above in declining to take administrative notice of the IPCC Report.

**Regarding the SO<sub>2</sub> information:** the Commission views the record as adequately developed on this subject to permit a reasonable decision, as set forth in further detail when the Commission specifically addresses valuation of that pollutant. In addition, it appears that information regarding SO<sub>2</sub> emissions raises factual and evidentiary issues more properly the subject of an adjudicative process than to the comment process available if the Commission were to take administrative notice of this SO<sub>2</sub> information.

Finally, after the considerable time devoted to developing the record in this matter it is desirable and reasonable to finalize the record so that some decisions can be made. Due to the scientific and regulatory interest in SO<sub>2</sub> emissions, it is inevitable that new information on this subject will continue to be developed, at least in the foreseeable future.<sup>3</sup> At some point, the Commission must allow the record to remain closed so that a decision can be made with respect to that record rather than continuously opening it to receive new information, with the attendant mandatory receipt of counter-analyses of that information.

**Regarding the mercury information:** the only new information proposed for administrative notice regarding mercury is that the EPA’s study of mercury will not be forthcoming for some time. In addition to the finality of the record considerations already mentioned, it is difficult to imagine that such information (that EPA’s final mercury study will not be available for a long time) would add any weight to the MPCA’s case for adopting an externality value for mercury based on the current record. Evidence to date either is strong enough to support a value for mercury or it is not. The fact that additional evidence (the EPA’s final mercury study) is unavailable could add nothing to the case for adopting a value for mercury and in fact would suggest the wisdom of refraining from establishing such a value at this time.

### **3. Admissibility of Department Witness Davis’ Testimony**

In his Post-Hearing Ruling on Evidentiary Motions, the ALJ granted the motions of Western Fuels, NSP, LEC, the Cooperatives and Otter Tail and struck all of the testimony of Department witness Davis on the grounds that he did not qualify as an expert witness. The Commission gives great weight to the ALJ’s determination regarding the admissibility of expert opinion. It is within the ALJ’s discretion to determine whether a particular witness is qualified to testify as an expert. The Commission finds that the record contains adequate

---

<sup>3</sup> In fact, parties mentioned that several other arguably relevant pieces of evidence have been developed by the EPA since the record was closed.

support for the ALJ's concern that the witness did not demonstrate an adequate familiarity with and background knowledge regarding several of the subjects of his testimony. Accordingly, the Commission will not overrule the ALJ's exclusion of such testimony.

#### **4. Admissibility of Witness Falkenberg's Testimony**

In his Post-Hearing Ruling on Evidentiary Motions, the ALJ denied the motions of Otter Tail, LEC and Dairyland to strike the testimony of Randall Falkenberg regarding the risk of regulation method of calculating the value of externalities. The ALJ did so on the grounds that there is at least an arguable logical connection between environmental damages and the risk of regulation.

In its exceptions to the ALJ's report, Dairyland renewed its objection to the inclusion of Falkenberg's testimony in the record. Dairyland claimed that financial risk, quantified by the risk of regulation method, is not included in this proceeding and that there is no authorization in the statute for the Commission to establish monetized values representing any such financial risks.

The Commission finds that the ALJ was justified in determining that there is a connection that can be argued between the risk of regulation methodology and environmental damage. The Commission will not exclude this information from the record, as requested by Dairyland.

### **C. Statutory Interpretations**

#### **1. "To the Extent Practicable"**

The Commission agrees with the ALJ that the common and approved usage of the term "practicable" is what the Legislature intended. Citing to Webster's New Universal Unabridged Dictionary, the ALJ defined "practicable" to mean "feasible" or "capable of being accomplished."

Some parties argued, unpersuasively, that the statutory requirement that the Commission quantify and establish environmental costs "to the extent practicable" involved some additional screening steps beyond determining whether it was possible to set such values. Additional screens suggested were to determine 1) whether it would be constitutional to do so and 2) whether the application of such values in resource decisions would be reasonable. In the relevant context, the "quantifying and establishing" phase of the statute, the Commission finds that these other considerations (constitutionality and reasonableness of the ultimate application

of the values) improperly complicate and distort what the legislation places before the Commission at this time.<sup>4</sup>

In short, the Commission finds that the term “practicable,” as used in the Environmental Costs Statute, means “feasible” or “capable of being accomplished.”

## 2. “Costs Associated With Each Method of Generation”

Several of the parties argued and the Commission finds that identification and valuation of all environmental costs, while theoretically desirable, would be arduous, if not impossible. Nevertheless, some parties argued that it would be improper for the Commission to set **any** environmental costs unless it sets them comprehensively. For these parties, costs are comprehensive only if they include

1. full fuel cycle costs, i.e. those that reflect **upstream costs** such as costs to the environment due to the extraction and transportation of the fuel used and **downstream costs** such as decommissioning of a plant and burial of wastes, as well as the environmental impacts resulting from the electrical generation itself;
2. **all** the associated costs, not just the most significant and relevant impacts; and
3. all such costs for **every** electric generating method, not just those likely to be most relevant in Minnesota.

The Commission finds that the statute imposes no such unreasonable demands.<sup>5</sup> Instead of

---

<sup>4</sup> The Commission notes that the 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. To underscore the fact that the environmental costs established in this Order will simply be **part** of the record considered in evaluating future resource options, the Commission will require that utilities include as part of their resource procurement submissions a base-case analysis considering direct costs only, i.e. attributing a zero value to externality costs. The base-case analysis will facilitate consideration of the ratemaking and other socioeconomic implications, if any, of accepting either of the other two analyses. See Ordering Paragraph 2

<sup>5</sup> No study as comprehensive as demanded by these parties has come to the Commission’s attention during the extensive course of this proceeding.

requiring absolute comprehensiveness, the statute requires that costs be established “to the extent practicable.” With respect to upstream and downstream costs, no party has proposed environmental cost values in this proceeding that reflect the full fuel cycle, not even the parties who argued so strongly that it is essential to consider such costs. Likewise regarding the quantification of **all** environmental impacts, however slight, difficult to measure, or irrelevant, the Commission again notes that no party has undertaken such a bottomless and highly speculative task. The Commission finds that the absence of record evidence supporting values for this category of impacts conclusively shows the impracticability of establishing values for such impacts but does not preclude the Commission from quantifying costs for which there is reasonable record support.

Some parties argued that the statutory reference to “method of generation” requires the Commission to establish values that apply to each generic method of generation, i.e. for coal, hydro-electric, wind, natural gas, nuclear, etc. The Commission finds that this would be an unreasonable reading of the statute. The Commission finds it impracticable to establish environmental values based strictly on the method of generation because the level of environmental impact is not uniform from site to site for each method of generation. The level of damage will vary greatly depending on the circumstances of plant. For example, the amount of pollutant emitted by Plant A may be much less than that emitted by Plant B despite the fact that they use the same method of generation (e.g. coal) because Plant A has superior, cleaner burning equipment and uses a superior (lower polluting) grade of fuel.

A preferable way to proceed was proposed by the Department:

1. The Commission should not directly establish a range of environmental costs for each generic method of generating electricity. The Commission should instead quantify the costs attributable to as many effects of by-products of generation as practical. The appropriate range of costs will then be assigned to any given generation addition, based on its own unique effects, and/or by-products. This is similar to the approach used in the interim stage of this proceeding.
2. The Commission should focus on the effects of by-products that cause the most significant costs. For example, modest noise pollution at a remote, non-recreational site probably imposes a lower environmental cost than ozone formation in large urban areas or acidic deposition in popular lakes.
3. The Commission should concentrate on the impacts that are easiest to quantify.

4. The Commission should emphasize effects attributable to the most likely resource decisions over the resource -planning horizon (15 years).

Based on these criteria, the Commission has chosen to concentrate on the most significant by-products of generation (EPA's six criteria pollutants plus mercury and carbon dioxide) and has quantified costs for them "to the extent practicable." The list of pollutants thus quantified is reasonably comprehensive and consistent with the statutory mandate. See discussion of each of these pollutants, below.

The Commission acknowledges the relevance of evidence regarding costs of other pollutants in a subsequent proceeding that addresses the merits of a particular company's resource options but does not view their quantification essential at this time. The relative unimportance of the comprehensiveness demanded by some parties becomes clear when we understand

- the limited nature of what the statute requires the Commission to decide in this Order (the quantification stage) and
- what it will be considering (in addition to the range of environmental costs established in this Order) when it evaluates particular resource options in future proceedings.

Adopting a range of environmental costs for certain pollutants does not preclude the submission of quantified evidence (other external factors, including socioeconomic costs) on those pollutants and any other pollutants for which costs have not been established in this Order in future proceedings. Nor does it preclude the consideration of unquantified impacts on a qualitative basis.

In short, this Order quantifies environmental impacts "to the extent practicable," as required by the statute, and leaves to future dockets the job of developing a record that focuses on the specific environmental cost-related circumstances of the resource options proposed in those dockets.

#### **D. Standard for the Burden of Proof**

Minn. Rules, Part 1400.7300, subp. 5 states the burden of proof to be used in administrative hearings as follows:

The party proposing that certain action be taken must prove the facts at issue by the preponderance of the evidence, unless the substantive law provides a different burden or standard.

The MPCA argued that substantive law does establish a different standard. The MPCA asserted that in requiring the Commission to establish environmental costs "to the extent

practicable,” the environmental externality statute establishes that phrase as the standard, in place of the preponderance of the evidence standard.

The ALJ rejected the MPCA’s proposition and so does the Commission. The Commission finds that the Legislature did not intend to override the rule establishing the preponderance of evidence test in administrative proceedings.

As applied in these proceedings, then, parties proposing environmental cost values have the burden of showing, by the preponderance of the evidence, that it is practicable to adopt the proposed values. Parties opposed to the adoption of any particular proposed value must counter the proposer’s evidence with a greater weight of evidence demonstrating the incorrectness of or impracticability of adopting the proposed value.

## **E. Principles Guiding Quantification of Environmental Cost Values**

### **1. The Damage-Cost Approach Preferred**

There are several methods for estimating environmental cost values including:

- Damage-cost method, which attempts to place an economic value on the net damage to the environment created by an energy resource.
- Willingness-to-pay method, which measures the amount that society would be willing to pay for reduced emissions.
- Cost-of-control method, which uses the costs of avoiding or reducing an environmental effect at the source to estimate the value of the externality.
- Mitigation cost method, which uses the costs of eliminating the harm or impact of an externality. An example is planting trees to offset emissions of CO<sub>2</sub>.
- Risk of regulation method, which estimates future taxes or costs that a utility might incur due to additional regulation.

The two methods used most often to establish a range of values for environmental costs are the damage-cost approach and the cost-of-control approach. Between those two approaches, the Commission finds that the damage-cost approach is superior because it appropriately focuses on actual damages from uncontrolled emissions. By contrast, the cost-of-control method does not attempt to measure directly residual damages and instead estimates the cost of reducing an emission at the source.

Despite the general theoretical shortcomings of the cost-of-control method, the Commission finds that this method may be reasonable in certain circumstances. In some instances, it may be much easier or less expensive to estimate control costs than to estimate actual damages.

### **2. Ranges Appropriately Take into Consideration a Certain Level of Unavoidable Scientific Uncertainty**

Quantification of environmental values necessarily involves the consideration of scientific evidence that generally does not provide definitive answers. The statute implemented here requires the Commission to establish a range of values. Using a range of values appropriately acknowledges the uncertainty attending the quantification of environmental costs. Using a range also permits the testing of resource plans for sensitivity to changes in environmental values.

### **3. Geographically Sensitive Values**

It is not possible for the Commission to establish environmental values that apply perfectly to every potential resource option. As noted previously, such a goal is beyond what is required in the quantification stage. The Commission does find it possible and appropriate, however, to adopt some refinements in the quantification process at this time to reflect the following factor: proximity to population centers.

- The amount of damage imposed by many pollutants depends largely on site-specific factors, including the number of people likely impacted by the emission.
- In addition, the level of geographic sensitivity is not uniform for each pollutant but varies from pollutant to pollutant.

Recognizing that environmental impacts will vary depending on the circumstances of the particular resource option in question, the Commission has adopted **ranges** of values for the various pollutants and, in addition, has found it appropriate to adopt ranges that differ depending on the location of the proposed generation site: urban, metropolitan fringe, and rural. The Commission's adopted values also reflect that the level of geographic sensitivity of each emission is not uniform but varies from emission to emission.

No further pinpointing of emission levels or costs per unit of emissions is necessary or possible at this time. In future proceedings, the parties addressing particular resource options will establish a record for the Commission's evaluation.

### **4. General Focus on Damage Occurring in Minnesota**

With the exception of the values adopted for CO<sub>2</sub>, which causes damages globally rather than regionally or locally, the Commission has quantified the costs of environmental damage occurring in Minnesota. This is consistent with the approach recommended by the Department and found reasonable by the Commission that the Commission focus on the effects of by-products that cause the most significant costs. With respect to CO<sub>2</sub>, this means assessing damage globally; for all other pollutants for which values are established in this Order, it means quantifying the damage they cause in Minnesota.

### **5. Damages in Minnesota From In-State and Out-of-State Generation Sources**

The general proposition that emissions generated in another state can do environmental damage in Minnesota appears indisputable. But since the level and amounts of damages are a function



of distance, at some distance from the Minnesota border, generating plant emissions lose their ability to damage the Minnesota environment.

With respect to all the pollutants quantified in this Order except CO<sub>2</sub>, for which global damages are addressed below, the Commission finds that the record supports finding in-state damages from a generating plant located up to 200 miles from the state border, but that it is not practicable (on the current record) to establish values for damages caused by emissions originating in plants beyond that point. Accordingly, the Commission has set values for emissions originating within the 200 mile band, as recommended by the Department and the ALJ. Environmental cost values for emissions from generating sites located beyond the 200 mile band are deemed to be zero.<sup>6</sup>

The State of North Dakota argued that Minnesota's externalities statute cannot be interpreted as extending to electric generation facilities located beyond Minnesota's boundaries because to do so would violate the U.S. Constitution. The Natural Gas Utilities countered that failure to apply the statute to out-of-state generation would give that generation a significant advantage over Minnesota-based generation during the resource planning process.

The Commission notes that the statute on its face does not differentiate between in-state generation and out-of-state generation and, as noted previously, the Commission is not in a position to decide Constitutional claims. The Commission, therefore, has executed its mandate under the statute to quantify all generation-related damages occurring in Minnesota, regardless of the location of the generating site in question, to the extent that it is feasible to do so.

## **5. Relationship of NAAQS to Externality Costs**

Under sections 108 and 109 of the Federal Clean Air Act, the U.S. Environmental Protection Agency (EPA) is required to issue National Ambient Air Quality Standards (NAAQS) for the criteria pollutants: sulfur dioxide (SO<sub>2</sub>), particulate matter less than 10 microns in diameter (PM<sub>10</sub>), nitrogen oxides (NO<sub>x</sub>), ozone (O<sub>3</sub>), carbon monoxide (CO), and lead (Pb). The EPA is supposed to set its standards with an adequate margin of safety to protect the public health.

Some parties argued that there can be no damages/costs to the environment as long as emissions do not cause ambient air concentrations to exceed the NAAQS. However, the EPA has not been able to keep the NAAQS updated. They do not reflect the latest scientific knowledge. Based on the record established in this matter, it is clear that the NAAQS currently are not necessarily set at no-cost levels. The Commission finds the Minnesota-specific state of the art damage cost

---

<sup>6</sup> Unlike all the other pollutants quantified in this Order, the per ton damage attributed to CO<sub>2</sub> is calculated by a method that estimates the damage that any given ton of CO<sub>2</sub> does to the globe, rather than to Minnesota in particular. Nevertheless, in order to treat CO<sub>2</sub> emissions similarly with the other pollutants whose damages are found to be zero unless they originate within 200 miles of the Minnesota border, the Commission will treat CO<sub>2</sub> emissions the same way, i.e. as having no environmental costs if they originate more than 200 miles from the Minnesota border. To do otherwise would overly complicate an already highly complex analytical process.

study sponsored by NSP, the Triangle Economic Research (TER) Study, more dependably reflects environmental costs in Minnesota.

## **6. Dependability of the TER Study, as Modified**

NSP submitted a state of the art damage study by Triangle Economic Research (TER). Dr. William Desvousges, the lead author of the TER Study, is an expert in valuing natural resources and preparation of damage cost studies. In order to capture the relevant effects and the magnitude and location of potential damages, the TER Study examined the effects of the six criteria pollutants in Minnesota<sup>7</sup> and developed environmental costs for three planning scenarios: a rural scenario, a metropolitan fringe scenario, and an urban scenario.

The TER Study modeled emissions for over sixty resources in each scenario and determined estimated damages at the zip code level (618 zip codes) for each hour of the year (8,700 hours). A total of 32.5 million concentrations were estimated for each scenario.

The TER Study examined three main categories of potential effects: human health effects in the form of morbidity and mortality risks, agricultural effects in the form of reduced crop yields, and material damages in the form of stone and metal corrosion and surface soiling. The TER Study reviewed over four hundred studies related to health, materials, soiling and agriculture.

The Department's expert witness Dr. Mark Thayer reviewed the TER Study and determined that the results of the study are consistent with the results and general trends found in recent research using the damage cost methodology to estimate the environmental costs of air emissions. Dr. Thayer's critique also included several recommendations that were adopted by Dr. Desvousges and incorporated into TER's final recommendations. For example, Dr. Desvousges and Dr. Thayer agreed that the effects of secondary particulates should be assigned to the original emissions, NO<sub>x</sub> and SO<sub>2</sub>. Using Dr. Thayer's calculations, Dr. Desvousges adjusted his NO<sub>x</sub> values upward to account for the effects of nitrates. Dr. Desvousges also agreed with Dr. Thayer that TER's original calculations for PM<sub>10</sub> underestimated soiling and visibility damages and revised his PM<sub>10</sub> values upward consistent with Dr. Thayer's conclusions.

In short, the Commission finds that the TER Study provides a sound basis for adopting the environmental cost values for the six pollutants addressed in that study, as modified in response to Dr. Thayer's comments. The existence of such a quality Minnesota-specific study makes it "practicable" to establish such values.

## **F. Quantification of the Cost of Specific Pollutants**

Several parties recommended establishing and quantifying a range of environmental cost values for the criteria pollutants: sulfur dioxide (SO<sub>2</sub>); particulate matter less than ten microns (PM<sub>10</sub>);

---

<sup>7</sup> The TER Study is the only study presented in this proceeding that focused on effects in Minnesota and, therefore, is the primary source of information in this record regarding effects specific to Minnesota.

nitrogen oxides (NO<sub>x</sub>); ozone (O<sub>3</sub>); carbon monoxide (CO) and lead (Pb). These were chosen because they have been the major focus of air quality regulations and they are factors for which significant amounts of information exist. The TER Study also indicated that previous studies have shown that these pollutants account for the majority of potential environmental damages.

In addition to the criteria pollutants, various parties recommended values for other emissions which are considered to have environmental effects: carbon dioxide (CO<sub>2</sub>), volatile organic compounds (VOCs), mercury, and methane. This section addresses each of the pollutants for which values were proposed and explains why, with respect to each, the Commission did or did not quantify a range of environmental cost values.

## **1. Sulfur Dioxide (SO<sub>2</sub>)**

### **a. Harm Associated**

Through chemical reactions, emissions of SO<sub>2</sub> result in acid deposition. SO<sub>2</sub> may also contribute to particulate matter through the formation of sulfates, resulting in the exacerbation of respiratory and cardiovascular problems, decreased visibility, the corrosion of structures, and the acidification of waterways.

### **b. SO<sub>2</sub> Values Proposed**

NSP stated that the TER Study showed midpoint damages from sulfur dioxide (SO<sub>2</sub>) emissions to be \$21 (1993 \$) per ton for resources in rural locations, \$54 per ton for resources in metropolitan fringe locations, and \$126 per ton for resources in urban locations. NSP proposed ranges between zero and \$21, \$54, and \$126 for the three scenarios (rural, fringe, and urban) respectively. MP supported adopting those values.

Using the endpoints of the ranges developed in the TER Study, EC, the MPCA, and the RUD-OAG proposed the following values for SO<sub>2</sub>:

|        |           |
|--------|-----------|
| Urban  | 106 - 178 |
| Fringe | 43 - 104  |
| Rural  | 9 - 24    |

MP, NSP, the Department and the RUD-OAG argued that beginning in the year 2000, a nationwide cap on emissions of SO<sub>2</sub> together with an allowance trading program mandated by the Clean Air Act Amendments will reduce the amount of net new emissions to zero. With the cap and trading program in place, any increase from a new source will require a corresponding reduction from another existing source, yielding no net new emissions of SO<sub>2</sub>. Under these conditions, SO<sub>2</sub> related damages will be internalized and no values should apply for SO<sub>2</sub> after 2000.

EC and the MPCA argued that the record does not support a finding that the sulfur dioxide emission cap will end damage to human health and the environment from that pollutant.

**c. The ALJ's Recommendation**

The ALJ recommended that the range of environmental costs proposed by the RUD-OAG, EC, and the MPCA should be applied to those resources not currently included in the emission allowance trading program until the year 2000, but that no dollar value should be applied to SO<sub>2</sub> after that date.

**d. The Commission's Decision Regarding SO<sub>2</sub>**

The Commission will adopt the ALJ's recommended ranges, updated to 1995 dollars.<sup>8</sup> The ALJ's ranges are the ranges proposed by the TER Study, EC, MPCA, and the RUD-OAG. The Commission finds that these ranges are reasonable, well supported in the record, and preferable to those proposed by MP and NSP. Theoretically, there is a ninety percent chance that the true externality value for a given pollutant lies in the indicated range adopted by the Commission. In contrast, there is only a fifty percent chance that the range proposed by NSP and supported by MP includes the true value of a given pollutant. The companies' proposed range suffers from other infirmities as well:

- For the high end of each of their proposed ranges, the companies chose the median figure from among the thousands of estimated damage points generated by the TER model for the scenario/pollutant in question.<sup>9</sup> The median is not a reasonable figure to serve as the high end of the range because mathematically speaking it is just as likely that the actual damage experienced will exceed the median than it is that the damage will be lower than the median. The Companies gave no reasonable explanation for ignoring the higher half of the damage points calculated by the TER Study.

---

<sup>8</sup> All of the ranges in the TER Study and recommended by the ALJ are stated in terms of 1993 dollars. In this Order, the values adopted by the Commission and listed in the Ordering Paragraphs are stated in terms of 1995 dollar figures.

<sup>9</sup> As previously noted, for each scenario/pollutant combination (e.g. rural/SO<sub>2</sub>) the TER Study generated thousands of estimated damage "points," one for every hour of the year. The median figure for those points is the point at which there is an equal number of estimated damage points higher and lower.

- Likewise it is unreasonable to adopt zero as the bottom of the range, as recommended by the companies. To do so unjustifiably ignores the findings of the TER Study with respect to the lower end of the range. Reasons given by the companies for introducing zero as the bottom of the range are unpersuasive: 1) that the Commission needs the zero figure there to give it the flexibility (discretion) to impose no values if to do so would be unfairly drive the regulated company's rates higher relative to less-regulated energy suppliers and 2) that establishing environmental values is such an uncertain undertaking that zero must be available. No such step is needed at this point to give the Commission the discretion to apply a "zero option" when it examines a resource planning petition. The Commission already has discretion under the statute to effectively discount environmental values (assigning them a zero value) if, in light of other external factors, including socioeconomic considerations, the Commission finds it appropriate to do so. As to the uncertainty argument, the Commission is aware of the scientific difficulties involved in establishing environmental values, but is convinced that the TER Study provides a sound basis for establishing the ranges adopted in his Order. No additional down-shifting of the TER ranges, "just in case," is appropriate.

Regarding post-2000 issue, the Commission finds that SO<sub>2</sub> damages will be internalized after 2000 and, therefore, applying externality costs would be unwarranted.

## **2. Nitrogen Oxides (NO<sub>x</sub>)**

### **a. Harm Associated**

Nitrogen oxides contribute to the formation of ozone, acid deposition and the creation of PM<sub>10</sub>. The health effects on adults of ozone exposure are increased lung irritation and lower resistance to respiratory infections.

### **b. NO<sub>x</sub> Values Proposed**

NSP and MP proposed the following ranges of NO<sub>x</sub> environmental values for the rural, fringe, and urban scenarios: \$0 - 61, \$0 - 190, and \$0 - 718, respectively. The companies' high end figures again represent the median of the TER damage calculations.

EC, the MPCA, and the RUD-OAG proposed the following ranges, as recommended by the TER Study. The TER Study found the formation of ozone (O<sub>3</sub>) to be more closely associated with NO<sub>x</sub> than with volatile organic compounds (VOCs), and therefore included the ozone externalities values with the NO<sub>x</sub> values and did not value ozone separately.

|        |             |
|--------|-------------|
| Rural  | \$ 17 - 96  |
| Fringe | \$132 - 251 |
| Urban  | \$350 - 922 |

The Department proposed a slightly higher set of ranges: rural -- \$18-102; fringe -- \$140 - 266; and urban -- \$371 - 978. The difference between the Department and the TER Study figures is due to the fact that the Department's figures are stated in 1995 dollars.

The MPCA generally supported the TER ranges, but argued that the TER Study's NO<sub>x</sub> value for the rural scenario was too low because it failed to reflect the agricultural damages for ozone depletion due to NO<sub>x</sub> emissions.

**c. The ALJ's Recommendation**

The ALJ recommended the ranges for nitrogen oxides (NO<sub>x</sub>) found in the TER Study and recommended by EC, the RUD-OAG, the Department (updated to 1995 dollars) and (except with respect to the rural scenario as discussed above) the MPCA.

**d. The Commission's Decision Regarding NO<sub>x</sub>**

The Commission finds that the ranges recommended in the TER Study are reasonable and soundly supported in the record of this proceeding. In Ordering Paragraph 1, the Commission updates those figures and states them in terms of 1995 dollars.

The Commission rejects the companies' proposed ranges for the reasons stated with respect to their recommendations regarding SO<sub>2</sub>: 1) the median of the TER damage calculations is an inappropriate high point for the NO<sub>x</sub> damage range and 2) zero is too low for the low end, as discussed previously.

The MPCA's proposed adjustment to the rural scenario was also not accepted. The MPCA did not perform ozone modeling to calculate its proposed values and did not base its damage estimates on Minnesota specific agricultural data. By contrast, Mr. Ballantine, the modeler whose ozone data was used in the TER study, relied on crop-specific dose-response functions, used county level ozone and agriculture data, and employed state of the art valuation techniques. Mr. Ballantine explained that any decrease in ozone indicated in the rural scenario is likely due to statistical "noise," i.e. concentrations indistinguishable from zero in the statistical sense. Consequently, the TER ozone model did not show a lowering of ozone concentrations when power plant emissions are present.

**3. Carbon Monoxide (CO)**

**a. Harm Associated**

CO inhibits the blood's ability to carry oxygen.

**b. CO Values Proposed**

The EC, MPCA, and the RUD-OAG recommended the following ranges, based on the TER Study:

|        |                |
|--------|----------------|
| Rural  | \$ .20 - .39   |
| Fringe | \$ .72 - 1.26  |
| Urban  | \$ 1.00 - 2.14 |

The Department proposed ranges reflecting the same figures, but stated in terms of 1995 dollars. MP and NSP proposed that the Commission quantify no externality values for carbon monoxide

because, in their view, the small damage-cost estimates associated with CO did not justify the administrative burden associated with incorporating those values.

**c. The ALJ's Recommendation**

The ALJ recommended the ranges in the TER Study.

**d. The Commission's Decision Regarding CO**

The Commission will adopt the ranges from the TER Study and recommended by the ALJ, updated to 1995 dollars using the updating methodology used by the Department. The Commission finds that although the costs of CO are small, the record demonstrates that it is practicable to quantify them as required by the statute and the Commission has done so. The administrative burden referenced by the companies is minimal.

**4. Particulate Matter Smaller Than 10 Microns (PM<sub>10</sub>)**

**a. Harm Associated**

Particulate emissions smaller than 10 microns can: (1) exacerbate existing respiratory problems; (2) cause respiratory illness and damage lungs; (3) reduce the body's defenses against foreign material; (4) cause cancer; (5) impair visibility; and (6) damage materials.

**b. PM<sub>10</sub> Values Proposed**

EC, the MPCA, and the RUD-OAG proposed PM<sub>10</sub> values based on the TER Study. The Department proposed the same values, updated to 1995 dollars. The values from the TER Study are as follows:

|        |                 |
|--------|-----------------|
| Rural  | \$ 530 - 806    |
| Fringe | \$1,873 - 2,720 |
| Urban  | \$4,206 - 6,054 |

NSP and MP proposed ranges with zero dollars at the low end and the median of the TER study damage estimates for PM<sub>10</sub> at the high end: rural \$0 - 668; fringe \$0 - 2,295; and urban \$0 - 5,128.

OTP asserted that the Commission cannot establish environmental cost values for any of the criteria pollutants, including PM<sub>10</sub>, because the present and likely future levels of those pollutants are far below the levels that the EPA has designated as posing a potential health hazard. The Commission has considered and rejected that argument, as explained previously in this Order.

OTP also objected that Dr. Desvousges was unqualified to interpret the epidemiological studies that he relied on to conclude that PM<sub>10</sub> is contributing to elevated mortality rates. OTP also asserted that Dr. Thayer lacked the background and personal knowledge needed to support his allegations about the health effects of PM<sub>10</sub>.

**c. The ALJ's Recommendation**

The ALJ recommended the ranges proposed by the EC, the MPCA, and the RUD-OAG. As previously stated, the same values were the basis for the 1995 dollar ranges proposed by the Department.

**d. The Commission's Decision Regarding PM<sub>10</sub>**

The Commission finds that it is practicable to quantify environmental values for PM<sub>10</sub> based on the TER Study and has done so. The ranges recommended by NSP and MP are improper, as discussed previously. The zero figure improperly inserts into the quantification phase considerations relevant only to the application phase and choice of the median as the high point improperly disregards the environmental damage estimated in excess of that point.

The Commission finds that OTP's challenges to the reliability of the testimony of Drs. Desvougues and Thayer are without merit. The record clearly indicates that these witnesses are experts in valuing natural resources and have extensive experience in assigning values to the environmental costs of electric power generation. These experts are clearly able to draw upon the studies they cite. OTP submitted no critique of the studies cited.

**5. Lead (Pb)**

**a. Harm Associated**

Lead affects the physiological processes and damages organs. It can be inhaled and ingested from contaminated food and water.

**b. Pb Values Proposed**

EC, the MPCA, and the RUD-OAG proposed lead (Pb) values based on the TER Study. The Department proposed the same values, updated to 1995 dollars. The TER Study ranges are as follows:

|        |                 |
|--------|-----------------|
| Rural  | \$ 379 - 422    |
| Fringe | \$1,557 - 1,881 |
| Urban  | \$2,951 - 3,653 |

NSP and MP recommended that the Commission adopt no values for lead. The companies argued that the total damages associated with lead emissions were extremely small and that the administrative burden of applying values for lead outweigh any benefit gained in improved decision quality.

**c. The ALJ's Recommendation**

The ALJ recommended that the Commission adopt the TER Study values.



#### **d. The Commission's Decision Regarding Pb**

The Commission accepts the lead values found in the TER Study, updated to 1995 dollars. The TER Study and accompanying testimony provides a record that made it practicable to establish such values and the Commission has done so. Contrary to the assertions by NSP and MP which seek to minimize the impact of lead emissions, the Commission finds that lead emissions are significant, relevant, and should be valued in this proceeding. The record shows that lead damages are second only to PM<sub>10</sub> on a per ton basis and the Twin Cities metropolitan area exceeds the NAAQS for lead. The administrative burden required by the companies is minimal.

#### **6. Volatile Organic Compounds (VOCs) and Ozone (O<sub>3</sub>)**

Volatile organic compounds (VOCs) contribute to ozone (O<sub>3</sub>) formation and ozone-related damages. The Commission finds that VOCs are appropriately reflected as a component of ozone. Further, as noted previously in the discussion of NO<sub>x</sub>, ozone damage has been reflected in the damage values adopted for NO<sub>x</sub>. Accordingly, no separate values need be established for either VOCs or ozone.

#### **7. Carbon Dioxide (CO<sub>2</sub>)**

##### **a. Harm Associated**

The basic theory underlying global warming is that greenhouse gasses (including CO<sub>2</sub>)<sup>10</sup> trap heat that would have otherwise radiated into space within the earth's atmosphere. This heat-trapping action keeps the earth's surface about 33 degrees Celsius warmer than it would be if the natural greenhouse effect were not present. Concerns over global warming, or the enhanced greenhouse effect attributable to human activities, arise because the amount of carbon dioxide in Earth's atmosphere has already risen from its preindustrial level of about 275 to 280 parts per million (ppm) to over 350 ppm, with the majority of this increase occurring since 1950.

In 1988, the United Nations Environment Program and the World Meteorological Organization created the Intergovernmental Panel on Climate Change (IPCC) to evaluate the environmental impacts associated with **anthropogenic** emissions of greenhouse gasses such as CO<sub>2</sub>.<sup>11</sup>

IPCC reports are the most authoritative sources available for information on climate change issues. Before publication, IPCC research reports are developed by technical committees composed of experts throughout the international scientific community and are subject to a rigorous multi-level peer review process. According to the IPCC, doubling CO<sub>2</sub> concentrations

---

<sup>10</sup> CO<sub>2</sub> is one of the several gasses known as greenhouse gasses because they have the effect of warming the earth. Energy emitted from the sun passes through the atmosphere, is absorbed by the earth, and then is radiated from the earth's surface. When the radiated energy, instead of radiating directly into space, is absorbed and re-emitted towards the earth by greenhouse gasses, the surface and lower atmosphere of the planet are warmed.

<sup>11</sup> Anthropogenic emissions are those generated by human activity.

in the atmosphere would lead to an increase in global average temperature that is likely to lie in the range of 1.5 to 4.5 degrees Celsius, which is 2.7 to 8.1 degrees Fahrenheit.<sup>12</sup>

According to the IPCC, climate change in the predicted range could involve a number of potentially catastrophic impacts, including a rise in sea level, heightened climatic variability, and changes in vegetation. Current limitations on the general circulation models (GCMs) relied upon by the IPCC make it difficult to draw definitive conclusions about shifts in the distribution of precipitation, agricultural output, and frequency and severity of extreme weather events for any specific location or even a given region. While some studies predict agricultural benefits to Minnesota from warming of the climate, others show the grain belts of the Northern hemisphere shifting north by hundreds of kilometers and significant die-back of the spruce/pine/fir forests found in parts of northern Minnesota.

#### **b. CO<sub>2</sub> Values Proposed**

EC initially proposed a value of \$25 per ton for CO<sub>2</sub>, based on the testimony of Dr. Stephen Bernow, who used an emissions target or environmental target approach. In its exceptions to the ALJ's Report, EC indicated that it could accept the following range: \$2.92 to \$14.29 per ton.

The MPCA originally proposed a range of \$4.28 to \$28.57 per ton for CO<sub>2</sub> emissions, based on the testimony of Peter Ciborowski who used a damage cost methodology. In its Exceptions to the ALJ's Report, the MPCA revised its proposal, recommending a range of \$2.14 to \$14.29 per ton.

The RUD-OAG did not provide any testimony, but proposed a range of costs for CO<sub>2</sub> emissions of \$1.00 to \$11.00 per ton, based on information in the record.

The Department initially proposed values based on testimony that was subsequently removed from the record. Thereafter, the Department recommended that the Commission order additional proceedings to allow the setting of environmental cost values for CO<sub>2</sub> based on a risk of future regulation approach.

Other parties have proposed that no value be set for CO<sub>2</sub> emissions on the basis that it is not practicable to do so because existing data is insufficient or unreliable.

#### **c. The ALJ's Recommendation**

The ALJ recommended a range of costs for CO<sub>2</sub> emissions of \$0.28 to \$2.92, based on Ciborowski's lower damage function (1 percent of global GDP) discounted at rates of 5 percent (lower end \$0.28) to 3 percent (higher end \$2.92).

---

<sup>12</sup> Based on past emission trends, equivalent CO<sub>2</sub> concentrations are expected to double from preindustrial levels before 2030 and to quadruple before 2100.

#### **d. The Commission's Decision Regarding CO<sub>2</sub>**

The Commission will adopt the range recommended by the ALJ as appropriate for all three scenarios: rural, fringe, and urban.<sup>13</sup> The Commission finds that the ALJ's calculation is well-reasoned and firmly based in the record. See ALJ's Report, Findings 102 - 114. The Commission will update the estimates to 1995 dollars, using the same method as used for the other types of emissions.

Several parties argued that it was impracticable to quantify any values for CO<sub>2</sub> because existing data is insufficient or unreliable. They argued that the Commission should desist from establishing values for this pollutant until clearer information is available. The Commission recognizes that there is a level of uncertainty associated with the estimates provided from the scientific community. However, the available data does provide a sufficiently reliable basis for estimating environmental damage now.

Parties further objected that it would be "impracticable" for Minnesota to adopt CO<sub>2</sub> values because CO<sub>2</sub> (and any associated global warming) could not be addressed with any appreciable impact by Minnesota alone. It is true that CO<sub>2</sub> emissions in Minnesota (approximately 33 million tons per year) constitutes approximately 0.1 percent of global CO<sub>2</sub> emissions (approximately 60 billion tons per year). The objectors' argument, however, does not really challenge the practicability (feasibility) of setting CO<sub>2</sub> values, but instead questions the wisdom of doing so in view of what they view as the inconsequential impact of such an effort. Their argument that nothing should be done because nothing "significant" (in the eyes of the objectors) can be done is a political argument not appropriately before the Commission. The legislature has made the appropriate political decision that the Commission should value CO<sub>2</sub> to the extent that this is feasible and, after rejecting some proposed ranges for CO<sub>2</sub>, the Commission has done so.<sup>14</sup>

#### **Rejected Ranges**

EC's proposed range (\$2.92 to \$14.29 per ton) is based on discounts of 3 and 1 percent, respectively. As indicated below, the Commission finds that a 3 percent discount is supported in the record, but for the high end of the range, rather than the low end as proposed by EC and the 1 percent discount (which produces EC's high end recommendation of \$14.29) is not.

Regarding the RUD-OAG's proposed \$1 - \$11 range, the Commission finds that support in the record for either endpoint is too weak to be accepted. The RUD-OAG did not sponsor a witness advocating any range.

---

<sup>13</sup> The damage caused by CO<sub>2</sub> emissions is experienced globally. It is not geographically sensitive as discussed previously with respect to, for example, the criteria pollutants. There is no quantifiable diminution of effect the farther the emitting plant is located from population centers. Hence, one range is appropriate for all three scenarios: rural, fringe, and urban.

<sup>14</sup> As indicated previously, the overall wisdom of choosing a particular set of resource options will be evaluated in resource plan and certificate of need proceedings.

Finally, despite approving the general approach taken by MPCA witness Ciborowski, the Commission has also rejected the MPCA's proposed range for CO<sub>2</sub>, for reasons explained in the following section.

### **The Acceptable Range**

The environmental values for CO<sub>2</sub> quantified in this Order follow MPCA witness Ciborowski's general methodology. First, Ciborowski estimated **long-term global costs** based on the existing economic literature and **discounted** them to current values. Then, he divided that amount by the amount of long-term CO<sub>2</sub> emissions to arrive at an average cost per ton. Ciborowski essentially converted published damage estimates made by economists from percentages of gross domestic product (GDP) into costs per ton of CO<sub>2</sub>.

Two factors account for the difference between the MPCA's recommended values and those adopted by the Commission: 1) the estimate of damage and 2) the discount rate used to reduce the stream of estimated damages to present value.

**Estimate of Global Damage** -- Ciborowski provided two damage figures: a "lower damage function" equal to 1 percent of global GDP and a "higher damage function" equal to 2 percent of global GDP. The MPCA used the higher function (2 percent) in calculating its proposed values. The Commission finds that the assumption that damages can be estimated at 2 percent of global GDP is factually unsupported by the record and is highly speculative given the available evidence. By contrast, the Commission finds that Ciborowski's "lower damage function" (1 percent) is well supported in the record, including the studies of Nordhaus and Frankhauser. The CO<sub>2</sub> values adopted in this Order, therefore, are calculated using a 1 percent damage function.

**Discount Rate** -- Once a damage stream has been estimated, it is necessary to select an appropriate discount factor to adjust the damage stream figures downward to present value. Ciborowski calculated the damage estimates using discount rates of 1, 2, 3, and 5 percent. He proposed a discount rate of approximately 1.5 percent based on a study performed by Cline.

Although Cline maintained that low discount rates are appropriate when discounting across generations, the Commission agrees with the ALJ that there is insufficient support for that position in the record. The weight of authority in the record supports a range of at least 3 - 5 percent for reducing future environmental damages to present value.<sup>15</sup> Therefore, the range of CO<sub>2</sub> values adopted in this Order are calculated using 3 percent to calculate the high end figure and 5 percent to calculate the low end figure.

---

<sup>15</sup> The New York State Environmental Cost Study valuing environmental externalities used a 3 percent rate. The DICE model uses a 6 percent discount rate, declining to about 3 percent as growth slows. The Lind model recommends a 4.6 percent discount rate. Nordhaus contends that rates of 4 - 6 percent are appropriate. The Academy of Sciences used discount rates of 3, 6, and 10 percent without recommending any single rate as being most appropriate.

## **8. Methane**

### **a. Harm Associated**

Methane is a greenhouse gas with a 100 year global warming potential 22 times greater than that of CO<sub>2</sub>.

### **b. Methane Values Proposed**

The only party to propose an environmental cost range for methane was EC: \$64.24 - \$314.38.<sup>16</sup>

### **c. The ALJ's Recommendation**

The ALJ recommended that the Commission establish no range of values for methane.

### **d. The Commission's Decision Regarding Methane**

Noting that methane's 100 year global warming potential is 22 times greater than that of CO<sub>2</sub>, EC argued that it would be reasonable to calculate the range for methane by multiplying the range for CO<sub>2</sub> by 22. The Commission is unwilling to set a range for methane based on such a formula. In the absence of more direct evidence that methane causes this range of damage, the Commission finds that such an arithmetic approach unreasonably increases the impact of any miscalculation in the CO<sub>2</sub> range. In short, there is insufficient evidence in the record to support an environmental cost for methane.

## **9. Mercury (Hg)**

### **a. Harm Associated**

Mercury is a neurotoxin that effects the functioning of the central nervous system. No knowledgeable witness either denied or disputed that mercury causes damage to the environment or has consequences that people care about.

Approximately three-fourths of the mercury deposited in Minnesota can be ascribed to human-generated sources. Coal-fired plants are estimated to be the source of one-sixth to one-fourth of the anthropogenic mercury emissions in the state. With the effects of the 1991 federal ban on mercury in paints and fungicides, coal burning has become the leading source of mercury emissions to the air in Minnesota.

### **b. Mercury Values Proposed**

While proposing different values earlier in the proceeding, EC, the MPCA, and the RUD-OAG ultimately proposed a range of \$1,429 to \$4,359 for each scenario. All the other parties opposed establishing values for mercury or were silent on the issue.

---

<sup>16</sup> The range cited is from EC's Exceptions to the ALJ's Report. Prior to that, EC's proposal was to value methane at \$550 per ton.

**c. The ALJ's Recommendation**

The ALJ recommended that the Commission defer adoption of an environmental cost value for mercury until better information becomes available. The ALJ further recommended that, until it has adopted a numerical value, the Commission require utilities to explain in their filings subject to the Environmental Externalities Statute how they considered mercury.

**d. The Commission's Decision Regarding Mercury**

The Commission finds that the record does not support the practicability of quantifying values for mercury. In light of the concern about mercury established in the record, however, the Commission will require utilities to explain in their filings subject to the statute how mercury emissions were considered in evaluating the resource options identified in the filing. The Commission's decision is based on the following analysis.

While mercury is a pollutant of concern, there are significant omissions and uncertainties in record data regarding the effect of mercury emissions from electrical generators:

- Current models do not exist to account for the complexity of the atmospheric chemistry of mercury and its deposition.
- The record contains insufficient data regarding the amount and form of mercury emissions from coal combustion. The form of mercury emitted not only determines how much of the mercury may be removed, but it also determines the fate, health effects and risk assessment of the mercury emissions.
- A third area of omissions and uncertainty in data is the amount and form of mercury emissions from natural as compared to anthropogenic sources.
- Also missing are data and models to estimate accurately the effect of changes in mercury concentration on fish.

In addition to the forementioned uncertainties arising from the behavior of mercury in the environment, there are major uncertainties about valuation. No model has been developed to quantitatively link mercury based fishing advisories to recreation choices. The record contains anecdotal suggestions of the link, but there is no quantitative evidence of the amount of recreational activity deterred by the advisories. Likewise, no data has been developed that allows monetization of health damages from mercury emissions.

The Commission notes that the TER Study concluded that the absence of adequate data and models and the resulting level of uncertainty make it impossible to quantify the potential damages from mercury emissions. Having reviewed the record, the Commission finds that the mercury values proposed by the EC, MPCA, and the RUD-OAG are not sufficiently reliable for planning purposes.

**EC:** EC initially proposed to value mercury at \$50 million per ton/\$25,000 per pound based on an asserted but not proven relationship between the losses estimated to be experienced by the Alaska salmon industry due to the Exxon Valdez oil spill and damage predicted to be

experienced by the Minnesota recreational fishing industry due to mercury contamination. The record contains no evidence that there has been, or will be, any significant stigmatization to Minnesota's recreational fishing industry resulting from mercury contamination.

EC's final position, expressed in its exceptions to the ALJ's Report, is that the Commission should adopt the MPCA's values as revised by the RUD-OAG (\$1,429 to \$4,359) as interim values and establish a final environmental cost value for mercury within two years of the final Order in this docket.

**MPCA:** The MPCA initially proposed a range of \$4,359 to \$9,781 based on a benefits transfer analysis that estimated mercury damages based on mercury's position on the air toxics index vis a vis other pollutants whose damages have been established in the TER Study, such as SO<sub>2</sub>, NO<sub>x</sub>, and PM<sub>10</sub>. However, based on the current state of scientific knowledge reflected in this record, the Commission cannot conclude that it is reasonable to rely on the technique of benefit transfer (using the air toxics index and its underlying fugacity model) with respect to mercury due to mercury's known unique properties, specifically its ability to cycle through the environment, taking on different chemical forms at different times.

As its final position, expressed in its exceptions to the ALJ's Report, the MPCA accepted the RUD-OAG's downward adjustment of the MPCA's mercury values (\$1,429 to \$4,359) and urged the Commission to adopt them on a temporary basis.

**RUD-OAG:** The RUD-OAG proposed a range based on a recalculation of MPCA's range for mercury. The RUD-OAG used MPCA witness McCarron's method but eliminated the PM<sub>10</sub> related values that Mr. McCarron had used in calculating MPCA's initially proposed range. The RUD-OAG's resulting range was \$1,429 to \$4,359. This was the range ultimately supported by EC and the MPCA.

The RUD-OAG acknowledged that there was a level of uncertainty associated with its proposed range but urged the Commission to adopt it nevertheless and simply factor in the uncertainty as the Commission exercised its discretion in applying the values in future resource selection proceedings.

The Commission recognizes that there are varying levels or depths of uncertainty, a continuum of uncertainty involved in the science underlying the valuation of externalities. At some levels of uncertainty it is still practicable (feasible) to quantify environmental values. The Commission found such levels of uncertainty (reasonable uncertainty) in connection with the pollutants for which it has established values in this Order, e.g. SO<sub>2</sub> and CO<sub>2</sub>. However, there is also a point on the uncertainty continuum where it becomes infeasible to quantify environmental costs even though the Commission is convinced that such costs exist.<sup>17</sup>

In considering the record with respect to mercury, the Commission finds that the level of reasonable uncertainty has been exceeded, primarily due to the unreliability of MPCA's attempt

---

<sup>17</sup> Similarly, not all fogs are of the same thickness: in some fog, it is still possible to land an airplane without instrumentation while in thicker fog, this task becomes impossible despite the certainty that both land and airplane exist.

to extrapolate mercury damages in reference to the air toxics index, as discussed previously. In these circumstances, the Commission is unable to quantify the damage resulting from mercury emitted from electric generating plants and will not do so.

The MPCA has argued the urgency of the situation, urging the Commission to quantify values on the basis of this record. The MPCA warned that failure to take environmental cost into planning considerations today will lead to expensive, sometimes irreversible, environmental losses in the future. The MPCA predicted that placing mercury emission costs at zero will result in relatively high mitigation or cleanup costs in the future.

However enticing the MPCA's calls to immediate action may be, they do not add information that makes it any more practicable to quantify damages on the basis of this record nor do they alter the legislature's directive that the Commission is to quantify values only if (to the extent) it is feasible (practicable) to do so.<sup>18</sup>

Moreover, the absence of a basis in the record of this proceeding for quantifying values for mercury does not mean that mercury's effect upon the environment will be ignored when resource options are evaluated. In this Order, the Commission has clarified that utilities will be required to explain in all filings subject to the Environmental Externalities Statute how mercury emissions were considered in the resource options identified in the filing. In addition, mercury's impact on the environment will be considered on a qualitative basis in such proceedings.

Finally, when better information on the valuation of mercury (or any other major pollutant) becomes available, any party believing that such information warrants quantifying and establishing a range of values for mercury may petition the Commission to initiate a new proceeding to do so.

## **G. Miscellaneous Clarifications**

### **1. Issues Related to Cogeneration Facilities**

The Natural Gas Utilities requested that the Commission determine how the values would apply to cogeneration facilities in future proceedings. The Natural Gas Utilities recommended that the environmental costs of cogenerated electricity be determined based on the additional emissions solely produced as a result of generating electricity, and that none of the environmental costs related to producing useful thermal energy should be allocated to the electric generation process.

The Commission finds that this is a resource planning process issue that should be considered in the Commission's rulemaking for the resource planning process, Docket No. E-999/R-94-649.

---

<sup>18</sup> Due to the statute's "practicability" standard, the ALJ's suggestion (but not recommendation) that the Commission could adopt the RUD-OAG's mercury range to "send a message" to the utilities about the seriousness of mercury pollution cannot be accepted. The Commission trusts, however, that such a message is carried by the discussion of mercury in the text of this Order and the directive in Ordering Paragraph 3 that utilities address the mercury problem in their resource option filings.



## **2. Order of Dispatch**

The Commission clarifies that the values established in this Order do not apply to decisions regarding the dispatch of electric power from existing facilities.

## **3. Revisiting the Values**

The Department recommended that the ranges of the values set in this proceeding be updated periodically with the Commission opening a new proceeding about two years after it issues a Final Order in this proceeding.

Some parties objected to the Department's recommendation, preferring that the values established in this proceeding be retained until the Commission determines that there is new information of sufficient importance to justify a new proceeding.

The Department indicated that it does not object to reasonable alternatives to a mandatory hearing after two years. However, the Department added that a potential disadvantage to waiting until another proceeding is necessary is that it encourages the natural inclination to continually postpone future hearings, even if significantly better information is available. Therefore, the Department suggested that the adopted values be revisited no later than four years after this proceeding is concluded.

The Commission finds that it is not necessary to set a specific date for revisiting the values set in this Order. The Commission will, of course, entertain motions to do so based on new evidence and may initiate such proceedings in response to such motions or on their own motion, as appropriate.

## **4. Mercury Advisory Committee**

The MPCA requested that the Commission assign a Commission staff member to head an advisory group to inform the Commission of developments in the mercury research cited by the ALJ and other research that may also be useful in further assessing mercury emissions.

In light of the fact that the MPCA already has a mercury task force in place, it appears that formation of a Commission taskforce on the same subject would be duplicative. Given the concern and interest in mercury demonstrated by various parties in this proceeding, it is unlikely that development of the mercury issue would appreciably benefit from direct Commission staff participation between proceedings. As indicated previously in this Order, the Commission believes its Order adequately emphasizes the importance it attaches to the mercury issue and will count on the parties to bring the issue forward again when scientific developments justify further consideration of this issue, consistent with statute's "practicability" standard.

## **5. Request for Filing of Specific Mercury Information**

The MPCA requested that the Commission require utilities to include the following items in their resource planning submissions:

- total annual mercury emissions for each feasible resource alternative, expressed in kilograms; and
- mercury emission rates for each feasible alternative, expressed as micrograms per kilowatt hour, including the effects on those rates of control equipment, installed voluntarily or required by permit or regulation.

The Commission declines to impose these specific filing requirements. The Commission realizes that various parties may wish to develop their critique of the utilities' plans based on different kinds of information and will leave this to be developed by the parties in their Requests for Information to the utilities. To highlight the importance of the mercury issue generally, however, the Commission has imposed a more general requirement, i.e. that the utilities explain in their filings how mercury emissions were considered in their evaluation of resource options.

### ORDER

1. The Commission hereby quantifies and establishes environmental values, stated in terms of 1995 dollars, as follows:

|                  |        | Urban         | Metropolitan<br>Fringe | Rural       | Within 200<br>Miles of<br>Minnesota |
|------------------|--------|---------------|------------------------|-------------|-------------------------------------|
| SO <sub>2</sub>  | \$/ton | 112 - 189     | 46 - 110               | 10 - 25     | 10 - 25                             |
| PM <sub>10</sub> | \$/ton | 4,462 - 6,423 | 1,987 - 2,886          | 562 - 855   | 562 - 885                           |
| CO               | \$/ton | 1.06 - 2.27   | 0.76 - 1.34            | 0.21 - 0.41 | 0.21 - 0.41                         |
| NO <sub>x</sub>  | \$/ton | 371 - 978     | 140 - 266              | 18 - 102    | 18 - 102                            |
| Pb               | \$/ton | 3,131 - 3,875 | 1,652 - 1995           | 402 - 448   | 402 - 448                           |
| CO <sub>2</sub>  | \$/ton | .30 - 3.10    | .30 - 3.10             | .30 - 3.10  | .30 - 3.10                          |

2. Utilities shall use the values adopted in this Order in resource selection proceedings by providing estimates of cost of resource options at the following three levels:
  - (1) the direct cost of resources without regard to environmental externalities,
  - (2) the direct cost plus the minimum values in the ranges specified in this proceeding, and
  - (3) the direct cost plus the maximum values in the ranges specified in this proceeding.

3. In their filings subject to the Environmental Externalities Statute, utilities shall explain how mercury emissions were considered in their evaluation of resource options.
4. These values shall not apply to decisions regarding the dispatch of electric power from existing facilities.
5. To the extent not separately addressed in this Order, the Commission adopts the decisions and analysis in ALJ's Report.
6. This Order shall become effective immediately.

BY ORDER OF THE COMMISSION

Burl W. Haar  
Executive Secretary

(S E A L)

This document can be made available in alternative formats (i.e., large print or audio tape) by calling (612) 297-4596 (voice), (612) 297-1200 (TTY), or 1-800-627-3529 (TTY relay service).