BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	R06-25
PROPOSED NEW 35 ILL. ADM. CODE 225	)	(Rulemaking – Air)
CONTROL OF EMISSIONS FROM	)	
LARGE COMBUSTION SOURCES(MERCURY)	)	

NOTICE

TO: Dorothy Gunn
Clerk
Illinois Pollution Control Board
James R. Thompson Center
100 West Randolph St., Suite 11-500
Chicago, IL 60601-3218

SEE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Illinois Pollution Control Board the MOTION TO AMEND RULEMAKING PROPOSAL, MOTION FOR LEAVE TO FILE INSTANTER AMENDED TESTIMONY OF JAMES E. STAUDT, Ph.D., and AMENDED TESTIMONY OF JAMES E. STAUDT, Ph.D., a copy of which is herewith served upon you.

ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY

By: _____
Gina Roccaforte
Assistant Counsel
Division of Legal Counsel

DATED: May 23, 2006

1021 North Grand Avenue East
P. O. Box 19276
Springfield, IL 62794-9276
217/782-5544

THIS FILING IS SUBMITTED ON RECYCLED PAPER

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	R06-25
PROPOSED NEW 35 ILL. ADM. CODE 225	)	(Rulemaking – Air)
CONTROL OF EMISSIONS FROM	)	
LARGE COMBUSTION SOURCES (MERCURY)	)	

MOTION TO AMEND RULEMAKING PROPOSAL

NOW COMES the Proponent, the ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (Illinois EPA), by its attorneys, and pursuant to 35 Ill. Adm. Code 101.500 and 102.402, moves that the Illinois Pollution Control Board (Board) amend proposed new Part 225 to add new Sections 225.234 and 225.238 to Subpart B. In support of its Motion, the Illinois EPA states as follows:

On March 14, 2006, the Illinois EPA filed a proposal with the Board to add a new Part 225, 35 Ill. Adm. Code Part 225, entitled "Control of Emissions from Large Combustion Sources" to control the emissions of mercury from coal-fired electric generating units (EGUs) beginning in 2009. The Illinois EPA's proposal is intended to meet certain obligations of the State of Illinois under the federal Clean Air Act (CAA), 42 U.S.C. § 7401 *et seq.*; specifically, to satisfy Illinois' obligation to submit a State plan to address the requirements of the Clean Air Mercury Rule (CAMR), *see*, 70 *Fed. Reg.* 28606 (May 18, 2005). Under CAMR, states are required to submit State plans to the United States Environmental Protection Agency by no later than November 17, 2006. *Id.* at 28649; 40 CFR § 60.24(h)(2).

The Illinois EPA engaged in extensive outreach on this proposal. In January 2006, the Illinois EPA commenced regular meetings with representatives of the affected

sources and public interest groups and the Illinois EPA distributed working drafts of the proposed rule to such parties.

During the formulation of the proposed rule, the Illinois EPA considered including a Temporary Technology Based Standard (TTBS) to provide additional regulatory flexibility for compliance with the proposed rule. This concept was presented at several of the stakeholder meetings. A limited number of comments were received; however, no stakeholders stated that they would utilize such a standard.

After the filing of the rulemaking proposal, a number of stakeholders requested the provisions of the TTBS. In addition, further review by Illinois EPA staff and an expert retained by the Illinois EPA identified additional circumstances related to practices and configurations of sources in the State that warrant the inclusion of the TTBS. Therefore, the Illinois EPA is now proposing to amend the rulemaking proposal as set forth in this motion.

The TTBS, as proposed, addresses both new and existing sources with EGUs. In order to provide additional, appropriate flexibility for compliance by both new and existing sources with EGUs, separate provisions encompassing the TTBS are warranted. Those EGUs that satisfy relevant eligibility requirements may demonstrate compliance with control requirements for mercury emissions via the TTBS provisions for a specified and limited time frame. Accordingly, the Illinois EPA recommends the acceptance by the Board of the following amendment to proposed new Part 225 to add new Sections 225.234 and 225.238:

Section 225.234 Temporary Technology-Based Standard for EGUs at Existing Sources

a) General

1) At a source with EGUs that commenced commercial operation on or before December 31, 2008, for an EGU that meets the eligibility criteria in subsection (b) of this Section, as an alternative to compliance with the mercury emission standards in Section 225.230 of this Subpart, the owner or operator of the EGU may temporarily comply with the requirements of this Section, through June 30, 2015, as further provided in subsections (c), (d), and (e) of this Section.

2) An EGU that is complying with the emission control requirements of this Subpart by operating under this Section may not be included in a compliance demonstration involving other EGUs during the period that it is operating under this Section.

3) The owner or operator of an EGU that is complying with this Subpart by means of this Section is not excused from applicable monitoring, recordkeeping, and reporting requirements in Sections 225.240 through 225.290 of this Subpart.

b) Eligibility

To be eligible to operate an EGU under this Section, the following criteria shall be met for the EGU:

1) The EGU is equipped and operated with the air pollution control equipment or systems that include injection of halogenated activated carbon and either (1) a cold-side electrostatic precipitator or (2) a fabric filter.

2) The owner or operator of the EGU is injecting halogenated activated carbon in an optimum manner for control of mercury emissions, which shall include injection of Alstrom, Norit, Sorbent Technologies, or other halogenated activated carbon that the owner or operator of the EGU shows to have similar or better effectiveness for control of mercury emissions, at least at the following rates, unless other provisions for injection of halogenated activated carbon are established in a federally enforceable operating permit issued for the EGU, with an injection system designed for effective absorption of mercury, considering the configuration of the EGU and its ductwork. For this purpose, flue gas flow rate shall be determined for the point of sorbent injection, provided, however, that this flow rate may be assumed to

be identical to the stack flow rate if the gas temperatures at the point of injection and the stack are normally within 100º F, or may otherwise be calculated from the stack flow rate, corrected for the difference in gas temperatures.

A) For an EGU firing subbituminous coal, 5.0 pounds per million actual cubic feet.

B) For an EGU firing bituminous coal, 10.0 pounds per million actual cubic feet.

C) For an EGU firing a blend of subbituminous and bituminous coal, a rate that is the weighted average of the above rates, based on the blend of coal being fired.

D) A rate or rates set on a unit-specific basis that are lower than the rate specified above to the extent that the owner or operator of the EGU demonstrates that such rate or rates are needed so that carbon injection would not increase particulate matter emissions or opacity so as to threaten compliance with applicable regulatory requirements for particulate matter or opacity.

3) The total capacity of the EGUs that operate under this Section does not exceed the applicable value below:

A) For the owner or operator of more than one existing source with EGUs, 25 percent of the total rated capacity, in MW, of all the EGUs at such existing sources that it owns or operates, other than any EGUs operating pursuant to Section 225.235 of this Subpart.

B) For the owner or operator of only a single existing source with EGUs (i.e., City, Water, Light & Power, City of Springfield, ID 167120AAO; Electric Energy, Inc., ID 127855AAC; Kincaid Generating Station, ID 021814AAB; and Southern Illinois Power Cooperative/Marion Generating Station, ID 199856AAC), 25 percent of the total rated capacity, in MW, of the all the EGUs at such existing sources, other than any EGUs operating pursuant to Section 225.235 of this Subpart.

c) Compliance Requirements

1) Emission Control Requirements

The owner or operator of an EGU that is operating pursuant to this Section shall continue to maintain and operate the EGU to comply with the criteria for eligibility for operation under this Section, except during an evaluation of the current sorbent, alternative sorbents or other techniques to control mercury emissions, as provided by subsection (e) of this Section.

2) Monitoring and Recordkeeping Requirements

In addition to complying with all applicable reporting requirements in Sections 225.240 through 225.290 of this Subpart, the owner or operator of an EGU operating pursuant to this Section shall also:

A) Through December 31, 2012, maintain records of the usage of activated carbon, the exhaust gas flow rate from the EGU, and the activated carbon feed rate, in pounds per million actual cubic feet of exhaust gas at the injection point, on a weekly average.

B) Beginning January 1, 2013, monitor activated carbon feed rate to the EGU, flue gas temperature at the point of sorbent injection, and exhaust gas flow rate from the EGU, automatically recording this data and the activated carbon feed rate, in pounds per million actual cubic feet of exhaust gas at the injection point, on an hourly average.

C) If a blend of bituminous and sub-bituminous coal is fired in the EGU, records of the amount of each type or coal burned and the required injection rate for injection of halogenated activated carbon, on a weekly basis.

3) Notification and Reporting Requirements

In addition to complying with all applicable reporting requirements in Sections 225.240 through 225.290 of this Subpart, the owner or operator of an EGU operating pursuant to this Section shall also submit the following notifications and reports to the Agency:

A) Written notification prior to the month in which any of the following events will occur: the EGU will no longer be eligible to operate under this Section due to a change in operation; the type of coal fired in the EGU will change; the mercury emission standard with which the owner or operator is attempting to comply for the EGU will change; or operation under this Section will be terminated.

B) Quarterly reports for the recordkeeping and monitoring conducted pursuant to subsection (c)(2) of this Section.

C) Annual reports detailing activities conducted for the EGU to further improve control of mercury emissions, including the measures taken during the past year and activities planned for the current year.

d) Applications to Operate under the Technology-Based Standard

1) Application Deadlines

A) The owner or operator of an EGU that is seeking to operate the EGU under this Section shall submit an application to the Agency no later than three months prior to the date that compliance with Section 225.230 of this Subpart would otherwise have to be demonstrated. For example, the owner or operator of an EGU that is applying to operate the EGU pursuant to this Section on June 30, 2010, when compliance with applicable mercury emission standards must be first demonstrated, shall apply by March 31, 2010 to operate under this Section.

B) Unless the Agency finds that the EGU is not eligible to operate under this Section or that the application for operation under this Section does not meet the requirements of subsection (d)(2) of this Section, the owner or operator of the EGU is authorized to operate the EGU under this Section beginning 60 days after receipt of the application by the Agency.

C) The owner or operator of an EGU operating pursuant to this Section must reapply to operate pursuant to this Section:

i) If it operated pursuant to this Section during the period of June 2010 through December 2012 and it seeks to operate pursuant to this Section during the period from January 2013 through June 2015.

ii) If it is planning a physical change to or a change in the method of operation of the EGU, control equipment or practices for injection of activated carbon that is expected to reduce the level of control of mercury emissions.

2) Contents of Application

An application to operate pursuant to this Section shall be submitted as an application for a new or revised federally enforceable operating permit for the EGU and include the following:

A) A formal request to operate pursuant to this Section showing that the EGU is eligible to operate pursuant to this Section and describing the reason for the request, the measures that have been taken for control of mercury emissions, and factors preventing more effective control of mercury emissions from the EGU.

B) The applicable mercury emission standard in Section 225.230(a) with which the owner or operator of the EGU is attempting to comply and a summary of relevant mercury emission data for the EGU.

C) If a unit-specific rate or rates for carbon injection are proposed pursuant to subsection (b)(2) of this Section, detailed information to support the proposed injection rates.

D) An action plan describing the measures that will be taken while operating under this Section to improve control of mercury emissions. This plan shall address measures such as evaluation of alternative forms or sources of activated carbon, changes to the injection system, changes to operation of the unit that affect the effectiveness of mercury absorption and collection, changes to the particulate matter control device to improve performance and changes to other emission control devices. For each measure contained in the plan, the plan shall provide a detailed description of the specific actions that are planned, the reason that the measure is being pursued and the range of improvement in control of mercury that is expected, and the factors that affect the timing for carrying out the measure, with the current schedule for the measure.

e) Evaluation of Alternative Control Techniques for Mercury Emissions

1) During an evaluation of the effectiveness of the current sorbent, alternative sorbent, or other technique to control mercury emissions, the owner or operator of an EGU operating under this Section need not comply with the eligibility criteria for operation under this Section as needed to carry out an evaluation of the

practicality and effectiveness of such technique, as further provided below:

A) The owner or operator of the EGU shall conduct the evaluation in accordance with a formal evaluation program submitted to the Illinois EPA at least 30 days in advance.

B) The duration and scope of the evaluation shall not exceed the duration and scope reasonably needed to complete the desired evaluation of the alternative control technique, as initially addressed by the owner or owner in a support document submitted with the evaluation program.

C) Notwithstanding 35 Ill. Adm. Code 201.146(hhh), the owner or operator of the EGU shall obtain a construction permit for any new or modified air pollution control equipment to be constructed as part of the evaluation of the alternative control technique.

D) The owner or operator of the EGU shall submit a report to the Illinois EPA no later than 90 days after the conclusion of the evaluation describing the evaluation that was conducted and providing the results of the evaluation.

2) If the evaluation of the alternative control technique shows less effective control of mercury emissions from the EGU than achieved with the prior control technique, the owner or operator of the EGU shall resume use of the prior control technique. If the evaluation of the alternative control technique shows comparable effectiveness, the owner or operator of the EGU may either continue to use the alternative control technique in an optimum manner or resume use of the prior control technique. If the evaluation of the alternative control technique shows more effective control of mercury emissions, the owner or operator of the EGU shall continue to use the alternative control technique in an optimum manner, if it continues to operate under this Section.

Section 225.238 Temporary Technology-Based Standard for New Sources with EGUs

a) General

1) At a source with EGUs that previously had not had any EGUs that commenced commercial operation before January 1, 2009, for an EGU that meets the eligibility criteria in subsection (b) of this Section, as an alternative to compliance with the mercury emission standards in Section 225.237of this Subpart, the owner or operator

of the EGU may temporarily comply with the requirements of this Section, through December 31, 2018, as further provided in subsections (c), (d), and (e) of this Section.

2) An EGU that is complying with the emission control requirements of this Subpart by operating under this Section may not be included in a compliance demonstration involving other EGUs at the source during the period that such standard is in effect.

3) The owner or operator of an EGU that is complying with this Subpart by means of this Section is not excused from applicable monitoring, recordkeeping, and reporting requirements in Sections 225.240 through 225.290 of this Subpart.

b) Eligibility

To be eligible to operate an EGU under this Section, the following criteria shall be met for the EGU:

1) The EGU is subject to Best Available Control Technology (BACT) for emissions of sulfur dioxide, nitrogen oxides and particulate matter and is equipped and operated with the air pollution control equipment or systems specified below, as applicable to the category of EGU:

A) For coal-fired boilers, injection of halogenated activated carbon.

B) For an EGU firing fuel gas produced by coal gasification, processing of the raw fuel gas prior to combustion for removal of mercury with system a using activated carbon.

2) For an EGU for which injection of halogenated activated carbon is required by subsection (b)(1) of this Section, the owner or operator of the EGU is injecting halogenated activated carbon in an optimum manner for control of mercury emissions, which shall include injection of Alstrom, Norit, Sorbent Technologies, or other halogenated activated carbon that the owner or operator of the EGU shows to have similar or better effectiveness for control of mercury emissions, at least at the following rates, unless other provisions for injection of halogenated activated carbon are established in a federally enforceable operating permit issued for the EGU, with an injection system designed for effective absorption of mercury. For this purpose, flue gas flow rate shall be determined for the point of sorbent injection, provided, however, that this flow rate may be assumed to be identical to the stack flow

rate if the gas temperatures at the point of injection and the stack are normally within 100º F, or may otherwise be calculated from the stack flow rate, corrected for the difference in gas temperatures.

A) For an EGU firing subbituminous coal, 5.0 pounds per million actual cubic feet.

B) For an EGU firing bituminous coal, 10.0 pounds per million actual cubic feet.

C) For an EGU firing a blend of subbituminous and bituminous coal, a rate that is the weighted average of the above rates, based on the blend of coal being fired.

c) Compliance Requirements

1) Emission Control Requirements

The owner or operator of an EGU that is operating pursuant to this Section shall continue to maintain and operate the EGU to comply with the criteria for eligibility for operation under this Section, except during an evaluation of the current sorbent, alternative sorbents or other techniques to control mercury emissions, as provided by subsection (e) of this Section.

2) Monitoring and Recordkeeping Requirements

In addition to complying with all applicable reporting requirements in Sections 225.240 through 225.290 of this Subpart, the owner or operator of a new EGU operating pursuant to this Section shall also:

A) Monitor activated carbon feed rate to the EGU, flue gas temperature at the point of sorbent injection, and exhaust gas flow rate from the EGU, automatically recording this data and the activated carbon feed rate, in pounds per million actual cubic feet of exhaust gas at the injection point, on an hourly average.

B) If a blend of bituminous and sub-bituminous coal is fired in the EGU, records of the amount of each type or coal burned and the required injection rate for injection of halogenated activated carbon, on a weekly basis.

3) Notification and Reporting Requirements

In addition to complying with all applicable reporting requirements in Sections 225.240 through 225.290 of this Subpart, the owner or operator of an EGU operating pursuant to this Section shall also submit the following notifications and reports to the Agency:

A) Written notification prior to the month in which any of the following events will occur: the EGU will no longer be eligible to operate under this Section due to a change in operation; the type of coal fired in the EGU will change; the mercury emission standard with which the owner or operator is attempting to comply for the EGU will change; or operation under this Section will be terminated.

B) Quarterly reports for the recordkeeping and monitoring conducted pursuant to subsection (c)(2) of this Section.

C) Annual reports detailing activities conducted for the EGU to further improve control of mercury emissions, including the measures taken during the past year and activities planned for the current year.

d) Applications to Operate under the Technology-Based Standard

1) Application Deadlines

A) The owner or operator of an EGU that is seeking to operate the EGU under this Section shall submit an application to the Agency no later than three months prior to the date that compliance with Section 225.237 of this Subpart would otherwise have to be demonstrated.

B) Unless the Agency finds that the EGU is not eligible to operate under this Section or that the application for operation under this Section does not meet the requirements of subsection (d)(2) of this Section, the owner or operator of the EGU is authorized to operate the EGU under this Section beginning 60 days after receipt of the application by the Agency.

C) The owner or operator of an EGU operating pursuant to this Section must reapply to operate pursuant to this Section if it is planning a physical change to or a change in the method of operation of the EGU, control equipment or practices for injection of activated carbon that is expected to reduce the level of control of mercury emissions.

2) Contents of Application

An application to operate pursuant to this Section shall be submitted as an application for a new or revised federally enforceable operating permit for the new EGU and include the following:

A) A formal request to operate pursuant to this Section showing that the EGU is eligible to operate pursuant to this Section and describing the reason for the request, the measures that have been taken for control of mercury emissions, and factors preventing more effective control of mercury emissions from the EGU.

B) The applicable mercury emission standard in Section 225.237 with which the owner or operator of the EGU is attempting to comply and a summary of relevant mercury emission data for the EGU.

C) If a unit-specific rate or rates for carbon injection are proposed pursuant to subsection (b)(2) of this Section, detailed information to support the proposed injection rates.

D) An action plan describing the measures that will be taken while operating under this Section to improve control of mercury emissions. This plan shall address measures such as evaluation of alternative forms or sources of activated carbon, changes to the injection system, changes to operation of the unit that affect the effectiveness of mercury absorption and collection, and changes to other emission control devices. For each measure contained in the plan, the plan shall provide a detailed description of the specific actions that are planned, the reason that the measure is being pursued and the range of improvement in control of mercury that is expected, and the factors that affect the timing for carrying out the measure, with the current schedule for the measure.

e) Evaluation of Alternative Control Techniques for Mercury Emissions

1) During an evaluation of the effectiveness of the current sorbent, alternative sorbent, or other technique to control mercury emissions, the owner or operator of an EGU operating under this Section need not comply with the eligibility criteria for operation under this Section as needed to carry out an evaluation of the

practicality and effectiveness of such technique, as further provided below:

A) The owner or operator of the EGU shall conduct the evaluation in accordance with a formal evaluation program submitted to the Illinois EPA at least 30 days in advance.

B) The duration and scope of the evaluation shall not exceed the duration and scope reasonably needed to complete the desired evaluation of the alternative control technique, as initially addressed by the owner or owner in a support document submitted with the evaluation program.

C) Notwithstanding 35 Ill. Adm. Code 201.146(hhh), the owner or operator of the EGU shall obtain a construction permit for any new or modified air pollution control equipment to be constructed as part of the evaluation of the alternative control technique.

D) The owner or operator of the EGU shall submit a report to the Illinois EPA no later than 90 days after the conclusion of the evaluation describing the evaluation that was conducted and providing the results of the evaluation.

2) If the evaluation of the alternative control technique shows less effective control of mercury emissions from the EGU than achieved with the prior control technique, the owner or operator of the EGU shall resume use of the prior control technique. If the evaluation of the alternative control technique shows comparable effectiveness, the owner or operator of the EGU may either continue to use the alternative control technique in an optimum manner or resume use of the prior control technique. If the evaluation of the alternative control technique shows more effective control of mercury emissions, the owner or operator of the EGU shall continue to use the alternative control technique in an optimum manner, if it continues to operate under this Section.

WHEREFORE, for the reasons set forth above, the Illinois EPA moves that the Board amend proposed new Part 225 to add new Sections 225.234 and 225.238 to Subpart B as set forth herein.

Respectfully submitted,

ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY

By: _____
Charles E. Matoesian
Assistant Counsel
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_____
Gina Roccaforte
Assistant Counsel
Division of Legal Counsel

DATED: May 23, 2006

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MOTION FOR LEAVE TO FILE INSTANTER AMENDED TESTIMONY OF JAMES E. STAUDT, Ph.D.

NOW COMES the Proponent, the Illinois Environmental Protection Agency (Illinois EPA), by its attorneys, and pursuant to 35 Ill. Adm. Code 101.500 and 102.402, hereby requests that the Illinois Pollution Control Board (Board) grant the Illinois EPA leave to file instanter the Amended Testimony of James E. Statudt, Ph.D. In support of this motion, the Illinois EPA states as follows:

1. On May 19, 2006, following consideration of an emergency motion filed by the Participants to this rulemaking proceeding, the Board's assigned Hearing Officer entered a scheduling order. The order included, *inter alia*, the acknowledgement that the Illinois EPA would be submitting amended pre-filed testimony of Dr. James Staudt on May 19, 2006, and that the Participants would in turn be required to submit pre-filed questions on May 19, 2006 as well.

2. Since the filing of Dr. Staudt's amended testimony on May 19th, further circumstances have transpired that require the further amendment of his testimony. For reasons fully addressed in the Illinois EPA's Motion to Amend Rulemaking Proposal, filed contemporaneously on this date, Dr. Staudt's testimony needs to be amended again to explain and reflect the additional provisions sought for inclusion in the rulemaking proposal.

3. Although the Illinois EPA regrets the timing of this latest request, the amended pre-filed testimony of Dr. Staudt that is the subject of this motion is being offered only two business days following the filing of the previous testimony. Further, this amended testimony is necessary to accompany the language that is the subject of the Motion to Amend Rulemaking Proposal.

WHEREFORE, for the reasons stated above, the Illinois EPA hereby respectfully requests that the Board grant the Illinois EPA leave to file instanter the amended testimony of Dr. Staudt.

Respectfully submitted,

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY,

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217/782-9143 (TDD)
Dated: May 23, 2006

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

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AMENDED TESTIMONY OF JAMES E. STAUDT, Ph.D.

I, James E. Staudt, have been retained by the Illinois Environmental Protection Agency (IL EPA) as an expert in this electric power plant mercury emissions rule development.

I expect to testify at the hearing on the current state-of-the-art of mercury emissions control technology for coal-fired power plants and the potential use of these control technologies by Illinois coal-fired power plants to comply with the rule that has been proposed by IL EPA.

I. BACKGROUND AND QUALIFICATIONS

I am currently the President of Andover Technology Partners ("ATP"). As President of ATP, I have advised power plants, equipment suppliers and government agencies on ways to comply with emissions regulations in cost-effective ways. For nearly twenty years, I have worked in the field of air pollution control technology, including mercury emissions control. For the past nine years (since 1997) I have been a consultant with my own business – Andover Technology Partners. My primary area of business as a consultant is associated with my expertise relating to the performance and cost of air pollution control technologies on power plants. Clients have included the US EPA, power plant owners, technology suppliers, and others. I have published several papers and reports, including papers in peer-reviewed journals and reports issued by the US EPA, on mercury control technology and the cost of controlling mercury on power plants. Several of these papers have been coauthored with staff of the US EPA. For most of the period from 1988 to 1997 I was employed by companies that supplied air pollution control technology (Research Cottrell and Fuel Tech) or power plant and refinery gas analyzers (Spectrum Diagnostix, a subsidiary of Physical Sciences that was acquired by Western Research). As an

employee of these companies over this period I sold, designed, and commissioned air pollution control technology at numerous power plants and industrial facilities.
I received my M.S. (1986) and Ph.D. (1987) in Mechanical Engineering from the Massachusetts Institute of Technology. I received my B.S. in Mechanical Engineering from the U.S. Naval Academy in 1979. From 1979 to 1984 I served as a commissioned officer in the U.S. Navy in the Engineering Department of a nuclear-powered aircraft carrier.

II. SUMMARY OF TESTIMONY

At the Hearing I expect to testify on how mercury emissions from coal power plants can be controlled and what those controls are expected to cost Illinois power plants that will be required to comply with the proposed mercury control rule should it be finalized. By reference, my testimony includes Section 8 of the Technical Support Document (TSD): Technological Feasibility of Controlling Mercury Emissions from Coal-fired Power Plants in Illinois.

Mercury Emissions From Coal Fired Power Plants

The mercury emissions from a coal-fired power plant are the result of the mercury content in the coal that is burned and the extent that processes in the boiler prevent the mercury from being released with the exhaust gases of the power plant. Mercury may be removed from the coal prior to combustion of the coal. This may be achieved by coal cleaning or by some other treatment of the coal. Or, mercury may be removed from the boiler flue gases by Air Pollution Control (APC) equipment. Sometimes the APC equipment that removes the mercury is equipment that is installed primarily to remove other pollutants, such as Particle Matter (PM) or acid gases in a Flue Gas Desulfurization system (FGD, also called SO_2 scrubbers). Mercury removal in this manner is called co-benefit mercury removal. Mercury may also be removed by air pollution control systems that are specifically designed to remove mercury from the flue gases.

Mercury Removal from Coal

Run of mine (ROM) bituminous coal is frequently cleaned for the following purposes:

- Removal of impurities to improve the heating value of the coal
- Reduction of transportation costs for coal to the power plant and ash from the power plant
- Maintenance of ash content in coal supply within contract requirements
- Removal of sulfur, mainly as pyrites, lowering SO_2 emissions when the coal is burned.

However, cleaning ROM coal will provide the added benefit of removing mercury from the coal. This is because mercury in the coal is preferentially associated with pyrites and other non-combustible materials that are removed in coal washing. Mercury removal from the coal before combustion through washing will contribute to lower mercury emissions from the plant.

Mercury Behavior In the Furnace and Cobenefit Capture

Mercury that is present in trace amounts in the coal is released from the coal during combustion. At furnace conditions, the released mercury is present in a gaseous state in the elemental form that is denoted as Hg^o. As the combustion exhaust gases cool in the boiler, chemistry shifts to favor an oxidized, or ionic, form of mercury, denoted as Hg^{2+}. Some of the Hg^{2+} is adsorbed onto particles to form $Hg_{p.}$ The Hg_p is readily captured in PM emission control devices that all IL coal power plants are equipped with – ESPs or fabric filters. Hg^{2+} is water soluble and can be captured by FGD systems if they are installed. However, not all of the Hg^o becomes Hg^{2+} or Hg_p due to limitations on the chemistry that result from several factors, such as concentration of chlorine (the most common form of Hg^{2+} is $HgCl_2$), flue gas temperature, and other factors. As a result of this, the level of cobenefit mercury capture in the PM emission control devices or SO_2 scrubbers may vary based upon the type of equipment, the constituents in the coal, and other factors. NOx controls, such as Selective Catalytic Reduction (SCR) and combustion staging, can enhance the capture that is achieved in PM or SO_2 controls. Results of measurements of co-benefit mercury removal rates taken in response to the U.S. EPA's Information Collection Request (ICR) as part of the development of the federal Clean Air Mercury Rule and subsequent

test programs since the ICR program provided data that indicates that the following cobenefit removal rates may be expected:

- For pulverized-coal boilers firing bituminous coal and equipped with SCR, and ESP, and wet FGD, co-benefit mercury capture is expected to be about 90%.
- For pulverized-coal boilers firing bituminous coal and equipped with an ESP, co-benefit mercury capture is expected to be in the range of about 30%-50%.
- For boilers firing bituminous coal in a circulating fluidized bed (CFB) arrangement with a fabric filter, co-benefit mercury capture over 90% is expected to be achieved.
- For pulverized-coal boilers firing subbituminous coal and equipped with only an ESP, low co-benefit mercury capture is expected.
- For pulverized-coal boilers firing any kind of coal and equipped with only a hot-side ESP, co-benefit mercury capture is expected to be low.

Cobenefit controls may be optimized through a variety of techniques that are described in more detail in the TSD. Depending upon the fuel being fired and the boiler's configuration, optimization methods can significantly improve cobenefit mercury removal.

Mercury-Specific Controls, Especially Sorbent Injection

The previous section addressed the important factors impacting mercury capture by co-benefit from NOx, PM or SO_2 control technologies. As discussed, boilers that fire subbituminous coal – which there currently are many of in Illinois – are not likely to achieve high levels of mercury removal from co-benefits alone. Some of the bituminous coal fired boilers may not achieve adequately low mercury emissions by co-benefits alone. Therefore, these plants may need additional controls to achieve the levels of mercury removal that are being required in the proposed rule.

Although many mercury control methods are under development, sorbent injection is clearly the most developed. It is the only approach that has been tested on several coal-fired boilers firing a wide range of fuels. Power companies have entered contracts for commercial systems, some

with statutory requirements to achieve 90% or more mercury removal. Moreover, injection of sorbent, particularly Powdered Activated Carbon (PAC), has been used for mercury control on hundreds of municipal waste combustors in the United States and in Europe for several years. The equipment is fairly simple, relatively easy to install, relatively inexpensive in capital cost, and it is well understood. The sorbent, PAC, is widely available from several suppliers.

There are three ways that the sorbent can be admitted to the gas stream:

- Normal sorbent injection – upstream of the existing ESP or fabric filter and the most inexpensive approach. Typical capital cost is around $2/KW
- TOXECON – An acronym for TOXic Emission CONtrol device. This entails retrofitting a fabric filter downstream of the existing ESP and injecting the sorbent into the gas stream between the ESP and the fabric filter with the fabric filter capturing the sorbent. This approach has been shown to work very effectively to provide over 90% removal for any fuel. It also keeps captured fly ash segregated from captured sorbent, an advantage for plants that market their fly ash. However, this is a more costly approach, with higher capital cost than normal sorbent injection.
- TOXECON-II. This is a newer approach that entails injecting the sorbent between fields of the ESP. Upstream ESP fields capture most of the fly ash and downstream ESP fields capture the sorbent and a small amount of fly ash. This approach can have advantages for power plants that sell their fly ash.

Sorbent injection technology for mercury control from coal-fired boilers has been a very active area of research because the low capital cost of the technology and ease of retrofit make it an attractive retrofit control method. The TSD lists over three dozen full scale field trials on operating electric utility boilers that I am aware of – all but a few having been completed. These tests have been on a wide range of coals and boiler configurations. Some tests have lasted only a few days, some for over 30 days of continuous operation and at least one for over a year. Virtually all of this testing has been in the last five years and most in the last 2-3 years. So, the technology has advanced rapidly over the last few years and experience from just a few years ago may be obsolete. This is especially true when considering the new sorbents that have been developed specifically for use on coal-fired boilers.

Although untreated PAC, as is used in municipal waste incinerators, has been tested and shown to be effective in some coal-fired boiler applications, experience has shown that for most coal-fired boiler applications PAC sorbents that are treated with halogens on the surface of the PAC are much more effective. Unlike untreated PACs, which have a wide range of industrial applications, halogenated PAC sorbents were specifically formulated to address the mercury capture needs of coal-fired boilers. As a result, halogenated PAC sorbents are the current state-of-the-art for most applications and few users would consider untreated PAC for high removal rates except possibly where a fabric filter was installed.

Controlling Mercury from IL Units

It is my opinion that the coal-fired units in the state of Illinois are capable of meeting the requirements of the proposed mercury control rule at a cost close to that described in the TSD. Because of the different coal types and boiler configurations, not all units will use the same approach. There is a risk that a small number of coal-fired units in Illinois may need a Temporary Technology Based Standard (TTBS) until they bring their emissions reductions in compliance with the emission reduction requirements of the rule. However, this would result in a very small increase in the overall cost of the program over what is described in the TSD.

Most of the boilers in IL fire subbituminous coal. For subbituminous coals, such as Powder River Basin (PRB) coals that are used widely in Illinois, halogenated PAC has been shown to be very effective at several full-scale coal-fired boiler installations providing 90% or more removal. At several sites injection of the halogenated PAC has shown that it provides over 90% mercury removal at treatment rates of about 3 pounds of sorbent per million actual cubic feet of flue gas (lb/MMacf) when injected upstream of a cold-side ESP. This testing includes at least two 30-day continuous trials where 93% or more mercury removal was achieved over the period. This treatment rate for 90% or more removal is equivalent to about 200 pounds per hour of sorbent on a 300 MW plant at full load, or about $180/hour in sorbent cost with sorbent priced at about $0.90/lb. When injected upstream of a fabric filter, as will be possible on a few Dynegy units that, under consent decree, are required to retrofit fabric filters, the sorbent requirements are far

less and the mercury removal is even higher. For subbituminous coal, the results of the field trials with halogenated PAC sorbent at various sites have been remarkably consistent from site to site. The consistency of these results from site to site suggests high confidence in the performance on other units firing similar fuels, such as many of the PRB fired units in Illinois. There is a risk, however, that on some subbituminous-fired units the design of the existing particulate control device may limit the injection rate of sorbent due to PM control issues or the use of SO_3 flue gas conditioning may limit sorbent effectiveness – thereby limiting mercury emissions reduction. But, this risk is likely to be small due to the very low halogenated sorbent injection rates that have been shown to be necessary on PRB fuel fired boilers and because there are alternative flue gas conditioning methods that may be used. Therefore, I would expect few, if any units would use a TTBS until they could comply with the reduction requirements of the rule.

For those bituminous coal units that are equipped with SCR and FGD, they are likely already achieving close to 90% removal or the output based limit of 0.008 lb/GWhr. Those that are not already at these levels of control are close enough that they can achieve the remainder through an optimization method, such as scrubber optimization, or a scrubber chemical additive, which will be a modest cost. Or, these units may use sorbent injection to achieve the very modest incremental reduction needed. Most of the pulverized coal capacity firing bituminous coal that is not equipped with SCR and FGD are firing low to medium sulfur coal. Dynegy's Vermillion plant will be equipped with a fabric filter in the future. With the fabric filter I expect Vermillion will have very high cobenefit mercury removal – close to 90% - and can readily achieve over 90% removal with sorbent injection. There is also a bituminous unit at Marion that uses CFB technology and a fabric filter. Most likely, this unit already achieves over 90% mercury removal. But, it could easily add sorbent injection to achieve over 90% removal if necessary.

A small fraction of the unscrubbed bituminous capacity fires some high-sulfur coal. But, some of these units (Hutsonville) are reported to be shifting to low-sulfur western coal as they deplete their high-sulfur coal inventories. Full-scale tests have shown that halogenated sorbents can achieve high removal rates on low to medium sulfur bituminous coal, albeit at somewhat higher injection concentrations than for PRB fuels. Combined with some cobenefit removal, 90%

mercury removal with halogenated sorbent injection in the range of 6-7 lb/MMacf has been shown on low-medium sulfur bituminous units. For the unscrubbed high-sulfur coal capacity, less mercury removal is likely. However, the unscrubbed high-sulfur units are Meredosia boilers 1-4 and are small, low capacity-factor units that are co-located on a site with a much larger unit that fires low-sulfur western coal. I expect that the much larger Merodosia #5 is capable of over 90% removal with halogenated activated carbon. It is possible that Meredosia boilers 1-5 may be able to average under the provisions of the IL rule to achieve the facility-wide target emission reduction. Alternatively, it may be possible for the smaller Meredosia boilers 1-4 to shift to the same low-sulfur coal that is burned in #5, which I expect would address the concern. Or, these units might reduce mercury with sorbent injection and use a TTBS until they can bring their emissions within the control requirements of the rule.

There are two units in Illinois – Waukegan 7 and Will County 3 - that are equipped with hot-side ESPs and have not announced plans to install fabric filters. Using a TOXECON system, these units can readily achieve 90% or more mercury removal. TOXECON has been assumed for these units in the cost estimate of the TSD. Although TOXECON is more costly than a normal sorbent injection system, a TOXECON system offers advantages with regard to PM emissions control, lower sorbent usage, and also segregates the fly ash from the collected sorbent.

Cost of the IL Rule Compared to US EPA's CAMR

US EPA's CAMR rule sets a 2010 allowance cap that requires IL plants to remove about 70% of the mercury in the coal or purchase the equivalent number of mercury allowances. A stricter cap is required in 2018. Because a mercury allowance market does not exist yet and prices are very uncertain, relying on allowances for compliance with CAMR in 2010 is very risky. Moreover, subbituminous units are among the least expensive units to control with sorbent injection. As a result, I expect that most or all of the subbituminous units in IL will install sorbent injection systems regardless of an IL mercury rule. Therefore, the cost of the IL rule over that of CAMR during the period from 2010 to 2018 may be estimated as only the incremental cost from 70% control to 90% control and is mainly the cost of additional sorbent. When comparing the cost of complying with the proposed IL rule with the cost of complying with CAMR, I determined that

the state-wide incremental cost of the IL rule over CAMR was roughly $32-$37 million per year spread across all of the Illinois units for the period 2010-2018. In the event that some units comply through a TTBS until they can achieve the required mercury emission reductions, the cost difference will be only slightly higher. There is, however, a small risk that some units will be unable to comply with the rule as anticipated in the TSD due to the limitation on the allowable MW that may use a TTBS. In this case, these units will require more costly controls. However, I believe that the limitation on the amount of generating capacity that may use a TTBS is likely to be sufficient to address the small number of units that may require extra time to comply. Therefore, more costly controls are likely to be avoided.

In 2018 the CAMR allowance cap is such that it will require about 90% or more mercury removal from the coal or purchase of an equivalent number of allowances. Therefore, in 2018 and thereafter the IL rule incurs little or no additional cost of compliance over CAMR.

Costs are Likely to Be Less in the Future

The state-of-the-art of mercury sorbent technology is improving. As discussed in the TSD, there are several emerging sorbent technologies that may improve mercury capture performance beyond what is possible with the currently available halogenated PACs and will thereby reduce the cost of control while improving mercury capture efficiency. New activated carbon sorbent formulations that are designed to address higher sulfur applications will be tested this year. Mineral-based sorbents are also under development and these sorbents are designed to address concerns about the impact of sorbent on marketable coal combustion products. These new sorbents are designed to work with the same PAC injection systems that utilities would install for compliance with the IL rule. So, investments in hardware will not be wasted if utilities switch to newer, improved sorbents that will likely be available in the future. Therefore, it is likely that in 2009 and beyond the mercury removal technology performance will be greater than it is now and the cost will be less than what I have estimated with today's state-of-the-art.

STATE OF ILLINOIS)
) SS
SANGAMON COUNTY)

AFFIDAVIT

I, James E. Staudt, Ph.D., upon my oath, do hereby state as follows:

1. I am the President of Andover Technology Partners.
2. I have been retained by the Illinois Environmental Protection Agency (Illinois EPA) as an expert in R06-25, *Proposed New 35 Ill. Adm. Code 225, Control of Emissions from Large Combustion Sources (Mercury)*.
3. I have reviewed the Illinois EPA's Motion to Amend Rulemaking Proposal to add a new Section that includes provisions for a Temporary Technology-Based Standard and have amended my testimony to address such a standard.
4. To the best of my knowledge, the testimony is true and accurate.

FURTHER AFFIANT SAYETH NOT.

James E. Staudt, Ph.D.

Subscribed and sworn to before me
this 23rd day of MAY, 2006

Notary Public

Theresa M. Kondrat
Notary Public
My Commission Expires
June 11, 2010

STATE OF ILLINOIS)
) **SS**
COUNTY OF SANGAMON)
)

CERTIFICATE OF SERVICE

I, the undersigned, an attorney, state that I have served electronically the attached MOTION TO AMEND RULEMAKING PROPOSAL, MOTION FOR LEAVE TO FILE INSTANTER AMENDED TESTIMONY OF JAMES E. STAUDT, Ph.D., and AMENDED TESTIMONY OF JAMES E. STAUDT, Ph.D. upon the following person:

Dorothy Gunn
Clerk
Illinois Pollution Control Board
James R. Thompson Center
100 West Randolph St., Suite 11-500
Chicago, IL 60601-3218

and mailing it by first-class mail from Springfield, Illinois, with sufficient postage affixed to the following persons:

SEE ATTACHED SERVICE LIST

ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY,

_____
Gina Roccaforte
Assistant Counsel
Division of Legal Counsel

Dated: May 23, 2006

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