BEFORE THE

NOVA SCOTIA UTILITY AND REVIEW BOARD

IN THE MATTER OF: The *Public Utilities Act*, R.S.N.S., 1989, c. 380, as amended

- and -

IN THE MATTER OF: An Application by Nova Scotia Power Incorporated for approval of Air Emissions Strategy capital projects.

EVIDENCE FILED BY ROBERT M. FAGAN

ON BEHALF OF:

THE NOVA SCOTIA UTILITY AND REVIEW BOARD STAFF

Redacted (Public) Version

JANUARY 30, 2006

DIRECT TESTIMONY OF
ROBERT M. FAGAN

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I. INTRODUCTION AND QUALIFICATIONS

Q. PLEASE STATE YOUR NAME, OCCUPATION, AND BUSINESS ADDRESS.

A. My name is Robert M. Fagan. I am a Senior Associate at Synapse Energy Economics Inc. ("Synapse"), 22 Pearl Street, Cambridge, Massachusetts, 02139.

Q. PLEASE SUMMARIZE YOUR PROFESSIONAL EXPERIENCE AND EDUCATIONAL BACKGROUND.

A. I am an energy economics analyst and mechanical engineer with 20 years of experience in the energy industry. My work has focused primarily on electric power industry issues, especially: economic and technical analysis of regulated electric utility issues and competitive electricity markets; electric industry energy, capacity and transmission pricing structures; and assessment and implementation of demand-side resource alternatives. I hold an M.A. from Boston University in Energy and Environmental Studies and a B.S. from Clarkson University in Mechanical Engineering. Details of my experience are provided in Exhibit RMF-1.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE NOVA SCOTIA UTILITY AND REVIEW BOARD?

A. I submitted pre-filed testimony during Nova Scotia Power Inc.'s (NSPI) Open Access Transmission Tariff proceeding in April of 2005, on behalf of the Nova Scotia Utility

and Review Board ("Board Staff"); I did not formally testify in Halifax because the case was settled prior to hearing.

Q. PLEASE DESCRIBE SYNAPSE ENERGY ECONOMICS.

A. Synapse is a research and consulting firm that specializes in energy, economic and environmental topics. Our primary emphasis is in analyzing policies that lead to sustainable, efficient and equitable energy production and use. Synapse provides research, testimony, reports and regulatory support to consumer advocates, environmental organizations, regulatory commissions, state energy offices, and others. The company was founded in May 1996 to specialize in consulting on electric industry regulatory, restructuring, and environmental issues. We have a staff of fifteen.

Q. HAS SYNAPSE WORKED WITH ANOTHER CONSULTANT IN EVALUATING NSPI'S AIR EMISSIONS STRATEGY APPLICATION?

A. Yes. We have worked with Mr. Rui Afonso of Energy and Environmental Strategies ("EES") of Shrewsbury, Massachusetts. Synapse reviewed NSPI's application, focusing in particular on NSPI's overall approach to evaluating potential emission reduction technology alternatives, especially including the economic reasonableness and appropriateness of the proposed systems. Mr. Afonso addressed particular technical issues associated with the applicants' chosen emission reduction technologies, and performed the Lingan site visit along with a Synapse staff person, Ms. Anna Sommer. Mr. Afonso is submitting separate Direct Testimony in this proceeding addressing the specific review areas undertaken by EES.

Q. HOW IS YOUR TESTIMONY ORGANIZED?

A. The testimony contains four parts: this introductory section; then a description of the scope of work and the materials we used in the evaluation of NSPI's application; a summary conclusion; and last a section describing Synapse's review and findings.

II. SCOPE OF WORK AND MATERIALS REVIEWED

Q. WHAT IS THE SCOPE OF WORK YOU WERE CONTRACTED TO PERFORM?

A. Synapse Energy Economics was hired to perform the following tasks:

1. Review NSPI's application and if necessary request additional information through issuance of formal information requests (IRs).
2. Visually inspect the Lingan station, in particular the physical location of the proposed emissions reduction technologies.
3. Review the emissions levels reduction alternatives considered for the proposed installation at Lingan including the associated costs developed by NSPI.
4. Compare the NSPI design specifications with those typically used at other plants, and with appropriate Canadian and US regulations and guidelines.
5. Consider the appropriateness of other alternatives as a means of correcting the emissions problems.
6. Prepare and file evidence including the following:
    a. Based on the visual inspection of Lingan, opine and comment on the appropriateness of the emissions reduction technologies chosen by NSPI;
    b. Opine on the reasonableness of all the technologies considered by NSPI for installation at Lingan;

c. Comment on other feasible alternatives, if any, not considered in NSPI's application;

d. Provide our opinion on the reasonableness of NSPI's recommended emissions reduction technologies approach, in the context of Nova Scotia's environmental plan and the maximum emissions limits; and

e. Provide our opinion as to the reasonableness of NSPI's cost estimates and cost-benefit analyses for its emissions reduction technologies considered and selected.

Q. DOES YOUR SCOPE OF WORK AND ACCOMPANYING TESTIMONY ADDRESS ALL OF THE BOARD'S ISSUES AS LISTED ON THE ISSUES LIST?

A. Yes, in general. The primary ones we considered were issues one through five, with issues six and seven being relevant to some of our examination. Issues one through five concern NSPI's overall Air Emissions Strategy, whether the application is a reasonable and prudent means of meeting emission requirements, determining the alternatives and if they have been adequately considered, the cost benefit analysis associated with all studied alternatives, and whether the design (at Lingan) is appropriate. Issues six and seven concerned cost recovery, including return and depreciation, and the remaining life estimates of the existing coal-fired plant.

Q. DOES YOUR SCOPE OF WORK INCLUDE MAKING A RECOMMENDATION AS TO WHICH ALTERNATIVE IS THE LEAST COST WAY TO MEET THE EMISSIONS REDUCTION REGULATIONS?

A. No, our scope of work does not require an explicit recommendation. Also, based on the evidence reviewed, a considerably more extensive analysis would be required to make such a determination.

Q. WHAT MATERIALS DID YOU REVIEW IN CONSIDERING NSPI'S APPLICATION?

A. Synapse reviewed the confidential version of NSPI's "Air Emissions Strategy Capital Applications" dated November, 2005. Synapse also reviewed all of the responses to information requests provided by NSPI. Those included responses to questions from the staff of the Nova Scotia Utility and Review Board, Synapse, the Nova Scotia Department of Energy, Ecology Action Center, Stora Enso Bowater, and Black River Wind.

III. SUMMARY CONCLUSION

Q. WHAT IS YOUR OVERALL CONCLUSION CONCERNING NSPI'S AIR EMISSIONS STRATEGY APPLICATION?

A. My overall conclusion based on the review and findings presented in the following section is that it is not reasonable to assume, based on the evidence submitted in the application, that the 320 MW wet scrubber option is the least cost choice for SO2 emissions reduction even among the limited options reviewed by NSPI, not to mention the full set of alternatives that could be considered. Because of similar methodological concerns, I also conclude that the evidence does not show that the low NOx burner controls proposed represent the least cost alternative.

IV. REVIEW AND FINDINGS

Q. PLEASE DESCRIBE THE REVIEW PROCESS USED BY SYNAPSE AND EES IN EVALUATING NSPI'S APPLICATION.

A. Synapse first reviewed NSPI's application material, and subsequently discussed the substantive issues with the UARB staff. EES and Synapse then arranged for a site visit at the Lingan station, conducted in the second week of December, 2005. Based on our review of the materials, the site visit, and a subsequent need for more information on the processes employed and the data used by NSPI in determining an emissions reduction choice, we developed a set of information requests to NSPI. We subsequently reviewed the responses to all information requests, and evaluated the overall approach used by NSPI.

Q. PLEASE COMMENT ON THE ROLE OF EES IN THIS REVIEW AND SUMMARIZE THE RESULTS OF MR. AFONSO'S ANALYSIS.

A. EES was sub-contracted to Synapse for the express purpose of reviewing the technological aspects of the proposed SO2 emissions reduction technology at Lingan station and the proposed use of low NOx burners to meet NOx requirements. Mr. Afonso has found that the proposed SO2 reduction installation at Lingan, and the proposed NOx reduction installations at several coal-fired stations are within the range (though on the high side) of expected costs for the technologies, will reliably remove the SO2 and NOx as designed, and are technically appropriate technologies to use in those stations. Mr. Afonso has not conducted any economic analysis of the alternatives for SO2 and NOx reduction for the NSPI system.

Q. WAS THE APPLICATION ITSELF SUFFICIENT TO CONDUCT A REVIEW OF THE ECONOMIC REASONABLENESS AND APPROPRIATENESS OF THE PROPOSED EMISSIONS REDUCTION STRATEGY?

A. No. The application itself was deficient in information needed to assess the economic analyses conducted by NSPI. The descriptions of the probabilistic and deterministic analyses were extremely limited, and only summary results were reported, and only in hard copy form. Furthermore, no or little information was provided on any methods used to arrive at subsets of six SO2-reducing options and three NOx-reducing options for which deterministic and probabilistic analyses where then conducted. All fuel costs were reported in system-wide aggregate form, thus no assessment of relative fuel price assumptions could be made until after receipt of the information request responses, which did contain fuel and unit-specific fuel price information. There was no detail provided on how other input assumptions were arrived at, such as the loads used, the way carbon dioxide impacts were modeled, or the generation plan for the period of concern.

Q. HOW DID THIS AFFECT YOUR ASSESSMENT OF THE APPLICATION?

A. No useful economic analysis could be conducted until after the receipt of responses to information requests. Synapse received a set of confidential responses on January 13th. Thus, one of the effects of the information-deficient application was to delay any ability to conduct a detailed examination of relevant economic information for the emissions reductions alternatives from mid-November until almost mid-January.

Q. PLEASE COMMENT ON THE SUFFICIENCY OF RESPONSE TO THE INFORMATION REQUESTS.

A. The information requests were in some cases non-responsive, and in other cases only partially responsive. Thus, NSPI's responses made it very difficult to conduct an adequately detailed examination of the economic reasonableness and appropriateness of the proposed emissions reductions option chosen. For example, Synapse IR-18 asked for all assumptions and supporting calculations underlying the table on page 2 of Appendix V that presented the results of the SO2 NPV analysis, in excel or text format. NSPI's response to UARB-25 (d) purportedly answered this question, but no information was provided in excel format, and no underlying calculations were provided; nor was a clear description of the detailed quantitative computations given. The discounted cash flow evaluation, SO2 abatement decision spreadsheets provided were in hard copy only, thus it was impossible to analyze in detail the underlying methods and formulas used and assumptions made.

Q. WERE YOU NONETHELESS ABLE TO COMMENT AND PROVIDE AN OPINION ON THE ECONOMIC REASONABLENESS AND APPROPRIATENESS OF NSPI'S CHOSEN OPTIONS?

A. Yes. As we describe, there are a number of deficiencies in the approach used by NSPI such that were able to determine that the proposed emissions reduction plan has not been shown to be economically appropriate or reasonable.

Q. WHAT ARE THE PROVINCIAL EMISSIONS REGULATIONS NSPI MUST COMPLY WITH?

A. The Nova Scotia provincial regulations mandate a reduction in SO2 emissions by NSPI to no greater than 72.5 kT (thousand metric tonnes) by 2010; a reduction in NOx emissions to no greater than 21.365 kT by 2009; and a reduction in mercury (Hg) emissions to no greater than 168 kilograms (kg) starting in 2005. NSPI states that the Kyoto requirements for greenhouse gas emissions are not finalized, but also states that it uses a constraint of in 2010 and in 2020 in their net present value ("NPV") analyses (confidential response to UARB-25 (b) Attachment 1).

Q. PLEASE SUMMARIZE THE OVERALL APPROACH USED BY NSPI TO SELECT AN EMISSIONS REDUCTION COMPLIANCE STRATEGY.

A. NSPI chose its NOx reduction technology based on a calculation of the net present value of three particular NOx reduction strategy options; it chose the option with the lowest computed NPV for the three alternatives analyzed. NSPI chose its SO2 reduction technology based on a two-step process: first, they conducted an NPV analysis of six particular SO2 reduction strategy options, and then they employed the "Strategist" production cost / dispatch / resource optimization model to choose between two options that had the lowest computed NPV from the first step. NSPI did not choose any CO2 reduction strategy, but rather assumed that compliance with CO2 regulations would be done via purchase of credits.

Q. HOW DID NSPI ARRIVE AT THE SIX SO2 AND THREE NOX ALTERNATIVES THEY ANALYZED?

A. NSPI's application does not explain how they arrived at the six SO2 options examined. In response to UARB IR-25 (b), NSPI indicates that the "generation plan" was used as part of the filtering process, but there is no documentation that the generation plan itself represents an optimal mix of supply and demand side resources, thus an economically optimal emissions reduction approach would not necessarily start with NSPI's generation plan.

For NOx, NSPI states in their application that they followed a two-step process comprised of identifying available, commercially proven technologies and then comparing cost estimates for those technologies. However, they did not explain or provide any supporting documentation on how they arrived at the three NOx reduction alternatives considered.

Q. DID NSPI ESTABLISH THAT THE PROJECTED LEVEL OF DEMAND USED IN THE SIX SO2 AND THREE NOX ALTERNATIVE SCENARIOS IS A VALID PROJECTION FOR THE PURPOSES OF OPTIMIZING AN EMISSIONS REDUCTION APPROACH?

A. No. Nowhere did NSPI establish that the current level of planned energy efficiency represents an optimal approach to meeting customer needs at the lowest total resource cost. The response to UARB-25 (c) states that no analysis was undertaken to evaluate additional energy efficiency beyond the current load forecast as part of an optimal emissions reduction strategy. To the extent that insufficient economical energy efficiency resources are being procured, NSPI's baseline energy requirements in its NPV and Strategist analyses are too high and thus the resulting analyses are

effectively invalid; they would need to be re-run at lower levels of projected consumption to see if the results remain the same.

Q. FOR THE SIX SO2 AND THREE NOX ALTERNATIVES CONSIDERED BY NSPI, DID NSPI REPORT THE NUMERICAL RESULTS OF ANY SENSITIVITY ANALYSES TO DETERMINE THE LOWEST NPV UNDER DIFFERENT INPUT ASSUMPTIONS?

A. No; the sensitivity results were reported only graphically, with no clear roadmap to check the plotted data. For example, for SO2, the NPV analyses (included as a confidential response to UARB 25 (d), Attachment 2) only contained one NPV numerical computation result for each of the six alternatives. NSPI did present two "SO2 Abatement NPV Cumulative Probability Curve[s]" (in hard copy format only) for each of the six alternatives, along with the same Tornado diagram (reflecting the sensitivity of the 320 MW wet scrubber NPV under different fuel, capital cost, and auxiliary power input assumptions) for each alternative. Also, NSPI did present 3 sets of input values (listed as "10", "50" and "90", and presumably representing a form of probabilistic input, e.g., the chance that the values would be at or below the stated level) for the assumptions used in the NPV calculations, but they did not show any NPV computations associated with the input assumptions under the "10" or "90" columns.

Q. PLEASE COMMENT ON ANY SENSITIVITY ANALYSIS NSPI DID CONDUCT.

A. The representations in the SO2 Abatement Decision Analysis seem to indicate that sensitivity analyses were conducted using three different sets of inputs. However, NSPI does not document how they computed any NPVs other than a single NPV for each alternative. If they did compute other NPVs, they did not show the result numerically, nor did they support any of the input assumption variations they listed as "10" and "90" values. Also, for CO2, the P10, P50 and P90 values listed on page 2 of Attachment 2 to UARB-25 (d) contrary to indications reported in Attachment 1 to the same data request response. Since the only NPV calculations conducted were using the six options, they did not conduct any sensitivity analysis of their results using assumptions outside of their stated alternatives, such as an aggressive energy efficiency case, or an increased purchased power case, or any combination of renewables other than the case where two dry scrubbers are used in addition to fully replacing the output of a coal-fired unit.

Q. DID NSPI PROPERLY ACCOUNT FOR GREENHOUSE GAS RISK AS PART OF THEIR EMISSIONS REDUCTION APPROACH?

A. It is unclear if NSPI has properly modeled carbon dioxide impacts in its basecase NPV assessment; it appears NSPI did not properly model CO2 in the limited NPV sensitivity runs they did conduct; and NSPI did not model CO2 impacts when using the Strategist tool, as noted in their response to UARB-12 (c).

The NPV assessments (e.g., for SO2, see the response to UARB-25 (d)) contain a single line item entitled "CO2 costs (credits) ($M / yr)". The actual year-by-year stream of values for NSPI's assumed CO2 cap, actual CO2 emitted, and

assumed prices for CO2 credits is not provided. Partial information is provided in the confidential response to UARB-25 (d) Attachment 1, but that information – i.e., 2010 and 2020 "P50" CO2 constraints, and "P50" CO2 credit prices - is not sufficient to create an annual cost impact stream; nor is it clear if the CO2 emission information included in the Strategist output file is the correct stream of CO2 emission values to use with constraint and price information listed in another document. Also, as noted, the values listed as P10 and P90 input assumptions for CO2 are the as the P50 value, contrary to NSPI's own statements on 1) Attachment 1 to the response to UARB-25 (d), and 2) on page 20 of Attachment 1 to the response to Synapse IR-9.

Nowhere does NSPI assess the risks associated with the potential for higher CO2 credit prices, and how those risks might impact the consideration of an emissions reduction approach. In response to Synapse IR-9, in a confidential Attachment 1, they include a table but they also note that it is "

". This implies an uncertainty of the price of CO2 credits, an understandable view in light of ongoing debate in Canada, the US and worldwide concerning the threat of greenhouse gas emissions. In particular, use of wet scrubber technologies will increase CO2 emissions, while use of energy efficiency and renewables will reduce greenhouse gas, SO2, NOx and Hg emissions.

Q. WHAT DOES THE NPV ANALYSIS ITSELF SHOW CONCERNING THE STREAM OF COSTS AND BENEFITS ASSOCIATED WITH NSPI'S "FIRST" AND "SECOND" PLACE FINISHERS?

A. The stream of "cumulative PV benefit" shown in Appendix VI of the application starts with positive benefit for NSPI's chosen option, but in 2013 the net benefits become negative, and stay negative until 2020. The benefits become positive again in 2020. This form of analysis attempts to correct for the time value of money by using a discount rate, however it does not directly address the risks and uncertainties of all the inputs to the calculations, especially those associated with the out years. In this instance, the year 2020 is notable because the operating costs of the "nonFGD" alternative – NSPI's compliance fuels approach – increase considerably. This appears to occur because of the imposed SO2 constraint in 2020. If this constraint were not present, it is unclear that NSPI's chosen option would be the lowest NPV, based on their own calculations.

Q. BASED ON YOUR REVIEW, WHAT ARE YOUR PRIMARY OBSERVATIONS AND FINDINGS?

A. Synapse's observations and findings are as follows:

1. The results of the decision analysis are not tested for robustness. NSPI's reported NPV benefit of $102 million for the 320 MW wet scrubber over the next best alternative (compliance fuels, or fuel switching) is approximately of NSPI's base value as represented in the decision analysis, and approximately f NSPI's base value as represented by PV utility cost in the Strategist runs. This fairly small margin of difference would be affected by changes to any number of input assumptions that remain uncertain. NSPI has not demonstrated how its choice of the 320 MW wet scrubber might fare

in an NPV analysis under reasonable alternative scenarios that contained some of the following permutations:

i. different load levels, especially as a result of utility-sponsored energy efficiency efforts;

ii. different fuel prices, especially testing reasonable assumptions concerning the price spreads between low and high sulphur fuels;

iii. unit retirement options;

iv. renewable generation alternatives other than the single alternative where the output from a single base load coal unit is replaced fully by wind, and dry scrubbers are also installed on other units ;

v. increased purchases from other regions; and

vi. combinations of the above factors, especially combinations beginning with the lowest cost demand-side resources.

This lack of analytical rigor is cause for considerable concern given the fairly small percentage margin between the 320 MW wet scrubber and the compliance fuels alternative. There is no attempt to define threshold values for crucial input assumptions beyond which the ordinal results of the decision analysis might change. Such an attempt would be but one method to examine the robustness of the chosen alternative.

2. NSPI's conclusion that the 320 MW Lingan wet scrubber option is the least cost emission reduction option by $102 million (net present value) over the next best alternative appears to be directly predicated in large part on the

imposition in 2020 of an emissions constraint (of 36 kT for SO2, 50% of the 2010 SO2 cap) that is not currently a Nova Scotia provincial emissions reduction regulation. Simultaneously, the carbon dioxide credit price and credit quantity is not adequately documented, though it doesn't appear that the risk of higher CO2 prices is represented in the NPV model in an analogous manner as the risk of tighter SO2 emissions is modeled. While NSPI's consideration of a more stringent emission regulation in the future for SO2 and NOx is commendable, it does not appear that they have used a similarly strict constraint for the effect of CO2 (i.e., purchase costs for carbon dioxide credits), such as the use of from page 20 of Attachment 1 to Synapse IR-9. Indeed, it appears in the NPV analysis that they have used the P50 value for all three P10, P50 and P90 assessments. Also, NSPI has not presented any evidence supporting the assumed cap level for SO2. If there were additional analyses that looked at reasonable projections of stricter emissions requirements (or higher carbon credit prices) consistently across all pollutants, and perhaps also evaluated options using solely the current regulatory criteria, the Board could then more fully understand how the optimal emission reduction approach could change given different sets of modeled emissions constraints. NSPI is thus inconsistent in its approach to incorporating risk of future emissions regulations into its analysis. NSPI does not appear to adopt more strict carbon regulations (via higher carbon credit prices) as a constraint in its analyses, while it does presume stricter SO2 and NOx regulations. This approach analytically biases the results in favor of

SO2 scrubbing technologies to the detriment of technologies that inherently are less carbon intensive (and also emit less or zero SO2 and NOx) such as increased energy efficiency, wind, or natural gas-fired options.

3. NSPI's method of narrowing the universe of options from which to choose an emissions reduction approach is not sufficiently documented in its application or in the responses to information requests. It is thus unclear how NSPI narrowed the field to the six alternatives on which a "decision analysis technique" was then employed. In particular, there are numerous and highly reasonable variations on the alternatives selected by NSPI for analysis that were not explicitly considered. For example:

   i. the magnitude of investment in energy efficiency versus the magnitude of investment in pollution controls is cause for concern; NSPI indicates it has incorporated the effects of energy efficiency into its load projections, but has not established that the relatively minimal energy efficiency efforts considered are already optimal when considering the capital investment and/or increased operating costs otherwise required for emissions reductions. In particular, NSPI has a low load case with 2010 energy requirements lower than its base case (response to Synapse IR-9, Attachment 1, page 4, Table 1.0), and more aggressive yet economically-efficient energy efficiency scenarios could be foreseen, given the relatively arms-length efforts NSPI put forward in its conservation and efficiency plan (available on its website, as referenced by NSPI in response to Synapse IR-20). NSPI did not include an "aggressive DSM

case" as one of its alternatives, and provided no evidence that such a case should not be considered.

ii. the fuel price forecast is particularly troubling, as post-2014 NSPI predicts To the extent this is a conservative forecast, it reduces the benefits associated with any energy efficiency or renewables alternative. The benefit of the wet scrubber proposed by NSPI is driven in part by the price of coals, which influence the relative economics of coal-burning resources versus other resources; and the benefit is also driven by the price differential between high sulfur and low sulfur coals, which influence the economics of the scrubber vs. compliance fuels alternatives. There is no discussion of past price trends, or reasons for projected future price trends in the coal market. The risk associated with these price effects has not been adequately evaluated by NSPI in its application.

iii. unit retirement was only evaluated in the context of being replaced by wind generation sufficient to make up the capacity of the unit retired; other retirement options could be considered, and thus an unnecessarily inflexible wind option was the only alternative reviewed.

4. NSPI has optimized for each emission regulation separately, and has reported that the combination of a 320 MW wet scrubber and low NOx combustion firing systems are optimal to meet the emissions requirements. Optimization for each emission regulation separately means that options that offer a co-benefit reduction, such as selective catalytic reduction (SCR) and FGD; or

renewables and energy efficiency, would be picked (or excluded) based solely on their ability (or inability) to optimally reduce any one of the criteria pollutants individually, not in combination. This implies that the chosen technology cannot be guaranteed to be the least cost optimization choice because it has not been analyzed simultaneously across the entire scope of air emission regulations. Nor has it been optimized against alternative load scenarios; use of a sub-optimal load profile due to a failure to capture all economically-efficient energy efficiency resources will invalidate the results of the NPV analysis.

5. The decision analysis technique itself, employed on an identified yet small set of options, is insufficiently explained and supported in the application, and NSPI's responses to information requests seeking greater clarity did not provide such clarity. In particular, a number of IR responses refer to the response to UARB IR-25 (d) for an explanation of how the analysis results presented in Appendix V of the application were obtained. The response to UARB IR-25 (d) did not explain how the decision analysis was carried out, and instead references the responses to NSDOE IR-16 and NSDOE IR-17 for an explanation of the decision analysis technique. The responses to the NSDOE's IR-16 and IR-17 do not explain the decision analysis technique. Thus the only information available are two sets of Discounted Cash Flow Evaluations, one for SO2 and one for NOx, with no documentation provided to explain how the resulting net present values for each of the six alternatives were arrived at.

The spreadsheets themselves sometimes extend to 2026, and at other times to 2027. The graphs of "SO2 Abatement NPV Cumulative Probability Curve[s]" state a time frame of 2010 – 2029, yet no 2028 or 2029 values are listed anywhere. The summary information provided in Appendix VI of the application uses a 2010-2025 timeframe for the NPV, compared to the 2010-2029 time frame stated on the NPV Cumulative Probability Curves. While computational differences arising from the use of different time frames may not result in material differences in the outcome, it's also possible that they may result in a change to ordinal results; any inconsistent use of time frames when conducting NPV analyses must be fully documented to ensure credible results.

6. It is unclear why subsequent use of the Strategist modeling tool was limited to evaluating just two alternatives within the Strategist framework. Its use is limited to testing two options, the 320 MW wet scrubber and the compliance fuels alternative. It does not represent a comprehensive testing of alternative resource options. Given the capabilities of the Strategist model to perform least cost optimization of alternative resource options, it is unclear why NSPI limited its use of the tool to a single comparison between two alternatives.

7. The $102 million benefit ascribed to the 320 MW wet scrubber option in the presentation of the deterministic analysis on page 1 of the "Evaluation" section of the FGD section in the application excludes the impact of CO2 constraints and credit prices. Using NSPI's value for the overall impact of CO2, the NPV benefit of the 320 MW wet scrubber is reduced to $70 million,

or only % of NSPI's base value in the decision analysis, furthering our concern that the margin of difference is so low that robustness of results must be tested before any outcomes can be considered conclusive. The primary results summarized on page 1 of the FGD Evaluation section did not contain this information, yet the application implied that the impact of carbon credits were included.

8. NSPI's decision analysis methodology and its Strategist analysis both use 2010 as the first year in determining a stream of costs out to 2025 over which a net present value calculation is made (back to 2006 dollars). This methodology ignores the effects of actions taken during 2006-2009 and how those actions might impact the net present value of costs commencing in 2006.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.