ORIGINAL

ILLINOIS POLLUTION CONTROL BOARD

August 16th, 2006

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

TRANSCRIPT OF PROCEEDINGS held in the above-entitled cause before Hearing Officer Marie E. Tipsord, called by the Illinois Pollution Control Board, pursuant to notice, taken before Cheryl L. Sandecki, CSR, RPR, a notary public within and for the County of Lake and State of Illinois, at the James R. Thompson Center, 100 West Randolph, Assembly Hall, Chicago, Illinois, on the 16th day of August, A.D., 2006, commencing at 1:30 p.m.

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Mr. Nicholas J. Melas, Board Member
Mr. Thomas Fox, Board Member
Mr. Thomas Johnson, Board Member

HEARING OFFICER TIPSORD: Let's go ahead and go back on the record. I believe we are at question 40 unless -- we were going to give you guys the break at lunch to look at the table. Do you have any questions on Exhibit 85, is it?

MR. AYERS: I think we will get to it.

HEARING OFFICER TIPSORD: You will get to it later on in the context of the questions.

Okay. Then we will go to question 40.

MR. CICHANOWICZ: Question 40, is it your opinion that an air pollution control technology should not be deployed until such a point that the utility industry determines that there is sufficiently little risk of there being problems with the technology?

Environmental controls should be deployed with the risks and uncertainties are commensurate with other factors that determine utility station reliability. My understanding of utility plant equipment evolution is that devices such as burners, pulverizers, feedwater heaters, condensers and other equipment that are first-of-a-kind designs require one year of commercial operation prior to being designated as a commercial development.

In the same manner, I believe one year of continuous operation with sorbent injection and other controls should be a prerequisite before broad application.

Question 41 --

HEARING OFFICER TIPSORD: Mr. Ayers has some follow-up.

MR. AYERS: In light of your answer, Mr. Cichanowicz, that there should be a year -- you testified there should be demonstrations of a year for every application, what would motivate power plants to do those kinds of long-term testing? Why would they want to certify a technology that is only then likely to be imposed upon them with the cost of money?

MR. CICHANOWICZ: Well, I feel this

is ground we have gone over before. It is to respond to a regulation.

MR. AYERS: I think it is a little different. You are talking about they are doing a lot of work ahead of time, a lot of testing and a lot of trying out the new technology before we move to regulation. And I have said, it is true, we have asked questions about what drives innovation before. I think it is a slightly different question.

If you are a utility and you think that the rule is that a one-year demonstration is the minimum, why would you do that?

MR. CICHANOWICZ: Why would you do what?

MR. AYERS: Why would you run a one-year demonstration if you knew that the regulatory agency wouldn't act without a one-year demonstration? Why would you put yourself in that position? Why would you invest money in developing the technology?

MR. CICHANOWICZ: I'm sorry, Mr. Ayers, I don't see why this is any different than what we have talked before. I am happy to go over it again with you.

But the question was are -- the question was directed to the risks. And there are certain levels of risks of new technologies, regardless of whether they are for environmental control or performance improvement.

And all I am saying is that conventional industry practice from most of the boiler manufacturers I spoke to says they want about a year under their belt before they offer something commercially. All I am saying is not every mercury technology, but certainly some of the ones we are talking about, would benefit from one year of operation so you actually learn performance capabilities.

MR. AYERS: Let me rephrase it. Do you think that mercury regulation like the one that is under consideration by the board should be held hostage to one-year demonstrations?

MR. ZABEL: I think that's your characterization, not his, Mr. Ayers.

MR. AYERS: That's my characterization.

MR. CICHANOWICZ: I think the regulation should be dependent upon reliable, informed data. And today, despite the very impressive work that has been done, except for the Gaston application, which ran for, we spoke about it yesterday, 12 months, all of the data that's available is parametric data, short-term data of hours or these 30-day tests, which are a very important percent. So that's all the data that is available.

And I think that's -- I think that's -- it's difficult to design a regulation in my opinion based on that data because we still haven't had a chance for the impacts to play out.

MR. AYERS: What role, if any, do you think that public health concerns should play in this kind of decision of when to deploy a new technology?

MR. CICHANOWICZ: Well, you know that's completely outside of my still set, Mr. Ayers.

MR. AYERS: Well, you have said that you think it should await long demonstrations until those in the power industry are comfortable with the technology. I am raising the point if there are other considerations there. I want to ask about that.

MR. CICHANOWICZ: Are you asking? Do you want me to answer?

MR. AYERS: Please do answer.

MR. CICHANOWICZ: I am sorry, I am having a hard time hearing the end of your sentence.

MR. AYERS: If you would like to answer about the role you see for public health considerations, please do.

MR. CICHANOWICZ: I don't have an opinion.

HEARING OFFICER TIPSORD: Okay.

Mr. Harley, you had a question?
MR. HARLEY: In follow-up to your response about the need for a period of time for technologies to be fully developed before implementation, you are familiar with the provisions of the proposed rule which indicate that the compliance date is more than a year away, aren't you?
MR. CICHANOWICZ: Yes.
MR. HARLEY: The compliance date, in fact, is three years away, if the rule were finalized according to the schedule that the agency is proposing?
MR. CICHANOWICZ: Yes.
MR. HARLEY: And during that three-year period of time, there would be 36 months of opportunity for utility companies -- effected utility companies to perfect the technology to the best they could to employ an output standard, a 90 percent standard, to take advantage of the opportunity to average units, to opt into the TTBS. And if it is a feature of

the final rule, to take advantage of the multi-pollutant strategy.

MR. CICHANOWICZ: Is that a question?

MR. HARLEY: It was a question. All of those things could take place within that three-year period of time?

MR. CICHANOWICZ: Well, that presumes -- I guess that presumes success, doesn't it?

MR. HARLEY: It presumes that there is a much longer period of time that you are imposing as an impediment of this rule being finalized.

MR. ZABEL: That is a mischaracterization.

MR. HARLEY: There is more than one year. There is three years.

HEARING OFFICER TIPSORD: Thank you. Mr. Nelson?

MR. NELSON: Sid Nelson. Are you aware of any utilities other than the TOXECON at Gaston that have done an ESP standard sorbent injection demonstration

for a year period yet?
MR. CICHANOWICZ: No.
MR. NELSON: Are you aware of any that have volunteered or have plans for a year demonstration of the standard ESP duct injection mercury control?
MR. CICHANOWICZ: No.
MR. NELSON: If the utility industry has had a couple years seeing these mercury regulations perhaps coming and if it is so critical to have this year, in addition to the experience with unburned carbon, don't you think that it would behoove them in their own best interests if it is so critical to have voluntarily done one of these right now or at least offer to do them in the future?
MR. CICHANOWICZ: Perhaps. It's a general question.
MR. NELSON: Would it be more consistent to think that all these 30-day tests, okay, are sufficient -- let me rephrase the question.
If, in fact, all these 30-day tests

are sufficient to demonstrate this, would that be more consistent with the observation that a whole year doesn't really have much value or would that be less consistent with the view that a whole year is so critical?

MR. CICHANOWICZ: Well, the one year -- the reason why that time period is important is because, remember, coal has a lot of trace elements in it. And the concentration is quite loaf. And it just takes time for a lot of these trace elements to accumulate to a certain level within a certain site.

You are tired of hearing about hot-side ESPs. But it took a year for the sodium to deplete in the layer adjacent to the emitting electrode. With scrubbers, the high chloride content of the sorbents takes a year. It takes long periods of time to accumulate. And again in the late '70s burning of high chloride coals, it took awhile to understand the corrosion problems because it requires time for those things to accumulate.

That's the purpose of the time constant. So I don't see how adding together consecutive 30-day demonstrations addresses that issue.

MR. NELSON: Do the hot-side ESPs today meet the particular requirements that they are required to meet?

MR. CICHANOWICZ: A lot of hot-side ESPs have been replaced and converted to cold-side. Some, at least Gaston, is augmented with a fabric filter. Some have been augmented with the cold-side. Others -- and I don't know the fraction, if they are still operating -- use, essentially -- I understand they come down and basically water wash the electrodes at three-point intervals to remove the layer of ash that's adhered to the emitting electrode. That's the problem.

So they work, but they are far from ideal. And everybody I know has not walked, run from them. That's why Pleasant Prairie is what it is today.

Because the designers -- the design for that was initially a hot-side unit. And when all these problems came up, the low NOx burner and the owners decided to go to the cold-side. That is why the duct work is so convoluted.

MR. NELSON: But today, in fact, about ten percent of the ESPs in the power industry are hot-sided, right?

MR. CICHANOWICZ: That is correct. And they absorb operating maintenance issues that they would prefer not to.

MR. NELSON: Last question, given all the 30-day test runs that have been done already and all the ones that are planned for the next two years as well, on all the different configurations and all the different coal types, would it be fair to say with respect to major air pollution control for utilities that this is by far the most pretested technology compared to SCR or SNCR or low NOx burners, compared to the major hot-side ESPs, that this is by far the most pretested technology that this country has ever seen?

MR. CICHANOWICZ: Well, as I said earlier, six or seven conferences a year, you can be a pro going to all of them. So there is a lot of data and there is a lot of work, yes.

HEARING OFFICER TIPSORD: Okay. Mr. Harley had his hand up.

MR. HARLEY: Just very quickly, are you familiar with the provisions of the Illinois Environmental Protection Act, Illinois Administrative Code that allow any person to seek to amend, remove or propose a rule before the Illinois Pollution Control Board?

MR. CICHANOWICZ: No, Mr. Harley, I am not.

MR. HARLEY: So you are not familiar with the process that could take place any time within the three years before these rules become effective that any party could appear before this Board and present evidence to this Board that, in fact, the rule that had been finalized was not justified?

MR. ZABEL: I think he answered that question with the prior one.

MR. HARLEY: Thank you.

HEARING OFFICER TIPSORD: Mr. Ayers?

MR. AYERS: Just a couple questions. I want to try to sum up on your question of the one-year demonstration, if I may.

MR. CICHANOWICZ: Please.

MR. AYERS: Is it correct then to say that your feeling is that the industry -- you yourself and probably the industry would be much more comfortable with meeting a mercury regulation like the one under consideration here if you had some test -- and I won't specify how many -- that had been run for a year or more?

MR. CICHANOWICZ: Yes. If those tests addressed the issues of concern for the state or rule, yes.

MR. AYERS: Granted. But is it also fair to say when the Board -- when the Board considers this proposal, it needs to consider factors or it may consider factors that go beyond those of whether the utility industry is comfortable with the technology because of its responsibility for public benefit?

MR. ZABEL: I believe that's a question that goes to the Act and he already stated he isn't familiar with it.

But you can go ahead and answer it, if you can.

MR. CICHANOWICZ: I understand that the needs of the power industry aren't the only issues that will be addressed.

HEARING OFFICER TIPSORD: Question No. 41.

MR. CICHANOWICZ: In section 3.3 of your testimony, you mentioned that the Franken plant in Germany installed in 1987 to '89 was the first to achieve 90 percent reduction. Okay. That's a statement, not a question. Question A, were not the German plants subject to a specific emission limit that could be complied with through SCR with lower than 90 percent removal in most cases?

The German plants were required to reduce NOx to the equivalent of approximately 100 ppm without the ability to average emissions over several units at one station. The Franken plant is a wet-bottom boiler that generated significant NOx of over 1,000 ppm and thus required in excess of 90 percent NOx reduction to achieve the 100 ppm limit.

Question B, what motivation would a plant have to operate a higher removal rate which would incur more ammonia cost and risk higher ammonia slip?

Given the fixed unit specific limit of 100 ppm the higher NOx removal compared to an average of 83 percent was not an option for the owner but a requirement to comply.

C, since there is not a citation here, what is your source for this information on German plants?

This information is based on a personal visit and discussion with the operators at Franken in Germany and accompanied by representatives of the catalyst supplier, which was Siemens, in June of 1998 and follow-up meetings in 2001 and 2002.

42, in the second paragraph on page 21 of your testimony, you describe a plant that had an SO3 plume. Which plant are you referring to?

American Electric Power's Gavin Station.

HEARING OFFICER TIPSORD: Mr. Ayers?

MR. AYERS: Was this plant not equipped with a wet FGD system downstream of the SCR?

MR. CICHANOWICZ: A wet FGD system?

MR. AYERS: Downstream of the SCR?

MR. CICHANOWICZ: Yes, it was.

MR. AYERS: Does a wet scrubber play a role in SO3 plumes?

MR. CICHANOWICZ: A wet scrubber can play a role in SO3 plumes, yes.

MR. AYERS: In your opinion was the SCR supplier at fault for the plume?

MR. CICHANOWICZ: In my opinion the

catalyst that was installed at Gavin had too high of an SO2 to SO3 conversion rate. And I don't know if it was the catalyst supplier, the process supplier or anybody else, but the specification for SO2, SO3 had not been properly considered in that design.

MR. AYERS: This is a kind of situation which occurs and you have referred to this kind of problem in your testimony. In your view who was in the best position to foresee and prevent this kind of problem from arising?

MR. CICHANOWICZ: Who was in the best position foreseeing to prevent that?

MR. AYERS: Yes.

MR. CICHANOWICZ: People writing the specification or preparing the design.

MR. AYERS: And those were?

MR. CICHANOWICZ: I don't know. It might have been AEP. It could have been the supplier. I was not -- I was not involved in that particular project, so I don't know.

MR. AYERS: Wouldn't the supplier write the specification -- I'm sorry.

Wouldn't the buyer, who is American Electric Power, been the one to essentially specify what the unit should look like and what it should do?

MR. CICHANOWICZ: That's true. But, you know, a lot of times the suppliers come to the utilities and say fear not, you don't need your expertise, you have us. A lot of the suppliers offer the option that all they have to do is be hired and there will be a no-risk solution.

And again I am not privy to the conversations that went on between them. But all I can say is that the catalyst that was consulting in that process, the buyer of SO2, SO3 conversion was appropriate.

MR. AYERS: Well, AEP didn't want to create an SO3 problem. So were they not in position to prevent that by the way they described the work they wanted done?

MR. ZABEL: I think he testified and answered that question. He doesn't know.

MR. AYERS: I'm not sure what the answer was, if there was an answer.

HEARING OFFICER TIPSORD: I was going to say could you -- I agree, I am not sure I followed what the answer was either.

MR. CICHANOWICZ: But my point is that I don't know who wrote the specification. And with evolving technology, a lot of times basically the supplier is in a stronger position than when the owners write the specification.

For example, if I was writing the specification for ACI, I would have put in provisions to make sure it didn't trip and create excess particulate matter through the breakthrough in the sorbent. But every supplier, as you probably heard so far, would take responsibility for it, but it doesn't always work out that way.

MR. AYERS: I bring it up because your testimony seems to suggest that the difficulties of this sort, that happen in the development of technologies, should shape the public policies that are adopted. And I want to put that as a question.

Do you think that taking Gavin, as an example, that the law should have made allowances for those failures or should it insist on compliance and place the burden on the company to make sure that failures like that don't occur?

MR. CICHANOWICZ: Well, is the burden on the company or is it on the supplier, I'm not sure. Again, I wasn't privy to all those that went out -- to those specifications that went out.

HEARING OFFICER TIPSORD: If I may, Mr. Ayers, I think the question is whether or not whoever was responsible for the problem --

MR. CICHANOWICZ: Yes.

HEARING OFFICER TIPSORD: -- that ultimately the company is the one who has to pay the fine, at least in Illinois.

MR. CICHANOWICZ: Okay.

HEARING OFFICER TIPSORD: But I think the question is is it your position -- is it your testimony that the law should be written to make allowances for those types of failures?

MR. AYERS: Yes.

MR. CICHANOWICZ: I think with an evolving technology, there has to be the flexibility to accommodate that there is going to be these kind of events. And there needs to be some flexibility built in.

MR. AYERS: Will you acknowledge then the incentives change when you do that, the incentives if the compliance is required are to take whatever steps are needed? And if the law makes allowances, then the incentives to do that become much less, isn't that correct?

MR. CICHANOWICZ: That is true, the incentives become less.

MR. AYERS: Could we talk some more about your discussion of FGD systems? Can

you tell me what an FGD system costs for a
power plant of 500 megawatts, let's say,
in rough terms?

MR. CICHANOWICZ: This is a new plant or a retrofit?

MR. AYERS: Both, if you can do that.

MR. CICHANOWICZ: Well, I think new plants, when you start with the green fields with nothing there but dirt, is probably, you know, a couple hundred dollars kilowatt in today's market. I think when you look at the retrofit costs may go up considerably from that to three to $400 a kilowatt. And that is just based on press releases that you can pull up off the Internet.

MR. AYERS: What would that translate to in terms of dollars for a 500 megawatt plant?

MR. CICHANOWICZ: Well, it is about a hundred million if it is $200 a kilowatt, right.

MR. AYERS: And twice that for

retrofit?

MR. CICHANOWICZ: Yes.

MR. AYERS: How long does it take to build an FGD system?

MR. CICHANOWICZ: Well, first of all, I want to acknowledge this, the construction and time lines are a little out of my skill set. I will be happy to answer these, as best I can. But there are people that know a lot more about this than me that are scheduled to testify. And I would -- any conflict in testimony I would defer to them.

MR. AYERS: All I would like is a rough formed estimate.

MR. CICHANOWICZ: I believe it is -- the question like everything else, what's the scope, where do you begin. I think the number of 18 or 20 or 22-months is about right. But I hear owners say that's unrealistic because it is going to take 12 months to get the permit.

So if you were to exclude the issues of permitting, I think 18, 20, 22 months is probably about the number that you are seeing. And it depends. If it is a custom design, it is probably closer to 24. If it is like what Duke Power has done and essential design modules that fit into all of their plants, it is going to be less. It is less engineering and they can set it up easily.

MR. AYERS: Two to three years might be a pretty good estimate as a rule of thumb?

MR. CICHANOWICZ: Yes.

MR. AYERS: And would you also agree that the scrubber process chemistry is very complicated? If I remember, I believe in the days when people described putting a scrubber on a power plant as adding a chemical factory to a generating plant.

MR. CICHANOWICZ: Well, I described earlier my first years at EPRI, I didn't work in the FGD processor, but my colleagues did, and there were six or seven of them that for five years did nothing but try to unravel the intricacies of the chemistry.

MR. AYERS: So considering the cost and complexity of the new FGD system, the time it takes to build it, if somebody had a new FGD design, a new and improved FGD design, wouldn't it take several years and an awful lot of money to demonstrate that?

MR. CICHANOWICZ: Well, not necessarily. There is actually -- I guess it depends on what you mean by new design. Alstom has a new reactor design that they are marketing that actually came out of a system built in a plant someplace where they basically rebuilt an existing system into a new contactor. And those people were able to market it through Alstom.

And I would -- I don't know to what extent orders for that units have been placed. But it may or may not, depending on the experience factor.

MR. AYERS: It is likely the test of a new FGD system would cost two orders of magnitude or more than the test that ACI

systems that are going on now, wouldn't
you say?
MR. CICHANOWICZ: A test, I guess it depends on what you mean by a test. You know, the scrubber chemistry we are pretty comfortable with. It's getting the mass transfer over the amount of pressure drop that you want to expend. So I don't know what you mean by test. Can you help me?
MR. AYERS: Let's do it historically then. How long did it take us to understand that chemistry and how much money was invested in understanding that?
MR. CICHANOWICZ: It took at least ten years.
MR. AYERS: And multiple hundreds of millions or billions?
MR. CICHANOWICZ: Well, not billions. But multiple hundreds of millions.
MR. AYERS: And the ACI demonstrations and tests by comparison are at least two orders of magnitude level drop?

MR. CICHANOWICZ: Well, yes, but it is a differing --

MR. AYERS: It is a different technology.

MR. CICHANOWICZ: The FGD was a capital intensive device. And the reagent cost was lost in the noise of the capital.

Here it's the inverse. It's the reagent cost that drives the process.

MR. AYERS: But the entire capital and reagent posture are still a couple of orders of magnitude lower than they are for FGDs, right?

MR. CICHANOWICZ: Well, if you are -- it depends. If it is just putting sorbent into an ESP that you are comfortable is going to sustain the injection rate, it is lower.

MR. AYERS: Can we talk about SCRs for a moment?

MR. CICHANOWICZ: Please.

MR. AYERS: Would you have similar statements about SCR, that the systems are relatively costly and take a relatively long time to build?

MR. CICHANOWICZ: I think the -- they don't cost as much as an FGD. And I don't think they take quite as long to install. Instead of the 18 to 24 months, you are probably looking at, you know, shaving at least three for four months off that.

MR. AYERS: Still if it is -- similarly, if you had a new design or a new process, catalytic process that you wanted to test, you would be talking about a substantial lead time before you could demonstrate that; isn't that correct?

MR. CICHANOWICZ: A new catalytic process? You mean if it is a different catalyst, it is probably -- no. In fact, I am involved in programs right now where we are trying to develop alternative catalysts and it is splitting into the existing reactor. But if it is a complete new process, then yeah.

MR. AYERS: I don't want to try to be a process chemist, because I am not. I am basically saying if you -- if you had a new selective catalytic mousetrap that you needed to demonstrate that was different from what we have seen, wouldn't we be talking about lead times that would stretch out over two, three years before you -- before you would see the results of the test to find out whether that mousetrap worked?

MR. CICHANOWICZ: Perhaps on that order. It is not months; it's multiple years.

MR. AYERS: And you would say the same kind of thing for ESPs or fabric filters or any other large piece of equipment, that these control equipment that these units use, tests of new units would take a lot of money and a lot of time?

MR. CICHANOWICZ: Depending on the diversion of the new technology from what's in the mainstream, yes. I want to be real careful because I don't want to over generalize.

MR. AYERS: Understood. Small innovations probably don't do this.

I wanted to get to this question. Would you agree that the sorbent injection system where a new fabric filter is not installed, we are excluding TOXECON, is considerably less expensive than an SCR or any of these other systems?

MR. CICHANOWICZ: Yes. If we are talking about sorbent injection systems, yes.

MR. AYERS: And it takes substantially less time to build?

MR. CICHANOWICZ: Agreed, yes.

MR. AYERS: So would it be fair to say that some of the impediments to development and testing of scrubbers and SCR units and some of the other technologies do not exist to the same extent with respect to the ACI technology?

MR. CICHANOWICZ: Because the need for the regulation is already there, I don't know.

MR. AYERS: No. I am just asking

whether the impediments were much larger in the case of those large complicated, sometimes chemically complicated systems as compared with this relatively uncomplicated system.

MR. CICHANOWICZ: Well, mechanically it is certainly uncomplicated. But we would like to -- we want the one year of testing to make sure that we can say that, make that statement with certainty. But it is a less complicated system, certainly.

MR. AYERS: Comparatively, it is certainly less.

MR. CICHANOWICZ: Right.

MR. AYERS: Are you aware of any other industrial uses of activated carbon injection?

MR. CICHANOWICZ: Oh, I think it is used a lot at the water treatment and in waste-to-energy facilities.

MR. AYERS: Waste-to-energy facilities?

MR. CICHANOWICZ: For mercury

control in waste-to-energy facilities mostly in Europe.

MR. AYERS: Air pollution?

MR. CICHANOWICZ: Yes.

MR. AYERS: Is there an EPA requirement on this?

MR. CICHANOWICZ: I actually don't know. There probably is.

MR. AYERS: Do you know how many incinerators or waste-to-energy plants have installed ACI?

MR. CICHANOWICZ: No, I don't.

MR. AYERS: Is it a substantial number? Dozens would you say?

MR. CICHANOWICZ: No. It might be more than that. Dozens, yes. But again we are talking about a different --

HEARING OFFICER TIPSORD: Excuse me, just a point of clarification. I thought I understood you to say most of the waste-to-energy facilities that have installed ACI are European. Did I hear that correctly?

MR. CICHANOWICZ: I said that, but I

didn't mean to exclude there are some in the U.S. This database of applications is not something I look at a lot, so I am guessing.

HEARING OFFICER TIPSORD: I wanted to clarify it wasn't exclusively European.

MR. CICHANOWICZ: No, it is not exclusively European.

MR. AYERS: Did you say that the chemical composition of fly ash and flue gas from a waste incinerator is more or less variable than that of a coal fired boiler that tends to fire a particular coal?

MR. CICHANOWICZ: It is probably more desirable simply because the mercury comes from a lot of things that go in in large pieces. So I think -- again this is out of my skill set. But my understanding has been that mercury content is much more highly desirable. But also the flue gas chloride is so much higher in the incinerator. And the sulfur is low. And there is other differences as well, particular loading as well.

MR. AYERS: Do you think then that the experience with municipal waste incinerators is helpful or not helpful in dealing with issues in implementing ACI in the power industry?

MR. CICHANOWICZ: I think it is certainly helpful to a point, helpful to a point of understanding. I think it has been key to getting us as far as we have gotten. But there is a limit because of the gas composition.

MR. AYERS: And compared, for example, to FGD, there was no similar technology experienced with that kind of system when you first started work and you tried to put those units onto power plants; is that correct?

MR. CICHANOWICZ: I believe that's true, yes.

MR. AYERS: It would appear that you have a leg up here compared to some of those previous examples that you cited?

MR. CICHANOWICZ: I think that's a

fair statement.

MR. AYERS: Could we turn to the SNCR technology? Are you familiar with that technology, selective noncatalytic reduction?

MR. CICHANOWICZ: Yes.

MR. AYERS: In terms of cost and complexity, would you say that is more like an FGD system or more like a sorbent injection system?

MR. CICHANOWICZ: I would say it is more like a sorbent injection system.

MR. AYERS: Was the first commercial SNCR system from a coal-fired boiler installed at what was then called the New England Power Company's Salem Harbor Station around 1993?

MR. CICHANOWICZ: I think that's about right. But there might have been one or two preceding it in '91 I believe. I'm recollecting Wisconsin Electric's Valley Station tried something around that time. But I don't think that's far off.

MR. AYERS: Do you recall the Valley

Station?

MR. CICHANOWICZ: I thought there was something called the Valley Station in the Wisconsin Electric System. But I can't remember if it was '91 or '94.

MR. AYERS: Could that have been a trial rather than a commitment to install for good?

MR. CICHANOWICZ: It could have been, yes.

MR. AYERS: Is it not correct to say that the Salem Harbor SNCR continues to operate and the plant currently relies on them to keep NOx emissions in check?

MR. CICHANOWICZ: I believe that's true. I haven't spoken to anyone there for a long time. But I believe it is still operating.

MR. AYERS: So you would say that so far as we can tell, the installation is a success?

MR. CICHANOWICZ: Yes.

MR. AYERS: When that unit was installed, were there any coal-fired SNCR

systems operating for over a year at a
time on any kind of test basis or any
other basis?

MR. CICHANOWICZ: You really are
testing my memory. Why didn't you make
this a question? I have all this stuff in
my office.

I don't remember. There was a lot
of activity going on around that time.
And I know Salem Harbor was a key point.
I just can't remember exactly if there
were any preceding or not on coal.

MR. AYERS: But you don't recall any
one-year tests prior to this installation?
None that stick in your mind?

MR. CICHANOWICZ: Correct.

MR. AYERS: We have a couple of
exhibits that we would like you to look
at, if I may.

MS. BASSI: May I do a follow-up?

HEARING OFFICER TIPSORD: You sure
can.

MS. BASSI: Mr. Cichanowicz, what
was the level of NOx removal required at

Salem Harbor, if you can recall?

MR. CICHANOWICZ: I don't know at Salem Harbor. But selective noncatalytic reduction -- and we had big debates about this -- the numbers were anywhere from 20 to 40 percent removal. The issue was ammonia slip. And I don't know what the Salem Harbor came in at. I am thinking a paper presented at a conference in 1995 by a guy named Staudt. See, I remember your papers. I think it was 28 percent. But the author is here, and he will correct me.

MR. STAUDT: Actually, I presented another paper.

MR. CICHANOWICZ: But they were on the order of -- 20 to 40 percent was on the order of the numbers people were expecting.

MR. AYERS: We understand it's less effective in that sense of technology than SCR. But we are looking at it in terms of its similarity to what we are considering now.

As I said, we have two exhibits we would like to look at.

HEARING OFFICER TIPSORD: I have been handed "Post Combustion NOx Control for Coal-Fired Utility Boilers" authored by Hoffman, Johnson, Nalco Fuel Tech of Naperville, Illinois, and "Cost Effectiveness of NOx Control Retrofit at Salem Harbor Station."

The first document "Post Combustion NOx Control" I will mark as Exhibit 98, if there is no objection. Seeing none, we will mark that as Exhibit 98. And the second one we will mark as Exhibit 99, if there is no objection. Seeing none, that's Exhibit 99.

MR. CICHANOWICZ: Mr. Ayers, you are toying with me. Because I am reaching for validity in my memory and you have it on paper in front of you.

MR. STAUDT: I wanted to tell you you would find out in a minute.

MR. AYERS: Could you look at the fourth page of Exhibit 98.

MR. CICHANOWICZ: Who is the lead author?

MR. AYERS: They are not numbered, so it is the fourth.

HEARING OFFICER TIPSORD: 98 is "Post Combustion NOx Control," Hoffman.

MR. AYERS: Hoffman is 98.

HEARING OFFICER TIPSORD: And 99 is the "Cost Effectiveness of NOx Control Retrofit" at Salem Harbor.

MR. GIRARD: Could I ask a quick clarifying question?

HEARING OFFICER TIPSORD: Sure.

MR. GIRARD: Mr. Ayers, on Exhibit 98, what is the date of that? Is this a presentation? I am not finding everything I need for a reference.

MR. AYERS: It was published -- it was a paper presented at the 1993 EPRI EPA NOx control symposium in a place called Val Harbour, Florida, May 24 through 27.

Could I direct you to the fourth page there? In the middle of that first full paragraph, there is a sentence which begins "NEPCO selected unit No. 2." Would you read that?

MR. CICHANOWICZ: "NEPCO selected unit No. 2 at the Salem Harbor Station for demonstration that is currently undergoing long-term characterization. NEPCO's demonstration was divided into two phases: A short-term optimization/parametric phase, five weeks, followed by a long-term assessment phase, two to three months."

MR. AYERS: And would you take a look at Exhibit No. 99, page 3? And at the top of the page, could you read those two sentences?

MR. CICHANOWICZ: Page 3, "In November 1992," is that it?

MR. AYERS: Yes.

MR. CICHANOWICZ: "In November 1992 New England Power and the Massachusetts Department of Environmental Protection agreed to establishing goals for reducing NOx emissions. The document established goals for reducing NOx levels in units 1, 2 and 3 and proposed technology combinations to achieve the goals. The proposed NOx control technologies were low NOx burners, LNBs, and SNCR."

MR. AYERS: And could you read the last sentence at the bottom of that page?

MR. CICHANOWICZ: "Completed in early 1993, the successful unit 2 SNCR demonstration was followed by commercial contracts to NFT for NOxOUT systems to be installed on units 1, 2 and 3. With installation by New England Power, all three systems were operational by August 1st, 1993."

MR. AYERS: So doesn't this mean that the utility tested this system for less than a year and then installed the new technology at full scale in three units?

MR. CICHANOWICZ: Well, first of all, number one, these units are small. Salem Harbor units are 90 megawatts, 9-0. So I think the whole paradigm on how to evaluate things for a small unit are different than on a larger unit.

Second of all, the concern with SNCR, as I remember, was simply the ability to get NOx removed without generating residual ammonia. And it was a matter of matching the injection to a very narrow window in the furnace.

The downside, that is risks that have to be incurred by the utility if there was a problem with this, was generating excess ammonia, which you could pretty much correct that by just cranking down the ammonia injection.

So my point is it was a fairly safe system. And that if you had a problem, you could crank down on the ammonia and essentially restore the residual level of ammonia so it didn't contaminate or damage the fly ash.

With electrostatic precipitation, you know, again, we are talking about the accumulation of ash on a collecting plate and as -- I don't want to keep going back to this the hot-side ESP takes a very long period of time for a very thin layer of ash adjacent to the plate to change its electrical characteristics to the point where it essentially rendered the -- caused significant operating problems.

And with the sorbent injection is the concern it will do the same. We are talking about things that are going to take a long time. You know, the time constant for accumulation and completion of these trace species is very different than what happened in the SNCR.

So you are right, it took less time. But it was a different technology. It had I think some exit ramps.

MR. AYERS: There was an emission, though, that had to be met?

MR. CICHANOWICZ: Yes, there was.

MR. AYERS: So you couldn't crank back on the ammonia too far.

MR. CICHANOWICZ: Well, you could. But you have to push your low NOx burners a little further and risk more carbon.

MR. AYERS: Could I ask you to take a look at page 5 of Exhibit 99 for a moment?

MR. ZABEL: Which exhibit, Mr. Ayers?

MR. AYERS: 99. And could you read the first statement under conclusions of this paper?

MR. CICHANOWICZ: Under conclusions?

HEARING OFFICER TIPSORD: Yes.

MR. CICHANOWICZ: "New England Power, Salem Harbor Station, has a NOx emission rate goal of 0.33 pounds per million BTU for units 1, 2 and 3. These pulverized coal, PC, fired units have been retrofitted and operated to achieve these goals in combinations of combustion and post-combustion NOx control technology as follows." Would you like me to read the matrix that beings here?

MR. AYERS: Not beyond the colon.

MR. CICHANOWICZ: Okay.

MR. AYERS: So you agree this statement states that the SNCR technology is installed and operating on the Salem Harbor units and meeting an emission standard?

MR. CICHANOWICZ: Yes.

MR. AYERS: To your knowledge, are there other SNCR systems operating on coal-fired units in the U.S.?

MR. CICHANOWICZ: Yes, there are.

MR. AYERS: Didn't several other coal-fire utilities install this technology within a few years, again without a lengthy demonstration program?

MR. CICHANOWICZ: Well, yes. But the -- my recollection is that all of the SNCR units are still relatively small on the order of a couple hundred megawatts of capacity.

Personally, one of my consulting assignments was working with PSE&G Mercer helping them on one-eighth of a unit. And I know we looked at that.

But I don't think -- the largest SNCR installation I can think of is not above a couple hundred megawatts capacity.

MR. AYERS: Would there be other reasons that might explain that, like it might be more economical to use an SCR unit on your large units?

MR. CICHANOWICZ: Well, I don't know if it is economical. I just think what we found was -- actually, what a number of researchers found was that as you got -- as you went up in generating capacity, the -- you know, the challenges of mixing became to the point where you weren't able to get the reagent mixed up within a short period of time. And you would be restricted in terms of NOx removal.

So I don't know if it was economical. I think for large units people haven't had the confidence to go to extremely high -- they go to very large -- to very large generating units with SNCR.

I believe Duke Powers Marshall Station, which is four or 500 megawatts, has SNCR. But you are only asking about 18 percent, 20 percent NOx removal.

So again you can --

MR. AYERS: Doesn't TBA have some SNCR units as well?

MR. CICHANOWICZ: TBA has probably one of everything.

MR. AYERS: More than one of everything.

MR. CICHANOWICZ: They probably do. I just -- you know, they probably do.

MR. AYERS: And the PSE&G Station has SNCR too, right?

MR. CICHANOWICZ: Yes.

MR. AYERS: And that is a large station, 600 megawatts or something like that?

MR. CICHANOWICZ: I don't know. I don't think Hudson has SNCR. I believe Mercer had SNCR because I helped them with it and they have since gone to SCR. I don't believe that Hudson has SNCR. I don't believe it does.

MR. AYERS: But you can summarize this discussion by saying that SNCR is a technology that was deployed with much less than a full-year demonstration or multiple full-year demonstrations in commercial use and has been successful based on what we know at this point, couldn't you?

MR. CICHANOWICZ: Yes. But, you know, it is a different process. And so I don't know that -- although that is informative and helpful, I don't know how relevant it is to activate coal injection.

MR. AYERS: Of course each process is different. But SNCR certainly -- isn't it more like ACI than it is like scrubbers and SCR in the sense of being simpler, simpler installed, simpler equipment, et cetera.

MR. CICHANOWICZ: In general, yes.

MR. AYERS: Thank you.

MR. ZABEL: I have a couple of follow-ups.

HEARING OFFICER TIPSORD: Yes, Mr. Zabel.

MR. ZABEL: Mr. Cichanowicz, Exhibit 99 on page 3, the first sentence Mr. Ayers had you read refers to goals for reducing NOx emissions, does it not? The sentence you read refers, as I said, to

goals for reducing NOx emissions; is that
correct?
MR. CICHANOWICZ: The document
established goals for reducing NOx levels.
MR. ZABEL: And in the second
bullet, does it not also refer to a goal
of 0.33 pound per million BTU limit
emission?
MR. CICHANOWICZ: Yes. "Subsequent
to the SNCR demonstration, LNBs would be
installed with a NOx goal of 0.33 pounds
per million BTU."
MR. ZABEL: And on page 5 in the
conclusion he had you read into the
record, does it not refer again to an
emission rate goal in the first line?
MR. CICHANOWICZ: Yes, it does,
emission rate goal.
MR. ZABEL: Can you tell from that
whether this effort -- and this is a 1994
paper for the installation of SNCR at
Salem -- was to meet a command and control
objective or an experimental objective?
MR. CICHANOWICZ: I guess I can't

tell the difference.

MR. ZABEL: Thank you.

MR. AYERS: Mr. Cichanowicz, would you look at the second bullet on page 5?

HEARING OFFICER TIPSORD: On Exhibit 99?

MR. AYERS: On Exhibit 99, second bullet. Would you agree that it says there that these units are expected to meet a state NOx RACT minimum of 0.45 pounds per million BTUs?

MR. CICHANOWICZ: Let me read this carefully. "Baseline NOx emission rates for these units were about one pound per million BTU. With LNB on unit one and LNB/OFA on unit No. 3, these units are expected to meet state RACT, reasonably available control technology, limits of 0.45 pounds per million BTU." What does it mean by these units are expected?

MR. AYERS: Doesn't that sound like a regulatory requirement to you?

MR. ZABEL: Well, I would point out the number in the first bullet was much lower for the goals. But I think this illustrates one of the problems I raised earlier, not allowing the witness to read an entire document and we don't want to take the time -- this one is very short, I admit -- presents these kinds of problems taking things out of context.

MR. AYERS: I don't see there is any problem here at all. I don't see any inconsistency between 0.5 parts per million BTUs emission standard and the goal of 0.33.

MR. ZABEL: But we don't know that the SNCR wasn't designed to do better than was necessary under the RACT. And the report may well say that if we read the entire thing.

My problem here, Mr. Ayers, is you want to put this into evidence, you should have called a witness with it and you should ask for another hearing. You are trying to put in evidence in cross-examination. It seems to be a somewhat inappropriate approach.

MR. AYERS: I think you are --

HEARING OFFICER TIPSORD: Gentlemen, gentlemen.

MR. ZABEL: It bears --

HEARING OFFICER TIPSORD: One at a time.

MR. ZABEL: All I am trying to show is the difficulty of using a piecemeal document that way to try and establish some evidentiary point hereafter.

MR. AYERS: We sat quietly all morning and watched you introduce new evidence into the record. And I don't think you are in much of a position to complain about that.

MR. ZABEL: I did introduce it. I didn't do it by cross-examination. You are here to cross-examine --

MR. AYERS: Still --

HEARING OFFICER TIPSORD: Gentlemen, the document is in the record. The document speaks for itself.

I would note that it is at least my recall that in Springfield when the agency's witnesses were on, there was more than one occasion -- and I am not saying it was you Mr. Zabel -- but there was more than one occasion when the members of the industry handed piecemeal pieces of material to the point where the Board had to specifically ask for the entire document, we weren't even given the entire document a time or two.

So I understand your problem. But I think the document speaks for itself, and I think we need to move on.

I believe we are at question 43. And I am hoping that we knocked off some of these questions when we were discussing this stuff.

MR. CICHANOWICZ: I don't know.

HEARING OFFICER TIPSORD: I think we did. I think some of these talk about cost of SCR and that down the line. Question 43.

MR. CICHANOWICZ: On page 21 you describe experience with ash plugging at Southern Company's Plant Bowen. What company was responsible for the design and construction of the SCR at Plant Bowen?

The Bowen SCR equipment was designed and constructed by several organizations. The catalyst and design for the process conditions was provided by Cormetech. The flow modeling that defines the mixing uniformity of ammonia and flue gas velocity and temperature by Mitsubishi Heavy Industries; and the reactor designed by the owner, which is Southern Company.

Question 44, regarding --

MR. AYERS: Madam Chairman?

HEARING OFFICER TIPSORD: Excuse me, Mr. Ayers has follow-up.

MR. AYERS: I want to follow up on that. I heard most of what you said, although I am having trouble when you are reading, it is hard to speak into the mic.

MR. CICHANOWICZ: You wore me out on the last exchange.

MR. AYERS: But my follow-up question is who is responsible for this large particle ash problem, is it the --

was it the US EPA, was it the contractors, was it Southern Company? Who was ultimately in charge of it?

MR. CICHANOWICZ: Well, all I know is I started working on SCR in 1979. And I probably have been to Europe eight times with leading utility fact-finding missions scoring the visibility of SCR before it was deployed in the U.S. And in those eight trips, there was one plant -- I repeat, there was one plant where the owner said we are having a little bit of a problem with these large ash particles and we don't know where they come from, they block the catalyst, but we don't know what to do about it. Everybody else didn't seem to have a problem.

We deployed the technology in the U.S. And for reasons that some very good people I know still can't figure out, we seem to be able to generate these large particles that block up a lot of catalysts. So in my opinion it was one of those uncertainties that you have when you transfer technology.

The initiative was straightforward. It was 30,000, 40,000 megawatts of SCR in Germany. We should be beyond that. So I don't believe anybody was responsible. I have my theories why LPA is generated, but that's not what's of interest.

But the point is this is an example of whenever you change the paradigm in which technology works, you may get different results.

MR. AYERS: Wasn't the Southern Company responsible since they were responsible for compliance by the plant?

MR. CICHANOWICZ: Let's put it this way, when Bowen came down after 69 days of operation, it was they who basically had to scramble, take down the plant and try to find replacement power while we're having the catalysts cleaned and how to figure out how to wrestle with this problem.

HEARING OFFICER TIPSORD: Question 44?

MR. CICHANOWICZ: Regarding section 3.3.2 of your testimony, you note the risks associated with rising costs when demand rises. Would not that argue for moving early to get entry-level prices?

Possibly. The price as demand increases will depend on the relative forces of supply and demand and the equipment inventory required to achieve the regulation.

Question 45 --

HEARING OFFICER TIPSORD: Mr. Ayers?

MR. AYERS: One follow-up. Even if the cost of sorbent injection systems increased from $2.50 per kilowatt the IEPA used to, say, $10 a kilowatt at a capital recovery rate of 14 percent and a capacity factor of about 70 percent, what impact would that difference have on generating cost measured in dollars per megawatt hour and how does that compare to the wholesale price of electricity in Illinois?

MR. CICHANOWICZ: Ann Smith left

yesterday. I am kidding. It's a small impact. It's a small impact. It's a small impact because it is a low capital cost.

MR. AYERS: Thank you.

HEARING OFFICER TIPSORD: Question No. 45?

MR. CICHANOWICZ: On page 22 of your testimony, you note that SCR catalyst cost has dropped due to competition. That was a statement, not a question. Question A, do you believe that all of those competitors in the SCR catalyst business would have been attracted to the U.S. market had very few SCRs built in the U.S.?

No. The decrease in cost and participation by suppliers was driven by the anticipated demand in SCR installations in response to the mid 1990s SIP-Call.

Question B, is it possible that a similar impact could happen for mercury sorbent as a result of a rule that creates a market for mercury sorbent?

It is possible, but there may be differences in the factors affecting the supply of carbon-derived sorbent and SCR catalyst that could change the outcome. SCR catalyst is a highly engineered, precisely manufactured, high value-added material. The production and manufacture evolved from relatively small quantities during an evolving market in Japan in the late '70s, ultimately to a large market in the U.S. and the world.

The introduction of several world-class technology companies as major players into the market did contribute to the significant decrease in catalyst unit cost. The case for activated carbon may be different as the present production capacity reportedly starts from a worldwide overcapacity, which may limit price decreases.

Question C, does not sorbent have a much bigger impact on cost of generation than capital cost in cases when sorbent is injected upstream of an ESP?

Depending on the capital cost of retrofitting ACI to an ESP and any modifications to the ductwork or ESP to alleviate operating problems, sorbent may dictate cost. If ACI truly requires only installing the injection equipment 2 to $4 a kilowatt based on estimates by the Institute of Clean Air Companies and technology providers, for 4 to $21 kilowatt based on the DOE, that means sorbent costs will drive ACI Hg removal costs. If ESP upgrades or ductwork modifications are required, the sorbent cost will be significant but perhaps not the major contributor.

Question 46, on page 25 of your testimony there is an equation. From what document was this equation taken from?

The equation describing the overall correlation of Hg removal with coal properties was reported in the initial report by EPRI evaluating the ICR data and also in a technical paper to the 2001 Mega

Symposium entitled "Estimating Total and Speciated Mercury Emissions from the U.S. Coal-Fired Power Plants" by Paul Chu, et al. The equation is contained in the latter reference and figure five in that reference graphically depicts the Hg removal.

Question 47 --

MR. AYERS: I am sorry, Mr. Cichanowicz, I have to ask you a couple questions. I would like you to look at another document.

HEARING OFFICER TIPSORD: This is Exhibit 100. I have been handed the "U.S. EPA Research and Development Performance and Cost of Mercury and Multi-Pollutant Emission Control Technology Applications on Electric Utility Boilers."

If there is no objection, I will mark this as Exhibit 100. Seeing none, we are at Exhibit 100.

MR. AYERS: Would you look at page 19, please?

MR. ZABEL: Again for the record,

the witness had an opportunity to read the 96 pages that are presented in Exhibit 100.

MR. AYERS: I don't think he will need to.

MR. ZABEL: At least, he hasn't had a chance to read it recently, as far as I know.

MR. AYERS: In equation one on 19 --

MR. CICHANOWICZ: Yes.

MR. AYERS: -- does this not show another equation specifically for cold-side ESPs that include both chlorine and SO2?

MR. CICHANOWICZ: Yes.

MR. AYERS: Yours does not include SO2, is that correct, in your testimony?

HEARING OFFICER TIPSORD: It is page 25 of the testimony.

MR. CICHANOWICZ: Yes.

MR. AYERS: Is that incorrect?

MR. CICHANOWICZ: No. The people that put the correlation together had a reason for not including SO2. And I forgot exactly what it was.

But they -- work was done by URS Corporation. And there was something in the correlation where they felt it correlated better without looking at the SO2 because they specifically called that equation out differently than all the other equations.

Absent the cold-side ESP, the equation looks like the one that is in this document.

MR. AYERS: Don't the papers that you mention all have the sulfur component in that equation?

MR. CICHANOWICZ: All of the correlations that were produced in EPRI's analysis of the ICR data use chlorine and SO2 except for cold-side ESP.

MR. AYERS: I think it is the other way around, only the cold-side ESP.

MR. CICHANOWICZ: Okay. All the equations have both SO2 and chloride except for the cold-side ESP, which just has chloride.

MR. AYERS: Which paper are you looking at?

MR. CICHANOWICZ: I'm looking at my testimony on page 25.

MR. AYERS: Right. Do you have Paul Chu's paper here? It's one of the papers you referred to.

MR. CICHANOWICZ: It should be.

MR. AYERS: Do you have it right here? Could you take a look at it?

MR. CICHANOWICZ: If I typed it wrong, I typed it wrong. It came from that document.

MR. AYERS: We have it here in electronic form.

(Short pause in proceedings.)

MR. CICHANOWICZ: The answer is I can't tell you. I took the data from the reference that was in the CD. I just typed it wrong.

MR. AYERS: Okay. So it should have the sulfur component?

MR. CICHANOWICZ: It should. It is a matter of me not being able to type.

MR. AYERS: So if you had a power river basin derivative-based coal that had an SO2 emission rate of about 0.4 pounds per million BTUs, would include that sulfur term result in a higher or lower estimated mercury capture rate?

MR. CICHANOWICZ: Compared to what?

MR. AYERS: Compared to not having that term in the equation. In other words, compared to the equation in your testimony, wouldn't the equation with the SO2 term -- how would the equation with the SO2 term affect the predicted mercury capture for a PRB coal with an emission rate of, say, 0.4 pounds per million BTUs.

MR. CICHANOWICZ: Well, the equation in my testimony is wrong. So you are asking me -- I don't know why you are --

MR. AYERS: You agreed to that. I will rephrase it.

What's the effect of that change on the 0.4 pound coal?

MR. CICHANOWICZ: I don't know. I have to punch in numbers and see. I don't know.

MR. AYERS: Wouldn't 0.4 be in the denominator of the equation?

MR. CICHANOWICZ: Yes.

MR. AYERS: So wouldn't that inevitably result in a bigger number as a result of the equation?

MR. CICHANOWICZ: Yes.

MR. AYERS: So it would -- it would result in a higher estimated mercury capture rate, correct?

MR. CICHANOWICZ: Yes. But again if -- if this is the ICR data, I really don't know why we are talking about it. We have much more recent data. And I will answer your question. Yes.

MR. AYERS: It was introduced in your testimony or the subject was introduced, so we had to check it.

If I may follow up slightly on it, doesn't that mean that the PRB units we just discussed, doesn't that mean that the

PRB units, which are most of the units in Illinois, would be under predicted by the equation that was in your testimony?

MR. CICHANOWICZ: Yes. But I don't know why we are talking about the equation in my testimony because I said it is in error and it was an example.

MR. AYERS: I guess we are talking about it because it was there. We have to ask about it.

And wouldn't that also make the cost estimate for control for those units higher -- wouldn't the estimate of the cost of control for these units be lower if you used the SO2 term?

MR. CICHANOWICZ: Yes. But that -- I don't know why we keep talking in circles. That equation is not used for anything but as part of an introductory background. It was not used in any of the calculations that were done.

MR. AYERS: Let me try to sum it up. Is it fair to say that chlorine and SO2 are both important to this equation?

MR. CICHANOWICZ: Yes.

MR. AYERS: And higher sulfur is bad for mercury removal and higher chlorine is good, assuming that higher removals are what we want?

MR. CICHANOWICZ: I think in general that's what we believe, higher sulfur is bad.

MR. AYERS: That's what the equation says.

MR. CICHANOWICZ: Yes.

MR. AYERS: Is the carbon content of ash also called LOI important also?

MR. CICHANOWICZ: Yes, it is.

MR. AYERS: And temperature?

MR. CICHANOWICZ: Yes, it is.

MR. AYERS: And I assume, as you describe in your testimony, you think size of ESP is important?

MR. CICHANOWICZ: I think it could be a factor.

MR. AYERS: Do you think it is a factor or could be a factor?

MR. CICHANOWICZ: I think it could

be a factor.

MR. AYERS: Thank you. On page 25 you also state "data from commercial-scale tests that suggests mercury removal is influenced by SCA, which may be consistent with fundamental analysis that suggests mass transfer between particles and flue gas is favorably affected by large SCA, Clack 2006."

MR. CICHANOWICZ: Yes.

MR. AYERS: Do you see that reference?

MR. CICHANOWICZ: Yes.

MR. AYERS: What data from commercial-scale test are you referring to in that statement?

MR. CICHANOWICZ: Well, that statement is based on the exhibit that I had proposed earlier.

MR. AYERS: Would that be figure 5.2?

MR. CICHANOWICZ: Yes. Basically, what I said was that -- from figure 5.2, yes.

MR. AYERS: Could we stop here for a break?

HEARING OFFICER TIPSORD: Sure. Let's take a break. Come back in about ten minutes.

MR. AYERS: Thank you.

(Short recess taken.)

HEARING OFFICER TIPSORD: Mr. Ayers, are we ready to move on to question 47?

MR. AYERS: I think we are.

HEARING OFFICER TIPSORD: Okay. Question 47.

MR. CICHANOWICZ: Please provide your source --

MR. AYERS: I'm sorry, I apologize. No, we are not.

HEARING OFFICER TIPSORD: Okay.

MR. AYERS: We do have some additional questions, the follow-ups on 46.

On page 25 of your testimony, Dr. Cichanowicz, you raised the issue of size of the ESP. I know it is in various places throughout your testimony. We would like to ask you some questions that relate to the assertion that ESP size could have an effect on mercury removal. I think the place to start is we have a couple of exhibits we would like to take a look at. And could we do now Exhibit 101? This is a paper by Sjostrom and others at a 2001 Mega Symposium in Chicago.

HEARING OFFICER TIPSORD: For the record, it is "Mercury Removal Trends in Full-Scale ESPs and Fabric Filters." If there is no objection, we will mark this as Exhibit 101. Seeing none, it is Exhibit 101.

MR. GIRARD: Mr. Ayers, could you repeat the conference where it was presented?

MR. AYERS: It is colloquially called the Mega Symposium. It is an EPA, DOE and EPRI sponsored symposium that occurs regularly to talk about these kind of pollution control issues. I can't be more specific than that. But it is basically a combined utility air pollution control symposium.

MR. GIRARD: And this was the 2001?

MR. AYERS: 2001, yes. Have you had a chance to look at that?

MR. CICHANOWICZ: The whole paper or is there a specific item?

MR. AYERS: I wanted to make sure you were ready.

MR. CICHANOWICZ: Yes.

MR. AYERS: Do you know any of the authors of this paper?

MR. CICHANOWICZ: I think I know in one way, shape or form all of them.

MR. AYERS: And in your opinion, are they knowledgeable people?

MR. CICHANOWICZ: Extremely.

MR. AYERS: Could I direct you to page 11 of this paper, the fourth bullet point on page 11. Could you read that fourth bullet point.

MR. CICHANOWICZ: "The size of the cold-side ESP, SCA, correlates with higher mercury removal in cold-side ESPs on lignite coals. Although this correlation appears to be significant, the highest level of mercury removal in this subset was seven percent. For subbituminous coals, there appears to be an inverse correlation between SCA and mercury removal. The smaller the SCA, the higher the removal. It is expected that other factors are contributing because it is unlikely that this is a true correlation."

MR. AYERS: So would you agree that these authors conclude that other factors than ESP size are influencing mercury capture -- or let me restate that. That ESP size is not a factor in determining mercury capture?

MR. CICHANOWICZ: I'd point out that this paper was presented in 2001, which means the data was generated before that. So, yes, that's what that bullet suggests; but that was, you know, quite sometime ago.

MR. AYERS: Okay. Could you look at page 12? There is a table there, table six. And could you tell me which factors on this table had the highest correlation with mercury capture for bituminous or subbituminous fuels?

MR. CICHANOWICZ: Well, for the cold-side ESP, the LOI and the mercury on the sampling filter, the subbituminous on the inlet temperature and the LOI.

MR. AYERS: And LOI was important for bituminous and subbituminous?

MR. CICHANOWICZ: Yes.

MR. AYERS: Is LOI an indication of how much carbon is in the fly ash?

MR. CICHANOWICZ: Yes, it is.

MR. AYERS: Does it make sense that LOI would have a high correlation with mercury capture?

MR. CICHANOWICZ: I believe so.

MR. AYERS: Why would that be?

MR. CICHANOWICZ: Well, because the carbon generated in the flame, even though it is not as attractive as manufactured sorbent in mercury will still do some attracting.

Can I read a bullet to you from this

paper? Do I get to do that?

MR. AYERS: You are the witness.

MR. CICHANOWICZ: Above that is the statement, the first bullet says "flue gas conditioning with SO3 was used on three of the five cold-side ESPs for boilers burning subbituminous coals. The use of SO3 conditioning did not appear to influence mercury removal." That was then, this is now. I appreciate the statements, but it is a 2001 paper.

MR. AYERS: Could you look at the conclusion on page 14? Do any of those conclusions state that ESP size as indicated by SCA has a significant effect on mercury capture?

MR. CICHANOWICZ: From this paper, none of the conclusions state that, that's correct.

MR. AYERS: On page 25, you cite a reference of Clack 2006.

MR. CICHANOWICZ: Yes.

MR. AYERS: Is that a paper or a communication or what?

MR. CICHANOWICZ: That was a technical paper presented at the -- I said there is six or seven mercury conferences a year. The first one is January in Tucson. It is very popular. Dr. Clack presented a paper there and the proceedings I believe I submitted in the file where he describes some mathematical modeling that he did looking at mass transfer and its enhancements within an ESP and the possible impacts on mercury removal.

MR. AYERS: So you cite this to indicate or suggest that mass transfer is favorably affected by large SCA in your testimony?

MR. CICHANOWICZ: Well, I cite it because his modeling showed that, in fact -- well, let me back up.

The thought used to be that the cake collected on the plate would provide some mercury capture. And he did some modeling to show that the cake that resides on the plate provides little or no capture. And any capture that is provided in the ESP is in the -- is when the particle migrates from the -- from the field once it accepts a charge to the plate. And he went into some analysis to show that. And one of the observations was that with a higher SCA ESP this effect would be greater. I only cited it just to show that people have been thinking about this for a while.

MR. AYERS: Do you have the Clack paper with you? If you don't, we do and we can share it with you.

MR. CICHANOWICZ: I don't have the piece of paper with me. But it was on the disk that I sent you.

MR. AYERS: We have it on paper. It might be helpful to talk from that.

HEARING OFFICER TIPSORD: Just a point of clarification for the record, this is included on the CD-rom.

MR. CICHANOWICZ: Yes.

MR. AYERS: Yes. It was placed in the record.

HEARING OFFICER TIPSORD: Actually,

for ease of the record since we are going to be looking at this and you are going to ask specifically, I am going to give this an exhibit number as well because it will be much easier in the transcript if this has an exhibit number. So we are going to mark this as Exhibit 102 if there is no objection. Seeing none, this is Exhibit 102. This is not a part --

MR. AYERS: That's a separate exhibit. We don't know whether this is on the disk.

HEARING OFFICER TIPSORD: Okay. I have been handed a PowerPoint slide presentation titled "Mass Transfer Limitations to Mercury Capture within Electrostatic Precipitators." I am going to mark this as Exhibit 103, if there is no objection. Seeing none, it is Exhibit 103.

MR. AYERS: Mr. Cichanowicz, would you characterize this paper, this first paper by Herek Clack as a theoretical calculation of potential mass transfer rather than actual measurements?

MR. CICHANOWICZ: Oh, yes. That is completely correct.

MR. AYERS: And it focuses on gas particle mass transfer and makes a number of simplifying assumptions in order to aid in the thinking, correct?

MR. CICHANOWICZ: Yes.

MR. AYERS: And it includes -- among the assumptions that go into the calculations are that the sorbent particles are treated as perfect mercury sinks having unlimited mercury capacity and maintaining a mercury concentration at their surface that is identically zero, correct?

MR. CICHANOWICZ: That is correct, yes.

MR. AYERS: Are you aware of any sorbent material that has such characteristics as has having unlimited mercury capacity?

MR. CICHANOWICZ: I think Mr. Nelson's does.

MR. AYERS: But he is not letting on.

MR. CICHANOWICZ: But outside of Mr. Nelson, I am not aware of material with those characteristics.

MR. AYERS: And are you aware of any material that has such characteristics of maintaining a mercury concentration at their surface that is identically zero?

MR. CICHANOWICZ: No, I'm not.

MR. AYERS: And are you aware of any sorbent that acts as a perfect mercury sink.

MR. CICHANOWICZ: No.

MR. AYERS: So would you say that Dr. Clack's estimates are realistic or theoretical? Or would they provide an upper bound -- an upper limit to the mercury uptake that you would calculate from this kind of a --

MR. CICHANOWICZ: They might provide a number. And in referencing Dr. Clack's work, I use the word fundamental analysis, which in my paradigm means exactly this and no more than that.

MR. AYERS: So any projections he made about mercury capture in this paper would have to be a greater than what would be expected in the real ESPs, correct?

MR. CICHANOWICZ: Well, I don't know that he -- depending on the analysis perhaps. But, yes, there was a lot of theoretical assumptions brought into the analysis.

MR. AYERS: If you could look at the abstract at the front of the paper, page 1, he addresses the question of absorption by the dust cake in the sentence that begins "an often unstated presumption..." It says that "...is that mercury capture within an ESP is the result of adsorption by dust cake collected on the ESP plate electrodes. This presentation summarizes recent mass transfer analyses that refute this hypothesis and show that in most cases the mass transfer potential and thus potential for mercury oxidation and or adsorption is generally less than 20 to 30 percent of the gas-phase mercury."

Is that a correct reading of what he states as his conclusions in the abstract?

MR. CICHANOWICZ: It is correct. I don't know if the -- yes, it is correct. Yes.

MR. AYERS: So would you agree with his statement that mercury capture by this mechanism appears to be fairly limited?

MR. CICHANOWICZ: Mr. Ayers, we didn't have to go through all of this to get me to say that. Because there is a later question that I say I believe with what Dr. Staudt said in Springfield that most of it takes place in the ductwork. And I only put this in here to show that fundamentally there are good people thinking about how to engage the precipitator to extract mercury removal.

I actually -- I am glad I read this again on the plane on the way here. But what triggered my interest was under conclusions is that the -- about halfway through the -- under conclusions there the statement that begins "by comparison" -- and again he is comparing the mass transfer on the plate to what happens when the particles move across the ESP -- "the conducted mass transfer analysis of mercury uptake on suspended particles during the collection within the ESP showed a far greater potential for mercury capture." And I understand the word potential.

The other thing is he uses the word in-flight differently. He uses the word in-flight as motion of the particle in the ESP. And I believe most everybody else uses it in the ductwork.

MR. AYERS: In terms of the phenomenon, it doesn't make any difference whether it is in the ductwork or the ESP, correct?

MR. CICHANOWICZ: That's correct, yes. That is correct.

MR. AYERS: So again staying on

page 8 in the conclusions, so you agree with that conclusion that you read about mercury uptake during -- the conclusion you just read out loud?

MR. CICHANOWICZ: Yes, I do agree.

MR. AYERS: Now, could we look at the Exhibit 103 I think it is, which is a slide presentation by Professor Clack. And you have to look at the fifth slide. They are not numbered, "Maximum PM and Hg Removal within ESPs."

Do you agree that this slide shows the results of the connective mass transfer calculation from different particle sizes and ESP energy levels?

MR. CICHANOWICZ: Yes.

MR. AYERS: Looking at the figure on the right for ten microgram particles -- micron, I am sorry, you see that the performance can be pretty good, close to 80 percent removal or 20 percent of the inlet fraction in the best case at energy levels of 200 kilovolts per meter?

MR. CICHANOWICZ: Yes.

MR. AYERS: At 600 the removal is only about 20 percent, correct.

MR. CICHANOWICZ: At 600 what?

MR. AYERS: 600 kilovolts per meter?

MR. CICHANOWICZ: Yes.

MR. AYERS: Would you agree that the figure shows that most of the capture occurs within the first two seconds or so at an energization level of 200 kilovolts per meter and within a fraction of a second at 600 kilovolts based on this presentation?

MR. CICHANOWICZ: Yes. That's what it shows.

MR. AYERS: So any capture beyond that mechanism is pretty limited, beyond the two seconds, I'm sorry?

MR. CICHANOWICZ: That's correct, within the -- within the ESP, yes.

MR. AYERS: Do you know what a typical energization level is for an ESP?

MR. CICHANOWICZ: I believe it is about 150 kilovolts per meter. No, that's not right. I believe it is -- I believe it is about 300.

MR. AYERS: About 300. According to his paper on page 6 -- you said around 300. On page 6 of his paper, doesn't it say "considered in figure three on the right are the peak enhancement factors at RED equals 2,000 achievable by the weakest, 340 kilovolts per meter, and strongest, 403 kilovolts per meter, electrical fields for a representative ESP geometry."

So if a typical ESP has an energization around 340 to 400 kilovolts per meter, we would expect to capture between somewhere between the 600 kilovolts per meter line and the 200 kilovolts per meter line on figure four, correct --

MR. CICHANOWICZ: Yes.

MR. AYERS: -- in the other Clack presentation.

So perhaps at a typical energization level, we might see the mercury removal from this effect around 40 to 60 percent for the ideal super duper sorbent within maybe a second or so, would that be correct?

MR. CICHANOWICZ: In general, yes.

MR. AYERS: And you probably get less removal with a real sorbent that has limited sorbent capacity that is sort of Sid Nelson's special, right? Correct?

MR. CICHANOWICZ: Well, I think so. But, you know, we are assigning a lot of attributes to this study to a full-scale plan. But all things being the same, yes.

MR. AYERS: So looking at the figure, in summary, after about two seconds in the best case, best case being the best removal case, there appears to be little additional mercury removal, agreed?

MR. CICHANOWICZ: Within the ESP based on this analysis, yes.

MR. AYERS: And in every case there is very little additional mercury removal after time shorter than two seconds or less in this chart?

HEARING OFFICER TIPSORD: Excuse me,

Mr. Cichanowicz, you nodded your head.

MR. CICHANOWICZ: Yes.

MR. AYERS: Would you expect that for a real sorbent that was injected upstream of the ESP somewhere in the duct and, therefore, had a chance to absorb some mercury there, that the threshold would be -- would likely be reached even sooner than two seconds?

MR. CICHANOWICZ: Depending on the mixing perhaps.

MR. AYERS: And let me start on a little different direction here. Would you agree that the smallest ESP in Illinois has an SCA of around a hundred square feet per thousand per ACFM?

MR. CICHANOWICZ: I think that's about right, yes.

MR. AYERS: We have a couple more things for you to look at.

HEARING OFFICER TIPSORD: This document I have been handed is "The Use of Treatment Time and Emissions Instead of SCA and Efficiency for Sizing

Electrostatic Precipitators" by Robert A. Mastropierto. If there is no objection, I will mark this as Exhibit No. 104. Seeing none, it is Exhibit 104.

MR. AYERS: As you can see from the cover of this document, Mr. Mastropierto is product director for ESPs at the Research-Cottrell Company, which makes ESPs for electric power plants.

What is of interest to us in this paper is with regard to what we have been discussing about Professor Clack's paper as a simple way to estimate the treatment time for an ESP that is offered on page 4 of this paper. We have circled or highlighted, but you may not be able to see that well. We have highlighted an equation that Mastropierto provided. And Dr. Staudt used a little math that you are free to review to estimate the frequent time for an ESP with an SCA of a hundred square feet per thousand ACFM.

HEARING OFFICER TIPSORD: Excuse me, Mr. Ayers, for point of clarification and make sure that the record is clear, on page 4 then these what appear to be handwritten notes are not a part of the article, but rather Dr. Staudt's calculation?

MR. AYERS: Correct.

HEARING OFFICER TIPSORD: Thank you.

MR. CICHANOWICZ: So you are waiting for me to concur?

MR. AYERS: I wanted to give you a chance to look back. Are you ready for a question?

MR. CICHANOWICZ: Yes.

MR. AYERS: It's a single question. Would you agree using this equation the estimated treatment time for such an ESP with nine-inch plate spacing would be about 2.25 seconds or longer than that if the plate spacing were wider?

MR. CICHANOWICZ: Well, I am trying to back out what the velocity and the precipitator was. And I don't see from this method of calculation. So I will accept these calculations at the moment as they are. But I do need to review this in some detail.

MR. AYERS: Okay. Let's give you something else to look at, second paper by Dr. Mastropierto.

HEARING OFFICER TIPSORD: This one is titled "Achieving Low Particulate Emissions with Electrostatic Precipitators." This will be Exhibit 105.

MR. AYERS: And can you look at figure one on page 5? I'm sorry.

MR. ZABEL: What was your reference, Mr. Ayers?

MR. AYERS: Page 5, figure one in the second paper. Figure one shows treatment times for ESPs built in different times. What is the lowest treatment time you can see on this figure?

MR. CICHANOWICZ: Two to four seconds.

MR. AYERS: Now, going back to Professor Clack's slide presentation that we were looking at earlier --

HEARING OFFICER TIPSORD: Which is

Exhibit 103?

MR. AYERS: Yes, "Maximum PM and Hg Removal," Exhibit 103. If you look there for where the curve of the removal is at about two seconds, which was the lowest treatment time in the Mastropierto paper, isn't it true that there is little or no additional mercury capture even in the best case with the super duper sorbent that they are using here after two seconds?

MR. CICHANOWICZ: Yes.

MR. AYERS: So all the action happens in the first two seconds or much less -- or in much less time in most cases?

MR. CICHANOWICZ: Yes.

MR. AYERS: So doesn't this suggest that any amount of mercury capture that is going to happen in an ESP through this mechanism will be complete within a 100 SCA ESP?

MR. CICHANOWICZ: Well, we are -- within the ESP, within the ESP, we --

there will be -- the removals are such
that most of it occurs up front, that's
correct, within the ESP.
MR. AYERS: Why are you qualifying
it?
MR. CICHANOWICZ: Well, because it's
-- the whole process as I -- when I put
the chart up -- and that was one of the
reasons for going through the -- one of
the reasons for going through the
satellite images this morning is that it's
more than just the ESP. It is basically
the sorbent -- it is basically the inlet
ductwork as well.
MR. AYERS: If some of the reaction
were occurring in the inlet ductwork also,
then wouldn't the effective plate size
need to be even smaller in order to
achieve the removal of most of the
mercury?
MR. CICHANOWICZ: Well, that depends
on the mixing that you get in the inlet
ductwork.
MR. AYERS: If the sorbent were in

the ductwork and it were taking up some of the mercury there, then wouldn't the time to the end of that take-up process be shorter once it was in the ESP because some of the mercury was already adsorbed?

MR. CICHANOWICZ: Yes. But again we are talking about -- we are taking one piece out and, essentially, not looking at the whole package. Okay. There is mixing of the sorbents in the ductwork. And again we are just right now talking about mercury removal. We are not really talking about the fact that the ESP has to respond to the sorbent that's injected and make sure that it basically prevents a breakthrough. We have just talked about mercury removal.

MR. AYERS: But do I take -- you are not changing your view, though, what these tables say? You agree that within the ESP, the take-up of mercury would be, essentially, complete within two or slightly more than two seconds?

MR. CICHANOWICZ: And, Mr. Ayers,

there is a question that we may get to next week at this rate where I am asked bluntly that. And I say most of it -- most of the uptake is in the ductwork and the inlet system. I say that very bluntly.

MR. AYERS: Okay.

HEARING OFFICER TIPSORD: And when we get there, we can skip that question, which is exactly what happened in Springfield. We got off on these things and then hopefully we go through very quickly and say we have addressed that. And we will do that.

Mr. Nelson, do you have a question?

MR. NELSON: Just to summarize then, if it takes place in the ductwork and we stipulate that very little of it is -- even theoretically, according to Clack, takes place on the plates and the measure of the plates is the SCA, that's the collection area, the specific collection area, then I believe you are changing your testimony from the written testimony. In the written testimony, don't you testify that all the small SCAs in Illinois are not going to see the same removal rate as these large ones, correct? And now --

MR. CICHANOWICZ: I think in my --

MR. NELSON: -- am I interpreting it correctly for you to say, no, all the removal takes place and it really doesn't matter how large the SCA, how large the collection area is?

MR. CICHANOWICZ: No. My testimony is there may be a relationship between mercury removal and SCA depending upon an envelope of parameters. Okay. That was the purpose of the images this morning. It is not just the ESP. It is everything else that goes around it.

MR. NELSON: But again, just to summarize, if Clack says theoretically very little removal takes place on the collection area, would you submit then that your graphs that you passed out this morning that show on the X axis specific collection area is largely, but not completely, irrelevant as far as mercury capture is concerned?

MR. CICHANOWICZ: When you -- ESPs of larger SCA may have other things about them that are desirable for mercury removal. Okay.

MR. NELSON: Such as what?

MR. CICHANOWICZ: Such as, basically, the inlet ductwork arrangement and the ability to get sorbent in quickly and get it mixed up.

Clack's analysis is for applying the process condition of the ESP and not within the ductwork. And so it applies to within the ESP.

And, further as I said, we talked this morning about the role of carbon, activated carbon versus carbon generated in combustion. Basically, the size of the SCA is important to ensuring that there will not be breakthrough of the sorbent that's injected. So it's the whole package.

MR. NELSON: Opacity or particulate

is a separate issue that I think we are going to address. But right now what you testified to this morning dealt with mercury removal. And did you show any data that said small SCA ESPs get less mercury removal, all other things being equal? Did you present or are you aware of any data to that effect?

MR. CICHANOWICZ: The data that I showed this morning didn't have all other things being equal. The data I showed this morning was a graph of figure 5-2 that laid out the results of the function of the SCA.

MR. NELSON: And did any of that data show, particularly for subbituminous coals like in Illinois, that small SCA ESPs have lower mercury performance, any measurements at all?

MR. CICHANOWICZ: What do you mean?

MR. NELSON: Could you point to a single measurement of the subbituminous coal in an ESP that shows lower mercury sorbent performance in small SCA ESPs?

MR. CICHANOWICZ: All the data, as I have said, are not directly noncomparable. And a couple of PRB units basically all show about the same removal.

MR. NELSON: I will refer you to Exhibit 88 this morning on the second smallest ESP in Illinois from Crawford. There it did look like high removals were achieved at an SCA of 119, correct?

MR. CICHANOWICZ: You know, I can -- until that data could be reviewed and discussed, it is hard for me to react to it, Mr. Nelson. You know that.

MR. NELSON: Theoretically according to Clack, there should be no relationship between mercury removal and the specific collection area in ESPs, correct?

MR. CICHANOWICZ: In the analysis that he did, basically, there is no relationship.

MR. NELSON: Thank you.

HEARING OFFICER TIPSORD: Are we ready for question 47?

MR. AYERS: I think we are.

HEARING OFFICER TIPSORD: Question 47.

MR. ZABEL: Do you have something, Mr. Ayers?

HEARING OFFICER TIPSORD: No. He was getting ready to read the question.

MR. CICHANOWICZ: Please provide your source for figure 4-1.

Figure 4-1 is based on the Energy Information Agency's Form 767, which contained design information on the ESP, including collecting plate surface area and the actual flue gas flow rate at the ESP. However, the data file as obtained by EIA is out of date, as it does not reflect ESP upgrades. The curve in figure 4-1 is based on an updated national ESP database that I have maintained over five years with Mr. James Marchetti. We update this file as we become informed of ESP upgrades through discussions with owners or technical papers.

HEARING OFFICER TIPSORD: Question 48.

MR. CICHANOWICZ: Regarding figure 4-1, is the range in ESP size at least in part due to coals burned in the U.S.?

HEARING OFFICER TIPSORD: Due to different coals.

MR. CICHANOWICZ: Due to different coals burned in the U.S. This is a statement preceding a series of questions. A, would ESPs designed for high sulfur bituminous coals be smaller than for medium sulfur bituminous --

HEARING OFFICER TIPSORD: 48 was the question. Regarding figure 4-1, is the range in ESP size, at least in part, due to different coals burned in the U.S.?

MR. CICHANOWICZ: Yes. Would ESPs designed for high sulfur bituminous coals be smaller than for medium sulfur bituminous coals, all else being equal?

All other factors being equal, higher sulfur bituminous coals will require smaller ESPs than medium sulfur bituminous coals.

Question B, would ESPs designed for low sulfur coals, especially PRB coals, be larger than for medium sulfur coals, all else equal?

All other factors being equal, lower sulfur bituminous coals and in particular PRB coals will require larger ESPs.

Question C, so would you agree that the tendency, therefore, would be that ESPs designed for PRB coals would generally be larger than those designed for bituminous coals, especially high sulfur coals, all else equal, correct?

Yes.

Question D, and that is why several Illinois units firing PRB fuel use SO3 conditioning to make the ESP act as if it's a higher sulfur coal as it was originally designed for?

Yes. The use of SO3 conditioning reduces ash, electrical resistivity to be on the order of the same as a medium high sulfur coal and thus allow the particle to allow a charge and also to prevent back-corona, which is a particle collage of the electric field that will reduce ESP efficiency.

Question 49, please describe the specifics for each of the units in figure 4.2 of your testimony: A, plant name and unit number; B, percent FGD gas bypass, if any; C, coal type; D, FGD type, limestone forced oxidation, limestone natural oxidation, magnesium enhanced lime, lime spray drier fabric filter, et cetera; E, percent SO2 removal by the FGD; F, particulate control device, ESP, fabric filter, et cetera.

I do not have access to the details of the units represented in figure 4-2. The complete technical presentation as delivered to the Electric Utilities Environment Conference in January of 2006 is included in references.

HEARING OFFICER TIPSORD: We didn't hear all that.

MR. CICHANOWICZ: I do not have access to the details of the units represented in figure 4-2. The complete technical presentation as delivered to the Electric Utilities Environment Conference in January of 2006 is included in the references.

HEARING OFFICER TIPSORD: The CDs, which are Exhibit 96?

MR. CICHANOWICZ: Yes. Question 50.

MR. AYERS: I'm sorry. That answer requires further questions. So the information in question is not on the disks supplied to the Illinois EPA this morning; is that right?

MR. CICHANOWICZ: That information is not available to me. It's part of an EPRI program and they have not released the sites, at least that I know.

MR. AYERS: So you don't know what units these are that are referred to in the table?

MR. CICHANOWICZ: That is correct.

MR. AYERS: Isn't it rather difficult for us or the board then to understand what to make of those if we

don't even know what plants they are or
how they were chosen? Don't we need to
understand items A through F in order to
make sense of this figure?
MR. CICHANOWICZ: Having the
information about the stations would be
more helpful. But it wasn't available to
me.
MR. AYERS: I think I go further
than that and say it isn't helpful at all
since we don't know what it is. I think
we would like to have that data excluded
if we can't figure out where it comes
from.
HEARING OFFICER TIPSORD: Is that a
motion?
MR. AYERS: That's a motion.
MR. ZABEL: I believe such motions
have to be in writing, if my recollection
is correct, Madam Hearing Officer.
HEARING OFFICER TIPSORD: It is
already entered as an exhibit. I don't
know that they have to be in writing to
exclude --

MR. ZABEL: You insisted in that case on our exclusion of Dr. Keeler's including Steubenville.

HEARING OFFICER TIPSORD: I asked it to be simply because I felt it was -- needed to be briefed by everyone.

In this case I think it is safe to say we are going to include this information. The Board is perfectly capable of examining it for what it's worth.

MR. ZABEL: My response is it doesn't have the specific data. Mr. Ayres Is quite right. It is not available to the author. It represents certain results from certain utilities. It has whatever credibility we give to an expert who has presented it at the conference and for whatever that data is worth.

Mr. Ayers is certainly competent on it to comment on his closing comments, as is everyone else.

HEARING OFFICER TIPSORD: And the board can also examine the CD and look at the reference material from Mr. Cichanowicz. But we are not going to exclude it.

MR. AYERS: Let me ask one further question --

HEARING OFFICER TIPSORD: You can ask, certainly.

MR. AYERS: -- on this point. We listed six factors in which -- for which we requested information. Isn't it true that each of those six factors could have an impact on the removal rate of the plants in question in this figure?

MR. CICHANOWICZ: Yes, that is true, they can have an impact.

MR. AYERS: So without knowing about those factors in each of the plants, it is very difficult to draw any conclusion, isn't it?

MR. CICHANOWICZ: Well, it basically represents -- it represents what people have observed in fuel tests with the role of SCR influencing mercury removal. And it was the range of results that have been observed and reported. I will turn over what has been reported in technical literature. And for a number of reasons, the details on those sites are not something that I can access to bring into a public forum.

MR. AYERS: Well, I sympathize with you about that. But I think that a table like us this that's shorn of names and shorn of all the relevant factors that influence those outcomes just doesn't mean very much. And I won't say anything more than that in support of my rejected motion.

MR. ZABEL: Are we on 50?

HEARING OFFICER TIPSORD: I think we are on question 50.

MR. CICHANOWICZ: Regarding your statement on the last paragraph of page 24 of your testimony pertaining to mercury in gypsum, question A --

HEARING OFFICER TIPSORD: Excuse me, that is page 28 of your testimony.

MR. CICHANOWICZ: On page 28, thank

you, of your testimony pertaining to mercury in gypsum, Question A, do you agree that the mercury is going into the gypsum today at plants with FGD, regardless of any requirement to control mercury? Yes.

Question B, is not the major issue whether or not the wallboard manufacturing process drives off some part of the mercury when the gypsum is heated? Yes.

C, is that what --

HEARING OFFICER TIPSORD: Hang on a second. Mr. Ayers lost his place. 50-A was yes.

MR. AYERS: And 50-B?

HEARING OFFICER TIPSORD: Was yes. And we are on 50-C.

MR. CICHANOWICZ: 50-C, is that why U.S. Gypsum's program is funded by DOE? I'm not aware of the rationale for DOE's funding various mercury technologies other than the desire to prove and commercially demonstrate control technology. I do concur that the presently funded program by U.S. Gypsum is addressing these issues.

MR. AYERS: May I ask one follow-up on that? If in the process of making -- of gypsum wallboard making, some mercury was driven off in that heating process. Couldn't that be addressed through a vent system on the wallboard plant with a carbon filter?

MR. CICHANOWICZ: Probably. Perhaps, yes.

MR. AYERS: Thank you.

HEARING OFFICER TIPSORD: 50-D.

MR. CICHANOWICZ: Question D, what percent of Illinois coal capacity has wet FGD?

About six percent or 1,000 megawatts of coal capacity is equipped with wet FGD.

Question 51, on page 30 of your testimony you describe experience with FGD additives in improving mercury capture. That's a statement.

51-A, are wet FGD systems effective in capturing elemental mercury? No. Generally oxidized mercury, primarily as mercuric chloride, is the most easily removed form of mercury in flue gas. Elemental Hg is not captured to any significant degree.

Question B, so without something to oxidize the elemental mercury such as an SCR catalyst or an oxidizing reagent, would you expect elemental mercury to be captured in a wet FGD?

No. Generally elemental mercury will not be captured in a wet FGD environment.

Question C, is being B&W's additive an oxidant designed to promote oxidation or is it designed to shift sulfite chemistry to avoid conversion of oxidized mercury, which can be captured, to elemental mercury, which is not captured?

My understanding is that B&W's additive prevents the re-emission of oxidized mercury as elemental mercury.

Question 52, you indicate in table 5-1, the Zimmer Station has a thiosorbic lime FGD system with ex-situ oxidation. Question A, is the process chemistry with regard to sulfites different at a scrubber of this type? Yes.

Question B, how many scrubbers of this type currently are in Illinois or are likely to be installed? None at present.

Question 53, did Endicott Station or Zimmer have an SCR to increase the level of oxidized mercury?

No means to increase mercury oxidation was present at either station.

Question A, how many wet FGD systems are there in Illinois that do not have an SCR upstream? None. All are equipped with SCR.

Question 54 --

MR. AYERS: Sorry, may I ask a follow-up?

HEARING OFFICER TIPSORD: Mr. Ayers.

MR. AYERS: Based on what you just said, would you expect that the units in Illinois with FGD would provide higher mercury removal than shown in table 5-1?

MR. CICHANOWICZ: Yes, I would, except for maybe Dominion, which I have listed as greater than 90 percent.

MR. AYERS: Dominion was one I was going to raise. Did this test of Dominion's Mt. Storm Plant with the SCR in service achieve 90 percent or better mercury removal with and without the additive?

MR. CICHANOWICZ: I believe it was 90 percent without the additive. And the additive had a small effect. But I believe it was 90 percent without the additive.

MR. AYERS: Is this testing with the SCR in operation at that plant far more relevant to Illinois units in light of the configuration of Illinois units that are equipped to have FGD based on what you said?

MR. CICHANOWICZ: That configuration is relevant. But the oxidation of mercury that we will derive from an SCR appears to depend upon a number of factors such as coal chlorine --

HEARING OFFICER TIPSORD: Could you speak up? We have the garage door opening.

MR. CICHANOWICZ: I am sorry. The oxidation of mercury across an SCR will depend on a number of factors including the chloride content of the coal. And I do need to point out that we are still understanding exactly this mechanism and what the longevity of the effect might be. So results from Dominion are certainly encouraging. But to know whether you are going to get 90 percent removal or not, you need to look at the coal chloride content. And we need to have a little bit better understanding of how the mercury oxidation provided by the catalyst will change with time, if it does change with time.

MR. AYERS: That was not the question I was getting at. Let me put it a different way. Given that the Mt. Storm Plant had an SCR -- had an FGD and that the plants that you mentioned in figure 5.1 do not, with the exception of the Storm, then isn't the Dominion Mt. Storm plant a much more relevant comparison for a state which has every unit with a scrubber led by an SCR?

MR. CICHANOWICZ: Yes, it is.

MR. AYERS: Okay. Thank you.

HEARING OFFICER TIPSORD: Question 54.

MR. CICHANOWICZ: As far as you know, is the testing of oxidizing chemicals limited to the work you have described?

Other means to oxidize mercury for removal in an FGD are the subject of research including oxidizing agents such as magnesium chloride presently being explored by the University of North Dakota.

Question 55, on page 31 of your testimony, you mention that dry FGD process conditions prevent high mercury removal. Do you mean for both bituminous and PRB/lignite coals or just for PRB and lignite coals?

The influence of dry FGD conditions on mercury removal depends on the coal type. Both the ICR data and the recent tests by Consol show that for bituminous coals dry FGD followed by a fabric filter provides conditions that promote mercury removal. With PRB coals, dry FGD can neutralize what little chloride is introduced with the coal and inhibit mercury removal.

Question 56, regarding the fuel additive KNX you state on page 32 that at Laramie Station, quote, based on short-term, e.g. several hours tests greater than 90 percent capture was noted. Extended tests are necessary, approximately one year, to verify that this level of Hg capture can be sustained considering boiler and equipment reliability. What is the basis of this statement?

The composition of the additive KNX

is maintained proprietary. If halogens or sodium-based compounds are the key additives that are used to promote the ability of injected sorbent to retain mercury, the role of these added compounds on boiler performance should be explored. Introducing halogens into the fireside of a boiler requires precautions to ensure that corrosion is not induced by secondary compounds generated by the halogens. It is true that boilers have successfully fired high chloride coals and also coals with sodium content, but form and impact of these compounds must be understood.

MR. AYERS: Could I?

HEARING OFFICER TIPSORD: Go ahead, Mr. Ayers.

MR. AYERS: I have to ask a follow-up on that. Your statement on page 32 that is quoted here in the question stating that extended tests are necessary to verify that this level of mercury capture can be sustained. Is that your opinion or an official finding? It is a bit hard to tell from the way it's phrased.

MR. CICHANOWICZ: Well, I guess it's my opinion because the additive is proprietary. I think -- I know I am told that if you sit down and are considering being a purchaser, that they may reveal it to you.

But the point is that when you are adding compounds on the fireside of the boiler, you just need to be careful that you don't interfere with the performance of the boiler. It is true that the industry has successfully fired high chloride coals for many years. And they have fired coals with sodium content.

So whatever they have in there might be actual. But I think what has to happen is that the details of the additive need to be explored to make sure there aren't any impacts on the boiler.

And, as I said before, maybe a year is the typical type of time that people feel comfortable with.

MR. AYERS: So you say approximately a year. Would six months be adequate?

MR. CICHANOWICZ: Perhaps.

MR. AYERS: Do you know if there is any test of this sort of planned here?

MR. CICHANOWICZ: I think there might be. I think that Alstom is marketing this pretty heavily. And there may be some people that are talking to them about it. But that type of information certainly is hard to come by.

MR. AYERS: All right. Thank you.

HEARING OFFICER TIPSORD: Question 57.

MR. CICHANOWICZ: On page 32 of your testimony, section 5.3 is entitled "Sorbent Injection Within ESPs." Aside from TOXECON II did you not intend to say sorbent injection upstream of ESPs? Yes.

HEARING OFFICER TIPSORD: Question 58.

MR. CICHANOWICZ: On page 32 of your testimony, you state historically for any environmental control maximizing residence time for contacting with reagent and absorption/reaction promotes efficient removal. It is anticipated a large ESP with extended lengths of inlet ductwork and generous collecting plate surface area will promote mercury removal while smaller ESPs with limited surface area and inlet ductwork residence time offer limited mercury removal.

Question A, are you stating that carbon is a reagent? No, carbon is not a reagent.

The purpose of this sentence is to show that any environmental process benefits by maximizing the contacting time and mixing between a reagent or a sorbent and also maximizing the residence time for reaction and material collection. Reagent-based environmental controls, such as limestone or lime-based wet FGD, lime-based dry FGA ammonia or urea for SCR and SNCR all exhibit similar tendencies. All things being equal, greater residence time for mixing and providing for a large reaction vessel promote the removal of SO_2 or NO_x depending on the process. The relationship between mercury and flue gas and sorbent is anticipated to be similar. The highest mercury removal will be attained with generous time for contacting and mixing and time for absorption.

Question B, can you describe the difference between a reagent and a sorbent?

A sorbent is a material that has the capacity to either absorb or adsorb another material or compound. A reagent is a substance used in a chemical reaction to detect, analyze or produce another substance.

MR. AYERS: My question is this. We are now moving into the area of ESP performance, which you devote quite a lot of your testimony to. So these questions, obviously, all relate to that.

The first question is, so would you agree with most chemical engineers that sorbents are largely mass transfer limited

rather than being limited by both chemical
kinetics as well as mass transfer as is a
reagent like ammonia in an SCR?

MR. CICHANOWICZ: Yes.

MR. AYERS: So it stands to reason
that mixing is the most important step,
correct.

MR. CICHANOWICZ: I believe so.
Yes.

MR. AYERS: And whatever you do to
improve mixing will improve performance?

MR. CICHANOWICZ: Yes.

MR. AYERS: Don't power plants
already use mixing devices to speed up
mixing?

MR. CICHANOWICZ: In many
applications, yes.

MR. AYERS: Okay. Thank you.

HEARING OFFICER TIPSORD: Question
59.

MR. CICHANOWICZ: The second
sentence, it is anticipated a large ESP
with extended lengths of inlet ductwork
and generous collecting plate surface area

will promote mercury removal while smaller ESPs with limited surface area and inlet ductwork residence time offer limited mercury removal.

Question A, what is the basis for this statement?

Large ESPs are generally accompanied by extended inlet ductwork, which frequently, but not always, is included as part of an ESP replacement. Further, large ESPs, of course, are built on large plants which are less space constrained than small units and the ductwork layout may be more generous.

Question B --

MR. AYERS: Could I ask a question about that?

HEARING OFFICER TIPSORD: Sure.

MR. AYERS: Then I take it from what you said that this passive forum, it is anticipating that? It means that you anticipate that; is that correct? Or you believe that or you opine that?

MR. CICHANOWICZ: I'm sorry, I need

to see the words.

MR. AYERS: It is in question 59. Do you see you use this very passive construction, and I wanted to know who was anticipating?

MR. CICHANOWICZ: It's my opinion.

MR. AYERS: Okay. So it is your opinion, you are not presenting it as an established fact that's widely accepted?

MR. CICHANOWICZ: That's true.

MR. AYERS: Is it your opinion -- and I think you have actually expressed yourself on this question -- that mercury capture occurs to a significant degree on the surface of the ESP plates?

MR. CICHANOWICZ: Well, that's question B. That's the next question.

MR. AYERS: Your version and mine look a little different. Fine, if that's question B, please answer that question.

MR. CICHANOWICZ: My question B is, is it your opinion that mercury capture occurs to a significant degree on the surface of ESP plates?

No. I concur that most mercury capture occurs prior to migration of the sorbent to the ESP plates with the bulk of the mercury removal achieved in the ductwork.

Question 60, is your theory --

HEARING OFFICER TIPSORD: Excuse me, Mr. Harley had a follow-up.

MR. HARLEY: You testified that a smaller facility may be constrained because of ductwork -- just may not be able to provide a physical location for all the necessary ductwork for the residence time to maximize the effectiveness of a sorbent; is that correct?

MR. CICHANOWICZ: Yes.

MR. HARLEY: Would a 90 megawatt facility be generally regarded as a smaller facility?

MR. CICHANOWICZ: Yes.

MR. HARLEY: Thank you.

HEARING OFFICER TIPSORD: Question No. 60.

MR. CICHANOWICZ: Is it your theory that ESP size plays a significant role in influencing mercury capture based on any other sources or information than the references you have cited in figure 5-2.?

First, please understand that I offer figure 5-2 as an anecdotal relationship, not a theory, as I clearly stated in the overview to my testimony. Figure 5-2 is simply a representation of mercury removal for different ESP sizes and, as we have discussed, is compounded by other variables such as sorbent injection rate and type, coal type, ESP temperature, et cetera.

Further, I am not the only one who is concerned that mercury removal may be problematic for small SCA ESPs. This was the reason for DOE initiating a second series of sorbent injection demonstrations following upon the early results from Salem Harbor, Brayton Point and Pleasant Prairie. A recent paper -- a recent review paper by Thomas Feely of the DOE

NETL stated, and I quote, in addition Phase II includes testing sorbents at several power plants with either low specific collection area, SCA, measured as square feet collection area per 1,000 actual cubic feet per minute of gas flow, close parenthesis, cold-side ESPs or hot-side ESPs, both of which can be difficult ACI applications.

HEARING OFFICER TIPSORD: Could you repeat the reference again without the quote, just the reference?

MR. CICHANOWICZ: The reference is a review paper by Thomas Feely Lee of the DOE NETL. And I don't -- it is called out in my testimony, but I don't have the name of it right here.

HEARING OFFICER TIPSORD: Okay, just double-checking.

MR. CICHANOWICZ: I will identify it.

HEARING OFFICER TIPSORD: Mr. Ayers?

MR. AYERS: Mr. Cichanowicz, we previously discussed the paper by

Professor Clack that discussed mercury capture in ESPs. And as part of that discussion, you noted that his work shows that mercury capture through convective mass transfer to plates is rather small. And as we discussed, Professor Clack's work shows that the capture of mercury from mass transfer to suspended particles appear to be completed well within the treatment time of even the smallest ESP in Illinois so that there would be no advantage of a large ESP over a small one for mercury capture.

Do you have any other mechanisms to offer of why -- that would explain why larger ESPs might be more effective?

MR. CICHANOWICZ: Well, as I pointed out, the larger the ESP comes with it, a different ductwork layout that may be more amenable to getting the mixing systems installed and getting the kind of mixing that you need very quickly. So we just simply may need more residence time in which to mix the sorbent. The sorbent, of course, has to mix very quickly. And I agree with everything that has been said that the rate at which the material absorbs mercury is probably not the limiting step. And don't forget Dr. Clacks assumes and you focused, Mr. Ayers, on the features of the sorbent, but it also assumed very good disbursement of particles and essentially, basically, good mixing through the uniform distribution through the gas.

So the point is the inlet ductwork array could be a factor. And again Dr. Staudt three-quarters of the way through his testimony in Springfield talked about the inlet residence time at Meramac as being a factor. And it is. That's a factor too. That's on the front end.

Now, on the back end we are basically talking about the ESP being able to pick up any residual carbon that may not be collected.

MR. AYERS: Do you have any data

about the -- to support the statement that you are making about the ductwork -- the differences in ductwork between large and small ESPs?

MR. CICHANOWICZ: Well, that was the purpose of those satellite images I showed you this morning. I don't have data to go in and make measurements and come up with calculated residence time.

MR. AYERS: Those didn't show -- you couldn't have used those pictures to determine -- to reach a conclusion that large ESP plants have more -- more -- yes, more effective, more usable, more mercury removing ductwork than the small, could you? I don't see how you could have in any way come to that --

MR. CICHANOWICZ: I didn't quantify all the different units. That is something that ideally could be done. But we just haven't done it.

I have been around I don't know how many hundreds of power plants. And generally there is not a lot of room between the last heat exchanger that's there that recovers heat in the air heater and the inlet ESP, particularly in older plants. They just didn't make them that way. There is not a lot of room.

So when I showed the satellite images of the plants that have the newer ESPs, there was a lot of ductwork. St. Clair, Meramac, Brayton Point, they all had some fairly optimizing duct runs. So by looking at it and having been around hundreds of power plants, I feel pretty comfortable that those offer good mixing conditions.

Now, when I showed you Will County and some of those, no, I couldn't see what was going on behind the boiler building. And that work would have to be done.

All I am saying is that it is open -- it is an open item.

HEARING OFFICER TIPSORD: For the record, the photos we are talking about from this morning are Exhibits 89 through 95.

MR. AYERS: I detect a rather large shift in the view expressed between your testimony and your comments today about the role of the ESP versus the ductwork ahead of the ESP. Would you say that that was true?

MR. CICHANOWICZ: No. Let me see if I can find my three-page introduction to my testimony. Well, it is not in the introduction. But inlet ductwork -- we can do a word search on my testimony. And you see it associated perhaps not with every station on the ESP SCA. But you are not suggesting this is the first time I am mentioning it today, Mr. Ayres, because it is in the testimony.

MR. AYERS: Wouldn't you have to say, though, based on the fact that the only real evidence offered is the pictures from the sky, that this theory that larger units are more able to capture mercury because of the greater ESP ductwork has to be considered speculation at this point?

MR. CICHANOWICZ: Well, you know,

you are welcome to -- it could be, yes, it is speculation. I mean, I have -- I put up the chart. And I say this was an anecdotal relationship. And I -- I have not used the word theory. I have gone out of my way to separate using the word theory with this.

All I'm saying was I laid out the plots and this is what it's suggesting and here are some possible reasons why it might be true. If you want to call that speculation, that's fine.

To an extent, it is. I don't have detailed data. But again that requires going through all ten plants in Illinois and, essentially, getting in a look at what the inlet ductwork looks like and doing some calculations. And that hasn't been done.

HEARING OFFICER TIPSORD: Mr. Nelson, you had a question earlier. Do you still have a question?

MR. NELSON: Just quickly. You mentioned the quote from Mr. Feely of DOE

NETL referring to the need to look at a couple of the smaller ESPs in the program of which the Crawford site is one. My question is, he wasn't referring to lower mercury removal in small ESPs, was he? But instead the concern or the possibility was that particulate emissions or opacity increases in smaller ESPs might be something they wanted to look at, would that be what he was referring to?

MR. CICHANOWICZ: I don't know, Mr. Nelson. How can it not be the same? Because if you could -- if you had a particulate matter breakthrough problem not unlike with SNCR, you can cut back on the reagent injection and take a lower mercury removal. It is related.

MR. NELSON: I thought that we have established that theoretically higher SCA doesn't give you higher mercury removal. But you can't point to a single piece of data from a low SCA plant that shows lower mercury removal. But it is just conjecture. Don't you think that opacity might really be the issue then, not mercury? Aren't they separate issues?

MR. CICHANOWICZ: I don't think so because if you have an opacity problem, one means of handling it is to cut down on the sorbent injection mass rate. If you are having problems collecting sorbent that comes in, one possible issue in addition to the other things that you might be able to do is simply to reduce the mass injected. And everybody's curves in the world, including yours, show that mercury removal is proportional to carbon sorbent injection. So I think they are related.

MR. NELSON: I don't want to get ahead of some of the questions. But have you seen any data that show increased opacity, for example, with respect to increased sorbent injection?

MR. CICHANOWICZ: Well the most recent ADA quarterly report that is on the website for the Conesville Station reports opacity problems with a couple of sorbents. And it basically -- we can have this here tomorrow, if you would like. It basically states that it sounds like all the others, that some opacity spikes are noted from a sorbent injection. And it is not clear what the sources are.

But the first quarterly report from ADA which is on the website now for Conesville reports opacity problems with two sorbents.

MR. NELSON: And that report is not in the record that you are citing?

MR. CICHANOWICZ: I believe it was referenced in the table that I handed out this morning because it was -- it is a Conesville application. That came up after I filed my testimony. Okay. And so it is in the record as part of the table that I submitted and it was on the disk that was submitted.

MR. NELSON: And that plant burns a high sulfur bituminous coal?

MR. CICHANOWICZ: Yes, it does. But your question was, essentially, show me where there has been a sorbent breakthrough problem with the ESP. And that's what I was answering.

MR. NELSON: Without seeing the document, I can't comment.

HEARING OFFICER TIPSORD: Mr. Ayers?

MR. AYERS: Just a follow-up on that. Don't power plants often have opacity problems?

MR. CICHANOWICZ: None of my clients.

MR. AYERS: You might want to look around the table there.

MR. CICHANOWICZ: From time to time, there is a difference between, you know, an occasional opacity problem and something that's somewhat persistent.

MR. AYERS: You know, it sounds like, yes, there have been -- may have been an occasional opacity problem that happened at the time there was a sorbent injection test going on.

But without looking at the pattern of capacity violations or exceedences for the given unit through the year without the test going on, it is a little hard to say whether it has anything to do with the injection, isn't it?

MR. CICHANOWICZ: Yes, that's true. Again I am just reporting that the latest report put on the ADA website or the DOE website for Conesville addressed possible -- not possible -- opacity issues, but wasn't clear what they were attributable to. That was one of the conclusions of the quarterly testing period, that they were going to look at the causes of that.

MR. AYERS: It would be a natural human tendency to notice it a lot more at that moment when you thought one of the potential problems here was opacity, wouldn't it?

MR. CICHANOWICZ: Repeat that, please.

MR. AYERS: Wouldn't it be a natural human tendency to notice the opacity violation that happened at the time you were testing the sorbent injection a lot

more than you noticed the ones that
happened at other times because you were
looking for it?

MR. CICHANOWICZ: I don't know that
that's a qualitative -- that's something
that you read on an opacity meter.

MR. AYERS: No, it is not something
you read on an opacity meter.

HEARING OFFICER TIPSORD: Mr. Zabel?

MR. ZABEL: Do you have a COM on the
unit at Conesville, do you know?

MR. CICHANOWICZ: I don't know.

MR. ZABEL: Would you expect they
do?

MR. CICHANOWICZ: I would expect
they do.

MR. ZABEL: And if they had one,
they don't have to notice it, the meter is
going to record it, will it not?

MR. CICHANOWICZ: I believe so, yes.

HEARING OFFICER TIPSORD: Okay.
Mr. Nelson?

MR. NELSON: Sid Nelson, just
quickly. At Conesville were they

injecting brominated carbon or plain carbon when this happened?

MR. CICHANOWICZ: I cannot remember. But it is in the quarterly report.

MR. NELSON: Because it was a high sulfur bituminous coal, would you suspect that it may not have been a brominated carbon?

MR. CICHANOWICZ: It had a new name Darco Hg with some letters on it I had never seen before. So I think it is a new special high sulfur.

MR. NELSON: So this is not a commercially available sorbent? Are they testing what they call high SO3 sorbents at this plant?

MR. CICHANOWICZ: I believe that's the first of the exercise, yes.

MR. NELSON: So this is not a commercially available sorbent that has been tested in all these other plants that have shown opacity?

MR. CICHANOWICZ: It's probably a commercial -- it's probably an experimental sorbent and it probably hasn't been tested on those fronts.

MR. NELSON: The injection rate at Conesville when they saw this, is that injection rate much, much higher than is required for 90 percent mercury control at subbituminous plants that you have here in Illinois? Do you recall what the injection rate was when they had the opacity?

MR. CICHANOWICZ: I don't recall it is on the DOE website. And we can probably access it tonight if you wish. I meant to have it here as a handout, but we didn't have time to pull it out.

MR. NELSON: Thank you.

HEARING OFFICER TIPSORD: It would be helpful. I thought I had understood you to say it is on the CD. Did I misunderstand that?

MR. CICHANOWICZ: It is on the CD.

HEARING OFFICER TIPSORD: Although we don't physically have a copy, it is in the Board's records.

MR. CICHANOWICZ: Yes.

HEARING OFFICER TIPSORD: Can we get through question 61?

MR. AYERS: We will give it a try.

MR. CICHANOWICZ: 61, on page 34 you state that at Detroit Edison's Monroe power plant, Hg removal with halogenated AC was less than the measured -- less than that measured with conventional, with highest removal being approximately 83 percent, referencing Sjostrom 2006, slide 24. Was the 83 percent removal attributable to the sorbent?

The Hg removal described is, quote, change in outlet mercury concentration, unquote, which if only vapor phase mercury is measured implies vapor phase mercury removal as a consequence to the sorbent. However, I was not able to corroborate this statement with data in the quarterly report describing the same text, which reports, quote, vapor-phase mercury removal, unquote, as measured from the ESP inlet to the outlet.

Figure five in the quarterly report for April to June 2005 from ADA addressing this test reports these data at a higher mercury removal than the new slide, perhaps accounting for the inherent vapor phase mercury removal across the ESP. That's my read answer to get my thoughts straight.

But this data point is the one change that I had this morning in that I did read the slide wrong. It was just the incremental mercury removal, not the total mercury removal. And I went back to the quarterly report and tried to sort that out. I put new data on the slide which I believe is -- is more representative.

But the way it is reported, I am still not sure it is the total mercury removal. But I did try to correct this.

HEARING OFFICER TIPSORD: Okay. A.

MR. CICHANOWICZ: According to the next slide in the referenced presentation, that shows the total removal including cobenefit, is total removal close to

90 percent? Yes, it is. That's the data that I corrected.

HEARING OFFICER TIPSORD: It is almost 5:00 o'clock and it has been a long afternoon. So let's go ahead and recess for today. We will start at 9:00 a.m. tomorrow. We will go from 9:00 to about 10:30 and recess until 1:00 clock for a board meeting.

(Whereupon the proceedings in the above-entitled cause were adjourned until August 17, 2006, at 9:00 a.m.)

STATE OF ILLINOIS)
) SS:
COUNTY OF LAKE)

I, Cheryl L. Sandecki, a Notary Public within and for the County of Lake and State of Illinois, and a Certified Shorthand Reporter of the State of Illinois, do hereby certify that I reported in shorthand the proceedings had at the taking of said hearing and that the foregoing is a true, complete, and correct transcript of my shorthand notes so taken as aforesaid, and contains all the proceedings given at said hearing.

____

Notary Public, Cook County, Illinois
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