STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

VERIFIED PETITION OF SOUTHERN INDIANA GAS AND ELECTRIC COMPANY d/b/a VECTREN ENERGY DELIVERY OF INDIANA, INC. FOR ISSUANCE OF A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR FEDERALLY MANDATED REQUIREMENTS; APPROVAL OF CLEAN COAL TECHNOLOGY, ENERGY AND COMPLIANCE PROJECTS; FOR ONGOING REVIEW; FOR APPROVAL OF FINANCIAL INCENTIVES INCLUDING (1) THE RECORDING OF A REGULATORY ASSET FOR COSTS INCURRED DURING TESTING AND OPERATION OF SUCH PROJECTS, INCLUDING CAPITAL, OPERATING, MAINTENANCE AND DEPRECIATION, TAX AND FINANCING COSTS, UNTIL SUCH COSTS ARE REFLECTED IN RATES AND (2) ALTERNATIVELY, THE TIMELY RECOVERY OF COSTS INCURRED DURING CONSTRUCTION AND OPERATION OF SUCH PROJECTS THROUGH A PERIODIC RATE ADJUSTMENT MECHANISM; ALL UNDER IND. CODE §§ 8-1-2-23, 8-1-8.4-1 *ET SEQ*, 8-1-8.7-1 *ET SEQ.*, AND 8-1-8.8 -1 *ET SEQ.*	CAUSE NO. 44446

VERIFIED (PUBLIC) DIRECT TESTIMONY

OF

DIANE M. FISCHER

BLACK & VEATCH

ON BEHALF OF

SOUTHERN INDIANA GAS AND ELECTRIC COMPANY
D/B/A
VECTREN ENERGY DELIVERY OF INDIANA, INC.

SPONSORING PETITIONER'S EXHIBIT NO. DMF-2 THROUGH DMF-3C

VERIFIED DIRECT TESTIMONY

OF

DIANE M. FISCHER

BLACK & VEATCH

Q. Please state your name, employer and business address.

A. Diane M. Fischer, Black & Veatch Corporation ("B&V"), 11401 Lamar Ave., Overland Park, Kansas, 66211.

Q. What position do you hold with B&V?

A. I am the Air Quality Control Services Area Leader for B&V's Energy Division.

Q. Please describe your educational background.

A. I received a Bachelor of Science Degree in Mechanical Engineering from Iowa State University in 1992. I am currently licensed as a Professional Engineer in the state of Missouri.

Q. Please describe your professional experience.

A. I have over 20 years of experience in Air Quality Control ("AQC") projects acting in roles such as Project Manager, Engineering Manager, and AQC Engineer. These projects have covered a broad spectrum of AQC compliance projects, mainly for domestic clients.

Q. What are your duties and responsibilities as B&V's AQC Services Area Leader?

A. Generally, my primary role is to provide oversight for our air quality control services projects. My duties include coordinating business development, developing and maintaining standard tools for AQC services projects, and monitoring project execution.

I also manage compliance studies, support detailed design of AQC projects, and maintain updated knowledge of the regulations associated with air quality compliance.

For Southern Indiana Gas & Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc.'s ("Vectren South" or the "Company") project, I am the Assistant Project Manager and I developed the technology demonstration protocol, lead B&V's evaluation of the technology demonstrations, and supported the project team in the technology selection process.

Q. Are you sponsoring any exhibits in support of your testimony?

A. Yes. I am sponsoring Petitioner's Exhibit No. DMF-1 through DMF-3, including the following:

EXHIBIT NUMBER	DESCRIPTION
Petitioner's Exhibit No. DMF-2	B&V's experience with mercury control technology
Petitioner's Exhibit No. DMF-3	MATS/NOV Phase I Preliminary EPCM Study – Technology Selection Report

Q. Were the exhibits identified above prepared or assembled by you or under your direction or supervision?

A. Yes, as the Assistant Project Manager for B&V on the project.

Q. What is the purpose of your Direct Testimony in this proceeding?

A. The purpose of my testimony is to provide information regarding the engineering work completed by B&V in support of Vectren South's objectives of complying with the Mercury and Air Toxic Standards ("MATS") rule and the Notice of Violation ("NOV") and explain the cost estimate B&V prepared to evaluate the cost of the recommended projects.

I. Black & Veatch

Q. Please describe B&V and its qualification and experience with utility environmental compliance studies.

A. B&V has executed numerous emissions control projects including a number of multi-pollutant compliance planning studies, continuous emissions monitoring, mercury ("Hg") control, selective catalytic reduction, particulate removal, mercury removal, and scrubber retrofit projects. In addition to project execution, B&V has examined mercury control and other MATS compliance technologies on over 100 units in the last several years. Petitioner's Exhibit No. DMF-2 is a summary of some of the mercury control projects that B&V has completed or is completing.

Q. What was B&V's role in Vectren South's analysis of pollution control technologies?

A. B&V has supported Vectren South in assessing the mercury control and sulfuric acid mist emissions control technologies available for use at its F.B. Culley ("Culley") and A.B. Brown ("Brown") generating stations. This included the following activities: performing an industry survey of available technologies, developing cost estimates for available technologies, assisting Vectren South in developing the technology demonstrations protocols, evaluating the results of the technology demonstrations, making recommendations regarding technology selection, and developing an execution plan to meet the MATS and NOV requirements.

II. Vectren South's Need for Pollution Control Technology

Q. What pollutants does Vectren South need to reduce to comply with MATS?

A. The MATS rule requires control of Hg, filterable particulate matter ("PM") and/or metallic hazardous air pollutants ("HAPs"), and hydrogen chloride ("HCl") and/or sulfur dioxide

("SO_2"). Table DMF-A lists the MATS requirements that Vectren South must meet at Culley and Brown Stations.

Table DMF-A, MATS Emissions Limits

MACT LIMITS	LIMIT
Acid Gases (lb/MBtu)	0.002 as HCl or 0.2 as SO_2
Filterable PM (lb/MBtu)	0.03
Hg (lb/TBtu)	1.2
lb/MBtu = pounds per million British thermal units lb/TBtu = pounds per trillion British thermal units	

Based on the results of the Baseline Testing performed by Vectren South and on the results of the Technology Demonstration, Culley and Brown Stations are currently in compliance with PM and HCl, but not Hg.

Q. What pollutants does Vectren South need to reduce to comply with the NOV?

A. Sulfuric acid mist ("SO_3") emissions.

Q. Which units were B&V engaged to evaluate MATS and NOV compliance strategies?

A. For MATS, Brown Unit 1, Brown Unit 2, Culley Unit 2 and Culley Unit 3. For NOV compliance, Brown Unit 1, Brown Unit 2, and Culley Unit 3.

Q. Describe the analysis conducted by B&V.

A. Our analysis was performed in two parts. "Phase 0" was a screening level analysis, and "Phase 1" included a conceptual design study and multiple technology demonstrations.

The Phase 0 study was performed between October 2012 and March 2013. This study was focused on evaluating all available mercury control technologies and narrowing the options to a manageable number of technologies that were most appropriate for the Culley and Brown Stations.

The Phase 1 study was performed between June 2013 and January 2014. This study was focused on performing an extensive technology demonstration of the key technologies and developing conceptual designs for the key technologies. The Phase 1 work was further broken down into three parts as follows:

- Phase 1 Technology Demonstration
- Phase 1 Conceptual Design
- Phase 1 Definitive Cost Estimate

III. MATS Analysis

Q. Describe the baseline testing B&V participated in to identify MATS compliance strategies for the Brown and Culley Stations.

A. Emissions investigations were conducted by Mostardi Platt on September 27-28, 2012 at Brown Unit 1, September 19-20, 2012 at Brown Unit 2, October 10-11, 2012 at Culley Unit 2, and October 3-4, 2012 at Culley Unit 3. Emissions investigations at both Brown and Culley were completed at high and low loads. Mercury was investigated at the boiler outlet, upstream of PM device, upstream of the wet flue gas desulfurization ("FGD"), and downstream of the wet FGD. PM and HCl were investigated downstream of the wet FGD.

Vectren South coordinated this testing and B&V was involved in the review and assessment of the results as part of the Phase 0 Study.

Q. What alternatives were considered for the Brown and Culley Stations?

A. For the Phase 0 Study, many mercury alternatives were initially screened for implementation at Brown and Culley. These include technologies that fall into the following:

- Coal additives
- Carbon injection technologies
- Non- carbon based injection technologies
- Scrubber Additives
- Scrubber modifications and operational changes

For the Phase 0 Study, the following technologies were selected for further review for the Brown and Culley Station: Powdered Activated Carbon ("PAC"), Shaw's (now CB&I's) Enhanced Mercury Oxidation ("EMO"™) and Hydrogen Bromide ("HBr") injection. B&V also evaluated STEAG's mercury capture system and Nalco MerControl 8034 for the Brown Station. A Phase 0 preliminary demonstration was performed of the EMO system and the Steag system. High level costs were developed for all technologies in the Phase 0 Study.

Q. How were the alternatives developed?

A. The initial list of alternatives was developed from the commercially available alternatives in the industry.

Q. Were any alternatives not considered?

A. Multiple technologies were not examined further. These include: ME2C-SEA Technology, Chem Mod, Hg Catalyst, Non-Carbon (Amended Silicates) Sorbent Injection, B&W Absorption Plus (PGGs), Calcium Bromide addition to the scrubber inlet, Gore/URS Mercury Control System, and Operational Changes to the existing scrubbers.

Q. Why were these alternatives not considered?

A. The alternatives were selected based on one of the following criteria:

- Low capital and operating cost
- Capability to meet MATS
- Capability to preserve Vectren South's ability to sell fly ash

Those technologies that were not selected were eliminated based on one of the above criteria.

Q. Describe the preliminary technology demonstration conducted to evaluate the various pollution control technologies.

A. The EMO HBr injection system and the STEAG system were both selected for a Phase 0 preliminary technology demonstrations. EMO was demonstrated at Culley on January 7-18, 2013 and at Brown on January 14-25, 2013. Additionally, lime injection and soda ash solution were used for SO_3 control at Culley and Brown respectively. STEAG was demonstrated on December 4-6, 2012 at Brown Unit 2 without SO_3 control. Since Culley currently sells its FGD byproduct, the STEAG system was not demonstrated at Culley.

Q. What was the result of the Phase 0 preliminary technology demonstration?

A. The following are B&V's conclusions after review of the Phase 0 preliminary technology demonstration results:

- The demonstrations were performed using fuel with a consistently low level of mercury content. As a result, there was uncertainty regarding whether compliance could be achieved with the CB&I EMO technology when firing fuel with higher levels mercury.
- The interaction between the mercury control (EMO HBr injection) and the SO3 control (lime at Culley and soda ash at Brown) is critical to mercury control. The

preliminary demonstration results at Culley and Brown did not clearly identify the optimal combination for maximum mercury control.

- The demonstration did not provide a clear correlation between mercury content and injection rate.
- The full impact of HBr injection on scrubber chemistry was not investigated during the preliminary demonstration.

Because of the uncertainty associated with the results of the Phase 0 preliminary demonstration, B&V recommended that a more extensive technology demonstration be performed.

Q. What further analysis was done?

A. A more extensive technology demonstration was recommended by B&V. Vectren South performed this additional demonstration, with support from B&V in July and August of 2013 (called the Phase 1 Technology Demonstration). The purpose of this demonstration was to resolve the open issues with the EMO system. In addition, B&V recommended the Phase 1 Technology Demonstration include Nalco's MerControl 8034 and Nalco MerControl 7895.

Q. What was the purpose of the Phase 1 Technology Demonstration?

A. The purpose of the Phase 1 Technology Demonstration was to confirm the long-term effectiveness of various technologies for mercury control while burning various coals/coal blends. The goals were to further optimize various process technologies for removal effectiveness/efficiencies with the plant's existing air pollution control devices, determine the interactions between technologies, determine balance-of-plant ("BOP") impacts to the plant by examining specific process parameters, measure and understand how process variables impact compliance capability, and provide specific information on optimal dosages and system operation for designing a full-scale, permanent technology system for sustained mercury emissions control. The Phase I Technology Demonstration also evaluated open issues, finalized system and control system design to ensure implementation of the chosen solution would be effective long term.

Q. What were the results of the Phase 1 Technology Demonstration for MATS compliance?

A. A summary of the Phase 1 Technology Demonstration for Brown Unit 1 is shown below in Table DMF-B.

Table DMF-B, Brown Unit 1 Phase 1 Technology Demonstration Results

TECHNOLOGY	FUEL	DID TECHOLOGY MEET MATS?
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

A summary of the Phase 1 Technology Demonstration for Culley Station is shown below in Table DMF-C.

Table DMF-C, Culley Station Phase 1 Technology Demonstration Results

TECHNOLOGY	FUEL	DID TECHOLOGY MEET MATS?
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

IV. NOV Analysis

Q. Describe the analysis conducted by B&V with regard to NOV compliance strategies.

A. B&V followed the same screening level analysis ("Phase 0") and conceptual design study and multiple technology demonstration ("Phase 1") process utilized for the MATS review.

Q. What alternatives were considered to bring the Brown and Culley Stations into compliance with the NOV?

A. The following technologies were considered in the initial screening process:

- Fuel switching
- Coal washing
- Boiler flue gas temperature control
- Furnace sorbent injection
- Dry sorbent injection (lime or sodium sorbents)
- SBS injection
- Wet ESP
- Polishing Semi-Dry FGD

Q. Were any alternatives not considered?

A. B&V considered all alternatives that we were aware of for sulfuric acid mist control. However, the focus of any technology demonstrations and conceptual designs was on soda ash injection (a form of SBS Injection) for Brown Station and lime injection for Culley Station.

Q. Why did you focus on these technologies?

A. The Phase 0 preliminary screening showed them to be the most cost effective. At Brown, the dual alkali scrubbers already use soda ash. Therefore, by using soda ash injection, the incremental reagent cost is very low. At Culley, the lime injection is a cost effective approach to SO3 control compared to other alternatives.

Q. Describe the Phase 0 preliminary technology demonstration conducted to evaluate the NOV technology.

A. EMO was demonstrated at Culley on January 7-18, 2013 and at Brown on January 14-25, 2013. During the same demonstration, lime injection and soda ash solution were used for SO_3 control at Culley and Brown respectively.

Q. What was the result of the analysis for the Brown station?

A. The Phase 0 preliminary technology demonstration at Brown showed that injecting soda ash appeared to help Hg removal at some HBr injection rates. It also showed that a significant amount of sulfur acid mist was removed from the flue gas using soda ash injection.

Q. What was the result of the analysis for the Culley station?

A. The Phase 0 preliminary technology demonstration was performed at Culley Unit 3 (not Culley Unit 2). It started with injecting hydrated lime for two days upstream of the fabric filter. During this demonstration, the mercury content in the ash reached 400 ppb in the fabric filter fly ash. This level of mercury would jeopardize the beneficial re-use of fly ash. The rest of the Phase 0 technology demonstration program consisted of injecting hydrated lime after Unit 3's ID fans.

It also showed that a significant amount of sulfur acid mist was removed from the flue gas using lime injection.

Hydrated lime injection benefits mercury removal when HBr is injected, but this benefit appears to lessen at higher hydrated lime injection rates. Negligible mercury removal was attained with HBr injection until SO_3 was controlled.

Q. Based on the Phase 0 preliminary technology demonstration, what were B&V's recommendations to Vectren South?

A. A follow up Phase 1 Technology Demonstration plan was recommended by B&V to resolve the open issues regarding the interaction between sulfuric acid mist control and mercury control. The Phase 1 Technology Demonstration for NOV compliance had the same objectives and goals as the MATS Phase 1 Technology Demonstration.

Q. What were the results of the follow up Phase 1 Technology Demonstration for the NOV projects?

A. At Brown, reagent injection was performed by URS, and emissions measurements were performed by Mostardi Platt. URS supplied a temporary soda ash injection system, which treated 100 percent of the flue gas on Unit 1. The reagent was injected in the north and south ducts at the outlet of each ID fan. The soda ash injection reagent flow rate, process data, and stack gas outlet measurements were all collected.

For Brown, the Phase 1 Technology Demonstration provided the information needed to determine the optimum amount of soda ash that should be injected to balance sorbent consumption, mercury reduction and sulfuric acid mist reduction.

At Culley, BCSI injected highly reactive hydrated lime at the inlet and outlet of the PM removal device. The Phase 1 Technology Demonstration was performed at different injection rates to evaluate the effect of the amount of hydrated lime injection on sulfuric acid mist removal. As with Brown, the Phase 1 Technology Demonstration provided the information needed to determine the sizing of the lime injection system.

V. Phase 1 Conceptual Design

Q. Describe the Phase 1 Conceptual Design conducted by Vectren South.

A. The following engineering activities were performed for each of the four units (Brown Unit 1, Brown Unit 2, Culley Unit 2, and Culley Unit 3) as part of the Phase 1 Conceptual Design process:

- Develop a design basis
- Identify the design criteria/sparing philosophy for each system
- Develop site arrangement drawings
- Develop preliminary flow diagrams
- Identify balance of plant needs for each technology at each plant
- Develop an engineering and construction execution plan for each technology

Q. What pollution control technologies were selected for the Phase 1 Conceptual Design MATS compliance?

A. The following technologies were selected for the Phase 1 Conceptual Design:

- HBr Injection for mercury control
- Nalco MerControl 8034 scrubber additive for mercury control

- Nalco MerControl 7895 (CaBr) fuel additive for mercury control
- PAC injection for mercury control
- Mist eliminator replacement

Q. What pollution control technologies were selected to comply with the NOV in the Phase 1 Conceptual Design?

A. Soda ash injection was selected for Brown Unit 1 and Brown Unit 2. Lime injection after the particulate control device was selected for Culley Unit 3.

Q. How were pollution control technologies selected for the Phase 1 Conceptual Design?

A. The technologies were selected because our preliminary screening showed them to be the most cost effective. At Brown, the dual alkali scrubbers already use soda ash. Therefore, by using soda ash injection, the incremental reagent cost is very low. At Culley, the lime injection is a cost effective approach to SO3 control compared to other alternatives. For the MATS projects, technologies were recommended based on their cost effectiveness (capital and operating costs), their ability to meet the MATS limits, and their ability to preserve Vectren South's ability for beneficial re-use of fly ash.

VI. Phase 1 Conceptual Design Cost Estimates

Q. How did B&V prepare the Phase 1 Conceptual Design capital cost estimates for the selected conceptual designs?

A. The Phase 1 Conceptual Designs cost estimates were developed by completing the following steps:

- A design basis was developed for each station. This design basis was used to size the air quality control equipment.

- A site visit was made to each plant to determine potential equipment locations and the location of existing utilities (power supply, compressed air, water, etc.).
- From the site visit, preliminary site arrangement drawings and flow diagrams were developed and used to develop the estimates.
- In collaboration with Vectren South personnel, design criteria were developed for each technology that identified the sizing criteria for sorbent storage, identified sparing philosophies for the equipment, and identified balance of plant equipment needed for a complete design.
- Budgetary quotations were obtained from each of the key technology vendors. These quotations were based on the design criteria that were developed.
- Quantities and costs for key equipment were determined.
- To develop costs for construction, construction factors (percentages of equipment costs) were used based on the quantities and types of construction that were needed for the project.
- Cost for construction indirects, construction management, engineering, and contingency, were based on typical factors (percentages of equipment costs).

Based on the above steps, a conceptual cost estimate was developed for each of the Phase 1 conceptual designs. This methodology is consistent with the guidelines provided by AACE International for a Class 3 level estimate. AACE International, formally called American Association of Cost Engineering, is a non-profit industry trade group that develops standards for cost estimating and provides certifications for cost estimating professionals.

Q. Explain the components of the Phase 1 Conceptual Design capital cost estimates.

A. The following components were included in the Phase 1 Conceptual Design capital cost estimates:

- Equipment costs for AQC technology equipment
- Equipment costs for balance of plant equipment, such as electrical equipment, compressors, storage silos, ductwork, control system equipment, etc.
- Commodities, such as electrical cable, piping, structural steel, insulation, lagging, etc.
- Costs for installing the equipment.
- Costs for construction management, engineering, contingency.
- Construction indirects for cranes, office equipment, tools, insurance, etc.

Q. How did B&V develop operation and maintenance ("O&M") cost estimates?

A. The O&M costs were based on economic criteria including sorbent costs, O&M labor costs, power costs, and other O&M costs.

The unit prices for sorbents, power, and labor were developed in collaboration with Vectren South. Sorbent vendors were consulted regarding the price of all sorbents. If Vectren South was already using the sorbent, the Company's existing contract pricing was used for that sorbent.

The consumption rates for sorbents were based on the Phase 1 Technology Demonstration results or on vendor-provided rates from their budgetary proposals. The power consumption rates were based on vendor-provided rates from their budgetary proposals.

A total O&M costs was calculated by summing up the individual O&M costs.

Q. What methodology was used by B&V to determine a present worth value?

A. B&V calculated a present worth factor using the following equation:

$$PWF = \quad 1+i^{\ n}-1 \ / \ i \ 1+i^{\ n}$$

Where: i = Present Worth Discount Rate (6.00 percent)

n = Economic Life (20 years)

The present worth factor was then used to calculate the present worth of the O&M costs. Therefore, the total present worth is calculated as follows:

$$\textit{Present Worth of Scenario} = \textit{Capital Cost} + (\textit{PWF} * \textit{O\&M Cost})$$

Q. Did B&V evaluate the risk that O&M costs could increase over the next twenty years?

A. Yes. O&M costs for the MATS projects may increase over the next 20 years. As a result, a sensitivity analysis was performed on the cost of sorbents to ensure that increases in sorbent costs, which represented the majority of the O&M costs for these technologies, did not change relative cost of each technology when compared to one another. . This sensitivity cost was performed by varying the costs of the sorbents up and down and then comparing the cost of each technology to each other with different sorbent costs.

The O&M costs for the NOV projects were not increased because the selected technologies were not being compared with other technologies.

Q. What level of reliability would you estimate these cost estimates represent?

A. The Phase I Conceptual Design capital cost estimate is consistent with an AACE Class 3 estimate. In accordance with AACE International guidelines, a Class 3 estimated is classified as having an accuracy on the low side of -10% to -20% and on the high side of the estimate of +10% to +30%, based on power industry estimating practices.

VII. Culley and Brown Station Recommendations (MATS)

Q. What recommendations did B&V make for the Brown station pollution control technology?

A. For Brown Unit 1, it is recommended that Vectren South install Nalco MerControl 8034. For Brown Unit 2, it is recommended that Vectren South install Nalco MerControl 8034 and HBr injection. As discussed previously, the Phase 0 technology demonstration showed that it is likely that additional oxidation of mercury may be required for Brown Unit 2 before entering the scrubber. Therefore, the HBr injection system is recommended for Unit 2 to provide the needed oxidation.

Q. What recommendations did B&V make for the Culley Station pollution control technology?

A. It is recommended that a Nalco MerControl 8034 injection system be installed in the common scrubber for Culley Units 2 and 3.

Q. Why were these projects recommended?

A. This combination represented the most cost effective solution to meet MATS limits, based on the present worth calculation.

Q. What does B&V estimate these projects will cost?

A. After completion of the Phase 1 Conceptual Designs and Phase 1 Conceptual Design cost estimates for all evaluated technologies, B&V performed a Phase 1 Definitive Cost Estimate for the selected technology. This definitive cost estimate was performed in compliance with AACE International guidelines for a Class 2 estimate.

The definitive cost estimate was performed for all four units combined. It indicates that the cost of the selected technology for Brown Unit 1, Brown Unit 2, Culley Unit 2 and Culley Unit 3 will be $47,800,000. Petitioner's Exhibit No. DMF-3 includes a summary of

B&V's cost estimate in Appendix C. This cost estimate includes the sulfuric acid mist control equipment as well as the MATS equipment. It should be noted that this cost is for the engineering, procurement, construction, and construction management costs that will be incurred by Vectren South. It does not include other costs that the Company will incur as part of complying with MATS and the NOV.

The accuracy of a Class 2 estimate is defined by AACE International, and based on power industry estimating practices, is -5% to -15% on the low end and +5% to +20% on the high end.

In developing the Phase 1 Definitive Cost Estimates, B&V built on the work done in developing the Phase 1 Conceptual Design cost estimates. The following additional activities were performed to produce the definitive cost estimate:

- Developed preliminary pipe routing for all large bore piping
- Developed preliminary cable routing for all cable
- Obtained budgetary pricing for balance of plant equipment.
- Developed an implementation schedule based on the MATS compliance requirements and Vectren South's outage schedule.
- Obtained +/-10 percent budgetary pricing from all key AQC technology vendors.
- Refined the site arrangement drawings based on updated vendor information.
- Developed preliminary structural designs for new ductwork.
- Performed material take offs for all commodity equipment on the site.
- Developed a detailed engineering schedule and staffing plan for implementation of the project.
- Developed a detailed construction management schedule and staffing plan for implementation of the project.

- Developed detailed cost estimates for all construction indirects based on a project-specific construction execution plan.
- Perform a risk analysis to determine the appropriate level of contingency for the project.

VIII. Use of Technology At Time of Enactment of Clean Air Act Amendments of 1990

Q. Was the injection of Nalco 8034, lime injection and HBr in general commercial use at the same or greater scale in new or existing facilities in the United States at the time of enactment of the Clean Air Act Amendments of 1990?

A. To our knowledge, neither Nalco MerControl 8034 or HBr injection were in use in 1990. There was no regulation requiring mercury control at that time.

Q. Was the injection of soda ash in general commercial use at the same or greater scale in new or existing facilities in the United States at the time of enactment of the Clean Air Act Amendments of 1990?

A. Based on our experience and research, B&V does not believe that soda ash was in general use in 1990.

According to an EPRI report, "SO3 Mitigation Guide" (initially issued in 1994 and later updated in 2004), it appears that soda ash injection was not in commercial use in 1990.

In addition, a Power Engineering International magazine article from 2004 that discusses SBS injection states: "The first permanent SBS Injection system was installed at the Bruce Mansfield plant of FirstEnergy, which began operation at Unit 1 in March 2003. A total of eight full-scale systems (totaling 5300 MW) are now operational, and several additional full-scale systems (totaling 4000 MW) are being planned for installation in 2005."

This research is consistent with B&V's own knowledge/experience of the soda ash technology.

Q. Was lime injection in general commercial use at the same or greater scale in new or existing facilities in the United States at the time of enactment of the Clean Air Act Amendments of 1990?

A. Based on our experience and research, Black & Veatch does not believe that lime injection was in general use in 1990.

Hydrated Lime was tested initially in 1991 and again in 1992/1993 for SO3 removal. The 1994 EPRI SO3 report stated "A full-scale demonstration of alkali addition with humidification for SO3 removal is planned for 1994 as part of the EPRI Mist Eliminator Studies Project (RP-2250)" (pdf page 42/90)."

This research is consistent with B&V's own knowledge/experience of the soda ash technology.

IX. Conclusion

Q. Does this conclude your prepared direct testimony?

A. Yes, at this time.

VERIFICATION

The undersigned, Diane M. Fischer, affirms under the penalties of perjury that the answers in the foregoing Direct Testimony in Cause No. 44446 are true to the best of her knowledge, information and belief.

Diane M. Fischer

PETITIONER'S EXHIBIT DMF-2

BLACK & VEATCH'S MATS AND MERCURY CONTROL TECHNOLOGIES EXPERIENCE

The table below provides a list of execution projects that we have completed or are completing. In addition to project execution, we have examined mercury control and other MATS compliance technologies on over 100 units in the last several years.

SORBENT AND PAC INJECTION SYSTEM PROJECT EXPERIENCE							
CLIENT	UNITS / FUELS	YEAR STARTUP	FUEL TYPE	UNIT SIZE	POLLUTANT CONTROLLED	SORBENT	B&V SCOPE OF WORK
City Water Light & Power, Springfield, Illinois	Dallman Unit 4	2009	Eastern Bituminous	200 MW	Mercury, Condensables	Activated Carbon, Lime	EPC contractor for new plant
Weston	Unit 4	2008	PRB	500 MW	Mercury	Activated Carbon	Owners engineering for new plant
Omaha Public Power District	Nebraska City Unit 2	2010	PRB	650 MW	Mercury	Activated Carbon	EPC contractor for new plant
Plum Point Energy Associates	Plum Point Unit 1	2010	PRB	650 MW	Mercury	Activated Carbon	EPC contractor for new plant
Platte River Power Authority	Rawhide Station	2009	PRB	280 MW	Mercury	Activated Carbon	Developed equipment supply specification and performed bid evaluation
PPGA	Whelan Energy Center Unit 2	2011	PRB	220 MW	Mercury	Activated Carbon	Owners engineer for new plant
Sandy Creek Energy Associates, L.P.	Sandy Creek Energy Station	2011	PRB	900 MW	Mercury	Activated Carbon	EPC contractor for new plant
Kansas City Power & Light	La Cygne Units 1 and 2	2014/2015	PRB/Eastern Bituminous Blend	800 MW/715 MW	Mercury	Activated Carbon	Owners engineer for retrofit of AQC equipment at existing plant

IURC
PETITIONER'S
EXHIBIT NO. DMF-2
7-30-14 AT
DATE REPORTER

SORBENT AND PAC INJECTION SYSTEM PROJECT EXPERIENCE							
CLIENT	UNITS / FUELS	YEAR STARTUP	FUEL TYPE	UNIT SIZE	POLLUTANT CONTROLLED	SORBENT	B&V SCOPE OF WORK
American Electric Power	Cardinal Units 1 and 2	2009	Bituminous	2 x 850 MW	SO3	Trona	Conceptual design, EpCM for BOP Design
American Electric Power	Conesville Unit 3	2010	Bituminous	620 MW	SO3	Trona	Owner's Engineer
American Electric Power	Clifty Creek Units 1-6	2013	Bituminous	6 x 220 MW	SO3	Trona	Conceptual design, EpCM for BOP Design
American Electric Power	Kyger Creek Units 1-6	2009	Bituminous	5 x 220 MW	SO3	Trona	Conceptual design, EpCM for BOP Design
Nesco	Klamath Falls Bioenergy	Awaiting permitting Engineering 50% Complete	Biomass	35 MW	SO2	Trona	Detailed design engineer
Nesco	Oregon Bioenergy Facility	Awaiting permitting	Biomass	35 MW	SO2	Trona	Detailed design engineer
Olgethorpe Power Corporation	Warren County Biomass Energy Facility	Project Cancelled	Biomass	100 MW	SO2, HCl	Trona or Sodium Bicarb	Detailed design engineer
Kansas City Kansas Board of Public Utilities	Nearman Unit 1, Quindaro Unit 1, and Quindaro Unit 2	Project Cancelled	PRB	235 MW, 70 MW, 135 MW	SO2	Trona	Developed specification for system purchase and bid evaluation

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SORBENT AND PAC INJECTION SYSTEM PROJECT EXPERIENCE							
CLIENT	UNITS / FUELS	YEAR STARTUP	FUEL TYPE	UNIT SIZE	POLLUTANT CONTROLLED	SORBENT	B&V SCOPE OF WORK
Louisville Gas & Electric /Kentucky Utilities	Brown Units 1, 2 and 3 Ghent Units 1, 2, 3 and 4, Mill Creek Units 1, 2, 3 and 4,	Varies 2013-2016	Bituminous	110 MW 180 MW 457 MW 541 MW 517 MW 523 MW 526 MW 330 MW 330 MW 423 MW 525 MW	Mercury, SO3, HCl	Activated Carbon, Trona or Lime	Developed specification for system purchase and bid evaluation
Florida Power & Light	Port Everglades Units 1 and 2	2006	Fuel Oil	2x300 MW	SO3	MgO	Engineering, Procurement Support, Construction Services
Confidential Client	Five Units	2014 to 2016	PRB and PRB Blend	Various	Mercury	Activated Carbon	Engineering, Procurement Support, Engineering Support for Construction
Confidential Client	One Unit	2012	PRB	< 100 MW	Mercury, SO2, HCl	Activated Carbon, Trona, Sodium Bicarb	Developed testing procedure and coordinated testing
Confidential Client	One Unit	2012	Western Sub-bituminous (not PRB)	Between 50 and 150 MW	SO2, HCl	Lime, Trona, Sodium Bicarb	Developed testing procedure and witnessing testing
Orlando Utilities Commission	Stanton Unit 1	2013	Bituminous	425 MW	SO3	Lime	Owner's Engineer