BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

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

NOTICE

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

SEE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Illinois Pollution Control Board the ILLINOIS ENVIRONMENTAL PROTECTION AGENCY'S PRE-FILED QUESTIONS, a copy of which is herewith served upon you.

ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY

By: _____
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DATED: August 7, 2006

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THIS FILING IS SUBMITTED ON RECYCLED PAPER

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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY'S PRE-FILED QUESTIONS

NOW COMES the ILLINOIS ENVIRONMENTAL PROTECTION AGENCY ("Illinois EPA"), by its attorneys, and submits the following questions based upon the testimony submitted by Dynegy Midwest Generation, Inc., Midwest Generation, LLC, Prairie State Generating Station, LLC, and Kincaid Generation, LLC.

Questions for J.E. Cichanowicz

1. Do you consider yourself an expert on utility mercury control? If so please describe your background, particularly with regard to experience in the area of power plant mercury emissions control? Describe any specific training, clients or contracts.

2. Please provide a list of your publications in the field of power plant mercury control.

3. Do you consider yourself an expert on electrostatic precipitators? If so, please describe your background, particularly with regard to experience in the area of power plant electrostatic precipitator design? Describe any specific training, clients or contracts.

4. Please provide a list of your publications in the field of power plant electrostatic precipitation.

5. Have you ever been an employee of a company that designs or constructs power plant air pollution control equipment, particularly electrostatic precipitators or mercury emissions control?

6. Are you an expert on mercury measurements or mercury CEMS? If so, please describe your background, particularly with regard to training and experience in

the area of mercury measurements or mercury CEMS? Describe any specific training, clients or contracts.

7. Are you being paid to testify today?

   a. Who are you testifying on behalf of today?

   b. What percentage of your clients are utilities versus public sector?

8. On page 2 of your testimony you state that " . . . the targeted outlet content of Hg - in many cases less than 1 microgram/m^3 - is too low to be accurately monitored for compliance." Are you in any way qualified to verify Mr. McRanie's testimony that you, by reference, include in yours?

9. You subsequently state that "In this testimony, I will accept – without verification or other validation - that such measurements can be made to within a reasonable degree of accuracy, precision, and bias." And later add, "Section 2.4.2 and 2.4.3 describe why I believe the cumulative effect of measurement uncertainty, variability in coal composition, and variability in process operation require a design Hg removal target of at least 93-95% to consistently deliver 90%." Are these inconsistent statements? If yes, which statement is correct?

10. On page 3 of your testimony you state: "First, as noted in Section 3, the history of environmental control evolution has taught us long-term experience - on the order of one year - is required before commercialization. Operating trials of a 30-day duration, although an impressive and a necessary first step, are inadequate." Would one-year programs be much more expensive than 30-day programs?

11. On page 3 of your testimony you state: "The use of ACI with existing ESPs could endure the same fate as hot-side ESPs - the accumulation of carbon could assert detrimental effects on particulate matter removal or reliability, similar to the way the yearlong accumulation of sodium on emitting electrodes compromised the hot-side ESP."

    a. Doesn't fly ash from many boilers contain significant levels of carbon?

    b. You describe later in your testimony that there was high LOI at Yates 1. Do you recall what that level was?

12. On page 3 of your testimony you state concerns about triggering NSR due to increased PM emissions. Does not the IL Rule, particularly the TTBE specifically address the risk of PM emissions?

13. On page 3 of your testimony you state: "Notwithstanding the belief by the Presque Isle project team that 90% Hg removal is certain, to date there is no data

defining such results for more than brief test periods." Do you believe that they are wrong or their beliefs are unfounded? If so, why?

14. On page 4 you state: "Further, Table 5-1 in Section 5.6 summarizes the significant ESP modifications – in some cases complete ESP replacements - implemented to six of the most frequently cited demonstration sites."

    a. Have you made a comprehensive evaluation of the ESP activities of all of the test programs cited in the IL EPA TSD?

    b. If not, why not?

    c. What is unique about these six facilities?

15. You further state on page 4, the fourth paragraph that there are a "confluence of events" that must occur for the IEPA regulation to be attainable. If ACI within small ESPs in Illinois were able to sustain carbon injection and provide Hg removal on a long-term basis sufficient to meet the requirements, why would the other things have to happen as well? If this were true, wouldn't the other issues be limited the two hot-side units and therefore be much less of a concern?

16. You further state on page 4 that your expected costs are 1.77 billion dollars. Is it true that most of the difference in your expected costs versus Illinois' estimated costs is attributable to differences in opinion regarding the performance and reliability of sorbent injection to provide mercury reductions when injected upstream of an ESP?

17. On page 4 of your testimony you refer to Figure 5-2 of your testimony as evidence that ESP size has an impact on mercury capture from ACI. Please provide for each of the data points on Figure 5-2 the following:

    a. Name of the facility
    b. Sorbent type (Darco-LH, BPAC, Darco-HG, HOK, etc.)
    c. Sorbent injection rate in lb/MMacf associated with that the test point displayed
    d. Intrinsic mercury removal versus mercury removal with sorbent
    e. Fuel type – PRB, Bituminous, Lignite, if a blend, indicate percentages
    f. Sulfur content of the fuel in lb/MMBtu (SO3, if measured)
    g. Carbon content of the fly ash
    h. ESP temperature
    i. Air preheater type (lungstrom or tubular)

18. So that it is easy to follow, please provide the figure with an assigned number for each data point. Please also provide a table containing this information for each data point.

19. On page 7 of your testimony in the second paragraph, you state that "the average content of Illinois basin coal fired can be considered to be 5.43 lbs/TBtu appears optimistic, compared to alternative sources."

20. Referring to Figure 2-2 of your testimony, please indicate what IL mercury concentration corresponds to the 50% cumulative percent level?

21. Referring to Figure 2-4 of your testimony, please indicate what IL mercury concentration corresponds to the peak, or mode, of that distribution?

22. On page 8 of your testimony you state:

    The methodology used to derive target Hg emission rates in state proceedings does not consider variability in coal Hg content, measurement, or process operations. State agencies may believe variability is irrelevant as a 12 month rolling average will eliminate the impact of variations. Consequently, a 90% Hg removal rate contemplated by many states actually mandates design targets such as 93-95%. The reasons for this are discussed in this section, and also considered in more detail in the testimony of Richard McRanie to the Illinois Pollution Control Board (PCB).

23. Are you suggesting that the averaging provides little benefit to address variability and uncertainty – so little that power plants have to emit only about half of the mercury emissions they are actually permitted to in order to have assurance of compliance?

24. On page 11 of your testimony, third paragraph, you state that one standard deviation in coal mercury concentration should be used to calculate necessary removal rates. What is the basis of using one standard deviation? Please discuss, in detail, the statistical theory for choosing this number.

25. Are you familiar with linear regression statistical methods?

26. On page 11 of your testimony, third paragraph, you give an example using a PRB coal of why more than 90% removal is required to achieve the output-based standard reliably.

    a. Wouldn't a bituminous coal user be more likely to use the output-based standard than a PRB user due to the lower average mercury content of IL coal?

    b. From Figures 2-2 through 2-4 is the standard deviation in the mercury content of IL coal less than that of PRB coal?

c. Based upon your theory, would a lower average coal mercury content and a lower standard deviation result in lower necessary mercury control rate by your method?

27. If only 90% removal is necessary, why do you argue that 93.7% is needed?

28. If the concentration of the mercury in a plant's coal was high enough that the 90% requirement was easier to attain, wouldn't they just comply with the removal standard instead of the output based standard? If so, why then would they have to control to greater than 90% as you testify?

29. On page 12 of your testimony you state, "Given the evolutionary nature of Hg CEMS, there is no documented reason to believe that the sum of all errors - either over-reporting or under-reporting Hg content -over a 12 month period will equally compensate." Do you have any evidence that 20% errors are systematic and, therefore would be additive?

30. If real evidence of systematic errors did exist in the coal analysis as you describe on page 12, "The uncertainties in Hg measurement were addressed in an early study by EPRI that was conducted in concert with the ICR coal measurement program. The results showed that for the most widely used ASTM D3684 method, employing the oxygen-bomb approach, both a high and low bias of reported Hg content was witnessed among participating laboratories. Specifically, a high bias to actual Hg content was noted for low ash coals, while a low bias to actual Hg content was noted for high ash coals (Goodman, 2006). Another widely used method – EPA 7476 – exhibited a low bias."

a. Could these uncertainties not be compensated for and would not EPA and ASTM recommend such compensation? If ASTM has not recommended compensation, why not?

b. What does the citation to "Goodman, 2006" refer to?

31. Would you prefer quarterly Ontario Hydro measurements upstream and downstream of emissions control devices, as required in some states, or upstream and downstream CEMS as used in numerous DOE programs to demonstrate percent mercury capture?

32. On page 13 of your testimony, you state that: "Several 30 day tests of ACI into an ESP and a one year-long trial with ACI into a fabric filter all exhibit variations in Hg outlet. Specifically, data from 30 day trials at Holcomb, Meramac, and St. Clair suggests that, depending on the unit, Hg removal varied between approximately 85% and 97+%. The average Hg removal reported for these trials - 91% for St. Clair and 93% for Holcomb and Meramac – suggest these variations are not of consequence."

a. Do not each of these boilers primarily burn western coal?

b. What type of coal is primarily burned in unscrubbed Illinois plants?

c. Doesn't this demonstrate that 97% removal does occur for short periods, thereby addressing your concerns about variability?

33. You further state that "Perhaps more significant is the variability in Hg control at Yates 1, where the injection of 4 lbs/MACF of conventional activated carbon into a small ESP produced total Hg removal of 60-85% - the result of inherent variations in boiler operation, sorbent injection rate, and inherent Hg removal."

a. Is not Yates 1 a scrubbed unit using wet FGD without SCR and firing bituminous coal?

b. How many Illinois units fit this description?

c. Over what range did the cobenefit ESP mercury removal vary?

d. Is it possible that poor sorbent distribution may have contributed to the poor performance at Plant Yates?

34. Would it be correct to state that the example in Section 2.5 of your testimony describes your reasoning why over 90% reduction is needed to achieve the output-based emission rate?

35. If the output based rate were more stringent for a particular unit, why would the decision be made to not choose to comply by meeting the reduction requirement?

36. In your testimony in Section 2.5 you include measurement uncertainty as an additional reason to over control. However, you previously testify (page 2) "In this testimony, I will accept – without verification or other validation - that such measurements can be made to within a reasonable degree of accuracy, precision, and bias." Are these statements inconsistent?

37. Are you familiar with how the statistical method called linear regression be used to make predictions within confidence ranges?

38. On page 16 of your testimony, you describe a scenario where a unit achieving under 90% removal must be averaged in with other units to achieve 90% average, causing the others to have to achieve higher than 90% removal rates to compensate. If compliance with the emissions requirement is not possible, isn't it true the owner would have the option to use the TTBS of the proposed rule to take the under-performing unit out of the average until they can remedy the performance of the underperforming unit?

39. In Section 3.2.1 of your testimony, and specifically, Figure 3-1:

    a. What do the percentages in the 1982 Reliability Survey Represent?

    b. The FGD market appeared to be fairly slow prior to the late 1970s. Was the pick up on business in the late 1970s largely due to New Source Performance Standard requirements?

    c. Does not this increase in business also coincide with improvements in removal efficiency?

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?

41. In section 3.3.1 of your testimony, you mention that the Franken plant in Germany, installed in 1987-89, was the first to achieve 90% reduction.

    a. Were not the German plants subject to a specific emission limit that could be complied with through SCR with lower than 90% removal in most cases?
    b. What motivation would a plant have to operate at a higher removal rate – which would incur more ammonia cost and risk higher ammonia slip?
    c. Since there is not a citation here, what is your source for this information on German plants?

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?

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

44. 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?

45. On page 22 of your testimony, you note that SCR catalyst cost has dropped due to competition.

    a. Do you believe that all of those competitors in the SCR catalyst business would have been attracted to the US market had very few SCRs been built in the US?

    b. Is it possible that a similar effect could happen for mercury sorbent as a result of a rule that creates a market for mercury sorbent?

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?

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

47. Please provide your source for Figure 4-1

48. Regarding Figure 4-1, is the range in ESP size, at least in part, due to different coals burned in the US?

a. Would ESPs designed for high sulfur bituminous coals be smaller than for medium sulfur bituminous coals, all else equal?

b. Would ESPs designed for low sulfur coals, especially PRB coals, be larger than for medium sulfur coals, all else equal?

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?

d. And that is why several IL 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?

49. Please describe the specifics for each of the units in Figure 4-2 of your testimony.

a. Plant name and unit #

b. % 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, etc.)

e. % SO_2 removal by the FGD

f. Particulate control device (ESP, FF, etc.)

50. Regarding your statement on the last paragraph of page 28 of your testimony pertaining to mercury in gypsum:

a. Do you agree that the mercury is going into the gypsum today at plants with FGD, regardless of any requirement to control mercury?

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?

c. Is that why US Gypsum's program is funded by DOE?

d. What percent of IL coal capacity has wet FGD?

51. On page 30 of your testimony you describe experience with FGD additive in improving mercury capture.

a. Are wet FGD systems effective in capturing elemental mercury?

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?

c. Is 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?

52. You indicate in table 5-1 Zimmer station has a thiosorbic lime FGD system, with ex-situ oxidation.

a. Is the process chemistry with regard to sulfites different at a scrubber of this type?

b. How many scrubbers of this type currently are in Illinois or are likely to be installed?

53. Did Endicott Station or Zimmer have an SCR to increase the level of oxidized mercury?

a. How many wet FGD systems are there in Illinois that do not have an SCR upstream?

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

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

56. Regarding the fuel additive KNX, you state on page 32 that at Laramie Station "Based on short-term (e.g. several hours) tests, greater than 90% Hg 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?

57. On page 32 of your testimony, Section 5.3 is entitled "SORBENT INJECTION WITHIN ESPS". Aside from TOXECON II, did you intend to say "SORBENT INJECTION UPSTREAM OF ESPS"?

58. 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 Hg removal while smaller ESPs with limited surface area and inlet ductwork residence time offer limited Hg removal."

    a. Are you stating that carbon is a reagent?

    b. Can you describe the difference between a reagent and a sorbent?

59. The second sentence, "It is anticipated a large ESP with extended lengths of inlet ductwork, and generous collecting plate surface area, will promote Hg removal while smaller ESPs with limited surface area and inlet ductwork residence time offer limited Hg removal."

    a. What is the basis for this statement?

    b. Is it your opinion that mercury capture occurs to a significant degree on the surface of the ESP plates?

60. Is 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 and Figure 5-2?

61. On page 34 you state that "At Detroit Edison's Monroe Plant, Hg removal with halogenated AC was less than that measured with conventional, with highest removal being approximately 83% (Sjostrom, 2006, Slide #24)." Was the 83% removal attributable to the sorbent?

    a. According to the next slide in the referenced presentation, that shows total removal including cobenefit, is total removal close to 90%?

62. You state on page 34 of your testimony that "Public pronouncements by suppliers of bromine that 100% price increases in bromine are possible further suggest that prices may not be stable. It should be noted there is only one source of bromine in the U.S. – saline aquifers in Arkansas – so transportation and supply conditions

could be constrained." What is the basis for this statement that transportation could be constrained?

63. What percent of the halogenated carbon is bromine?

64. If it is only a few percent, won't any cost impact from the price changes you predict for bromine be fairly muted?

65. If the Gaston baghouse was originally designed and constructed with the intent of being a TOXECON system for capturing the additional particulate from the carbon injection, in your opinion would 90% removal or more be demonstrated in a long-term test?

66. On page 36 of your testimony you state that :The role of coal blending on Hg removal performance of ACI with an ESP can be inferred by comparing data from Ameren's Meramac and Detroit Edison's Monroe Station. Both of the tested units featured ESPs of similar SCA, but fired different fuels - Meramac exclusively fires PRB, while Monroe fires PRB with a 40% blend of bituminous coal." Does this demonstrate that fuel characteristics play a very significant role in performance?

67. Why does Table 5-2 of your testimony show only seven plants when according to Figure 5-1 you have data on 25 plants?

68. Why does Figure 5-2 of your testimony show only 14 plants when according to Figure 5-1 you have data on 25 plants?

69. You state on page 38 of your testimony that "In summary, although Figure 5-2 mixes several variables on one chart - sorbent type, duration of test, mass injection rate, and ESP design – the resultant trend suggests that major ESP upgrades are required to derive 90% Hg removal." Does this statement take into consideration these and other critical factors such as fuel type?

    a. Do you agree that sulfur and coal type have significant effects on mercury capture?

    b. Does this figure in any way distinguish those effects from others?

    c. Do not bituminous coals tend to have higher sulfur levels than PRB coals?

    d. If so, do bituminous coals not achieve as much removal at the same sorbent rate?

    e. Do you agree that sulfur and coal type have significant effects on the sizing of an ESP?

f. Does this figure in any way distinguish those effects from others?

g. Are not the ESPs designed for bituminous coals generally smaller than those for PRB coals?

70. As far as you know, is an even, parallel, and somewhat laminar flow important for good ESP performance?

a. If so, do you know why?

71. Don't ESP suppliers install devices to attempt to achieve these flow conditions?

72. Do you think that TOXECON II possibly disturbs this flow field within the ESP by blowing carbon right into the middle of it?

73. In light of the fact that the Monroe ESP was smaller than the "effective" ESP (what remained after sorbent injection) at Coal Creek's TOXECON II site and no problems were cited at Monroe, is it likely that problems at Coal Creek's TOXECON II test were a result of challenges with the TOXECON II technology and not an ESP limitation that would exist if sorbent were injected upstream of the ESP?

74. On page 40 of your testimony, you state:
"Carbon – like any other solid – can accumulate within the ductwork or internal surfaces of the ESP, and influence the electrical properties. Specifically, erratic electrical behavior was witnessed at Yates due to shorting of current over insulators; and deposits on insulators at Coal Creek may have contributed to T/R set failure. This problem, which perhaps contributed to a compromise in ESP performance at both sites, may not be a fatal flaw, but additional tests to evaluate new insulator or cleaning equipment is required." Wasn't the Coal Creek test a TOXECON II test, where carbon is injected into the middle of the ESP rather than upstream of the ESP?

75. Referring to the paragraph on page 11 of the paper titled, "Sorbent Injection for Mercury Control Upstream of Small-SCA ESPs" by Dombrowski that is referenced in the TSD

a. Does this indicate any problem from carbon injection during this test?

b. Could you please read the fourth bullet under the Conclusions on page 12. Does this indicate any problem from carbon injection during this test?

76. According to the report titled Sorbent Injection for Small ESP Mercury Control in Low Sulfur Eastern Bituminous Coal Flue Gas Quarterly Technical Progress Report April 1– June 30, 2005, the Yates 1 ESP has a design basis flowrate of 490,000 acfm. At a treatment rate of 17 lb/MMacf – roughly the highest injection

rate experienced at Yates 1 – how much carbon is being introduced to the gas stream per hour?

a. How much at around 6 lb/MMacf?

77. According to 2004 EIA Form 767 data submitted by the plant owner, the average heating value of the fuel was about 12400 Btu/lb, and the average ash was about 11.4%. Using this or other information you may have from the owner, please make a rough estimate of how much fly ash enters the Yates ESP each hour at full load? If you relied on other information from the plant owner, describe the information.

78. You state on page 40 of your testimony, "First, the PM emissions standards for Yates are well below the Georgia limit 0.2 lbs/MBtu; the owner frequently operates these units at less than 0.10 lbs/MBtu, which typifies PM limits in other regions in their system. (For example, Alabama requires a PM limit of 0.10 lbs/MBtu). Data presented in the quarterly report to the DOE summarizing these results (Richardson, 2005) shows baseline PM emissions less than 0.10 lbs/MBtu." Is this report by Richardson the sole source for your statement, or are there others?

79. With regard to the report titled Sorbent Injection for Small ESP Mercury Control in Low Sulfur Eastern Bituminous Coal Flue Gas Quarterly Technical Progress Report April 1– June 30, 2005:

a. Did not inspections find that stand-off insulators were damaged?

b. Would damaged stand off insulators impact the performance of the ESP?

c. Although visual inspection found carbon in the insulators are there any other sources of carbon in the ESP than the activated carbon?

80. Again, with regard to the report titled Sorbent Injection for Small ESP Mercury Control in Low Sulfur Eastern Bituminous Coal Flue Gas Quarterly Technical Progress Report April 1– June 30, 2005. Please refer to the first paragraph on page 3-32. Doesn't this state that ESP behaved erratically prior to injection of any carbon during the long-term test but leaves open the question of whether short-term tests affected the ESP insulators?

81. On page 3-33 of the report titled Sorbent Injection for Small ESP Mercury Control in Low Sulfur Eastern Bituminous Coal Flue Gas Quarterly Technical Progress Report April 1– June 30, 2005, it states that "The arc rate in the first (A) field is significantly higher than arcing in the B field, which is higher than arcing in the C field. Furthermore, arcing in the B and C field does not occur unless there is significant arcing in field A. While arcing in the first field was as high as 35

apm, no sparking was observed." Is it not normal that the first field has a higher arc rate than the subsequent fields because it captures the most material?

82. On page 2-16 of that same report the fourth paragraph says, ". . . the vortex-like flow at the ESP inlet made isokinetic sampling impossible. It was decided that for the final Ontario Hydro campaign that the ESP inlet site be omitted in favor of the stack location."

    a. Do you know if vortex-like flow is desirable or helpful in an ESP?

    b. Don't ESP suppliers attempt to straighten the flow out with flow control devices in order to improve performance?

83. On page 41 of your testimony it discusses the results of testing at Yates 6. Please provide your source of this information.

84. On page 42 of your testimony you describe your version of a conversation with Mr. Peter Hoeflich regarding experience at a Progress Energy plant. Who is Mr. Hoeflich?

85. In section 5.6.5 of your testimony that starts on page 42, you express your concern that sorbent injection could trigger NSR.

    a. According to your calculations and interpretation of this ruling, could not NSR be triggered due to the normal variability of the coal ash content and capture of fly ash in the ESP, regardless of the injection of carbon?

    b. Please provide the contractual coal specifications – specifically for heating value and ash content - for the plants where you believe this is a concern.

    c. Even if this is were a concern, could it not also be handled through the TTBS in the rule?

86. On page 44 of your testimony, you state that **"**The willingness of developers to offer such guarantees is a sign of their confidence in success. However, the terms and conditions of the guarantees are limited. This section will describe how, despite attempts by suppliers to mitigate risk, the uncertainties incurred by early adopters of control technology are significant risk in terms of uncompensated costs and revenue loss."

    a. Are you aware of any air pollution control supplier, or any supplier of any piece of power plant equipment, that is willing to take unlimited liabilities as part of their guarantees?

    b. If so, please provide details and supporting evidence.

87. On pages 44 and 45 of your testimony, you use the term “collateral damage”, are you referring to what is normally described as “consequential damages” in contract language?

88. On page 46, you state regarding demonstration tests and guarantees:
“ . . The demonstration data suggests that in excess of 90% Hg removal can be achieved with 3 lbs sorbent /MACF.

89. If meeting the targeted Hg removal requires 5 lbs/MACF instead of 3 lbs/MACF, the additional cost for reagent (at 80% capacity factor) is $1.342 M per year (at a delivered sorbent price of $0.85/lb). The supplier will provide this additional sorbent at no cost, but limited to the contract value of $1.27 M. Thus, after 25 months of providing additional reagent, the owner must bear all costs, while future revenue to the supplier increases by 66%. Consequently, the supplier has little to lose and significant up-side market potential with this guarantee.”

    a. Are you suggesting the supplier sees a benefit in missing a guarantee?

    b. In this case, after the 25 month period where the extra sorbent is provided for a fee, what is to prevent the owner from shopping for other, less expensive or more effective sorbents?

90. On page 59 of your testimony you state:
“The ability to uniformly disperse sorbent throughout the entirely of a flue gas cross-section, necessary for high Hg removal, is assumed to increase with the size of the flue gas duct. This view is consistent with a global review of the various ACI demonstrations - among the highest Hg removal was noted at the smallest generating sites (e.g. St. Claire, Meramac) and among the lowest at the largest generating sites (Pleasant Prairie, Monroe). Although coal composition and SCA likely also play a role, given the information available to date it is not possible to exclude generating size. This concern is bolstered by release of results from CFD modeling of reagent injection systems that report the distribution of residence time in real systems can be only half that calculated for “plug flow” conditions. Although these specific results for Brayton Point did not compromise performance, they do not allay concerns that sorbent mixing and distribution problems are independent of generating size”

    a. Wasn’t the smallest test site the Lausche plant? How did the performance at the Lausche plant compare with that at Saint Claire or Meramac?

    b. Isn’t Monroe a bituminous unit, which you’d expect to be more difficult than Saint Claire or Meramac?

    c. Didn’t Pleasant Prarie use untreated sorbent, which we now know to be unsuitable for PRB units, while Meramec and Saint Claire used halogenated sorbent, which is the best sorbent at this time for these units?

91. Didn't the modeling at Monroe, Brayton Point and other sites show that turbulence – which controls mixing – is the most important parameter?

92. On page 60 of your testimony you state that "The data of Durham (2005) suggest a compromise in Hg removal by 20-40% is incurred for only 6 ppm SO3; accordingly a 20% compromise is assumed contingent upon a 50% increase in AC injection rate**."**Are you assuming that it is not possible to reposition the SO3 injection system to be downstream of the sorbent injection system?

    a. Are you assuming that companies would not try alternative flue gas conditioning methods?

93. On page 60 of your testimony you state that "Significantly, data from the 600 MW Monroe unit shows that 75-80% Hg removal was achieved, approximately the same as the value attained with conventional ACI." Was not over 80% Hg removal achieved? Is that removal close to 90% if you include cobenefit removal?

94. On page 66 of your testimony, you state: "The design study conducted to support this project shows the capital cost for three 90 MW units will be $34 M, equivalent to $120/kW. The capital cost can be scaled with a 0.333 power-law, with values "capped" by those for units beyond 600 MW." Is it your testimony that a 90 MW unit would be equivalent to $120/KW or that a 270 MW unit would be equivalent to $120/KW?

95. In Section A-7 of your testimony, do you assume that the FBC will have to retrofit a fabric filter?

    a. Doesn't the sole FBC in Illinois already have a fabric filter?

    b. If so, why would you add that cost?

96. On page 84, you describe data for COHPAC's derived from full FF data and dry FGD data. Won't full fabric filter data be high because of the lower air to cloth ratio for a full fabric filter?

97. What pressure drop was assumed for the COHPAC fabric filter?

98. On pages 87 and 88 of your testimony you have estimates for capital cost and fixed operating cost. Please provide a table for the capital cost estimates to show:

    a. Erected equipment cost (estimated or quoted), what equipment is included.

    b. Assumptions regarding:
        i. Retrofit difficulty
        ii. Engineering and home office costs

iii. General facilities
iv. Contingency
v. Any other components assumed in the costs

99. Provide a similar table to show how fixed operating cost was estimated. What activities does it include.

Questions for William DePriest

1. Are you familiar with the cost estimates described in Section B-5 of Mr. Cichanowicz's testimony regarding Activated Carbon Injection Hardware?

2. Did your company produce these estimates?

3. If yes, please provide details of these cost estimates in a table.

4. With reference to your statement on pages 5 and 6 of your testimony: "However, it is likely that enhanced mercury control will be needed to achieve overall control efficiencies in the range of 90%." On what basis is this statement made?

5. Do you have any test results for mercury removal on IL units with SCR and FGD?

6. With reference to your statement on page 6 of your testimony, "This scenario should provide some mercury reduction, but it will be limited by the capability of the existing ESP to capture the activated carbon without exceeding the plant's particulate emission limit or opacity limit.", have you calculated any increase in particulate emissions for any IL plants as a result of the use of sorbent injection for mercury control? If so, please provide all calculations.

7. With reference to your statement on page 6 of your testimony, "In the dry FGD control scenario, activated carbon would be injected upstream of the FGD reaction vessel and the baghouse. Injection of the activated carbon prior to the FGD is necessary to take advantage of any halides (particularly chlorides) in the flue gas as they enhance the ability of the carbon to capture mercury, Most halides are effectively captured in an FGD system and, therefore, the AC injection needs to be prior to the FGD system.", could not halogenated activated carbon be injected after the FGD reactor and prior to the fabric filter for high mercury removal as was performed at Sunflower Electric's Holcomb Station for roughly 95% mercury removal at only about 2 lb/MMacf?

8. With reference to your statement on page 7 of your testimony, "In the wet FGD control scenario, an activated carbon injection system with an associated baghouse could be used to supplement the inherent mercury capture capabilities of the wet FGD absorber and would need to be located upstream of the wet FGD vessel. Mercury adsorbed on to the activated carbon would be removed from the flue gas stream in the baghouse prior to the wet FGD.", why would a company install a fabric filter rather than inject the sorbent upstream of the existing ESP?

9. With reference to your paragraph on page 7:

   "Although activated carbon injection is the most commercially developed mercury control system, pollution control companies are actively working on other techniques to enhance mercury capture in FGD control systems. For example, research is underway to evaluate existing SCR catalysts and develop new catalysts that oxidize elemental mercury

in the flue gas stream. Oxidized forms of mercury are effectively captured in FGD control systems. Similarly, strategies to modify the flue gas composition are being studied to increase mercury capture in FGD control systems. Flue gas modification strategies include introducing halogens, primarily chlorine or bromine, into the combustion process to enhance mercury oxidation and facilitate its capture in the FGD control system.",

What is the relevance of this paragraph?

10. With regard to your paragraph on page 8 that begins: "For units where a dry FGD/fabric filter is planned for CAIR compliance . . ."

    a. If 90% reduction is achievable with halogenated ACI on the unit injected upstream of the ESP, why wouldn't the plant install halogenated ACI upstream of the existing ESP to meet the mercury requirements of the rule and then add the dry FGD/fabric filter later?

    b. If that were done, wouldn't that avoid the costs associated with the ductwork that you refer to and only leave the possible cost of relocating the ACI injection port to the fabric filter – which should be much less expensive?

    c. Regarding the same paragraph, if the company chose to install the dry FGD/fabric filter earlier, wouldn't that provide the benefit of earlier SO2 reductions as well, including SO2 allowances that might be sold or banked?

    d. Regarding the paragraph at the top of page 9, if the company chose to install the dry FGD/fabric filter earlier, wouldn't that avoid additional outages related to installing the equipment separately?

11. Regarding the statement on page 9, "For units that plan to install a wet FGD system in the future for CAIR compliance, a smaller "polishing" fabric filter could be needed in 2009 to meet the proposed Illinois mercury rule" and the following discussion regarding associated costs, why would a company install a fabric filter rather than inject the sorbent upstream of the existing ESP if the emissions levels of the IL rule were achievable in that manner? Wouldn't that approach be far less expensive?

12. Regarding the statement on page 10, "The owners of the Illinois coal-fired units have reached the conclusion that they will not be able to meet the requirements of the proposed Illinois mercury rule with activated carbon injection alone at most units, based on lack of precipitator margin." Have the owners of these plants performed any tests of sorbent to base their opinions? If not, with Federal and state regulations on the way, why not?

13. What analysis of their ESPs, have the companies performed to reach their conclusion?

14. Regarding the statement on page 10, "In addition, suppliers of the activated carbon technology are currently not willing to guarantee 90% mercury removal with activated

carbon injection alone." Has your client performed any testing with any company to potentially provide guarantees?

15. Mr. Cichanowicz has testified that "Guarantees in environmental control technology provide only partial compensation for shortcomings, and are not significant factors in the decision to adopt any particular technology."

    Do you agree with this statement?

16. Regarding your statements beginning on page 11, Capabilities of the Existing Electrostatic Precipitator (ESP) to Capture Mercury-Specific Sorbents Without Exceeding the Particulate Emission Limitations of the Plant, and, specifically, "Consequently, very little, if any, margin typically exists beyond this design criteria to accommodate the addition and capture of mercury-specific sorbents."

    Please provide all calculations and any test results for ESPs in question that form the basis of your stated opinion, including

    a. Any CFD flow modeling of the ESPs
    b. Calculations of sorbent injection rates fly ash mass flow rates and capture rates of sorbent and fly ash in the ESPs. Please be prepared to go through these calculations in detail for at least one example.
    c. Any test results of sorbent injection tests performed on the specific IL power plant ESPs in question.

17. On page 11 you also state that: "The capabilities of these existing ESPs to capture these sorbents without exceeding particulate/opacity limitations will vary significantly across the coal-fired units in Illinois."

    a. Does that suggest that you believe that some units will have acceptable performance while others do not?
    b. Doesn't the Temporary Technology-Based Standard (TTBS) address the concerns for those that may have difficulty?

18. Regarding your stated concerns on pages 12 through 14 (#2 through 6), are these not largely a result of your client's position that the only way to comply with the proposed IL rule is by retrofitting fabric filters on every unit?

19. Regarding your stated concern #7, "Waste Disposal Limitations", if a fabric filter is used, as you have testified power plant owners believe is necessary, does this concern not largely go away?

20. Regarding your stated concern #7, "Waste Disposal Limitations", and your statement "if the existing ESP is used to collect the mercury sorbent, the operator will need to make the necessary provisions for landfill of the unmarketable fly ash, with the attendant costs and

secondary environmental risks." Do you agree that these additional costs are already included in the estimated cost of the rule in the Technology Support Document?

21. Regarding your statement on page 15, "Current projections for flue gas desulfurization projects required to meet the SO_2 requirements of Phase I of CAIR will require the installation of over 150 new FGD systems representing over 60,000 MWs of coalfired capacity in the U.S. These new FGD systems will go into service between 2006 and 2010 and represent a market that is more than 7 times the size of that which was achieved in all of the 1990s. This environmental market, in conjunction with the ongoing SCR program for NOx and the accelerating construction of new coal plants across the country, is straining the capabilities of industry resources to keep up with both the quality and quantity demands of the utility industry."

    a. If it were possible to comply with the IL Rule through sorbent injection alone – without the need for fabric filters, except on the two units with hot-side ESPs, would that not largely mitigate the issues you discuss here and in the following pages through page 20?
    b. With specific regard to your statement "These new FGD systems will go into service between 2006 and 2010 and represent a market that is more than 7 times the size of that which was achieved in all of the 1990's", do you think suppliers of FGD technology consider the 1990's a particularly robust period of business, or would it be better characterized as somewhat of a disappointing level of FGD activity? Wasn't the 90's a fairly slow period for the scrubber business, with most of the compliance activity associated with coal switching?
    c. In contrast to the low level of FGD business in the 1990's, roughly how many MW of coal fired SCR systems were installed in the period 1998 through 2005?
    d. Roughly how many combined cycle plants – which nearly all required SCRs and many man hours of boilermaker craft labor – were brought on line in that same period?
    e. By and large, were these air pollution control projects – admittedly costly and difficult - performed satisfactorily by the air pollution control industry?
    f. Doesn't the air pollution control industry include some of the largest companies in the world?

22. If it were possible to comply with the IL Rule through sorbent injection alone – without the need for fabric filters, except on the two units with hot-side ESPs, would that not largely mitigate the issues you discuss here and in the following pages through page 20?

23. Comments and testimony indicate that several power plants support the federal Clean Air Mercury Rule (CAMR) rule.

    a. Was an assessment done on a plant by plant and unit by unit basis of any of Illinois' electric generating units that determined what additional control equipment, control measures, and costs (if any) would be required to comply with the federal CAMR in Phase 1? Same question for Phase 2 of CAMR.

b. If yes, what were the results of this assessment? Please provide the expected additional control equipment, control measures, and costs needed to meet CAMR for each plant and unit for each phase of CAMR.

c. Who conducted this assessment and what measures did they utilize to reach their conclusions?

d. What are the expected reductions, if any, in mercury emissions in pounds reduced per year and percentage reduced per year from a given base year as a result each plant's federal CAMR compliance strategy in Phase 1? Same question for Phase 2 of CAMR. Please use a year from 2002 to 2005 as the base year, if available. If not, please identify the base year.

24. Have you conducted an assessment of which coal-fired power plants and electric generating units in Illinois would likely delay or completely avoid installation of mercury controls such that they would need to purchase or use banked allowances for a period under the federal CAMR due to installation of controls being uneconomical, difficult, or any other reason?

a. If yes, what were the results of this assessment? Please identify which plants and units would likely purchase or use banked allowances.

25. What measures were utilized to reach your conclusions?

26. What is the expected duration of use of purchased or banked allowances at the plants and units identified to use these means of compliance?

27. What would be the actual "additional and financing costs" associated with installing a baghouse 6 years early, as referred to on page 6 of your testimony?

28. Please provide documentary evidence of the "conclusion" of the owners of Illinois' electric generating units, including the lack of precipitator margin, as discussed on page 10 of your testimony.

29. What ESP upgrade projects have Sargent & Lundy been involved with for existing ESPs other than adding additional collection area (see page 12 of testimony)?

30. Do electrical upgrades to the electrical system at a power plant provide an opportunity for electrical reliability or efficiency improvements (see page 12 of testimony)?

31. Are outage schedules adjusted when unforeseen problems arise with a generating unit (see page 14 of testimony)?

32. How many new FGDs will be installed in 2008 and 2009 in Illinois out of the 150 new FGDs identified in your testimony (see page 15 of testimony)?

a. Why would 50% of Illinois' coal fired generating units take an outage in the spring of 2009 (see page 19 of testimony)?

b. Why would this affect power availability if outages were staggered?

Questions for Gail Charnley, Ph. D.

1. Prior to this rule-making have you ever provided expert testimony on the relationship between power plant mercury emissions and fish methylmercury concentrations?

   b. Have you ever conducted and published any scientific research on the relationship between power plant mercury emissions and fish methylmercury concentrations?

   c. Have you ever conducted and published any scientific research on the toxicology of methylmercury?

   d. Have you ever conducted an environmental health risk analysis of power plant emissions for any of the coal-fired power plants in Illinois?

   e. Were you asked by the National Research Council/National Academy of Sciences to provide an independent review of any draft versions of the report entitled Toxicological Effects of Methylmercury (2000)?

2. How do you reconcile the statement in your testimony (page 2) that "about half of global mercury emissions are naturally occurring . . ." with the cited source for this information (see footnote #1) which indicates, both in text and in a pie-chart, that only one-third of mercury emissions are naturally occurring?

3. Do you dispute that the National Research Council's Committee on the Toxicological Effects of Methylmercury produced a recommendation on the reference dose for methylmercury exposure that supported USEPA's numerical value of 0.1 micrograms/kilogram/day?

4. On page 4, you state that "Figure 24 in the Florida report shows clearly that between 1994 and 2000, the time period of interest, there was no decline in deposition". Do you disagree with the assertion that the plot shows a general decline from 1994-1999, as well as an overall decline for the longer time period of 1994 – 2002?

5. In regard to the Florida and Massachusetts studies, do you contend that the results are scientifically invalid because they weren't published in a peer-reviewed journal (see page 6)?

6. You state that ". . . reducing mercury emissions should not be oversold as a means of improving public health and protecting children in general" (page 8). How would you define an "oversold" situation for Illinois?

7. You have largely focused on the results of the Seychelles Islands studies in your discussion on methylmercury and developmental toxicity, and give limited discussion to the Faroes Islands study and essentially none to the New Zealand study. Do you dispute the findings (regarding methylmercury-related developmental neurotoxicity) of the New

Zealand study as described in the TSD? Do you disagree with Dr. Louise Ryan's evaluation of the modeling results for the three epidemiological studies (see Technical Support Document, Appendix A, pp. 26-27).

8. Has the Hibbeln (2006) work received widespread acceptance in the scientific community? Has it undergone peer-reviewed publication?

9. On page 12, you state that "It is my opinion and that of many other scientists that the results of the Faroe Islands study at best should be attributed to combined exposure to methylmercury and PCBs." Is you opinion (and presumably that of others) supported by data that you have independently generated regarding breast milk PCB concentrations in the Faroes Islands study (maternal) participants? On what basis do you reject the position expressed by the NRC's Committee on the Toxicological Effects of Methylmercury in the 2000 NRC report?

10. On page 11, you write that "it is not surprising that where there were fewer benefits from fish, the effects of methylmercury were more likely to be manifested". Under what circumstances, and for which particular studies, would you consider there to be "fewer benefits" from eating fish?

11. You write (page 12) that "The US Centers for Disease Control (CDC) reports that children and women of childbearing age in the US have methylmercury levels in their blood well below those that have been reported to produce adverse effects". Do you believe that this can be interpreted as a CDC claim that there are no children and women of childbearing age with methylmercury levels that have resulted in adverse health effects?

12. Do you agree that the "5% likelihood of poorer performance on the Boston Naming Test . . . among children in the Faroe Islands" (page 13) was associated with 85 micrograms mercury per liter in umbilical cord blood, not non-cord blood?

13. Do you contend that there is no exposure level at which women whose exposures exceed USEPA's methylmercury reference dose are "at risk" of having developmentally impaired children?

14. You discuss the Seychelles study as being negative, as interpreted by the authors of the study.

    a. Please explain benchmark dose analysis and what the BMDL signifies.

    b. Are you aware that the Seychelles investigators have published a BMD analysis of their results in the children at 66 months of age, and more recently at 9 years of age?

    c. Are you aware of the statement from van Wigngaarden *et al*., in Neurotoxicology (in press, available online) "benchmark mercury concentrations of around 20 ppm in maternal hair from the 9-year follow-up of the Seychelles cohort are slightly

below … estimates previously reported for this cohort at 66 months follow-up. Additionally, they are within the range of benchmark findings reported for the Faroe Islands and New Zealand"?

d. Are you aware of the following statement from the Seychelles investigators (Davidson *et al*., Neurotoxicology, in press, available online): "Secondary analyses have generally supported the primary analyses, but more recently have suggested that latent or delayed effects might be emerging at exposure above 10 to 20 ppm as the child matures"?

e. Are you aware that the starting point (BMDL) from the Boston Naming Test from the Faroe Island study is 12 ppm in maternal hair?

15. You refer to the Daniels *et al*. study, in which umbilical cord mercury levels were used as a marker of methylmercury exposure.

a. Are you aware of any other studies that used this tissue as the marker of exposure in analyses of the effects of *in utero* exposure to methylmercury on neuropsychological function of children?

b. Are you aware of the statement in Daniels *et al*. "we noted a threshold for the relation between fish and cognitive development, indicating benefit from eating fish at least once every two weeks, but no incremental increase in benefit with more frequent fish consumption"?

c. Are you aware that the average fish intake in the Faroe Islands study was about 2 meals/week, and that almost half the women ate three or more fish meals/week?

16. You refer to a talk by Dr. Hibbeln on the relationship between IQ, fish intake, and methylmercury exposure.

a. Have any data from this study, with Dr. Hibbeln as an author, been published in the peer-reviewed literature?

b. Do you have access to the results of the study so that you can make a scientific determination regarding its quality?

17. You mention the Oken *et al.* study in Massachusetts of the relationship between fish consumption, mercury levels in the mother, and performance of the infants.

a. Are you aware that in that study, for each increase of 1 ppm of mercury in the mother's hair, the score of the baby decreased (got worse) by 7.5 points?

b. Are you aware that in an ancillary analysis, performance of infants whose mothers had hair levels corresponding to intake above the EPA reference dose performed more poorly on the test of memory than infants whose mothers' hair mercury levels were below the EPA reference dose?

c. Did you hold the position of adjunct faculty member with the Harvard Center for Risk Analysis?

d. Are you aware that in the analysis of the potential benefits of fish consumption performed by the Harvard Center for Risk Analysis, and funded by the fishing industry, the effects on the child's IQ related to the mother's methylmercury intake and fish consumption was estimated under various scenarios of changes in fish consumption pattern, including women decreasing consumption of high mercury fish while maintaining the same overall fish consumption, decreasing total fish consumption by 17%, or increasing their fish consumption by 50% with no regard to mercury levels?

e. Are you aware that, under every scenario, the effect of methylmercury on IQ was greater than any effect resulting from omega-3 fatty acids, and that an indiscriminate increase in fish consumption resulted in a net loss of 270,000 IQ points a year?

18. You mention that the greatest source of mercury exposure in the Faroe Islands was from consumption of whale meat, and that this may account for the fact that effects were observed in that study.

a. Are you aware that deficits were observed in the New Zealand longitudinal prospective study, in which methylmercury exposure was from fish?

b. Are you aware of a number of cross-sectional studies documenting adverse effects of methylmercury on neurological function in children, in which exposure was through fish?

c. Are you aware that deficits were related to methylmercury levels in the Oken *et al*. study in Massachusetts, in which exposure was through fish?

19. You discuss the issue of co-exposure to PCBs in the Faroe Islands study.

a. Did you hold the positions of Director, Toxicology and Risk Assessment Program, NAS, in 1994, and Senior Science Advisor and Project Director, 1992-1997?

b. Do you consider the analysis of the health effects of methylmercury performed by the NAS to be of high scientific quality?

c. Are you aware that the correlation between PCB and mercury levels in the mothers in the Faroe Islands study was .28-.42, depending on the congener?

d. Is there any reason to believe that postnatal PCB exposure would be highly correlated with *in utero* mercury exposure, given that PCB levels in breast milk would be similar to levels in the mother's blood or cord tissue (on a lipid basis)?

e. Is there reason to believe, or data to support, the hypothesis that the length of breast feeding, which would be a major determinant of the postnatal PCB exposure to the infant, would be correlated with prenatal methylmercury exposure?

f. Isn't it the case that if prenatal exposure to methylmercury and postnatal PCB exposure are not correlated, postnatal PCB exposure cannot be responsible for effects attributable to methylmercury?

g. Are you aware that the Faroe Islands investigators published results in 2006 from these same children at 14 years of age, and methylmercury-related effects continued to be observed but that no effects of PCBs were identified?

20. You discuss the review of exposure to PCBs on neuropsychological function in children by Schantz, Widholm, and Rice.

a. Are you aware that in addition to discussing the 1997 paper by the Faroe Islands group on the effects of methylmercury at 7 years of age, Schantz *et al*. also discuss a 2001 analysis of the effects of PCBs in this same study?

b. Are you aware of the conclusion from that subsequent analysis: "After adjusting for mercury exposure in the statistical analysis, the association of test scores with PCB exposure was reduced to a nonsignificant level on both the Boston Naming Test and the CPT" (Schantz *et al*., p. 366)?

c. Are you aware that there was no indication of any effects of PCBs in this study when the children were 14 years old?

21. You discuss the issue of levels of mercury in the mothers of the large epidemiological studies reviewed by the NAS compared to those in the U.S. population.

a. Are you aware that, according to the NAS modeling, in the Faroe Islands study there is no evidence of a threshold within the range of exposures in the study, down to about 1 ug/L in cord blood?

b. Are you aware that an umbilical cord blood level of 1 ug/L would be an average equivalent to a maternal blood level of 0.6 ug/L based on an analysis of a dozen papers of the relationship between maternal and cord blood, and that this is below the level of half the women in the U.S. of reproductive age?

c. Are you aware that when the Faroe Islands children were tested again at 14 years, deficits were also observed starting at the lowest exposures as evidenced by the graphic presentations in the publication?

d. Are you aware that at both 7 and 14 years, the relationship between exposure and effect was log-linear; in other words, that effects were relatively greater at lower exposures?

e. Are you aware that in the study of infant memory in Massachusetts, effects were found in a population that was not chosen on the basis of high fish consumption?

f. Are you aware that, in the Massachusetts study, infants of mothers with hair levels above the EPA reference dose (1.2 ppm) performed more poorly than infants of mothers with lower hair levels?

g. Are you aware that about 16 percent of women in the U.S. have hair levels above the EPA reference dose?

h. Are you aware of any epidemiological studies in Japan exploring potential neuropsychological consequences to the offspring of maternal fish consumption or methylmercury exposure in the general population? If not, of what relevance are data from Japan?

22. You state that the U.S. EPA did not include the Seychelles study in the derivation of the reference dose.

a. Are you aware that the NAS performed an integrative analysis including all three studies: the Faroe Islands, Seychelles, and New Zealand?

b. Are you aware that EPA derived exploratory reference doses based on a number of endpoints, including the integrative analysis, and that this analysis also yielded a reference dose of 0.1 ug/kg/day?

c. Are you aware that the BMDL from the integrative analysis is 34 ug/L mercury in blood, lower than the 58 ug/L for the Boston Naming Test from the Faroe Islands study?

d. Are you aware that the reference doses from the New Zealand study were lower than those from the Faroe Islands or Seychelles, and that if EPA had relied on the New Zealand study, the reference dose may have been lower than the current 0.1 ug/kg/day, as evidenced in the IRIS summary?

e. Are you aware that the hair level that may be associated with deficits in the Seychelles study at 9 years, 12 ppm in maternal hair, is the same as the point of departure for the EPA reference dose?

f. Are you aware that the analysis by Dr. Louise Ryan of Harvard University calculated that the IQ loss in the children associated with increased maternal hair mercury levels was almost identical for all three studies?

23. Please state the definition of the reference dose according to U.S. EPA.

a. Does this definition include the phrase “with uncertainty spanning perhaps an order of magnitude”?

b. Is there anything in the definition that indicates that there is any more certainty concerning the level at which adverse effects occur below the reference dose than above it?

c. Is there any reason to believe that there is certainty about the lack of risk of adverse effects below the reference dose, compared to the risk of adverse effects above it?

24. You discuss the evidence for cardiovascular effects related to fish consumption and methylmercury exposure.

a. Are you aware that the physicians' study recently identified increased atrial fibrillation related to increased fish consumption in men?

b. Are you aware that in an analysis of multiple clinical randomized control trials of consumption of fish oil on cardiovascular health, that no beneficial effects were observed (Hooper *et al*., Brit. Med. Jour. 2006 online)?

c. Are you aware that the amount of omega-3 fatty acids in fish oil capsules is greater than what could reasonably be consumed through fish consumption?

d. Isn't it true that the randomized control trial design of these studies, in which people are assigned randomly to fish oil or control, eliminates problems associated with letting people choose their own behavior (to eat fish or not)?

e. Is it possible that there are other lifestyle choices by people who eat fish that may be responsible for, or contributing to, the observed correlation between fish consumption and cardiovascular health, such as decreased meat consumption or increased exercise?

f. Are you aware that other studies in addition to the Finnish study you discussed found an association between methylmercury levels and increased risk for adverse cardiovascular events?

g. Are you aware that there are studies in which omega-3 oils from plants rather than fish have been found to reduce cardiovascular disease?

Questions for C. J. Saladino

1. What is the description and responsibilities that fall under the position of Station Director of the Kincaid Generation L.L.C. power plant?

2. How long have you been the station director?

3. Have you been employed outside of Kincaid after receiving your degree?

4. Do you have any formal training in economics?

5. What experience have you had with mercury control technology?

6. What experience do you have assessing the mercury control technology economic market?

7. What experience do you have with activated carbon injection?

8. What experience do you have with testing mercury emissions?

9. Has there been any testing performed at Kincaid to evaluate mercury control at the facility?

   a. If yes, please describe the testing performed?

   b. What were the results and conclusions of any testing performed?

   c. Based on any test results, what is the current level of mercury control occurring at Kincaid with the existing controls?

   d. Based on any testing, what additional level of mercury control would be required by halogenated ACI in order to achieve compliance with the proposed rule requirements of either 90% reduction or 0.0080 lb/GWh?

   e. Has the company assessed whether this additional level of control is achievable using halogenated ACI?

Questions for Andy Yaros

1. Has your company made an assessment of what level of mercury control the control configuration at Kincaid achieves?

   b. If yes, what were the results of this assessment?

   c. Who conducted this assessment and what measures did they utilize to reach their conclusions?

   d. Has the company assessed whether there are mercury control optimization techniques for the existing controls at Kincaid that could help improve mercury control? Please refer to the Section 8 of the Agency's Technical Support Document for the proposed mercury rule for potential optimization techniques.

2. Has your company evaluated whether compliance could be achieved at Kincaid by utilizing either the 90% reduction option or the 0.0080 lb/GWh option, in accordance with the proposed mercury rule?

a. If yes, what were the results of this evaluation?

b. Who conducted this evaluation and what measures did they use to make this assessment?

3. Has your company assessed what additional control equipment, measures and/or costs would be required at Kincaid to comply with the proposed mercury rule?

a. If yes, what were the results of this assessment?

b. Who conducted this assessment and what measures did they utilize to reach their conclusions?

4. Your testimony states that your company supports the federal CAMR rule. Has your company assessed what additional control equipment, measures, and costs would be required to comply with federal CAMR in Phase 1? Same question for Phase 2 of CAMR?

a. If yes, what were the results of this assessment?

b. Who conducted this assessment and what measures did they utilize to reach their conclusions?

c. What are the expected reductions in mercury emissions in pounds reduced per year and percentage reduced per year from a given base year as a result of your federal CAMR compliance strategy in Phase 1? Same question for Phase 2? Please use a year from 2002 to 2005 as the base year, if available. If not, please identify the base year.

d.. Would Kincaid purchase or bank mercury emissions under the federal CAMR rule? Please explain.

5. On page 2 of your testimony, you claim that there is “a continuing problem with the current state of the mercury CEMs (sic) technology.” However, isn’t it true that the proposed Illinois rule also allows for the use of sorbent trap monitoring?

6. Therefore, isn’t it also true that your reasoning for rejecting the 90% reduction based on monitoring issues is flawed, as you based that reasoning on the claim that one is unable to measure low concentrations of Hg?

Questions for Dr. Ishwar Prasad Murarka

1. a. Do you consider yourself a national expert on the use of fly ash in concrete?

   b. Have you ever worked for a fly ash marketing company or a concrete producer?

   c. Please describe any specific concrete training or contracts with fly ash marketing companies or concrete company clients that you have had.

2. Please provide a list of your publications or conference presentations in the field of the use of fly ash in concretes.

3. Are you or your firm a member of the American Coal Ash Association?

4. What specific sources of actual data or information did you rely on to prepare your written testimony?

5. What fraction of Ish Inc. consulting revenues over the last three years were paid by utilities or utility-industry sources?

6. Who are the three largest fly ash marketing companies for Illinois fly ash?

7. If the American Association of State Highway & Transportation Officials (AASHTO) standard for carbon in concrete is 5 wt% and the ASTM standard is 6 wt%, why is it that "The Illinois power plants that have contracts to sell fly ash as a substitute for cement in concrete are required to meet a 1% limit on LOI content in fly ash sold?"

8. Are highways and roads the largest use of concrete in Illinois? Consequently, is the State of Illinois itself the largest purchaser of concrete? Doesn't the State of Illinois itself control any color requirements for highway concrete?

9. How many of their Illinois fly ash marketing contracts have you personally examined over the last ten years?

10. Can high-LOI fly ash, such as might be generated with ACI, be used beneficially for flowable fill, raw feed for clinker, structural fills, embankments, road base, sub-base, pavement, soil modification or stabilization, mineral filler in asphalt, snow and ice control, roofing granules, mining applications, waste stabilization or solidification, agriculture, aggregate, and other uses?

11. You testify that according to the American Coal Ash Association 40% of electric power plant fly ash was beneficially utilized nationally in 2004, 28 million tons, of which 14.1 million tons -- or only half -- was used in concrete. Similarly, you testify that 40% of Illinois fly ash was beneficially utilized in 2004 according to the TSD. If only half of beneficially-used fly ash is typically used for concrete, how do you explain your testimony that "Illinois power

plants utilized approximately 40% of fly ash produced in 2004 as a substitute for cement in concrete"?

12. According to the plant-specific data on fly ash sales in this Exhibit, what fraction of Illinois fly ash that was sold for beneficial use in 2003 and 2004?

13. If only 30% to 35% of Illinois fly ash was actually beneficially sold, not 40%, and if half of this could still be sold because added carbon is irrelevant, would your estimate of deleterious impacts decline further?

14. Didn't the TSD assume the worst case in its economic cost modeling anyway – that no fly ash with PAC would be sold for concrete – so anything able to be sold would just lessen the relatively low total costs already calculated?

15. Prior to beginning your own company, you worked 25 years for the Electric Power Research Institute, which is funded by utility companies, correct?

16. Please describe the purpose of the Electric Power Research Institute's Toxecon®, Toxecon II®, and Toxecon III® technologies.

17. Why did you leave mention of these technologies out of your testimony?

18. You testify that ozone passivation [sic] technology to solve the carbon/concrete issue is not commercially available yet. What have the results been from EPRI's tests?

19. Are you familiar with data from any company on the foam indexes of fly ashes containing "cement friendly" activated carbon?

20. What fraction of U.S. utility coal mercury is already going into utility fly ash today?

21. What percent of this is liberated when fly ash is used in clinker/cement manufacturing?

22. If substantially all of the mercury contained in fly ash is liberated by the kilns of clinker/cement manufacturing, do you think that it would be a good idea today for Illinois or the U.S. EPA to regulate or restrict mercury-containing fly ash going to this use?

23. What evidence in your submitted testimony did you rely on for your Overall Conclusion that "It is almost a foregone conclusion" that the proposed rule will "increase the potential for environmental impacts from land disposal operations"?

24. What sources of data did you rely on for your Overall Conclusion that "It is almost a foregone conclusion" that the proposed rule will "increase the potential for environmental impacts from land disposal operations"?

25. Are you familiar with data indicating that activated carbons in fly ash continue to adsorb mercury from ambient air when placed in landfills or absorb mercury from water when ponded?

26. Are you familiar with U.S. Environmental Protection Agency, U.S. Department of Energy, or Electric Power Research Institute data on the leachability or revolatilization of mercury from fly ash samples containing plain or brominated carbons?

27. What are the positions or preliminary conclusions of the U.S. EPA, DOE, and EPRI concerning the expected adverse environmental impacts from the disposal of such PAC-containing fly ashes?

28. How do you square these with your Overall Conclusion?

Questions for James Marchetti

1. On page 4 of your testimony, you describe the control options in the Emission-Economic Modeling System ("EEMS") model.

   a) Please describe the cost and operational assumptions for each of the emissions control technologies listed on page 4 of your testimony, specifically as implemented in the EEMS model analysis.

   b) Please provide the specific environmental retrofits selected by the model for each coal-fired generating unit in Illinois, along with the associated capital and variable operating costs.

   c) Also on page 4, you describe the rationale for the "50 year old rule." Please explain what you mean by a "major capital investment" in this context.

      i. If installation of an HPAC injection system as described by Dr. Staudt and Mr. Nelson in their previous testimony were all that were required for a given unit to meet the Illinois rule, would you considered this to be a "major capital investment"?

2. On page 5, you note that "Capital and operating costs were developed based upon IL electric generators' experience in retrofitting recent SO_2, NOx and mercury control technologies." Please identify the experience to which you refer, specifically with respect to the installation of mercury control technologies, and show how that experience was used to set the control cost parameters used in the EEMS model.

3. Please explain the implementation of the proposed rule in the EEMS model.

   a) Please describe exactly what constraints are placed on mercury emissions for each unit in the model implementation.

   b) Please explain the decisions made by the model with respect to least-cost implementation of mercury controls.

4. On page 5 you note that there is a 5% reduction in the output of IL coal generating units in the model as a result of the implementation of the IL rule. Please identify which IL units have their output reduced in this model run compared to the CAIR/CAMR model run. In addition, please provide the variable operating costs of these units for each of these model runs.

5. Table 1 (found on page 6 of your testimony) shows a reduction not only in coal-fired generation, but also in gas and oil-fired generation in the years 2009 and 2010, for the IL rule run relative to the CAIR/CAMR run. Please explain this result.

6. Table 4 (found on page 8 of your testimony) shows a *cumulative annualized* compliance cost for mercury controls of $2.63 billion for the IL rule for the years 2009-2018. The total capital investment (Table 3) is $1.77 billion. Please identify the capital recovery factor (CRF) used in this analysis. Please identify and itemize this annualized cost, and detail any increase in operating costs included in this number.

7. On Page 13 you conclude that "The IL rule would increase the cost of operating the state's coal-fired facilities by $200 million per year." Please explain this statement, identifying the operating costs to which you refer.

8. In Appendix A, first page (on page 17 of your testimony) you state, "EEMS identifies a combination of control options (technology versus allowances) that approximates the least cost solution for a given utility system and regulatory (e.g., trading) regime." Would you agree that the EEMS model is specifically designed to model environmental regulations based on emissions trading?

9. In Appendix A, first page (on page 17 of your testimony) you state, "…under a command-and-control regulatory regime, which is effectively what the IL Rule is because of the lack of flexibility in the rule, EEMS systematically assigns control technology until the reduction target is achieved at the least possible cost." Please explain exactly how the control technologies are selected and applied by the EEMS model.

10. In Dr. Smith's Addendum to your testimony (on page 23), she states that she provided you with "annual generation and coal choices for Illinois coal-fired generators and allowance prices for SO_2, NO_X and mercury for both the CAIR and CAMR policies." Did she also provide you with this information for a model implementation including the Illinois rule?

11. If so, please provide the annual output by generator for each of the CAIR/CAMR case and for the Illinois Rule case.

12. Dr. Smith also states that "NEEM was designed specifically to be able to simultaneously model least-cost compliance with all state, regional and national, seasonal and annual emissions caps for SO_2, NO_X and Hg. The least-cost outcome is the expected result in a competitive wholesale electricity market." Do you conclude that the compliance scenario produced by the model is, in fact, the least-cost compliance scenario for each of the CAMR and the IL rule cases?

13. The NEEM model also produce pollution control installation decisions. Was this function of the NEEM model used in your analysis? If so, how did the outcome of the model compare with the installation decisions made by the EEMS model?

14. Table 1 presents the 22 coal plants in Illinois that would be subject to the proposed rule, which together comprise 51 operating units. Please provide the capacity factors for each of these units for each of the model cases (CAIR/CAMR and IL Rule).

15. Table 8 shows a large increase in the consumption of IL coal in the IL rule case relative to CAIR/CAMR. Was this switch exogenous to the model, or based on the model output? Please explain.

16. Comments and testimony indicate that several power plants support the federal CAMR rule. Was an assessment done on a plant by plant and unit by unit basis of all of Illinois' electric generating units that determined what additional control equipment, control measures, and costs (if any) would be required to comply with the federal CAMR in Phase 1? Same question for Phase 2 of CAMR?

17. If yes, what were the results of this assessment? Please provide the expected additional control equipment, control measures, and costs needed to meet CAMR for each plant and unit for each phase of CAMR.

18. Who conducted this assessment and what measures did they utilize to reach their conclusions?

19. What are the expected reductions, if any, in mercury emissions in pounds reduced per year and percentage reduced per year from a given base year as a result each plant's federal CAMR compliance strategy in Phase 1? Same question for Phase 2? Please use a year from 2002 to 2005 as the base year, if available. If not, please identify the base year.

20. Have you conducted an assessment of which coal-fired power plants and electric generating units in Illinois would likely delay or completely avoid installation of mercury controls such that they would need to purchase or use banked allowances for a period under the federal CAMR due to installation of controls being uneconomical, difficult, or any other reason?

21. If yes, what were the results of this assessment? Please identify which plants and units would likely purchase or use banked allowances.

22. What measures were utilized to reach your conclusions?

23. What is the expected duration of use of purchased or banked allowances at the plants and units identified to use these means of compliance?

Questions for Dr. Peter Chapman

1. Under Section 2.0 on page 2 of your testimony, you state "The goal of the proposed rule, as summarized in Marcia Willhite's written testimony at p. 4 ("In order to assure that 95% of largemouth bass in Illinois waters may be consumed by sensitive subpopulations, a 90% reduction of mercury in fish tissue is needed"), will not be achieved." Is your statement consistent with other testimony on this issue as provided by Jim Ross in testimony provided on June 19, 2006, at the hearing held in Springfield (as found on page 127 of that day's transcript)?

2. On page 5 of your testimony, you state that "methyl mercury produced in water bodies from inorganic mercury can be augmented by direct precipitation of methyl mercury from other sources, including: the atmosphere, runoff from land or inputs from other waterbodies such as wetlands." What are the sources of methyl mercury in the atmosphere, on the land or in other waterbodies?

3. On page 6 of your testimony, do you refer to testimony provided by Marcia Willhite in support of your statement that, "runoff may be a significant source of mercury in southern Illinois"?

4. Citing to the analysis of mercury in effluent of point source discharges, you emphasize the potential 1.5 ton maximum loading (as found on page 6 of your testimony), isn't it true that to reach the "potential maximum loading" of 1.5 tons per year statewide, all point sources would have to simultaneously discharge at their maximum level and maximum mercury effluent concentration?

5. Regarding footnote 20 at the bottom of page 6 of your testimony, please describe the "available data on mercury related to combined sewer overflow discharges from MWRDGC" and demonstrate how you calculated the loading as being tens of pounds per year.

6. What is the basis of your opinion as stated on page 7 of your testimony that "other local sources of mercury will have inputs to different waterbodies that likely are, in some cases, greater than those from coal-fired power plants"?

7. In your professional opinion, what are the most important factors to mercury bioaccumulation in fish tissue and how would you recommend those factors be controlled in order to reduce mercury levels in fish tissue?

8. In Section 4.0 of your testimony, on pages 9 and 10, you state that "The relationship between the power plant mercury emissions and mercury in fish in Illinois can be assessed using two key pieces of information: sediment mercury data and fish tissue mercury data." You further state "There is no consistent

relationship between total mercury concentrations in sediments and mercury concentrations in fish tissues of impaired waters." How would you explain the very widespread occurrence of elevated mercury fish tissue levels, i.e. two-thirds of the Illinois waterbodies that have been tested?

9. On pages 10 and 11 of your testimony, you state that "[coal-fired power plant] emissions cannot be directly related to mercury concentrations in fish collected from nearby waters." Why not?

10. On page 11 of your testimony, you state that "Illinois' proposed rule would only result in a 4% reduction in deposition in Illinois from Illinois coal-fired power plant emissions compared to CAMR." What percent reduction in deposition would occur under CAMR from units that buy credits to comply rather than control?

11. By your answer to the second question you posed in your testimony, are you recommending that Illinois not aggressively address the 26% of waters currently listed as impaired only for mercury?

12. The Illinois EPA's Technical Support Document ("TSD") states that the average mercury concentration of 397 largemouth bass samples collected between 1985-2004 is 0.17 or 0.19 mg/kg, depending on how non-detects are treated (TSD, pages 62-63). Further, Dr. Hornshaw submitted tables showing that approximately 2/3 to 3/4 of all waters with fish sampled for mercury between 1988-2001 had predator species that would require a consumption advisory. Given this information, would you agree that more than 26% of the State's waters might be impaired due to mercury?

13. Would the information presented above change your answer to your second question regarding lifting impairment listings for mercury?

14. In Table 2 of your testimony there are several entries in which two fish mercury samples having the same concentration are paired with two different sediment mercury values, e.g., lines 3 and 4 for the 1988 Jackson County samples. Do the two sediment values represent the averages for the 2.5 years before and after the 1988 fish sample or something else? Are the two fish values of 0.167 mg/kg for a single sample, two samples, or all samples collected from Jackson County in 1988?

15. There are two 1990 Cook County samples in Table 2 having a fish mercury concentration of 0.47 mg/kg and sediment values of 0.061 and 0.1 mg/kg, and there is a 1990 Cook County fish sample in Table 3 also having a mercury concentration of 0.47 mg/kg but with a sediment mercury value of 0.074 mg/kg. If this is the same fish mercury sample, please explain the discrepancy between the listed sediment mercury values.

Questions for Dianna Tickner

1. In your March 13, 2006, letter attached to your testimony, attachment 2, page 4 and 5, are you suggesting that compliance be determined on a monthly basis?

    a. If yes, isn't it true that the rule does in fact determine compliance on the entire 12 months of data?

2. On page 6 of that same letter, do you suggest that the definition of the rolling 12-month basis would cause problems when units operate only a few days during a given month?

    a. If yes, isn't it true that no such problem would occur because the equations in the proposed Illinois rule address the entire past year, not just the single month?

3. In the same letter, attachment 3, page 5, do you suggest that the monitoring requirements of the proposed Illinois rule are inconsistent with CAMR. What are the supposed inconsistencies?

4. Isn't it true that if this rule is submitted to USEPA as part of the State Implementation Plan and, once approved, will indeed be federally enforceable like all such rules that go through this process?

5. On page 7 of the same letter, do you object to having to certify monitors within 90 days? Isn't it true that you are requesting Illinois to incorporate by reference the monitoring requirements of CAMR. So why are you asking that the Illinois rule deviate from Part 75 now?

6. Also on page 7 of that letter, you suggest that Illinois should not be allowed 120 days to review monitor certifications. Once again, why are you asking that the Illinois rule deviate from Part 75?

7. Has your company made an assessment of what level of mercury control the control configuration at the proposed Prairie State facility would achieve?

    e. If yes, what were the results of this assessment?

    f. Who conducted this assessment and what measures did they utilize to reach their conclusions?

8. Has your company evaluated whether compliance could be achieved with the rule by utilizing either the 90% reduction option, the 0.0080 lb/GWh option, or the Temporary Technology Based Standard?

a. If yes, what were the results of this evaluation?

c. Who conducted this evaluation and what measures did they use?

9. Has your company assessed what additional control equipment, measures and/or costs other than those currently planned for installation in accordance with your construction permit, if any, would be required to comply with the proposed mercury rule?

a. If yes, what were the results of this assessment?

b. Who conducted this assessment and what measures did they utilize to reach their conclusions?

10. Under the federal CAMR, do you expect your plant will achieve enough mercury emission reductions such that it will be able to sell and/or bank mercury allowances?

11. Do you have any formal training in engineering?

12. Do you have any formal training in economics?

13. Do you have any experience with mercury control technology?

14. What experience have you had with pollution control technology?

15. What degrees have you received?

16. Would you provide or explain your previous work experience?

17. Would you explain your current job responsibilities?

18. In Attachment 1 to your testimony it states “Corrected July 28, 2006”.

a. Who made these corrections?

b. Are all corrections noted?

19. Attachment 1 to your testimony is signed by Colin M. Kelly.

a. Is he the sole author?

b. If not who else participated in the creation of the document?

c. What are their, including Mr. Kelly, educational and work experience?

d. Did you participate in the creation of the document?

20. You identify a study at Conesville Unit 6.

a. Have you reviewed that complete study?

b. Has that study been published or is available for public review?

c. Would it be possible for you to provide that study for the record?

21. You state that "Prairie State to date has been unable to obtain a guarantee for 90% mercury removal on its high sulfur coal".

a. What companies has Prairie State contacted?

i. What mercury control technologies have these companies been unable to guarantee?

ii. Would you provide or explain the reason each of the other companies was unable to provide a guarantee for 90% mercury removal?

b. Is it the practice of activated carbon injection companies to guarantee a plant or unit without field testing?

Questions for Krish Vijayaraghavan

1. On p. 3 of his testiomony, Mr. Vijayaraghavan states that "the relative proportions of Hgo, Hg2+ and Hgp differ in time and location, and the fractions of Hg2+ and Hgp can be considerably larger near man-made sources." Is a 20km x 20km grid spacing the most appropriate model resolution to assess Hg deposition close to emission sources? Is it true that within the 20km x 20 km grid cell, the deposition amount at a point of maximum deposition would be averaged together with lower deposition amounts to arrive at the "average" deposition amount over that large area?

2. On p. 10, Mr. Vijayaraghavan notes that "…U.S. coal-fired power plants are calculated to contribute 19% of mercury deposition in Illinois in 2006. For the Illinois grid cells, only 4 out of the 474 20 km x 20km grid cells receive more than half of their mercury deposition from U.S. coal-fired power plant emissions.."

a. How is the 19% figure calculated if some cells receive more than 50% of their deposition from U.S. emissions?
b. Where are the 4 Illinois grid cells that receive more than half their mercury deposition from U.S. coal-fired power plant emissions? What is the maximum percentage for any Illinois cell?

3. Related to the 2010 CAIR/CAMR simulation, Mr. Vijayaraghavan notes that "Illinois grid cells show decreases in mercury deposition of up to 51%. There is only one grid cell in Illinois that shows an increase (< 1%) in mercury deposition."

a. Where are the Illinois grid cells that have decreases in deposition that are less than 51%?
b. Where is the Illinois grid cell that has no decrease in mercury deposition in 2010 due to CAMR?

4. On p. 11 of his testimony, Mr. Vijayaraghavan states that the TEAM results for 2010 CAMR with 90% Illinois controls indicated, "In relative terms, most of the Illinois area shows decreases of 1 to 5% due to the Illinois 90% emission reduction with only a few grid cells with decreases in the 15 to 35% range."

a. How many grid cells had decreases in the 15 to 35% range? Where are they located?

5. According to Mr. Vijayaraghavan, the 2020 CAIR/CAMR simulation "leads [after 10 years] to lower mercury deposition in Illinois than the 2010 CAIR/CAMR simulation with 90% Illinois mercury control except for 3 grid cells in Illinois where very small increases are predicted.."

a. Where are the 3 Illinois grid cells where 2020 CAIR/CAMR would lead to 3% increases in mercury deposition?

6. On p. 16 of his testimony, Mr. Vijayaraghavan notes that because incinerators emit a higher fraction of Hg2+ and have shorter stacks than coal-fired power plants, that it is inappropriate to extrapolate the results of an incinerator program to the potential effects of a coal-fired power plant emission reduction program.

a. Is it likely that most of the Hg2+ emitted from a coal-fired power units deposits within 150 km of the emission point? If there are waterbodies in the path of that plume, would you expect deposition to those water bodies?

b. Would you expect there to be a point of maximum deposition of Hg in the plume of power plant emissions?

c. If a deposition model predicts a point of maximum mercury deposition from incinerator emissions in a water body that is close to the source and predicts a point of maximum mercury deposition from a coal fired power plant that is relatively close to the source, would there be any difference in the significance of that information (other than the impact point from the power plant is probably farther from the source)? (What I'm trying to get at here is that Hg2+ from incinerators is not different from Hg2+ from coal fired power plants—the difference is the proportion in the emission and the distance it will be transported due to different release parameters. Once it comes down, if comes down in an impaired water body, it makes no difference where it came from) If you reduce the mercury emissions by 90%, whether it's an incinerator or a coal-fired power plant, wouldn't you expect a 90% reduction in deposition at the point of maximum impact?

7. You are employed as a paid consultant, are you not? Who is funding the modeling study you described in your testimony?

8. On page 3 of your testimony, you state that U.S. coal-fired power plants contribute less than 1% to the world-wide emissions of mercury. What do coal-fired power plants contribute to just the total emissions of mercury in just the U.S.? Are coal-fired power plants the largest category of mercury emissions in the U.S.?

9. On page 6 of your testimony, you mention the Mercury Deposition Network. Could you please describe the Mercury Deposition Network? (How many monitors in the U.S.? How many monitors in Illinois? Are the monitors located in urban areas or rural areas? Who operates the network? Does it measure both wet and dry deposition?) Is the network designed to measure regional deposition or deposition from specific sources? Are there any monitoring data in Illinois that can be used to evaluate local-scale deposition?

10. On page 7, you mention that the model you used has a grid resolution of 20 km. Please describe the effects of grid resolution on model performance. What factors influence your selection of the model's resolution? Is 20 km adequate for regional modeling? Is 20km adequate for local-scale modeling? What would the model show with respect to mercury deposition near power plants if finer grid resolution were used?

11. On page 9, you describe the modeling scenarios you ran. Is there a reason you did not run a 2020 scenario with CAIR/CAMR and with Illinois' proposed 90% control? In your summary of the results on page 11, you stated that the 2020 CAIR/CAMR scenario provides lower mercury deposition than the 2010 scenario with CAIR/CAMR and with 90% mercury control in Illinois. Wouldn't you also expect lower mercury deposition in 2020 with CAIR/CAMR and with 90% mercury control in Illinois than with just CAIR/CAMR in 2020?

12. What is the importance of precipitation in deposition? Is it important to ensure that precipitation is handled properly in the model (both amounts and locations?) Did you evaluate this specifically?

13. On page 15, you noted that large convective storms may extend to the upper troposphere. What is the typical height (in feet or meters) of these storms in the Midwest? Are large convective storms important for mercury deposition? How are they handled in grid based modeling? What is the height of the top of the model's highest grid layer? Is it high enough to model large convective storms? If not, wouldn't the performance of the model be compromised with respect to wet deposition from these events?

Questions for Richard McRanie

1. On page 6 of your testimony, in the section titled "General Discussion of the Portable Monitoring Issue," you state, "It appears that the State of Illinois has proposed these new mercury control regulations without seriously considering any of the Hg emissions measurement issues." What is the basis for this statement?

2. In the next paragraph, you state, "Unfortunately, virtually all regulators assume that emissions measurements can be made at whatever level might be desirable with no accuracy, precision or bias problem." What is the basis for this statement?

3. Are you claiming that USEPA did not have the proper technical knowledge to write the Part 75 mercury monitoring provisions?

4. On page 7 of your testimony, you claim that trading programs spread out any possible monitor bias. Isn't it true that a trading program allows averaging across both time and multiple units?

5. Again on page 7 of your testimony, you state, "Regulators have developed the habit of adding significant figures to emission limits in an attempt to tighten the limits." What is the basis for this statement?

6. On page 10 of your testimony, you claim that there have been hardware failures in mercury monitors. Isn't it true that, if such failures occur, they would occur whether sources are subject to the proposed Illinois regulation or CAMR?

7. Also on page 10 of your testimony, you state, "I am always amazed that regulators sit down at their desks and write Hg monitoring regulations without ever having seen a Hg CEMS or having any reasonable level of knowledge about how they work." Did you actually talk to any Illinois EPA employee who participated in the development of these regulations?

8. On page 13 of your testimony, you claim that mercury CEMS are "difficult to work on." Even if that statement is presumed to be correct, wouldn't that be the case whether sources are subject to the proposed Illinois regulation or CAMR?

9. On page 17 of your testimony, you state, "I hope the issues are resolved by the time Hg calibrations have to be done under a regulatory program." Isn't it true that the supposed technical "issues" in question are the same whether sources in Illinois would be subject to the proposed Illinois regulation or CAMR?

10. You describe on page 22 of your testimony to an example of the need to conduct a NOx CEMS relative accuracy test audit. If USEPA already requires combustion turbines to control NOx to levels that you argue are below the RATA reference method accuracy

levels, do you agree that under the same principle RATA reference method accuracy shouldn't be an issue for mercury either?

11. On page 25 of your testimony, you state, "We have not detected any particular bias in the continuous Hg CEMS measurements." You then claim that "a small bias would be virtually impossible to detect." In such a case where no bias has been detected, would it be scientifically valid to assume a bias might be present, or, in fact, wouldn't the correct conclusion be to have simply said that no bias has been detected?

12. In the next paragraph of page 25 of your testimony, you discuss biases in SO2 monitoring. Isn't it correct that, in fact, this has nothing to do with the proposed Illinois mercury rule and you are only discussing it because, as you admitted, there has been no bias detected in mercury CEMS?

13. On page 29 of your testimony, you discuss some CEMS tests and state, "by the 40 CFR Part 75 rules, the RATAs were invalid." Isn't it true that these test results would be the same whether sources in Illinois are subject to the proposed Illinois regulation or CAMR?

14. On page 37 of your testimony, you wonder how Illinois proposes to calculate input pounds of mercury. Can this calculation be made given that on page 36 of your testimony you quote Section 225.265(a)(4) regarding the measurement of mercury content in coal as being in units of pounds per trillion Btu, and given that EGUs know how many Btu they generate?

15. On page 38 of your testimony, you state that a source of error "is typically ignored by regulatory personnel and I expect this is the case for the proposed Illinois rule." What is the basis for this statement?

16. On page 39 of your testimony, you claim that a carbon injection system will not stop excursions because of the time lag in increasing the carbon feed rate. Isn't it true that an averaging period over 12 months, as contained in the proposed Illinois rule, will mitigate any short-term potential issues like this due to the much longer-term averaging time?

17. In Appendix 2 of your testimony, you used a CO2 value of 11.53%. Why did you choose that value, which you admit in the calculation is being assumed?

18. Do CAMR and Illinois' proposed rule allow for sorbent trap monitoring as an alternative to CEMS?

19. Your testimony is based in large part on your experience at the Trimble County plant. Is that plant equipped with a wet FGD?

20. Could you describe the type of stack conditions that exist at Trimble County?

21. You focus heavily on Continuous Analyzer methods. Are there other methods of measurement for measuring Hg from flue gases that comply with the proposed Illinois rule and CAMR? If so, what is your familiarity with those methods?

Respectfully submitted,

ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY

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

DATED: August 7, 2006

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)

CERTIFICATE OF SERVICE

I, the undersigned, an attorney, state that I have served electronically the attached

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY'S PRE-FILED QUESTIONS

upon the following person:

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

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

SEE ATTACHED SERVICE LIST

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Charles E. Matoesian
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Dated: August 7, 2006

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