

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

In the Matter of:)
)
AMENDMENTS TO) **R18-20**
35 ILL. ADM. CODE 225.233,) **(Rulemaking – Air)**
MULTI-POLLUTANT STANDARDS (MPS))

NOTICE OF FILING

To: ALL PARTIES ON THE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today electronically filed with the Office of the Clerk of the Illinois Pollution Control Board the attached **DYNEGY'S RESPONSES TO QUESTIONS**, copies of which are herewith served upon you.

/s/ Ryan Granholm
Ryan Granholm

Dated: February 16, 2018

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RESPONSES TO QUESTIONS FOR DYNEGY’S WITNESSES

NOW COME Dynegy Midwest Generation, LLC, Illinois Power Generating Company, Illinois Power Resources Generating, LLC and Electric Energy, Inc. (collectively, “Dynegy”), by their attorneys, Schiff Hardin LLP, and hereby respond to questions raised during the January 17 and 18, 2018 hearings and the January 29, 2018, Hearing Officer Order.

I. Questions for Dynegy Witnesses from the First Hearing

1. Does Dynegy sponsor environmental projects in its host community? (IPCB Technical Staff, Alisa Liu, Jan. 18, 2018 Tr., pg. 110-11)

Dynegy sponsors a number of projects related to the environment. As one example, we undertook one of the largest reforestation projects in the world for the sole purpose of carbon offset. Specifically, in 1999, Dynegy partnered with the U.S. Fish and Wildlife Service and others to restore more than 45,000 acres of hardwood forests. The project involved planting more than two million hardwood seedlings on state and federally protected lands in Arkansas, Kentucky, Louisiana, Mississippi, Tennessee, Alabama, and Oklahoma in the Lower Mississippi River Valley and is projected to remove more than 6 million tons of carbon dioxide (“CO₂”) over its 60-year term. In 2012, the project was registered under the Verified Carbon Standard, the first U.S. forest carbon offset project to receive this certification. This project was not performed in connection

with Dynegy meeting its obligations under a Consent Decree entered with the United States to resolve alleged Clean Air Act violations.

In Illinois, Dynegy has funded prairie, bottomland hardwood and savannah restoration projects in partnership with the Illinois Conservation Foundation. We also beneficially reuse coal combustion residuals (“CCR”) produced at our coal-fired generation units, including through agreements with cement manufacturers that incorporate the material into cement products, helping to reduce CO₂ emissions from the cement manufacturing process. In addition, working with the Illinois Department of Natural Resources (“IDNR”), Dynegy allows public access to many of our cooling ponds/lakes for recreational use, including fishing and boating.

Dynegy has also sponsored environmental projects in connection with Consent Decree obligations, including truck stop electrification projects to reduce particulate matter, NO_x, volatile organic compounds, and CO₂ emissions; clean diesel retrofits for school busses and municipal fleets; and donation of more than 1,000 acres of land to the IDNR.

Attached as Exhibit A is a list of voluntary environmental and community projects performed by or at our coal-fired generating stations located in Illinois.

2. Would Dynegy be willing to produce a report with dates and times when the Duck Creek and Coffeen Plants were run at a loss for purposes of MPS compliance over a three-year period? (IL AG, James Gignac, Jan. 18, 2018 Tr., pg. 133)

Dynegy is providing a chart depicting the percentage of time units at Coffeen and Duck Creek were bid into MISO as “must-run” units, primarily to ensure compliance with the MPS, and a table showing the number of days when the units were bid as “must-run” and they operated at a loss. The chart and table are included as Exhibit B.

- 3. Can you provide a written analysis supporting your claim that the scrubbed plants will not be retired or mothballed if the proposal is granted? (Env. Groups, Lindsay Dubin, Jan. 18, pg. 152)**

Illinois EPA's proposal would grant Dynegy needed flexibility, improving the viability of the entire Illinois fleet. Dynegy's goal in supporting the proposal is to make the entire fleet, including each individual plant, cash-flow positive. *Id.* at 103:12-14. Currently, as set forth in Exhibit B, Dynegy is forced to dispatch Duck Creek and Coffeen at a loss. Dynegy does not intend or expect to retire or mothball any units solely as a result of the adoption of the proposal. *See* Jan. 18, 2018 Tr. 115:10-13.

- 4. How much of the time did Duck Creek and Coffeen receive an energy price at or above their marginal cost of operation? (IL AG, James Gignac, Jan. 18, 2018 Tr., pg. 150)**

See Exhibit B, which shows each time Duck Creek and Coffeen were bid into MISO and received an energy price below their marginal cost. At all other times the Duck Creek and Coffeen units were bid into MISO they received an energy price at or above their marginal cost.

- 5. Can you put an analysis into writing regarding your answer to environmental groups' pre-filed question 6.a., that 3000 MW of generation in the MPS are cash flow neutral to negative and effectively at risk? (Env. Groups, Lindsay Dubin, Jan. 18, 2018 Tr., pg. 156-57)**

Dynegy cannot provide the specific information requested because it contains highly confidential business information that has competitive value. As a whole, the Illinois fleet is cash-flow negative. Specifically, for the nine months ending September 30, 2017, the "MISO" segment reported an operating loss of \$90 million and the "IPH" segment reported an operating income of \$ 40 million, for a total net operating loss of \$50 million for the MPS fleet. For the year ending 2016, the "MISO" segment reported an operating loss of \$745 million and the "IPH" segment reported an operating loss of \$87 million. For the year ending 2015, the "MISO" segment reported an operating loss of \$92 million, and the "IPH" segment reported an operating income of \$49

million, for a total net operating loss of \$43 million for the MPS fleet. The operating income/loss does not include the cost of capital expenditures.

6. Can you provide Dynegy's 5-year forecasts which would include, if possible, capacity factor forecasts, some metric of how often the units run, etc.? (IL AG, Andrew Armstrong, Jan. 18, 2018, pg. 158)

Dynegy cannot provide this information because it contains highly confidential business information that would give our competitors significant information about how we view the operations of our plants. Furthermore, we believe the appropriate metric for evaluating the environmental benefits of the proposal is to compare the allowable emissions under the current MPS with the proposal. The proposal will result in an approximate 17% reduction in allowable SO₂ emissions and 24% reduction in allowable NO_x emissions.

7. Questions from IPCB Assistant Attorney Tanya Rabczak (Jan. 18, 2018 Tr., pg. 179 and 186):

a) How [does Dynegy] control [its] capacity?

Dynegy performs regular maintenance to ensure that its units are available when called upon by MISO. When Dynegy bids units into MISO, it identifies the capacity that is available. However, not all available capacity will necessarily be utilized by MISO. MISO, not Dynegy, determines which units will run and how much they will run.

b) How [does Dynegy] decide which plants run at which time?

As discussed during the first hearing (Jan 18, 2018 Tr., pg. 180), for the most part, MISO determines which units run. For example, as set forth on Exhibit B, Dynegy can bid units in as "must-run." However, as depicted on Exhibit B, when the units are bid in as "must run" they often operate at a loss.

c) Which plants run at what capacity?

We are obligated to offer the units up to the capacity that we've sold into the MISO capacity market. There are a number of factors that affect each unit's available capacity, including, for example, ambient air temperatures, river temperatures, and slagging and fouling in the boiler components. As discussed above, MISO determines how much of Dynegy's available capacity will be needed.

d) How [does Dynegy] control the emission rates?

Emission rates are dependent on the various inputs and outputs of each unit. Jan. 18, 2018 Tr. at 182:7-9. Specifically, SO₂ emissions are primarily dependent upon the sulfur content of the coal and the control efficiency of any pollution controls. All of Dynegy's MPS plants have switched from the use of high sulfur coal to low sulfur coal which alone can result in up to 85% lower SO₂ emissions. In 2017, all of the coal delivered to Dynegy's MPS units came from mines in the Powder River Basin ("PRB") coal region located near Gillette, Wyoming. In addition to using low sulfur coal, the Coffeen and Duck Creek generating stations utilize Flue Gas Desulfurization (FGD) devices and the Baldwin and Havana generating stations utilize Spray Dryer Absorbers (i.e. dry scrubbers) to reduce SO₂ emissions.

NO_x emissions at each of the MPS plants are reduced by combustion controls, post-combustion controls or a combination of the two. Dynegy units use three primary means to reduce NO_x emissions: low NO_x burners, overfire air, and Selective Catalytic Reduction.

e) How [does Dynegy] control capacity factor?

The capacity factor is determined by how many megawatt hours the unit produces, which is primarily determined by MISO. MISO selects offers from all of the available resources and, through an algorithm, determines on a day-ahead and hourly basis which units to run.

- f) **How does [the] MPS change what and how [Dynergy bids] into both capacity markets and energy markets, and how does that affect specifically the units that are under threat of shutdown?**

Dynergy closely monitors each MPS group's fleet average emission rate. On a number of occasions, in order to meet the fleet-wide average emission rate set by the MPS, Dynergy has bid lower-rate units into MISO as "must-run" units at a price that does not cover costs. This is typically done several times a year, in a variety of circumstances. Jan. 25, 2018 Tr. at 131:17-18. Exhibit B contains more detailed information about when Dynergy has bid units into MISO at a loss, often to ensure compliance with the emission rate set by the MPS. The practice of operating certain units at a loss is detrimental to the overall viability of Dynergy's fleet. Pre-filed Test. of R. Diericx at 11.

- g) **[W]ould that change what happens to the unit that is under threat of shutdown if the proposal as proposed is accepted?**

The proposal would allow Dynergy to operate its Illinois coal-fired generation fleet in a more economically rational manner. Specifically, if adopted, Dynergy will no longer need to bid units at Coffeen and Duck Creek into the market at a loss to ensure compliance with the MPS. Instead, Dynergy will be able to bid units into MISO in a way that will ensure those units cover their costs when they are called upon. This will increase the economic viability of the Illinois fleet as a whole. However, neither the MPS nor the MPS revision alone will determine whether any units are or are not mothballed or retired.

II. Questions from the January 29, 2018, Hearing Officer Order

1. **[D]oes Dynergy, IEPA, or any other participant plan to provide testimony at the next hearings, which are scheduled in Edwardsville in March 2018, to address the proposed rules' health effects from exposure to SO₂ and NO_x emissions from MPS sources?**

In response to this question, IEPA stated that allowable emissions will decrease and actual emissions may increase, decrease or stay the same under both the current MPS as well as the

proposal. On February 6, 2018, the Environmental Groups submitted pre-filed testimony of Brian Urbaszewski, which asserts, without any support, that the proposal will adversely affect human health.

In response to the Hearing Officers' question and the Environmental Groups' pre-filed testimony, Dynege engaged toxicologist Dr. Lucy Frasier to provide an expert opinion on the health effects of SO₂ under the proposed rule. Dr. Frasier's report is attached as Exhibit C. The report also provides a toxicologist's perspective of the protectiveness of the SO₂ NAAQS. *Dr. Fraiser will be available at the March 6, 2018 hearing* to answer any questions on the attached report. As Dr. Frasier and IEPA conclude, there will be no adverse impact on human health as a result of adopting the proposed amendments to the MPS.

Exhibit A

Exhibit A

Illinois Voluntary Environmental and Community Projects

Baldwin

- 75% beneficial re-use of CCRs
- Public access on 2,000 acre cooling pond (managed by IDNR)
- Allows IDNR to access water intake for waterfowl habitat
- Active with Lower Kaskaskia Stakeholders Inc., which is dedicated to river preservation
- Income from farm leases donated to charity

Coffeen

- 38% beneficial re-use of CCRs
- Public access on 1,100 acre cooling lake (managed by IDNR)
- Income from farm leases donated to charity

Duck Creek

- 70% beneficial re-use of CCRs
- Income from farm leases donated to charity
- Donation to City of Canton following gas explosion at Opera House

Edwards

- 100% beneficial re-use of CCRs

Havana

- 59% beneficial re-use of CCRs
- Worked with vendors to donate equipment to widen road near area school
- Donation to Mason County for road improvements
- Income from farm leases donated to charity

Hennepin

- 72% beneficial re-use of CCRs
- Allows IDNR to access water intake for waterfowl habitat
- Annual donations to and employees volunteer at the Hennepin Wetlands Foundation
- Donations to DePue Park District for improvements along lake and river
- River bank cleanup by employees in 2016
- Income from farm leases donated to charity

Joppa

- 75% beneficial use of CCRs
- Income from farm leases donated to charity

Exhibit A

Kincaid

- Public access on 1,377 acre Sangchris Lake (managed by IDNR)
- Income from farm leases donated to charity

Newton

- Public access on 1,800 acre cooling lake (managed by IDNR)
- Partial final cover of Phase II landfill, even though not required until structure is closed
- Income from farm leases donated to charity

Vermilion (retired facility)

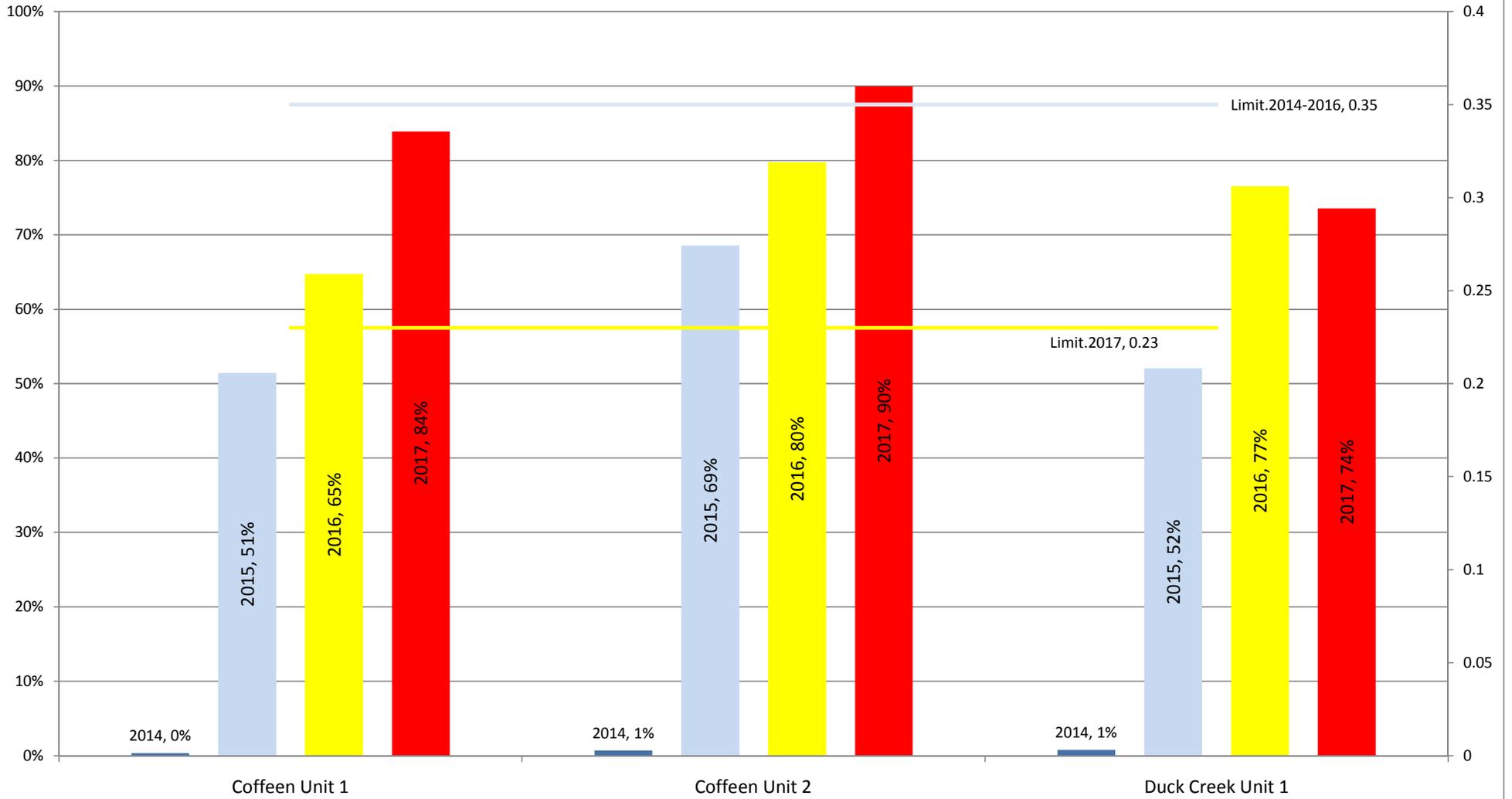
- Public access to Orchid Hill Heritage Site (Vermilion property maintained by IDNR)

Wood River (retired facility)

- Allows Great River Aquatic Research Center to draw water from intake for biological research

Exhibit B

Percent of Annual Hours Dispatched as Must-Run



Electronic Filing: Received, Clerk's Office 2/16/2018

Number of Days - Must-Run Dispatch and Operation at a Loss

| | <u>Coffeen 1</u> | <u>Coffeen 2</u> | <u>Duck Creek</u> |
|-------------|------------------|------------------|-------------------|
| <u>Year</u> | <u>Days</u> | <u>Days</u> | <u>Days</u> |
| 2015 | 26 | 33 | 8 |
| 2016 | 26 | 33 | 4 |
| 2017 | 35 | 33 | 13 |

Exhibit C



Date: February 16, 2018

Illinois Pollution Control Board
C/O Marie E. Tipsord
Hearing Officer
100 W Randolph
Suite 11-500
Chicago, Illinois 60601
Marie.Tipsord@illinois.gov

Re: Amendments to 35 Ill. Adm. Code 225.233, Multi-Pollutant Standards (MPS), Illinois Pollution Control Board R2018- 20

Dear Members of the Illinois Pollution Control Board:

The purpose of this letter is to respond to a request made by the Illinois Pollution Control Board (“the Board”) to address:

- Impacts of the Amendments to 35 Ill. Adm. Code 225.233, Multi-Pollutant Standards (MPS), on the potential for health effects due to oxides of nitrogen (NO_x) and sulfur dioxide (SO₂) emissions from MPS sources; and
- Potential health concerns raised by numerous public comments.

Responses to these items are provided in this letter.

1.0 Impacts of the Proposed Amendments to the Multi-Pollutant Standards (MPS)

The proposed amendments to the MPS will limit the combined MPS Group to 55,000 tons of SO₂ annually, a reduction from the 66,354 tons of allowable SO₂ emissions per year under the current MPS. Likewise, the proposed amendments will also limit the combined MPS Group to 25,000 tons of NO_x annually rather than the 32,841 tons of annual NO_x emissions allowed under the current MPS. Finally, the proposed amendments would limit the combined MPS Group to 11,500 tons of NO_x during the Ozone Season rather than the 13,766 tons of NO_x emissions allowed annually under the current MPS. Moreover, the following new and additional requirements on the Dynegy fleet are expected to result in even greater reductions in emissions:

- Mandatory year-round operation of existing Selective Catalytic Reduction (SCR) equipment used for NO_x emission control;
- Lower ozone season NO_x emission rates for Baldwin, Edwards, Duck Creek, Havana, and Coffeen facilities; and
- A specific annual SO₂ tonnage cap for the Joppa Power Station.



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Therefore, the proposed amendments to the MPS will reduce allowable emissions of SO₂ and NO_x and will impose additional requirements beyond those that exist under current provisions of the MPS. If these changes are adopted, actual emissions in the future may be higher, lower, or approximately the same compared to previous years, but they must be less than the reduced allowable limits of 55,000 tons of SO₂ and 25,000 tons of NO_x per year in the new MPS proposal, and they are not expected to interfere with meeting the National Ambient Air Quality Standards (NAAQS), as discussed in the next section.

1.1 Evidence that the Proposed MPS Amendments Will Not Adversely Affect Health or Welfare

The MPS cannot undermine the goals and obligations of the Regional Haze State Implementation Plan (SIP). The current MPS allowable limits for NO_x and SO₂ were a major component of the Illinois Environmental Protection Agency's (IEPA) SIP submittal for meeting the requirements of the federal Regional Haze Rule¹ because NO_x and SO₂ contribute to haze and reduce visibility.² The Regional Haze SIP has been previously approved by Region 5 of U.S. EPA (U.S. EPA).

1.1.1 Emission Limits Under the Proposed MPS Are Lower than NO₂ and SO₂ Emissions Contemplated in the Regional Haze SIP

The total anticipated NO_x emissions set forth in the Regional Haze SIP submittals from the MPS Group is 27,951 tons annually, while the MPS amendments include an annual mass allowable emission limit for the combined MPS Group of 25,000 tons. The total anticipated SO₂ emissions set forth in the Regional Haze SIP submittals from the MPS Group is 55,953 tons annually by comparison to the proposed annual mass allowable emission limit for the combined MPS Group of 55,000 tons in the proposed MPS amendments. As such, the proposed mass emission limits for the combined MPS Group are sufficient to limit total emissions of both pollutants to less than the levels that were determined to be necessary to achieve the visibility improvement goals discussed in the Regional Haze SIP submittals, which satisfies the requirements under Section 110(1) of the CAA.³ Although allowable emissions are not the same as actual emissions, the lower allowable limits in the MPS proposal will constrain actual annual emissions to levels below the emissions allowed under the current MPS.

¹ Pg. 15, Section 6.1 of the Technical Support Document for Proposed Rule Amendments for Multi-Pollutant Standards Electrical Generation Units. AQPSTR 17-06. September 2017.

² Pg. 36 of the Transcript from the Proceedings of the R18-20 Hearing, lines 3 – 5. January 17, 2018.

³ Pg. 19, Section 6.1 of the Technical Support Document for Proposed Rule Amendments for Multi-Pollutant Standards Electrical Generation Units. AQPSTR 17-06. September 2017.



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IEPA confirmed in the R18-20 hearing (January 17, 2018) that the MPS is used to meet IEPA's obligations to reduce regional haze and, therefore, the MPS proposal was submitted to U.S. EPA to ensure that they concurred that the changes being proposed would not interfere with IEPA's ability to reduce regional haze.⁴ According to testimony provided by IEPA's David Bloomberg, the proposed changes to the MPS were approvable by U.S. EPA since the proposed changes result in a "straightforward reduction in allowable emissions" and "the Section 110(l) anti-backsliding demonstrations are acceptable..."

Therefore, the amendments to the MPS are not expected to adversely affect welfare.

1.1.2 IEPA's Evaluation Demonstrates that the Proposed MPS Limits Will Not Threaten NAAQS Attainment

The state is responsible for ensuring all geographic areas comply with the NAAQS and if ambient air concentrations in an area fail to meet the NAAQS, the state is responsible for creating a plan, known as a SIP, which may include regulations to bring the area into attainment with NAAQS.⁵

Importantly, the MPS rule is not relied upon by IEPA to ensure compliance with the NAAQS as there are numerous other state and federal rules in existence that ensure that the NAAQS are met. That is to say, even if the MPS did not exist, or were to go completely away, the remaining existing rules have been determined by both IEPA and U.S. EPA to be sufficient to maintain or attain compliance with the NAAQS. In particular, for SO₂, the IEPA emphasized this point in testimony submitted by Mr. Rory Davis for the first hearing where Mr. Davis states in his conclusion on page 5: "Already-promulgated Illinois regulations ensure that the SO₂ NAAQS is protected around certain significant emission sources to protect the public from localized impacts around those sources."

Mr. David Bloomberg of the IEPA further testified at the first hearing that the MPS is not used for attaining or maintaining any NAAQS, as evidenced on page 35 of the January 17th hearing transcript:⁶

MR. MORE: Is the MPS part of any State Implementation Plan that is currently being used by the state to implement any NAAQS?

MR. BLOOMBERG: No, not any NAAQS. The MPS is only part of the regional haze SIP under Clean Air Act Section 169(a).

⁴ Pg. 36 of the Transcript from the Proceedings of the R18-20 Hearing, lines 19 – 24. January 17, 2018.

⁵ Pg. 34 of the Transcript from the Proceedings of the R18-20 Hearing, lines 4 – 10 and lines 20 – 24. January 17, 2018.

⁶ Pg. 35 of the Transcript from the Proceedings of the R18-20 Hearing, lines 16 – 21. January 17, 2018.



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Clearly any changes to a rule that is not needed to meet the NAAQS cannot have a material impact on the NAAQS being met, and certainly it could never be accurately stated that a revision to such a rule would adversely impact IEPA's ability to ensure compliance with the NAAQS and relatedly, IEPA's obligation to adequately protect public health and welfare. This is especially true when the revised rule reduces the emissions allowed to be emitted under the rule.

In addition, as part of the proposed MPS rulemaking, previous SO₂ modeling (for 2012 – 2014) for each of the plants conducted under the Data Requirements Rule (DRR) (part of implementing the 2010 1-hour SO₂ NAAQS)⁷ was reviewed. The modeling was used to evaluate the margin of safety present with the SO₂ NAAQS. IEPA determined that the proposed MPS allowable SO₂ limit did not pose a potential risk of a NAAQS violation.

A similar analysis was not done for NO₂, but NO₂ levels are so low in Illinois, as well as in the rest of the U.S., that the risk of a NAAQS violation is extremely small⁸ as discussed below.

Because NAAQS are established to protect public health with a margin of safety the amendments to the MPS are not expected to adversely affect public health.

1.2 Evidence that SO₂ and NO_x Emissions from MPS Sources Will Not Cause Health Effects Under the Proposed MPS

Section 109 of the Clean Air Act (CAA) requires U.S. EPA to establish NAAQS for criteria pollutants, such as NO_x and SO₂ (the NAAQS for NO_x is based on nitrogen dioxide [NO₂]), and per this law, the NAAQS must protect human health, welfare, and the environment with an adequate margin of safety.⁹ NAAQS provide protection both for the population as a whole and those groups potentially at increased risk for health effects from exposure to criteria air pollutants (e.g., children, the elderly, and the sick). If concentrations of NO_x and SO₂ in the air are maintained at levels below the NAAQS, adverse health effects are not expected. NAAQS are coupled with the requirement for states to develop SIPs that ensure that the NAAQS will be attained.

⁷ Required by the Data Requirements Rule for the 2010 1-hour SO₂ NAAQS (80 Fed. Reg. 51052).

⁸ Pg. 4-19 of Policy Assessment for the Review of the Primary National Ambient Air Quality Standards for Oxides of Nitrogen. EPA-452/R-17-003. April 2017.

⁹ 42 U.S. Code § 7409(b)(2).



1.2.1 NAAQS Are Based on the Most Up-to-Date Scientific Research and Undergo Rigorous Review to Ensure Protection of Public Health, Welfare and the Environment

The CAA requires review of the science upon which the NAAQS are based and the standards themselves every five years via a lengthy and complex process, which is illustrated in **Figure 1**. A comprehensive evaluation of the most up-to-date toxicology (laboratory evaluation of the severity, reversibility, and dose ranges at which adverse effects occur in animals), clinical (research involving human volunteers), and epidemiology (study of health and disease in the general population) studies is conducted by U.S. EPA in a process that affords many opportunities for scientists, environmentalists, and other interested parties to comment on EPA decisions about where to set the NAAQS. By the time a NAAQS is established by U.S. EPA, the supporting science has undergone an extensive and thorough review unlike any other health and welfare-based standards to ensure that the NAAQS is protective of health, welfare, and the environment.

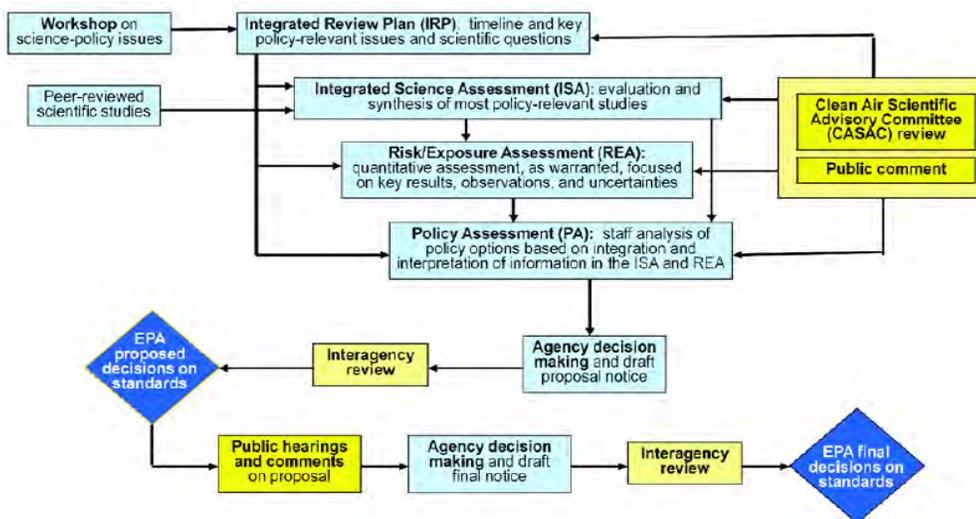


Figure 1: Steps in Review of NAAQS

1.2.2 Ambient Concentrations Below the NAAQS Are Not Expected to Cause Adverse Health Effects

The way in which NAAQS are set is highly conservative (i.e., NAAQS are set at levels below which health and welfare effects are expected) and as such, concentrations of criteria pollutants that are below the NAAQS are not expected to cause adverse health impacts. In setting air quality standards, U.S. EPA must consider and incorporate not only the results of research, but also the additional requirement for margins of safety. In other words, U.S. EPA builds in a buffer between the level at which the NAAQS



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are set and the level at which potential adverse effects may occur, which is discussed in the criteria pollutant-specific sections that follow.

1.2.2.1 The SO₂ NAAQS Is Conservatively Based on Minor Respiratory Symptoms that Occurred Inconsistently in Exercising Asthmatics

Short-term exposure to high levels of SO₂ can cause adverse effects on the respiratory system and make breathing difficult. This effect can be worse in children, the elderly and individuals who suffer from asthma. The 1-hour NAAQS for SO₂ of 75 ppb was developed from short-term human studies in asthmatics (a sensitive population) because the associated observational (epidemiological) studies, which evaluate effects to populations in the natural environment, do not provide evidence suggesting a causal relationship between long-term exposure to SO₂ and asthma, bronchitis, or respiratory systems.

U.S. EPA conservatively established the 1-hour SO₂ NAAQS at the 1-hour equivalent of the lowest concentration tested in human exposure studies, even though only a few of the sensitive population tested (exercising asthmatics) in a single study experienced decreases in the amount of air that could be exhaled during a forced breath and/or increased respiratory symptoms, such as cough, chest tightness, throat irritation.¹⁰ In other words, the 1-hour SO₂ NAAQS is based on limited evidence of relatively minor respiratory symptoms in a few asthmatics that were made more susceptible to the effects of SO₂ by requiring them to exercise vigorously while being exposed to SO₂.

Several epidemiological SO₂ studies (study observations made in the population) were relied upon by U.S. EPA as supporting evidence for the 1-hour NAAQS for SO₂. The epidemiological studies only inconsistently showed SO₂-related effects like those described above in populations with asthma.¹¹ Of the primary epidemiological studies relied upon, most found either no relationship or very small effects of short-term SO₂ concentrations on hospitalizations and Emergency Room visits for respiratory causes. Moreover, epidemiological studies do not provide good evidence of a causal relationship between SO₂ levels and any long-term health effects (respiratory, cardiovascular, cancer).¹² Considering its basis, even exposure above the SO₂ NAAQS would only be expected to cause minor respiratory symptoms that would go away once exposure ceased.

¹⁰ Exercising increases the amount of SO₂ delivered to the lungs.

¹¹ Tables 5-5 and 5-6 on Pgs. 5-27 and 5-31 of the Integrated Science Assessment for Sulfur Oxides – Health Criteria. EPA/600/R-17/451. December 2017.

¹² Table ES-1 on Pg. xviii of the Integrated Science Assessment for Sulfur Oxides – Health Criteria. EPA/600/R-17/451. December 2017.



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The U.S. EPA is presently conducting the review cycle for the SO₂ NAAQS. While this effort will not likely be completed for several years to come, the draft Risk and Exposure Assessment (REA)¹³ and Policy Assessment (PA)¹⁴ for SO₂ released in August 2017 indicate that U.S. EPA is unlikely to propose changes to the 1-hour SO₂ NAAQS even though new studies have become available since the last review¹⁵ and the analysis was conducted differently in the most recent REA.¹⁶

1.2.2.2 *The NO₂ NAAQS Is Conservatively Based on Minor Airway Constriction that Only Occurred Inconsistently*

U.S. EPA recently completed (2017) a review of the scientific evidence on health impacts from nitrogen dioxide (NO₂) and other oxides of nitrogen (NO_x). In this review, EPA proposed to retain the current NAAQS, concluding that the current NAAQS for NO₂ protect public health with an adequate margin of safety for the general public as well as older adults, children and people with asthma.¹⁷

The 1-hour NAAQS of 100 ppb for NO_x, which is based on NO₂, derives primarily from information from human studies that were conducted in a laboratory. These studies indicated that short-term exposure to NO₂ can cause increased sensitivity of the airways (e.g., constriction), which is the defining characteristic of asthma. Like the 1-hour NAAQS for SO₂, however, U.S. EPA conservatively established the 1-hour NO₂ NAAQS at the lowest 1-hour concentration tested (i.e., 100 ppb) in humans, even though only one study reported significant airway constriction at this level. Like the basis for the SO₂ NAAQS, this represents a relatively minor effect that is completely reversible once the NO₂ is removed. Considering its basis, even exposure above the NO₂ NAAQS is only expected to cause minor effects (airway constriction) that would be quickly reversed.

Observational (epidemiological) studies conducted at the population level show a relationship between short-term NO₂ concentrations and respiratory symptoms and hospitalization or Emergency Room visits for respiratory causes. However, a significant problem with the observational studies on NO₂ is that NO₂ has generally not been shown to be *independently* associated with these effects because it is a

¹³ Risk and Exposure Assessment for the Review of the Primary National Ambient Air Quality Standard for Sulfur Oxides, External Review Draft. EPA-452/P-17-002. August 2017.

¹⁴ Policy Assessment for the Review of the Primary National Ambient Air Quality Standard for Sulfur Oxides, External Review Draft. EPA-452/P-17-003. August 2017.

¹⁵ The newly available evidence does not lead to different conclusions regarding the primary health effects of SO₂ in ambient air or regarding exposure concentrations associated with those effects; nor does it identify different populations at risk of SO₂-related effects (EPA, 2017a, pg.3-52, lines 20 – 22).

¹⁶ Less than 1% of children with asthma are estimated to experience, while at elevated ventilation, a daily maximum 5-minute exposure per year at or above 200 ppb, on average across the 3-year period, with a maximum of approximately 2% in the highest single year and no child (or adult) with asthma is estimated to experience, while at elevated ventilation, a daily maximum 5-minute exposure per year at or above 400 ppb (in any of the three years simulated across the three study areas) (EPA, 2017a, pg. 3-55 at lines 26 – 32).

¹⁷ Policy Assessment for the Review of the Primary National Ambient Air Quality Standards for Oxides of Nitrogen. EPA-452/R-17-003 April 2017.



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component of traffic-related pollutant mixtures. In other words, it is impossible to tell if the effects are caused by NO₂ or something else in the traffic-related mixture.

U.S. EPA conducted analyses comparing NO₂ air quality with health-based benchmarks to estimate the potential for exposures of public health concern that could be allowed by the current NAAQS during the recent review and concluded that there is little potential for exposures to ambient NO₂ concentrations that would be of public health concern in locations meeting the current 1-hour standard.

U.S. EPA also re-affirmed the long-term NO₂ NAAQS of 53 ppb in the most recent review of the NO₂ NAAQS and concluded that there is likely a relationship between long-term exposure to NO₂ and respiratory effects (but no others) even though the study results were inconsistent and concern about the potential for confusion with other traffic-related co-pollutants and measurement error was high.¹⁸

2.0 Health Concerns Raised in Public Testimony

During public testimony provided during the R2018-20 MPS Rulemaking hearing on January 17 and 18 of 2018, several commenters expressed concern for adverse health outcomes related to power plant emissions. While worries about potential health effects associated with exposure to NO₂ and SO₂ are understandable, it appears that there is a misunderstanding about levels of NO₂ and SO₂ that are safe, the concentrations in ambient air to which Illinois citizens are potentially exposed, the adverse health effects potentially caused by exposure to high levels of SO₂ and NO₂, and what triggers symptoms in most asthmatics. The possible misunderstandings, misconceptions and misinformation contained in the hearing transcripts from January 17 and 18, 2018 are discussed in the following sections.

2.1 Air Monitoring Data Indicate No Reason for Concern About the Potential for Adverse Health Outcomes from NO₂ or SO₂ Emissions from MPS Sources

Other than the area around Pekin (Tazewell County), where individual 1-hour SO₂ concentrations have occasionally exceeded the 1-hour SO₂ NAAQS in the past (11 times out of 4,496 days of monitoring for all stations in 2016, 15 times out of 8,154 monitoring days across all monitors in 2015, and 28 out of 5,484 monitoring days across all monitors in 2014), NO₂ and SO₂ levels in Illinois are low.

Although portions of Peoria and Tazewell Counties are non-attainment for SO₂, the SO₂ exceedances that occurred in the past at the Pekin monitor, which is responsible for the non-attainment status, have been attributed to Pacific Ethanol (formerly Aventine Renewables). As indicated in the 2015

¹⁸ Pg. 3-35 of Policy Assessment for the Review of the Primary National Ambient Air Quality Standards for Oxides of Nitrogen. EPA-452/R-17-003. April 2017.



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Memorandum of Agreement (MOA) between IEPA and Illinois Power Resources Generating LLC (IRPG),¹⁹ the IEPA determined that the wind direction during SO₂ exceedances at the Pekin monitor was either from the west or southwest, indicating that emissions from the Edwards Station did not contribute to elevated SO₂ concentrations at the Pekin monitor. In other words, IEPA confirmed that the Edwards Station is not culpable for the elevated hourly SO₂ levels in the Pekin area. U.S. EPA recently approved Illinois' non-attainment plan for the 2010 1-hour SO₂ NAAQS.²⁰ The 2015 MOA established SO₂ limits for the Edwards Plant, which are now included in 35 IAC 214.603 (which is part of the recently approved SO₂ nonattainment plan).

Incidentally, Pacific Ethanol has since upgraded its ethanol plant in Pekin by replacing old boiler technology with two newly installed natural gas boilers. As a result, all SO₂ levels at the Pekin monitor were well below the 1-hour 75 ppb SO₂ NAAQS in 2017 (highest concentration was 31.5 ppb in April 2017) and considerably lower than in previous years, as shown in **Figure 2**. In other words, the source of the elevated SO₂ levels in Tazewell County in the past has been removed.

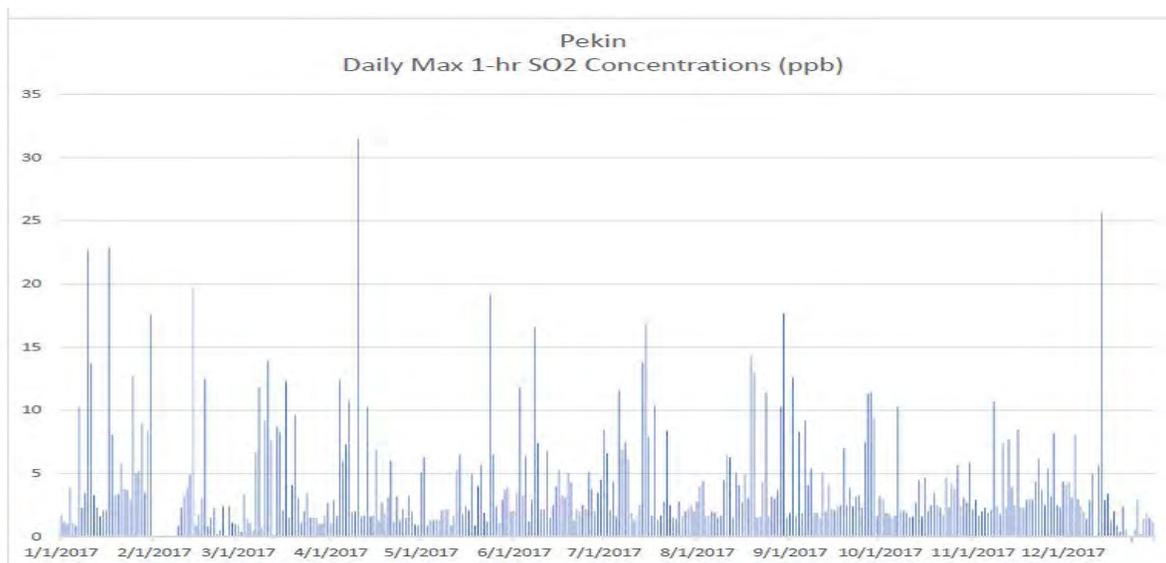


Figure 2: SO₂ Levels at Pekin Monitor in 2017

¹⁹ Pg. 1 of the Memorandum of Agreement Between the Illinois Environmental Protection Agency and Illinois Power Resources Generating, LLC. January 9, 2015.

²⁰ 40 CFR 52, Air Plan Approval; Illinois; Nonattainment Plans for the Lemont and Pekin SO₂ Nonattainment Areas. [EPA-R05-OAR-2016-0138; FRL-9973-48- Region 5]. February 1, 2018. <https://www.gpo.gov/fdsys/pkg/FR-2018-02-01/pdf/2018-01925.pdf>.



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Moreover, recent data (2014 – 2016) indicate that the rest of the state is in compliance with the SO₂ NAAQS and the State-wide Design Value for SO₂ (which represents the three-year average of the 99th percentile concentration for demonstrating compliance with the 1-hour SO₂ NAAQS) for the three-year period of 2014-2016 was 30 ppb, which is well below the NAAQS of 75 ppb.²¹ Based on currently monitored levels of SO₂ in Illinois, there is no reason for concern about SO₂-related health effects from emissions.

No 1-hour NO₂ concentrations have been monitored at concentrations greater than the 1-hour NAAQS of 100 ppb and there have been no violations of the annual NAAQS for NO₂ of 53 ppb at any Illinois monitor between 2014 and 2016.²² Therefore, based on recent ambient measurements in Illinois, all of which meet the current NO₂ NAAQS, there is almost no potential for exposures to NO₂ concentrations at or above levels that could cause health effects, which is consistent with conclusions made by EPA about NO₂ exposure across the nation.²³

Based on these results, there is no reason for concern about the potential for adverse health outcomes from SO₂ or NO₂ emissions from MPS sources.

2.2 “Real World” Data Do Not Support that Emissions of NO₂ or SO₂ from MPS Sources Influences Asthma

Over the last 10 years, concentrations of NO₂ and SO₂ in Illinois have decreased 31% and 69%, respectively,²⁴ while it appears that asthma prevalence has increased over that same time for the state of Illinois and the U.S. population in general.²⁵ This suggests that concentrations of NO₂ and SO₂ in ambient air is not the reason why asthma rates have increased in Illinois or the U.S. over the last several decades. There are many theories as to why asthma prevalence has increased (despite improved air quality for all criteria pollutants) and generally they relate to triggers in the home. Common triggers of asthma are smoking, including exposure to secondhand smoke, mold, pets, dust mites and other

²¹ Table B-15 on Pg. 77, Table B-16 on Pg. 78 and Table B-17 on Pg. 79 of the Illinois Air Quality Report. AQI Air Quality Index 2016. Illinois Environmental Protection Agency. <http://www.epa.illinois.gov/topics/air-quality/air-quality-reports/index>.

²² Table B-20 on Pg. 83, Table B-21 on Pg. 84 of the Illinois Air Quality Report. AQI Air Quality Index 2016. Illinois Environmental Protection Agency. <http://www.epa.illinois.gov/topics/air-quality/air-quality-reports/index>.

²³ Pg. 4-19 of Policy Assessment for the Review of the Primary National Ambient Air Quality Standards for Oxides of Nitrogen. EPA-452/R-17-003. April 2017.

²⁴ Pg. 8 of the Illinois Air Quality Report. AQI Air Quality Index 2016. Illinois Environmental Protection Agency. <http://www.epa.illinois.gov/topics/air-quality/air-quality-reports/index>.

²⁵ Pg. 7 of The Burden of Asthma in Illinois, 2000-2011. August 2013. <http://www.dph.illinois.gov/sites/default/files/publications/ilburdenasthmaaugust2013r.pdf>.



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allergens. In addition, certain controllable and non-controllable risk factors increase the likelihood that a person will develop asthma such as socioeconomic status, obesity, and lack of physical activity.²⁶

Many of the public comments during the R2018-20 hearing were from citizens of Peoria and Tazewell counties who raised concerns about the impact of emissions from MPS sources on respiratory health in general and asthma in particular.²⁷ However, as described in the previous sections, recent monitoring data show that concentrations of SO₂ in Tazewell County are well below the SO₂ NAAQS, which is specifically designed to protect asthmatics. Although not shown in **Figure 2**, 2017 SO₂ concentrations in Peoria County are even lower than in Tazewell County (high of 22 ppb in Peoria). Monitored NO₂ levels across the state are well below the NAAQS, which is also specifically designed to protect asthmatics. Moreover, data on asthma prevalence from the Illinois Department of Public Health, and the fact that asthma prevalence has increased over the same period that air quality has dramatically improved, do not support fears that emissions of NO₂ or SO₂ from MPS sources in the Peoria/Tazewell Counties or other areas are likely to adversely impact asthmatics.

Table 1 shows the lifetime adult and child asthma prevalence for Illinois counties where MPS sources are located (shown in **Figure 3**) relative to the asthma prevalence in the state of Illinois as a whole. As shown in **Table 1**, neither the lifetime adult asthma prevalence, nor childhood asthma prevalence in Peoria County (where Edwards is located) or Tazewell County (occasionally downwind of Edwards and where elevated SO₂ levels have been attributed to Pacific Ethanol) are higher than the state of Illinois' lifetime asthma prevalence, indicating that elevated SO₂ levels in Tazewell County did not increase the asthma prevalence. As shown in the table, there is no consistent pattern suggesting that the MPS sources are associated with higher asthma prevalence.²⁸

2.3 Alarmist Views that NAAQS are Not Protective and that the MPS Amendments Will Result in Sickness and Death Are Without Any Foundation in Science

Brian Urbaszewski, Director of the Environmental Health Programs for the Respiratory Health

²⁶ *Id.* At Pg. 36.

²⁷ Pg. 215 of the Transcript from the Proceedings of the R18-20 Hearing, lines 11 – 24, Pg. 216, line 1, Pg. 223, line 2 – 3, Pg. 228, lines 15 – 20, Pg. 231, lines 14 – 16, Pg. 243, lines 4 – 10, Pg. 244, lines 22 – 24, Pg. 247, lines 1 – 9, .Pg. 254, lines 1 – 3, Pg. 310, lines 13 – 16, Pg. 313, lines 14 – 17, Pg. 318, lines 18 – 24, Pg. 319, lines 1 – 2 and lines 13 – 17, Pg. 325, lines 23- 24, and Pg. 326, lines 1 – 3. January 17, 2018.

²⁸ Counties in Table 1 with the highest lifetime asthma prevalence have amongst the lowest crude asthma hospitalization rates of all Illinois counties (see Pg. 50 of The Burden of Asthma in Illinois, 2000-2011), which illustrates the complex nature of asthma and why gross assumptions about its causes are irresponsible.



Table 1: Lifetime Asthma Prevalence - 2010

| Area | MPS Source | Asthma Prevalence | |
|-------------------|------------|-------------------|----------------|
| | | Adult Lifetime | Child Lifetime |
| State of Illinois | -- | 13.6% | 13.6% |
| Fulton County | Duck Creek | 10.9% | 15.9% |
| Jasper County | Newton | 9.3% | 4.5% |
| Mason | Havana | 17% | -- |
| Massac | Joppa | 13.5% | 15.9% |
| Montgomery | Coffeen | 6.9% | 9.1% |
| Peoria | Edwards | 12.8% | 13.5% |
| Tazewell | | 11.7% | 9% |
| Putnam | Hennepin | 12.2% | 13.7% |
| Randolph | Baldwin | 12.4% | 20.6% |

Source: The Burden of Asthma in Illinois, 2000-2011. August 2013.
<http://www.dph.illinois.gov/sites/default/files/publications/ilburdenasthmaaugust2013r.pdf>.

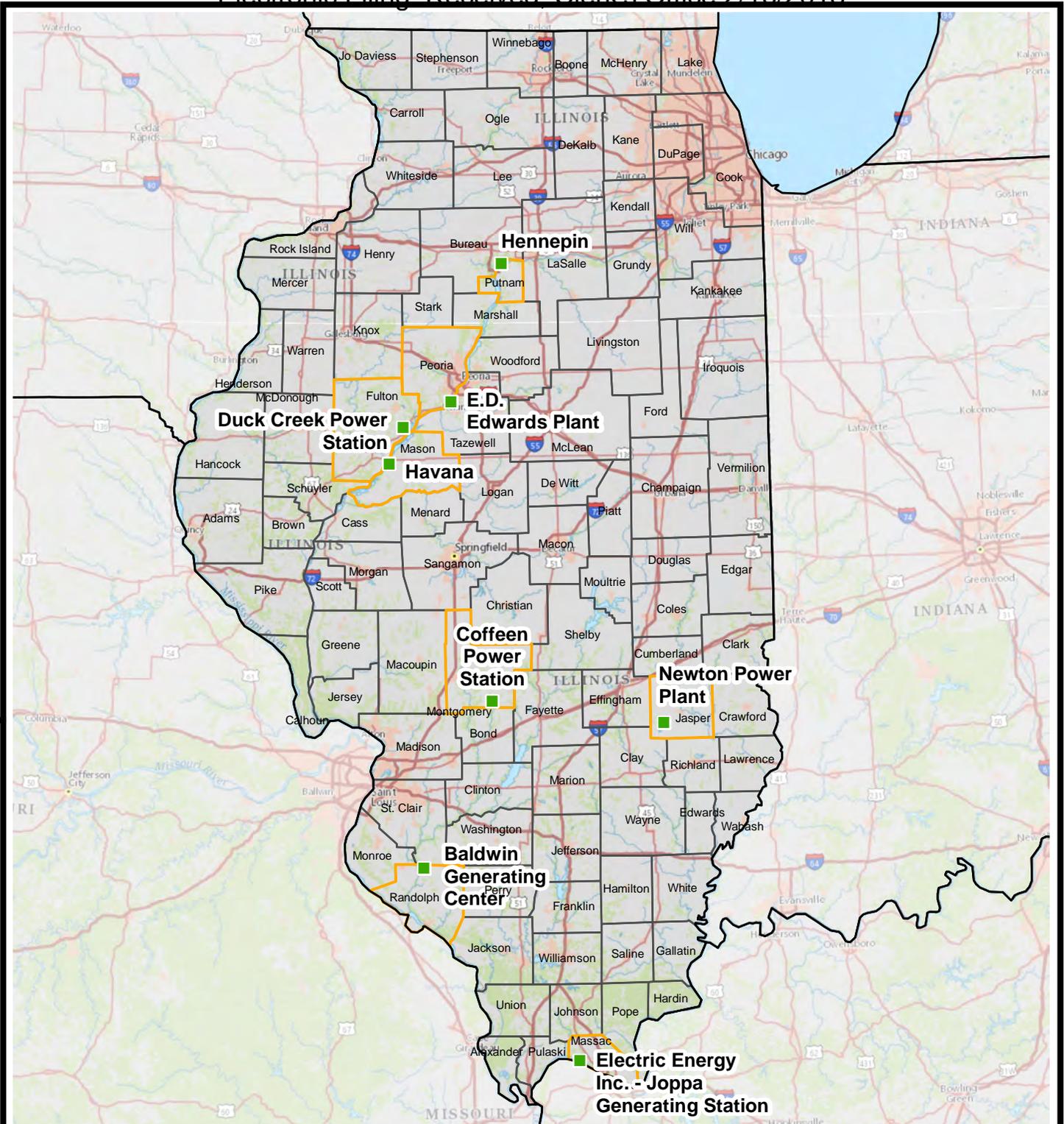
Association issued an oral public comment that he believes that the MPS rule change will result in hundreds to thousands of people getting sick and dozens dying and that having ambient air concentrations below the NAAQS does not mean that the air is safe.²⁹ However, he references the Powerton station in his comment, which is neither owned by Dynegy nor subject to the MPS. Mr. Urbaszewski, goes on to state that there is no level at which particulate matter does not cause health problems like asthma attacks, heart attacks, strokes and premature deaths and refers to a study “using U.S. EPA’s method” that estimated premature deaths associated with several power plants in Illinois, although he provides no reference or backup for the assertions he makes.³⁰ In his pre-filed testimony, Mr. Urbaszewski also implies that the 1-hour SO₂ NAAQS may not be health protective enough because two epidemiological studies out of the hundreds of studies available documented effects at concentrations as low as 50 ppb.³¹

²⁹ Pg. 238 of the Transcript from the Proceedings of the R18-20 Hearing, lines 1 – 4 and lines 17 – 22. January 17, 2018.

³⁰ Pg. 239 of the Transcript from the Proceedings of the R18-20 Hearing, lines 3 – 6 and lines 10 – 17. January 17, 2018. Pg. 3 of Pre-Filed Testimony of Brian Urbaszewski on behalf Sierra Club, Environmental Law and Policy Center, and Respiratory Health Association of Metropolitan Chicago. February 6, 2018.

³¹ Pg. 4 of Pre-Filed Testimony of Brian Urbaszewski on behalf Sierra Club, Environmental Law and Policy Center, and Respiratory Health Association of Metropolitan Chicago. February 6, 2018.

FIGURE 3: MAP OF MPS SOURCES
 Electronic Filing: Received Clerk's Office 2/16/2018



Legend

■ Electric Power Generating Units



0 25 50
 Miles

1 in = 50 miles



**FIGURE 3
 MPS SOURCES**

| | |
|---------------------------------|-----------------|
| DRAWN BY: | L WILSON |
| APPROVED BY: | L FRAISER |
| ELECTRIC POWER GENERATING UNITS | |
| FILE NO. | MPS Sources.mxd |
| DATE: | FEBRUARY 2018 |



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While the premature death estimates that Mr. Urbaszewski cites in his testimony sound alarming, the view that particulate matter concentrations below the EPA promulgated NAAQS kills people and that there is no safe level is an extreme one that is neither held by the mainstream scientific community, nor supported by reliable scientific evidence. Likewise, his claims that SO₂ concentrations below the NAAQS are harmful are not well informed. In general, EPA has concluded that epidemiological results for SO₂ are not robust enough to support a quantitative risk assessment³² and that is why the 1-hour SO₂ NAAQS is based primarily on controlled human exposure studies conducted in the laboratory. But even so, the strongest epidemiologic evidence of an association between ambient SO₂ and Emergency Room visits and hospitalizations was in cities where 99th percentile 1-hour daily maximum SO₂ concentrations ranged from about 75 to 150 ppb³³ and EPA concluded that this fact could have been used to justify a higher 1-hour SO₂ NAAQS, in the range of 100 to 150 ppb. U.S. EPA does not establish NAAQS levels based on one or two studies, they evaluate the full body of scientific research and then use a weight of evidence approach to select a NAAQS level that is supported by the majority of the data.

As discussed in section 1.2.1, to suggest that there is significant risk at levels below the NAAQS contradicts the CAA and defies the U.S. EPA's scientific findings, as well as common sense, particularly considering the extensive scientific review that occurs when NAAQS are set, and again when they are periodically reviewed. U.S. EPA considers the extent to which evidence for a pollutant threshold³⁴ exists in setting the NAAQS and by law, the NAAQS must be protective of health, welfare, and the environment.³⁵ Moreover, the CAA precludes the U.S. EPA from considering costs when establishing NAAQS and, therefore, NAAQS are not influenced by economics. Anyone that believes that levels below the NAAQS represent a serious risk clearly does not have a proper appreciation of the extensive scientific review that the standards go through. In setting NAAQS that "protect the public health" with "an adequate margin of safety" at non-zero levels, the U.S. EPA retains its discretionary authority not to regulate risks that it reasonably considers trivial in the context of other regularly encountered risks.³⁶

The "study" to which Mr. Urbaszewski refers is the Clean Air Task Force's (CATF) website and the figures he cites are from an interactive map on the CATF website that provides premature mortality and other health endpoint estimates from modeled (not actual) coal-fired power plant emissions.³⁷ What is important to understand is that the health impacts estimated are nothing more than statistical projections

³² Pg. 58 of Risk and Exposure Assessment to Support the Review of the SO₂ Primary National Ambient Air Quality Standards: Final Report. EPA-452/R-09-007. July 2009.

³³ *Id* at Pg. 390.

³⁴ A threshold is a level below which adverse effects are not expected.

³⁵ U.S. EPA. Letter from Gina McCarthy to Hon. Fred Upton, Chairman of Committee on Energy and Commerce, U.S. House of Representatives at 14. Feb. 3, 2012.

³⁶ McClellan, R.O. Role of science and judgment in setting national ambient air quality standards: how low is low enough? *Air Qual. Atmos. Health* 5:243- 258. 2012.

³⁷ Death and Disease from Power Plants. http://www.catf.us/fossil/problems/power_plants/.



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of hypothetical deaths and hospitalizations, not actual deaths or hospitalizations that can be verified or validated. These models estimate huge impacts in terms of hypothetical lives lost and hospitalizations because they predict the addition of tiny amounts of particulate matter from coal-fired power plants to every county in the U.S. In so doing, fractions of deaths are predicted in every county across the U.S., and when these “fractions of a death” are added together, they result in hundreds of estimated deaths across the U.S. (or possibly, several in a single county). Most of the impacts from these models are estimated at locations distant from the plants modeled, a fact that is rarely appreciated by citizens that live near the modeled plants and whose fears these groups exploit with their unsubstantiated claims about health effects attributable to coal-fired power plants.

3.0 Conclusions and Closing

The MPS group’s allowable emissions of NO₂ and SO₂ will decrease if the proposed changes to the MPS are adopted. In making its decision whether to approve the proposed MPS amendments, I urge the Board to consider the following: 1) the testimony and evaluation of the impacts of the proposed rule change by IEPA and U.S EPA’s concurrence that the allowable emissions will in fact be lowered under the proposed MPS rule; 2) the extensive evaluation on the health effects of NO₂ and SO₂ conducted by U.S. EPA in developing NAAQS that are protective of health, welfare and the environment; 3) the scientific evidence on health effects associated with NO₂ and SO₂ and the concentration levels at which those effects have been demonstrated to occur relative to the conservative levels at which the NAAQS have been set; 4) the numerous redundant rules and other safeguards in place to prevent harm (i.e., MPS is not relied upon to meet NAAQS, but the NAAQS attainment is ensured by other rules); and 5) air monitoring data coupled with health surveillance information indicating that emissions of NO₂ and SO₂ from MPS sources are not causing adverse health effects.

Based on the abovementioned information, it is my opinion that the proposed changes to the MPS rule will not result in adverse health effects. I plan to attend the March 6th and 7th hearings in Edwardsville at which time I will be happy to answer any questions the Board may have.



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Sincerely,

Lucy Fraiser Toxicology Consulting LLC

A handwritten signature in blue ink that reads "Lucy Fraiser". The signature is written in a cursive style.

Lucy Fraiser, PhD, DABT
Principal Owner

A handwritten signature in blue ink that reads "Kirby H Tyndall". The signature is written in a cursive style.

Kirby H Tyndall, PhD, DABT
Senior Toxicologist

Attachments:

- A. Memorandum of Agreement Between the Illinois Environmental Protection Agency and Illinois Power Resources Generating, LLC. January 9, 2015
- B. C.V. of Lucy Fraiser

ATTACHMENT A

**MEMORANDUM OF AGREEMENT BETWEEN THE ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY AND ILLINOIS POWER
RESOURCES GENERATING, LLC. JANUARY 9, 201**

Memorandum of Agreement
Between the
Illinois Environmental Protection Agency
and
Illinois Power Resources Generating, LLC

This Memorandum of Agreement (“MOA” or “Agreement”) is entered into by and between the Illinois Environmental Protection Agency (“Illinois EPA”) and Illinois Power Resources Generating, LLC (“IPRG”) and is dated and effective as of the last date of signature in the signature block. Illinois EPA and IPRG are each referred to herein as a “Party” and collectively as the “Parties.”

This Agreement reflects IPRG’s ongoing commitment to help improve air quality in the State of Illinois. The Parties have entered into this Agreement in order to document IPRG’s voluntary sulfur dioxide (“SO₂”) early emission reduction commitments at its E.D. Edwards Power Station (“Edwards Station” or “Station”) so that the Illinois EPA is aware of and can appropriately factor IPRG’s voluntary early reductions into its air quality plans for the State of Illinois.

A. Background

Edwards Station is located in Hollis Township in Peoria County. The Station has three coal-fired electric generating units, which were placed into service between 1960 and 1972 and have a combined maximum generation capacity of 695 MW (net winter). Units 1 and 2 emit through a common stack (Stack 1) and Unit 3 emits through its own dedicated stack (Stack 2). The units are capable of firing either Illinois bituminous coal or Western sub-bituminous coal.

On June 2, 2011, in response to the United States Environmental Protection Agency’s (“U.S. EPA”) promulgation of a new primary 1-hour SO₂ National Ambient Air Quality Standard (“NAAQS”), the Illinois EPA submitted its recommendations to the U.S. EPA, Region 5 on attainment and nonattainment designations for the State of Illinois. As part of its recommendation with respect to the Pekin monitor in Pekin Township, Tazewell County, the Illinois EPA determined that the wind direction during exceedance hours was either from the west or southwest, indicating that emissions from the Edwards Station did not contribute to the high SO₂ concentrations at the Pekin monitor. As such, the Illinois EPA recommended the Pekin nonattainment area be limited to Pekin Township and Cincinnati Township. On February 6, 2013, the Regional Administrator for U.S. EPA Region 5 notified the Illinois EPA that, despite its recommendation, the U.S. EPA intended to designate Hollis Township, an area which includes the Edwards Station, as part of the nonattainment area. On August 5, 2013, the U.S. EPA designated the Pekin area, including Hollis Township, as nonattainment. On September 5, 2013, AmerenEnergy Resources Generating Company appealed the U.S. EPA’s decision to include Hollis Township based, in part, on the U.S. EPA’s failure to justify that the Edwards Station impacted the SO₂ concentrations at the Pekin monitor. That appeal has been maintained by IPRG and is currently pending.

As a result of the nonattainment designation by the U.S. EPA, the Illinois EPA is required by the Clean Air Act to develop and submit a State Implementation Plan (“SIP”) that provides for attainment of the SO₂ NAAQS as expeditiously as practicable, but no later than five years from the effective date of the nonattainment designation, i.e., by October 4, 2018. In accordance with U.S. EPA guidance on 1-hour SO₂ nonattainment area SIP submissions (dated April 23, 2014), sources are expected to begin complying with emission limits sufficient to provide for attainment with the 1-hour SO₂ NAAQS by no later than January 1, 2017.

Despite IPRG’s belief in the merits of its appeal challenging the inclusion of Hollis Township in the designated nonattainment area, IPRG is willing to agree voluntarily to an early reduction in the allowable SO₂ emissions at the Edwards Station because such an agreement is beneficial to the State’s air quality planning process. IPRG hereby voluntarily agrees to reduce Edwards Station’s current allowable SO₂ emissions by the effective date of this Agreement, more than three and one-half years in advance of the attainment deadline and two years earlier than would be required by U.S. EPA SIP guidance. As shown in Table 1, this represents a 92.2 percent reduction from the Edwards Station’s current allowable SO₂ emissions. The current and future allowable SO₂ emissions for the Edwards Station, expressed as pounds per hour (lbs/hr), and the resulting emission reductions are identified in Table 1.

Table 1. E.D. Edwards Station SO₂ Emissions (lbs/hr)

| | Stack 1 | Stack 2 | Station |
|--------------------------|----------------|----------------|----------------|
| Current Allowable | 31,968 | 30,317 | 62,285 |
| Future Allowable | 2,100 | 2,756 | 4,856 |
| Reduction | 29,868 | 27,561 | 57,429 |

In the event IPRG, in its sole discretion, permanently retires both Units 1 and 2 at the Edwards Station after the effective date of this Agreement,¹ IPRG agrees to lower the allowable Station SO₂ emissions further. In this situation, instead of maximum allowable SO₂ emissions of 4,856 pounds per hour combined from Stacks 1 and 2, IPRG agrees to maximum allowable SO₂ emissions of no more than 4,000 pounds per hour from Stack 2. Should Units 1 and 2 be permanently retired, there will be no emissions from Stack 1. As shown in Table 2, this compliance alternative represents a 93.6 percent reduction from the Edwards Station’s current allowable SO₂ emissions. This significant and voluntary agreement to additional reduction of SO₂ emissions, in the event IPRG retires both Units 1 and 2, will provide further benefit to the local air quality.

¹ Illinois Power Holdings, LLC (IPH), an indirect parent company of IPRG, previously has committed to retire Edwards Unit 1 as soon as the MISO allows Unit 1 to be retired. Nothing in this Agreement shall require IPRG to permanently retire both Units 1 and 2.

Table 2. E.D. Edwards Station SO₂ Emissions (lbs/hr)

| | Stack 1 | Stack 2 | Station |
|---|---------|---------|---------|
| Current Allowable | 31,968 | 30,317 | 62,285 |
| Future Allowable (if Units 1 & 2 are permanently retired) | 0 | 4,000 | 4,000 |
| Reduction | 31,968 | 26,317 | 58,285 |

B. SO₂ Emission Limits

1. Beginning on the effective date of this Agreement, IPRG shall comply with either of the following SO₂ emission limits at Edwards Station:
 - a. Stack 1 emissions shall not exceed 2,100 lbs SO₂/hour and Stack 2 emissions shall not exceed 2,756 lbs SO₂/hour; or
 - b. In the event IPRG, in its sole discretion, permanently retires both Units 1 and 2 on or after the effective date of this Agreement, Stack 2 emissions shall not exceed 4,000 lbs SO₂/hour beginning on the date that Units 1 and 2 are both permanently retired. IPRG shall provide the Illinois EPA 30-day prior written notice of its decision to comply with the Stack 2 SO₂ emission limit under this Section B.1.b of the MOA.
2. Compliance with the applicable voluntary early emission limits identified in Section B.1.a or B.1.b of this MOA shall be met on a one-hour average basis as determined by the Station's SO₂ continuous emission monitoring system required in accordance with 40 C.F.R. Part 75.

C. Regulatory Uses of the Voluntary SO₂ Early Emission Reductions

1. IPRG and the Illinois EPA agree that IPRG is agreeing to accept the early commitments in this Agreement voluntarily and despite IPRG's pending appeal of the nonattainment designation.
2. The Illinois EPA has determined that compliance with the emission limits in this Agreement satisfies Edwards Station's current obligations with respect to attainment and maintenance of the 2010 1-hour SO₂ NAAQS in Illinois, including in the designated Pekin nonattainment area.
3. The Illinois EPA shall use its best efforts to support and represent the requirements of this Agreement as satisfying the Edwards Station's current obligations with respect to the 2010 1-hour SO₂ NAAQS. Illinois EPA will not pursue a rulemaking or take Agency permitting action for Edwards Station with respect to the 2010 1-hour SO₂ NAAQS that seeks more stringent SO₂ reductions from the Edwards Station than as set forth in this MOA (however, this provision, and

any similar provision in this Agreement, does not preclude any sulfur content limitations for fuel oil that may be proposed by the Illinois EPA and that may impact the Edwards Station).

4. After the Illinois SO₂ regulation is approved by the Illinois Pollution Control Board, the Illinois EPA shall include the SO₂ emission limits set forth in this Agreement as part of its 1-hour SO₂ SIP submittal to the U.S. EPA pursuant to sections 110 and 172 of the Clean Air Act.

5. In developing rules, regulations, SIP revisions, or other actions designed to comply with the 2010 1-hour SO₂ NAAQS, the Illinois EPA, taking into account all emission reduction efforts and other appropriate factors, agrees to use best efforts to support SO₂ reductions for the Edwards Station that are no more stringent than agreed to in this MOA.

D. Miscellaneous

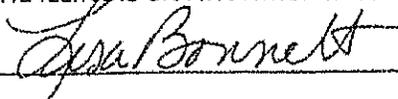
1. Nothing in this Agreement relieves IPRG from its continuing obligation to comply with the air quality requirements of applicable Federal and State laws, regulations, and permits.

2. The terms of the MOA may be amended or modified by mutual agreement of the Illinois EPA and IPRG.

3. The Parties understand and agree that nothing in this Agreement is intended to constitute an admission or statement by IPRG that the Edwards Station has adversely impacted or has the potential to adversely impact the 1-hour SO₂ NAAQS in the Pekin nonattainment area. This Agreement is not to be cited as evidence of an admission or statement by IPRG that the Edwards Station has adversely impacted or has the potential to adversely impact the 1-hour SO₂ NAAQS in the Pekin nonattainment area. It is further agreed and acknowledged that IPRG has voluntarily agreed to reduce SO₂ emissions early from the Edwards Station to help improve air quality in the State of Illinois and that IPRG does not admit that emissions from the Edwards Station have impacted or have the potential to impact the 1-hour SO₂ NAAQS in the Pekin nonattainment area.

Agreed to and accepted:

FOR THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY:

BY: 

ITS: Director

DATE: January 9, 2015

FOR ILLINOIS POWER RESOURCES GENERATING, LLC:

BY: 

ITS: Vice President & General Manager

DATE: 1/9/2015

ATTACHMENT B

Lucy Fraiser Toxicology Consulting LLC

AREAS OF EXPERTISE

- Toxicological Evaluations
- Risk Assessments
- Risk Communication
- Litigation Support
- Development of Innovative Risk-Based Approaches
- Exposure Modeling

EDUCATION

Ph.D., Toxicology,
University of Texas at Austin,
1992

B.A. Psychology, *University*
of Texas at Austin, 1985

CERTIFICATIONS/AFFILIATIONS

Diplomate of the American
Board of Toxicology

American College of Toxicology

National Society of Toxicology

Lone Star Society of Toxicology

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Management Association

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Dr. Lucy Fraiser is a board-certified toxicologist with over 25 years of experience in the areas of exposure and risk assessment, health effects and toxicology evaluations, development of quantitative toxicity criteria, development of risk-based air quality guidelines and soil cleanup criteria, and risk communication. While Dr. Fraiser works with all environmental media, she specializes in air quality health evaluations, including assessment of whether criteria pollutant emissions cause or contribute to a condition of air pollution and determination of the likelihood that air toxics will adversely impact health or welfare.

Dr. Fraiser has worked in both the public and private sectors over the last 25 years. She has conducted and managed multi-pathway exposure and human health risk assessments for a wide variety of environmental pollutants and sources. Dr. Fraiser has, on many occasions, examined the scientific foundation on which exposure assumptions and toxicity criteria are based on behalf of private and public-sector clients and trade organizations. Her leading work on these issues has resulted in corrections to regulatory guidance and risk-based criteria on several occasions. She has conducted hundreds of exposure assessments for chemicals used in pharmaceutical laboratories and industrial processes, chemicals applied to control pests and unwanted vegetation, and chemicals released as unwanted by-products of chemical and product manufacturing, combustion of fossil and waste-derived fuels, generation of electricity, petroleum refining, smelting, rock crushing, and activities at military installations.

Litigation Experience

Dr. Fraiser has been qualified as an expert, deposed, and has provided expert testimony in contested case hearings, criminal case hearings, Federal Civil suits, and toxic tort litigation on numerous occasions. She has testified before the Texas State Legislature, in public meetings, and before numerous state regulatory agencies on behalf of commercial clients. Dr. Fraiser also conducted a televised press conference on behalf of a state and a national trade organization regarding mercury emissions from power plants.

Dr. Fraiser recently provided critical expert testimony in a high-profile toxic tort case involving a flaring event at a multi-national petrochemical company that resulted in a jury verdict for the defense. She also recently provided critical testimony in a citizen suit against a Texas energy company in which a judge from the Western District of Texas ruled from the bench that there were no violations of the Clean Air Act and later ordered the Plaintiff to pay \$6.4 million in defense attorneys' fees. Dr. Fraiser also recently provided critical expert testimony in a citizen suit against a Texas petrochemical company involving excess air emission and maintenance, startup, and shutdown events. The federal cases involved alleged violations of opacity standards, National Ambient Air Quality Standards, and in the

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case of the petrochemical plant, screening levels for compounds considered to be hazardous air pollutants.

She has provided testimony on potential risks associated with permitting of rock crushers (silica, limestone, PM_{10/2.5}), a concrete batch plant (silica, PM_{10/2.5}), hazardous waste combustion units (polycyclic aromatic hydrocarbons, polychlorinated biphenyls (PCBs), dioxins), and a copper smelter (PM_{10/2.5}, NO₂, SO₂, sulfuric acid, arsenic, lead, and cadmium). Dr. Fraiser has developed opinions in cases that did not go to hearing regarding the likelihood that exposure to H₂S/SO₂ from a Sulfur Recovery Unit release was sufficient to cause known health effects, the potential for health effects associated with relatively short-term exposure to benzene concentrations in drinking water above the Maximum Contaminant Level, and potential risks associated with lead and total petroleum hydrocarbon (TPH) levels detected in street sweepings.

Regulatory Experience

As a Senior Toxicologist with the TCEQ, Dr. Fraiser conducted and managed risk assessments for incinerators and industrial boilers seeking permits to burn hazardous waste, provided support to the US Environmental Protection Agency (EPA) as they formulated national policies related to combustion risk assessment, provided critical input into the development of protective concentrations under the TRRP, served as an external peer reviewer for risk assessment guidance documents developed by EPA Region 6 and adopted as national guidance, and represented the Agency on EPA workgroups and in contested case hearings.

Dr. Fraiser recently provided comments to EPA on behalf of commercial clients and a trade organization questioning the extent to which health studies support the need for a tighter ozone NAAQS. She also provided comments on the Boiler MACT Health-Based Emissions Limitations on behalf of a trade organization. In the past, she has developed technical comments on EPA Risk Assessment Protocols for Hazardous Waste Combustion Facilities on behalf of the Louisiana Chemical Association and the Cement Kiln Recycling Coalition, and completed formal technical comments on behalf of a power generation client on a risk-based program intended to significantly reduce levels of toxic air contaminants in Kentucky.

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Air Quality Health Impact Evaluations

Dr. Fraiser was the health risk assessment advisor for a study recently completed on behalf of the Electric Power Research Institute (EPRI) that evaluated the potential health risk from emissions of coal fired power plants throughout the U.S. She recently served as project manager responsible for multi-pathway risk assessment updates for a specialty chemical company to support permitting activity that reflected the installation of new sulfur dioxide (SO₂) abatement equipment, served as the risk assessment team lead for a vapor intrusion evaluation using crawl-space soil vapor and ambient air samples collected beneath and near a house in the vicinity of a crude oil release, and performed a health risk assessment using indoor and ambient air samples from a manufacturing facility.

Dr. Fraiser has conducted or served as task leader on more than two dozen human health risk assessments conducted in support of Resource Conservation Recovery Act (RCRA) Part B permit applications for hazardous waste combustion units at chemical plants, waste management facilities, army depots, and cement kilns.

Risk-Based Corrective Action and Risk Assessment

Dr. Fraiser has conducted and/or served as task leader for over 75 human health risk assessments and/or risk-based corrective action (RBCA) evaluations in support of RCRA closures or under the Comprehensive Environmental Response, Compensation, and Liability Act for both commercial companies and government clients.

Dr. Fraiser has substantial experience performing risk evaluations under the Texas Risk Reduction Rule and the Texas Risk Reduction Program (TRRP), as well as other state RBCA programs. She has completed and received Texas Commission on Environmental Quality (TCEQ) approval for several Affected Property Assessment Reports and has provided support on the successful completion of several Response Action Completion Reports.

Dr. Fraiser recently completed a multi-media human health risk assessment for high school at which placement of fill material to build up the area for sports fields resulted in PCB contamination. She also recently completed a toxicity assessment and fish cooking loss study for dioxins and PCBs for a contaminated river segment in the northeast.

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***Toxicological Evaluations and Risk-Based Regulatory
Criteria Development***

Dr. Fraiser has developed numerous health-based criteria for compounds lacking published values using toxicity studies, structure activity relationships, and her knowledge of pharmacokinetics. She has developed risk-based regulatory criteria including emergency response planning guidelines, inhalation reference concentrations, water quality criteria, and acceptable ambient air levels, including Effects Screening Levels (ESLs), for several compounds. Based on her understanding of the human health underpinnings of federal regulations and state corrective action and air quality guidelines, Dr. Fraiser has assisted many clients wishing to challenge health-based criteria during public comment periods and in identifying adjustments to existing criteria.

Publications, Presentations and Training Courses

Fraiser L. Trends in Setting National Ambient Air Quality Standards. Earth Day Legal Symposium. Dallas, TX. April 21, 2017

Fraiser L. In Chemical Litigation, Toxicology Fundamentals Matter. American Bar Association Newsletter. August 2016.

Fraiser L. EPA May Go Beyond Law and Science in Setting NAAQS. Natural Gas & Electricity, 30(3):1-8. October 2014.

Fraiser L., and Karen Olson. Ozone NAAQS – Where is it Headed? Texas Association of Business, Austin TX. July 24, 2014.

Fraiser L. Ozone NAAQS – Where is it Headed? Houston Regional Monitoring Association, Houston, TX. July 9, 2014.

Fraiser L., and Davis B. Ozone NAAQS – Where is it Headed? Clean Air Force of Central Texas, Austin TX. April 24, 2014.

Fraiser L., and Karen Olson. Ozone NAAQS – Where is it Headed? Winstead PC, Austin TX. May 27, 2014.

Fraiser L., and Sullivan, T. Ozone NAAQS – Where is it Headed? Texas Pipeline Association, Austin TX. April 9, 2014.

Fraiser, L. Recent Reductions in NAAQS – Good Science or Perpetuation of Dogma on Health Consequences of Low-Level Air Pollutants? Energy Utility Environment Conference, Phoenix AZ. February 3 -5, 2014.

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Fraiser, L.H. and Bradley, L.J.N. Key Decisions in Establishing National Ambient Air Quality Standards. 52nd Annual Meeting of the Society of Toxicology. San Antonio, Texas. March 10 – 14, 2013.

Fraiser, L.H. Health Basis for EPA's 1-Hr SO₂ NAAQS. Alamo Chapter AWMA Meeting, January 10, 2013.

Ruffle, B., Fraiser, L., Kaczmar, S., Schew, W. Update on Cooking Loss Factors for PCDD/PCDFs, PCBs and Chlorinated Pesticides. Passaic River Symposium V. Passaic River Institute of Montclair State University. October 19, 2012.

Fraiser, L.H. and Vosnakis, K.A.S. Evolution of PCB Regulations and Toxicity Assessment: Impact on Environmental Management. 27th Annual International Conference on Soils, Sediments, Water and Energy, Amherst, Massachusetts. October 17 – 19, 2011.

Fraiser, L. Toxicology & Risk Assessment in the News: Recent EPA Proposals with Broad Implications. Invited Presented at the Gulf Coast Air & Waste Management Association Meeting. Houston, Texas. June 08, 2010.

Fraiser, L.H. Toxicology & Risk Assessment in the News: Recent EPA Proposals with Broad Implications. Houston Air & Waste Management Association. June 2010.

Fraiser, L.H., Quintin, A. Durocher, K. Szembek, C. Heinold, D. EPRI Human Health and Environmental Risk Assessment Process. February 18, 2010.

Fraiser, L.H. Trends in International Risk-Based Screening Levels (RBSLs). Society of Toxicology and Chemistry, New Orleans, Louisiana. November 19 – 23, 2009.

Fraiser, L.H. Risk Assessment: How it Can Inform Site Closure Decisions. Invited Short Course presented to the Department of Environment Malaysia, Kuala Lumpur. March 4 – 5, 2009.

Fraiser, L.H. Incinerator Risk Assessment: Principles and Practices, Hong Kong. Regional Conference on Sustainable Waste Management in Carbon-Conscious Cities. December 2008.

Site-Specific Risk Assessments, RCRA Omnibus Provision and Combining Risk Burns and Comprehensive Performance Tests. MACT EEE EPA Training Workshop, Dallas, TX. November 3 – 8, 2008.

Fraiser, L.H. Involvement of Local Governments in Air Toxics Regulation. Texas Chemical Council/ Association of Chemical Industry of Texas's EH&S Seminar Moody Gardens Hotel, Galveston Texas. June 10, 2008.

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Fraiser, L.H., and Chaudhuri, I. Short-Term Toxicity Benchmark for Nickel Oxide. 42nd Annual Society of Toxicology Meeting. March 9 – 14, 2002. Salt Lake City, Utah.

Fraiser, L.H., and Ruffle, B. "Chemical Regulations with Business Implications." Environmental Protection. June 2002.

Fraiser, L.H., and Chaudhuri, I. Short-Term Toxicity Benchmark for Nickel Oxide. International Conference on Incineration & Thermal Treatment Technologies Proceedings. May 13 -17, 2002. New Orleans, Louisiana.

Fraiser, L.H., and Chaudhuri, I. Short-Term Toxicity Benchmark for Nickel Oxide. Proceedings of the Air & Waste Management Association. April 16 - 19, 2002. St. Louis, Missouri.

Fraiser, L.H., Chaudhuri, I, and Smith, D. EPA's Dioxin Reassessment – Potential Impacts to the Regulated Community. Proceedings of the Air & Waste Management Association. June 24 - 28, 2001. Orlando, Florida.

Fraiser, L.H., Roeck, D., and Smith, D. New Developments in Dioxin Regulation – Potential Impacts on the Regulated Community. International Conference on Incineration & Thermal Treatment Technologies Proceedings. May 14 -18, 2001. Philadelphia, Pennsylvania.

Fraiser, L.H., Roeck, D., and Smith, D. Current Environment of Hazardous Waste Combustion. International Conference on Incineration & Thermal Treatment Technologies Proceedings. May 14 -18, 2001. Philadelphia, Pennsylvania.

Fraiser, L.H., and Pope, P.G. Hazardous Waste Combustion Risk Assessment — Artifact or True Risk? International Conference on Incineration & Thermal Treatment Technologies Proceedings. May 8-12, 2000. Portland, Oregon.

Fraiser, L.H., and Lewis, D. Detection Limits: Practical Implications for Risk Assessments Conducted on Hazardous Waste Combustion Units. Presented before the Louisiana Chemical Association. September 9, 1999. Baton Rouge, Louisiana.

Fraiser, L.H., Tachovsky, J.A., King, M.L., McCoy, J.T., and Haws, L.C. Hazardous Waste Combustion Risk Assessment Experience in the State of Texas. International Conference on Incineration & Thermal Treatment Technologies Proceedings. pp. 189-196. May 11-15, 1998. Salt Lake City, Utah.

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Fraiser, L., McCoy, J.T., Perry, C., King, M., and Haws, L.C. Screening Risk Analysis for the Bayer Corporation Facility in Baytown, Texas. TNRCC publication number AS-120, AS-120A, and AS-120B. November 1996.

Fraiser, L., Lund, L., Tyndall, K., King, M., Schultz, D., and Haws, L. Case Studies in Risk Assessment for Hazardous Waste Burning Cement Kilns in Waste Combustion in Boilers and Industrial Furnaces Proceedings. pp.208-225. March 26-27, 1996. Kansas City, Missouri.

Fraiser, L., Lund, L., Hueske, K., and Haws, L.C. Indirect Risk Assessment: Case Studies of Hazardous Waste Combustors. Toxicologist 30:6, 1996.

Fraiser, L., Lund, L., Hueske, K., King, M., and Haws, L.C. Screening Risk Analysis for the North Texas Cement Company (NTCC) Facility in Midlothian, Texas. TNRCC publication number AS-71, AS-71A, and AS-71B. January 31, 1996.

Fraiser, L., Lund, L., Hueske, K., King, M., and Haws, L.C. Screening Risk Analysis for the Texas Industries (TXI) Facility in Midlothian, Texas. TNRCC publication number AS-72, AS-72A, and AS-72B. November 2, 1995.

Ramu, K., Fraiser, L., Mamiya, B., Ahmed, T., and Kehrer, J.P. Acrolein Mercapturates: Synthesis, Characterization, and Assessment of Their Role in the Bladder Toxicity of Cyclophosphamide. Chem. Res. Toxicol. 8:515-524, 1995.

Fraiser, L., and Kehrer, J.P. Effect of Indomethacin, Aspirin, Nordihydroguareitic Acid, and Piperonyl Butoxide on Cyclophosphamide-Induced Bladder Damage. Drug Chem. Toxicol. 16(2):117-133, 1993.

Fraiser, L., Barnett, J.W., and Hixson, E.J. 'Toxicity Equivalents for Chlorinated Hydrocarbon Pesticides Lacking EPA-Verified Toxicity Values.' Toxicologist 14: 1540, 1994.

Kanekal, S., Fraiser, L., and Kehrer, J.P. Pharmacokinetics, Metabolism, and Lung Toxicity of Cyclophosphamide in C57/Bl6 and ICR Mice. Toxicol. Appl. Pharmacol. 114:1-8, 1992.

Fraiser, L., and Kehrer, J.P. Murine Strain Differences in Bladder Toxicity of Cyclophosphamide. Toxicol. 75:257-272, 1992.

Fraiser, L., Kanekal, S., and Kehrer, J.P. Cyclophosphamide Toxicity: Characterizing and Avoiding the Problem. Drugs. 42(5):781 -795, 1991.

CERTIFICATE OF SERVICE

I, the undersigned, certify that on this 16th day of February, 2018, I have electronically served the attached **DYNEGY'S RESPONSES TO QUESTIONS FOR DYNEGY'S WITNESSES**, upon all parties on the attached service list.

My e-mail address is rgranholm@schiffhardin.com;

The number of pages in the e-mail transmission is 47.

The e-mail transmission took place before 5:00 p.m.

/s/ Ryan Granholm

Ryan Granholm

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