BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

IN THE MATTER OF THE APPLICATION OF PUBLIC SERVICE COMPANY OF NEW MEXICO FOR APPROVAL TO ABANDON SAN JUAN GENERATING STATION UNITS 2 AND 3, ISSUANCE OF CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY FOR REPLACEMENT POWER RESOURCES, ISSUANCE OF ACCOUNTING ORDERS AND DETERMINATION OF RELATED RATEMAKING PRINCIPLES AND TREATMENT,	)	**Case No. 13-00390-UT**
PUBLIC SERVICE COMPANY OF NEW MEXICO,	)	
Applicant	)	

SUPPLEMENTAL DIRECT TESTIMONY

OF

CHRIS M. OLSON

February 5, 2014

SUPPLEMENTAL DIRECT TESTIMONY OF
CHRIS M. OLSON
NMPRC CASE NO. 13-00390-UT

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

A. My name is Chris M. Olson. I am Vice President, Generation, for Public Service Company of New Mexico ("PNM" or the "Company"). My business address is 2401 Aztec Road, NE, Albuquerque, New Mexico 87107.

Q. HAVE YOU PREVIOUSLY FILED TESTIMONY IN THIS PROCEEDING?

A. Yes. I submitted my Direct Testimony in this proceeding on December 20, 2013.

Q. WHAT IS THE PURPOSE OF YOUR SUPPLEMENTAL DIRECT TESTIMONY?

A. My Supplemental Direct Testimony responds to certain sections of the *Initial Order Requiring Filing of Supplemental Testimony* ("Initial Order") that was issued by the New Mexico Public Regulation Commission ("NMPRC" or "Commission") on January 22, 2014. In this Supplemental Direct Testimony, I address the following ordering paragraphs and subject matters in the Initial Order:

Initial Order ¶	Subject
¶A.3.	Additional documentation for PNM's cost estimates for the EPA-dictated pollution controls pursuant to the FIP
¶A.6.	A copy of the Revised SIP as adopted by the NMEIB
¶A.7.	Details of the anticipated Swap Agreement, including expected timing of the Swap Agreement and the reasons PNM is seeking 78 MW of capacity in San Juan Unit 4 versus some other amount.

¶A.9.	An explanation of whether PNM has committed, either through the Term Sheet, or in connection with the Revised SIP, to construct the proposed 177MW peaking plant at San Juan The current status and projected timeline for PNM's efforts to procure the proposed 177 MW natural gas peaking facility

Q. ARE YOU SPONSORING ANY EXHIBITS IN YOUR SUPPLEMENTAL DIRECT TESTIMONY?

A. Yes. My Supplemental Direct Testimony includes the following exhibits:

- PNM Exhibit CMO-1 (Supplemental) – "Public Service Company of New Mexico San Juan Generating Station Units 1, 2, 3 and 4 SNCR and SCR Cost Estimates" dated March 29, 2013 prepared by S&L

- PNM Exhibit CMO-2 (Supplemental)[1] – New Mexico Revised SIP Package provided to EPA

- PNM Exhibit CMO-3 (Supplemental) - List of Enclosure to New Mexico Revised SIP Package

- PNM Exhibit CMO-4 (Supplemental) – PNM Timeline for 177 MW Natural Gas Peaking Facility at San Juan Generating Station

Q. CAN YOU PLEASE PROVIDE AND DISCUSS ANY ADDITIONAL DOCUMENTATION FOR PNM'S COST ESTIMATE FOR THE INSTALLATION OF SCR AT SAN JUAN AS REQUIRED UNDER THE

[1] A hard copy of PNM Exhibit CMO-2 (Supplemental) is submitted for filing of record. Due to the voluminous nature of this exhibit, a CD-ROM containing PNM Exhibit CMO-2 (Supplemental) is included with each service copy of this Supplemental Direct Testimony in lieu of a hard copy.

EPA'S FIP IN RESPONSE TO PARAGRAPH A.3 OF THE INITIAL ORDER?

A. Attached as PNM Exhibit CMO-1 (Supplemental) is a cost study prepared by S&L entitled "*Public Service Company of New Mexico San Juan Generating Station Units 1, 2, 3 and 4 SNCR and SCR Cost Estimates*" dated March 29, 2013 ("S&L Cost Study"). The S&L Cost Study was prepared expressly for the new BART analysis that serves as one of the bases for the NMEIB's adoption of the Revised SIP. It is included in the Revised SIP package attached as PNM Exhibit CMO-2 (Supplemental) discussed below which has been submitted for EPA review and approval. The details for the cost estimate for the SCR project are set forth in Attachments B and C of the S&L Cost Study.

As explained by PNM Witness O'Connell, the S&L Cost Study was used in the analyses of the relative cost-effectiveness of the SCR project compared to implementation of the Revised SIP and various generation replacement portfolios. PNM Witness Henry Monroy also used the S&L Cost Study in his customer bill impact analyses.

Q. IN YOUR DIRECT TESTIMONY YOU REFERENCED AN EPC CONTRACT WITH FLUOR. WAS ANY COST INFORMATION FROM THE FLUOR CONTACT USED IN THE VARIOUS PNM ANALYSES?

A. No, the cost estimates from the Fluor EPC contract were not used in any of the PNM analyses submitted in the case. As explained by PNM Witness O'Connell,

the Fluor EPC contract provided cost information on construction costs only where the S&L Cost Study includes not just construction costs but operations and maintenance costs as well. A proper cost analysis necessarily includes consideration of operations and maintenance costs. Mr. O'Connell confirms that, while the estimated construction costs under the Fluor EPC contract were somewhat lower than the construction costs under the S&L Cost study, use of the Fluor cost data would not change the results of his analyses.

Q. CAN YOU PLEASE PROVIDE A COPY OF THE REVISED SIP IN RESPONSE TO PARAGRAPH A.6 OF THE INITIAL ORDER?

A. Yes. Attached as PNM Exhibit CMO-2 (Supplemental) is a copy of the Revised SIP package that was sent by Governor Martinez to the EPA for review and approval. As you can see, the Revised SIP package is quite voluminous and includes the revised portions of the SIP and the revised NOx BART determination for San Juan, together with supporting documentation such as pre-filed testimony, public comments and the hearing transcript.

Q. CAN YOU PLEASE DIRECT OUR ATTENTION TO THE PORTIONS OF THE REVISED SIP PACKAGE THAT CONSTITUTE THE REVISED SIP?

A. For the convenience of the Commission and the parties to this proceeding, I have attached as PNM Exhibit CMO-3 (Supplemental) the "List of Enclosures" from the Revised SIP package. The first document referenced on the List of Enclosures

is entitled "Chapter 10, Section 309 Revised State Implementation Plan." This is the revised portion of the New Mexico Regional Haze SIP. The second document referenced is entitled "Appendix D – Revised New Mexico BART Determination for San Juan Generating Station." This is the new San Juan BART determination which includes the requirements for the retirement of SJGS Units 2 and 3 and the installation of SNCR technology on SJGS Units 1 and 4. It should be noted that, rather than submitting an entirely new SIP, New Mexico included in its Revised SIP package only those portions of the SIP that were being revised. The original Regional Haze SIP package that New Mexico submitted to EPA on June 24, 2011 is available on the NMED website at:

http://www.nmenv.state.nm.us/aqb/reghaz/NMRegionalHazeandInfrastructureSIPsubmittals.htm

Q. WHAT INFORMATION CAN YOU PROVIDE IN RESPONSE TO PARAGRAPH A.7 OF THE INITIAL ORDER RELATING TO THE ANTICIPATED "SWAP AGREEMENT" INVOLVING PNM ACQUIRING A PROPOSED ADDITIONAL 78 MW CAPACITY IN SAN JUAN UNIT 4?

A. With the retirement of San Juan Units 2 and 3, PNM will need additional generation capacity. Additional capacity from San Juan Unit 4 is ideal because it is a known, low cost, reliable resource which has been providing service to New Mexico customers for decades. The amount of additional capacity PNM can acquire is based, in significant measure, on the willingness of other San Juan owners to trade their interests in Unit 4. PNM believes that it will be able to

acquire at least 78 MW because it understands that the California owners are looking to exit their positions in San Juan.

As I indicated in my Direct Testimony, the negotiations over the so-called Swap Agreement are ongoing and confidential. PNM continues to diligently pursue an agreement on a final ownership structure for San Juan following the retirement of Units 2 and 3. However, I am still not at liberty to discuss any specific details beyond the information that I provided in my Direct Testimony.

The anticipated minimum amount of capacity that PNM will acquire in SJGS Unit is 78 MW. Thus, that is the amount of capacity for which PNM has requested a CCN in this proceeding. If a larger amount of capacity is negotiated early enough in this proceeding, PNM will amend its request for a CCN for the larger amount. If not, PNM will seek a CCN for any capacity in excess of 78 MW in a subsequent proceeding.

Q. TURNING TO PARAGRAPH A.9. OF THE INITIAL ORDER, HAS PNM COMMITTED TO BUILD THE PROPOSED 177 MW PEAKING FACILITY AT SAN JUAN UNDER EITHER THE REVISED SIP, THE TERM SHEET, OR OTHERWISE?

A. The Revised SIP (PNM Exhibit CMO-2 (Supplemental)) does not address any replacement generation capacity, including the proposed 177 MW peaking plant. However, in the Term Sheet (PNM Exhibit RND-6) PNM committed, subject to

Commission approval, to pursue the construction of a proposed natural gas turbine at San Juan. The Term Sheet also includes certain performance requirements for this proposed gas turbine in terms of requiring a BACT analysis and restricting its aggregate annual NOx emissions to not more than 75 tons.

As PNM Witness O'Connell demonstrates, the proposed 177 MW peaking facility is needed and San Juan is an ideal location based on PNM's existing property ownership and the existing transmission and other infrastructure. Of course, locating the 177 MW facility at San Juan has the added benefit of mitigating the local economic impacts from the retirement of San Juan Units 2 and 3.

Q. WHAT TASKS HAS PNM UNDERTAKEN TO DATE WITH RESPECT TO THE DEVELOPMENT OF THE PROPOSED 177 MW PEAKING FACILITY?

A. PNM contacted major suppliers to develop insights into various natural gas generation alternatives. PNM also assessed gas and electric interconnections. PNM has developed some preliminary cost estimates based on contacts with suppliers and other knowledgeable sources within the industry. Internally, PNM has assigned an initial project team for the proposed 177 MW facility. PNM is working on a draft request for proposal for the owner's engineer as well as a draft Large Generator Interconnection Agreement application.

Q. HAS PNM DEVELOPED A TIMELINE FOR THE 177 MW PEAKING PROJECT?

A. Yes, a preliminary project timeline is attached as PNM Exhibit CMO-4 (Supplemental). As reflected in the timeline, commercial production would commence in 2018, provided the requisite Commission approval is obtained.

Q. CAN YOU ADDRESS WHY PNM DOES NOT PLAN TO FILE AN APPLICATION FOR A CCN FOR THE 177 MW FACILITY UNTIL DECEMBER 2014?

A. This is partially addressed in the timeline set out in PNM Exhibit CMO-4 (Supplemental) in terms of the current status of the planning for this project. Indeed, as the project planning continues to be refined, it may be possible that an application for a CCN may not need to be filed with the Commission until the spring of 2015. In addition to ongoing project planning, PNM Witness Ortiz provides a discussion of PNM's timing and sequencing for the applications for CCNs for the various proposed replacement resources, including the 177 MW natural gas facility, in his Supplemental Direct Testimony.

Q. DOES THIS CONCLUDE YOUR SUPPLEMENTAL DIRECT TESTIMONY?

A. Yes, it does.

PNM EXHIBIT CMO-1 (Supplemental)

Consisting of 67 pages

PNM EXHIBIT CMO-1 (SUPPLEMENTAL)

PUBLIC SERVICE OF NEW MEXICO

SAN JUAN GENERATING STATION UNITS 1, 2, 3, & 4

SNCR AND SCR COST ESTIMATES

Final Report

March 29, 2013

Project 11278-034

Prepared by:

Sargent & Lundy LLC

55 East Monroe Street
Chicago, IL 60603

LEGAL NOTICE

This Deliverable was prepared by Sargent & Lundy, L.L.C. (S&L), at the request of and expressly for the sole use of Public Service of New Mexico (Client) in accordance with the agreement between S&L and Client. This Deliverable was prepared using the degree of skill and care ordinarily exercised by engineers practicing under similar circumstances. Client acknowledges: (1) S&L prepared this Deliverable subject to the particular scope limitations, budgetary and time constraints, and business objectives of the Client; (2) information and data provided by others may not have been independently verified by S&L; and (3) the information and data contained in this Deliverable are time sensitive and changes in the data, applicable codes, standards, and acceptable engineering practices may invalidate the findings of this Deliverable.

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1. INTRODUCTION AND BACKGROUND

On February 15, 2013, PNM entered into a Term Sheet agreement with the U.S. Environmental Protection Agency (EPA) and the State of New Mexico. Provisions specified in the Term Sheet reflect "a tentative agreement on technical terms and an appended corresponding timeline for action intended to address pollution control requirements for the San Juan Generating Station under the Clean Air Act's requirements for regional haze and interstate transport for visibility." Among other requirements, the agreement requires PNM to submit a new Best Available Retrofit Technology (BART) analysis to the New Mexico Environment Department (NMED). The Term Sheet requires PNM to prepare a "five-factor BART analysis in accordance with the BART Guidelines, and other EPA guidance, as applicable, including documentation relied upon in making the BART determination."

EPA published guidelines for conducting a BART determination on July 6, 2005 (40 CFR Part 51 Appendix Y, 70 Fed. Reg. 39156). The five basic steps of a BART analysis are:

1. Identify All Available Retrofit Control Technologies.
2. Eliminate Technically Infeasible Options.
3. Evaluate Control Effectiveness of Remaining Control Technologies.
4. Evaluate Impacts and Document Results.
5. Evaluate Visibility Impacts.

Step 4 of the five-factor BART analysis includes an evaluation of the compliance costs associated with each technically feasible and available control technology. The BART Guidance includes the following three-step approach to developing an equipment cost estimate: (1) identify the emissions units being controlled; (2) identify design parameters for emission controls; and (3) develop cost estimates based on these design parameters.[1] The guidance document instructs that the basis for equipment cost estimates should be documented, either with data supplied by an equipment vendor or by a referenced source such as EPA's OAQPS Control Cost Manual.[2] The cost analysis should take into account any site-specific design or other conditions that affect the cost of a particular control technology, provided that the cost estimate includes documentation of any additional

[1] See, 70 FR 39166, col. 2.

[2] OAQPS Control Cost Manual, Fifth Edition, February 1996, EPA 453/B-96-001.

information that was used for the cost calculations that affects assumptions regarding purchased equipment costs, equipment life, replacement of major components, and any other element of the calculation that differs from the Control Cost Manual.[3]

As part of its agreement to prepare a BART analysis for the San Juan Generating Station (SJGS), PNM contracted S&L to update previously prepared conceptual cost estimates for both selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR) control systems. In 2011, S&L prepared a conceptual design, cost estimate, and Engineer, Procurement & Construction (EPC) specification to install SCR on all four units; and in September 2012, S&L developed a scoping-level cost estimates for SNCR. Based on PNM's request, S&L updated these costs estimates to reflect the approach described in EPA's Control Cost Manual. Cost estimates were prepared for the following control technology options:

Option 1: Installing selective catalytic reduction (SCR) control on all four units;
Option 2: Installing selective non-catalytic reduction (SNCR) control on all four units; and
Option 3: Installing SNCR on Units 1 & 4 and retiring Units 2 & 3.

This report provides a summary of the SCR and SNCR cost estimates prepared for SJGS, and includes an overview of the approach, design parameters, and assumptions used to develop the cost estimates. Cost estimates for each option, including capital costs, annual operating and maintenance (O&M) costs, and total annual costs are included in Attachments A, B, and C to the report, respectively.

2. BART COST ESTIMATING

The Appendix Y BART Guidelines describe the methodology that should be used to determine control system costs and to calculate control system cost effectiveness. The guidelines state that "[i]n order to maintain and improve consistency, cost estimates should be based on the Control Cost Manual, where possible." The Control Cost Manual describes the equipment and other directs costs that are typically included in a cost estimate, and provides cost factors that can be used to calculate certain indirect costs, if needed. Specific chapters are provided for a number of add-on air pollution control systems, including both SNCR (Section 4.2 – NOx Post-Combustion, Chapter 1) and SCR (Section 4.2, Chapter 2).

[3] See, 70 FR 39166, col. 3, and footnote 15.

With respect to cost-effectiveness evaluations, the Control Cost Manual provides a methodology to calculate the Total Annual Cost (TAC) associated with the air pollution control system. TAC includes three elements, and is calculated using the following equation:

TAC = DC + IC – RC (Cost Manual, equation 2-1, page 2-7)

Where:

DC = direct costs;

IC = indirect costs; and

RC = recovery credits

Direct costs are those that tend to be directly proportional (variable costs) or partially proportional (semi-variable costs) to some measure of productivity (e.g., exhaust gas process by the control system per unit time). Direct costs include raw materials (reagents), utilities, waste treatment and disposal, maintenance materials, replacement parts, and operating, supervisory, and maintenance labor. Indirect, or "fixed", annual costs are independent of the level of production, and would be incurred even if the control system were shut down. Indirect costs include the capital recovery costs, administrative charges, property taxes, and insurance. Recovery credits account for materials or energy recovered by the control system, which may be sold, recycled, or reused to offset the direct and indirect annual costs.

Capital recovery can represent a significant portion of the annual indirect costs, especially on large, capital intensive air pollution control projects. Capital recovery is an annualized cost of capital calculated as an annual payment sufficient to finance total capital costs over the life of the investment. The annualized capital recovery cost is a function of the Total Capital Investment (TCI), operational life of the control technology, and an appropriate discount interest rate that reflects the financial structure of the applicants business.[4]

TCI includes all costs required to purchase equipment needed for the control system (purchased equipment cost), the costs of labor and materials for installing that equipment (direct installation costs), costs for site preparation and buildings, and certain other costs (indirect installation costs).[5] TCI also includes costs for working capital and off-site facilities.[6] Direct installation costs include costs for foundations and supports, erecting and handling the equipment, electrical work, piping, insulation, and painting. Indirect installation costs include costs such as engineering costs; construction and field expenses (i.e., cost for construction supervisory personnel, office

[4] See, *OAQPS Control Cost Manual*, page 2-21.

[5] *Id.* at page 2-5.

[6] *Id.*

personnel, rental of temporary offices, etc.); contractor fees (for construction and engineering firms involved in the project); start-up and performance test costs (to get the control system running and to verify that it meets performance guarantees); and contingencies.

The Control Cost Manual provides flexibility, and is not so proscriptive as to explicitly exclude from a cost estimate actual tangible costs that an applicant will incur as part of an air pollution control project. For example, the manual states that "the user has to be able to exercise 'engineering judgment' on those occasions when the procedures may need to be modified or disregarded;"[7] and that "the application of an appropriate [indirect capital cost] factor requires the subjective application of the analyst's best judgment."[8] In addition, the Control Costs Manual specifically states that for certain control systems (e.g., SCR reactors and FGD units) it deviates from its standard approach of providing study level costs and, instead, provides a description of the factors that influence TCI for the analyst to consider when dealing with a vendor quotation.[9] The Control Cost Manual takes this approach because "the control in question is either so large or so site-specific in design that suppliers design, fabricate, and construct each control according to the specific needs of the facility."[10]

3. S&L'S CONTROL TECHNOLOGY COST ESTIMATES

PNM contracted S&L to prepare the following three cost estimates for NOx control options at its San Juan Generation Station: (1) Selective Non-Catalytic Reduction (SNCR) control on SJGS Units 1, 2, 3, & 4; (2) SNCR control systems on SJGS Units 1 & 4 only; and (3) SCR control on all four units.

3.1 Emission Units and Control System Design Parameters

SJGS is located 15 miles west of Farmington, New Mexico, and is comprised of Units 1 and 2 (nominally 370 MW each) and Units 3 and 4 (nominally 544 MW each). All four units fire western subbituminous coal produced at an adjacent mine. The steam generating units for Units 1 and 2 were manufactured by Foster Wheeler Corporation and the steam generating units for Units 3 and 4 were manufactured by The Babcock & Wilcox Company. All four steam turbine generators were originally manufactured by General Electric. All four units are designed with low-NOx burners and over-fired air systems to control NOx emissions, activated carbon injection for mercury control, pulse jet fabric filter baghouse control systems for particulate matter control, and

[7] *Id.*, at page 1-7.
[8] *Id.*, at page 2-28.
[9] *Id.*, at page 2-27.
[10] *Id.*

wet flue gas desulfurization (WFGD) for sulfur dioxide control. The units are also equipped with hot-side electrostatic precipitators (ESPs) that were de-energized upon installation of the baghouses.

Design and operating parameters affecting the design of both SCR and SNCR control technologies include, but are not necessarily limited to boiler heat input, flue gas volumes and residence time, flue gas temperatures, uncontrolled NOx emissions, and the design target NOx emission rates. Operating parameters for the San Juan units were developed based on Process Information (PI) data available from the station, as well as experience from similar control technology projects. Design and operating parameters used as the basis of the SCR and SNCR cost estimates are summarized in Table 1.

Table 1. SJGU Units 1, 2, 3, & 4 Design & Operating Parameters

Plant Operating Data						
Variable	**Units**	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Status***
Gross Load	MW	370	370	544	544	v
Minimum Load	MW	144	144	222	222	v
Heat Input	mmBtu/hr	3,707	3,688	5,758	5,649	v
O_2 at Economizer Outlet	%vol (set)	3.36	2.67	3.00	2.78	v
Air H_2O	lb/lb dry air	0.013	0.013	0.013	0.013	ej
Ash-Boiler	wt%	20	20	20	20	ej
Ambient Pressure	psia	12.08	12.08	12.08	12.08	v
Ambient Temp	°F	70	70	70	70	v
Economizer Outlet Pressure	in. w.c.	+11.7	+11.4	+6.9	+7.3	v
Boiler SO_2 to SO_3 oxidation	wt% SO_2	0.8	0.8	0.8	0.8	ej
Control System Design Parameters						
SCR SO_2 to SO_3 Oxidation	wt% SO2	0.5	0.5	0.5	0.5	design
Economizer Outlet Temperature	°F	658 ± 15	670 ± 20	670 ± 20	680 ± 15	v
Minimum Load Temperature	°F	500	475	450	450	ej
Inlet Ash Loading	lb/mmBtu	18.34	18.34	18.34	18.34	v
Maximum Inlet NOx	lb/mmBtu	0.40	0.40	0.40	0.40	design
Average Inlet NOx	lb/mmBtu	0.30	0.30	0.30	0.30	design
NOx Emission Limit (SCR)	lb/mmBtu	0.05	0.05	0.05	0.05	v
SCR Pressure Drop	in. w.c.	-8.0 to -11.0	-8.0 to -11.0	-8.0 to -11.0	-8.0 to -11.0	design
NH_3 Slip (SCR)	ppmvd @3% O_2	2	2	2	2	design
NOx Emission Limit (SNCR)	lb/mmBtu	0.23	0.23	0.23	0.23	design
NH_3 Slip (SNCR)	ppmvd @3% O_2	10	10	10	10	design

* v = verified; uv = unverified; ej = engineering judgment; design = design criteria

3.2 SCR Cost Estimate Methodology & Assumptions

In 2011, PNM contracted S&L to prepare a conceptual design, project cost estimate, and technical portions of an Engineer, Procurement, and Construction (EPC) specification as a preliminary step towards awarding a contract to install SCR control systems on SJGS Units 1, 2, 3, & 4. The SCR cost estimate was based on equipment cost estimates provided by equipment vendors for the major components of the SCR control system (e.g., SCR reaction vessel, SCR catalyst, ammonia handling system, etc.), and unit-specific balance-of-plant costs (e.g., economizer bypass modification, ash handling modification, tie-ins, duct work, fan modifications, foundations, structural steel, etc.). The following initial tasks were performed to establish the SCR control system design parameters and to prepare the documents to support a construction request for proposals:

- Review and analyze the operating conditions at SJGS including air flow, temperature data, fuel data, pressure drop across the SCR, ash flow and handling, fan capacity, and alternative reagents.
- Review ductwork and/or boiler stiffening required to withstand the new operating conditions required for compliance with NFPA-85, air heater modifications, and modifications necessary after the SCR addition.
- Evaluate the existing auxiliary electric system to determine what modifications are required to accommodate the addition of SCRs and the sorbent injection system.
- Develop General Arrangement (GA) drawings for the SCRs, new ductwork, and the other additional equipment required to safely and reliably integrate the SCRs into the plant's operation.
- Estimate the quantities of materials (e.g., steel, concrete, piping, ductwork, etc.) needed for SCR installation based on the GA drawings.
- Obtain budgetary equipment cost quotes from manufacturers of the major system components.

3.2.1 Factors Affecting the Design:

Several site-specific factors affect the conceptual design of the SJGS SCR control systems. Design considerations affecting the SCR cost estimates include the congested existing plant configuration, the high ash content of the coal-fired, NOx reduction requirements, and the existing and anticipated permit limits for other regulated air pollutants. Some of the more significant factors affecting the design of the SCR control systems are described in more detail below.

Site Congestion: SJGS is a congested site. One site congestion issue that affects SCR design and construction is that SJGS has de-energized "hot-side" ESPs that are located ahead of the air preheater in the flue gas path. Most coal-fired power plants have "cold-side" ESPs that are located downstream of the air preheater. Because the ESPs for the SJGS are located in front of the air heaters, they are in the middle of the

boiler outlet duct area. Because the stacks are also located adjacent to the air heaters, the area in which SCRs may be installed is severely restricted.

The conceptual design study prepared for the SCR control systems concluded that, given the space constraints, the best location for the SCRs will be above the existing air heaters. Building SCRs in this location will require installation of ducts to convey the full gas path above the existing ESPs. The bottom ducts of the SCRs will be 120 feet above ground level, requiring more structural support than would be required if they were located closer to the ground. The congestion also limits the options for structural steel column placements to support the new SCR reactors and ductwork, contributing to a less efficient steel arrangement and increasing the complexity of the design compared to a more open installation.

Another manifestation of the congested site is that all four units are constructed side by side in a row. This leaves two units (Unit 2 and Unit 3) on the interior of the row. There is very little space between the units. This tight configuration creates constructability issues because it limits crane placement and the type of structural foundations that can be added to support the weight of the SCR. Crane placement is important because of the need to build the ductwork over the existing ESPs, which means lifts spanning above the two outside units to reach the two interior units will be required, where there is also limited room to assemble and disassemble the cranes. The long spans and limited placement choices limit the crane selection choices to the larger, more expensive cranes.

The tight site configuration also dictates that a more expensive type of deep structural foundations be used. The very low overhead clearances and tight quarters adjacent to the existing stacks, particularly south of the Unit 1 stack where the adjacent fabric filter restricts access to the area and also south of the Unit 2 stack where existing ash piping, would hamper access during construction and leads to the choice of micropiles for support of the new SCRs and ductwork. This construction option is a special type of pile that requires special installation equipment and expertise. The installed cost of this type of pile by a specialty contractor will be high compared to other deep foundation installations, at least double the cost of conventional drilled or driven piles. The cost of structural foundations also increases due to the height of the SCR above ground level, as discussed earlier for the structural steel support structure.

Controlled NOx Emission Limit: Based on the August 22, 2011 Regional Haze Federal Implementation Plan (the "Regional Haze FIP"),[11] the SJGS SCRs would be required to achieve an enforceable NOx emission

[11] See, 76 Fed. Reg. 52388

limit of 0.05 lb/mmBtu. Thus, the SCRs must be designed to achieve a controlled NOx emission rate of less than 0.05 lb/mmBtu under most operating scenarios to provide compliance margin during those periods of time when NOx emissions may exceed the limit (e.g., startup, shutdown, and malfunction). To achieve controlled NOx emissions of less than 0.05 lb/mmBtu, the conceptual design study determined that the SJGS SCRs should be designed to hold four layers of catalyst. Three layers will be installed initially, with the fourth layer being added after approximately two years of operation. Once the fourth layer has been added to the SCR, one layer of catalyst would be replaced every two years. The four-layer catalyst design requirement affects SCR costs by:

- Fan upgrades will be required to accommodate the additional pressure drop across the SCRs;
- Four layers of catalyst results in a larger SCR reaction box and additional weight that must be supported by the structural steel;
- Increased ammonia consumption will be required to achieve the lower NOx emission rate, which affects the cost of the ammonia handling system, ammonia storage, and delivery to the SCR; and
- Increased construction costs in terms of initial catalyst procurement.

Sulfuric Acid Mist Emission Limit: SJGS is required by the Regional Haze FIP to meet a sulfuric acid mist (SAM) emission limit of 2.6×10^{-4} lb/mmBtu (or approximately 0.10 ppmvd @ 3% O_2). SCR controls result in increased SO_2 to SO_3 oxidation. SO_3 formed across the SCR catalyst can react with water in the flue gas to form SAM, increasing SAM loading to downstream equipment. In order to meet the SAM emission limit, the conceptual design study specified an ultra-low conversion catalyst to minimize SO_3 formation across the SCR. Ultra-low conversion catalyst will increase the size of the SCR reactor box and increase the weight of the SCR. Based on vendor input from recent SCR installations, it is unlikely that PNM will be able to obtain a guaranteed SAM emission limit of 2.6×10^{-4} lb/mmBtu from any of the SCR contractors. Therefore, the conceptual design study specified installation of dry sorbent injection (DSI) for SO_3 control. Installation of the SCR control systems significantly increases the need for DSI control, and it is very unlikely that the units will meet the SAM emission limit without DSI control.

Fugitive Emissions Control and Balanced Draft Conversion: As part of the SCR design review process, PNM verified that the SJGS may be required to reduce existing fugitive emissions at the plant. Most of the fugitive emissions result from the boilers' pressurized design. Internal boiler and ductwork pressures push fine ash particles out through any small openings in the existing ductwork. Converting the plant to a balanced draft operation, which means internal pressures in the boiler and ductwork will be close to atmospheric pressure, will minimize or eliminate these fugitive emissions. Because of the potential need to address fugitive emissions, ancillary equipment costs (including fan sizing, boiler and ductwork stiffening

requirements, auxiliary power requirements, and electrical system upgrades) were developed to address both the pressure drop through the SCR and balanced draft conversion. Because of the significant pressure drop across the SCR, new fans will be required on all four SJGS units regardless of whether the units are converted to balanced draft. Balanced draft conversion would incrementally add to the size (and cost) of the new fans and electrical system upgrades, and would require additional boiler and ductwork stiffening. Based on an evaluation of fan sizing needed for the SCR project alone, these costs were split between the two projects by assigning 80% of the costs to the SCR and 20% to the additional needed for balance draft conversion.

3.2.2 Project-Specific SCR Design Criteria and Assumptions

Based on a site-specific review of the NOx reduction requirements and retrofit challenges associated with the installation of SCR control systems at SJGS, the following project-specific issues were taken into consideration in the development of the SCR cost estimates:

- SCR Location. The proposed SCR reactors are located above the existing air heaters. The ductwork from the economizer outlet to the air heater inlet will be replaced. The existing electrostatic precipitators will be abandoned in place. Galleries will be provided at each catalyst level, at the ammonia injection grid level, and at the ash handling levels to allow for maintenance and inspection of the SCR system.

- SCR Reactors. The conceptual design calls for a single reactor per unit for Units 1 and 2 and two reactors per unit for Units 3 and 4. Each reactor will have slots for four layers of catalyst (three layers plus a spare) and will use anhydrous ammonia as the reagent.

- Economizer Bypass. Based on SJGS coal parameters, an economizer outlet temperature of at least 580 °F is required for proper operation of the SCR. If flue gas flowing through the SCR is less than 580 °F, ammonia cannot be injected into the SCR and catalyst reactivity will be reduced. For periods of operation when the economizer outlet temperature is less than 580 °F, a means to increase the outlet temperature must be included in the SCR design. A water-side bypass in the economizer has been used on other recent SCR installation projects to increase the economizer outlet temperature, and a similar low-load temperature control system is needed on the SJGS units to allow low-load operation and unit cycling. Thus, economizer bypass costs were included in the cost estimate for the SJGS SCRs.

- Demolition of the Existing Hot-Side ESPs. Demolition of the existing hot-side precipitators is needed to fit the retrofit SCR control systems into the available space. The configuration of the SCR control system requires that it be placed above the existing air heater. Due to the height of the ductwork leading to the air heater, the top of the SCR, as designed, is already approaching the top of the boiler building. If this height is exceeded, impacts on the existing chimney and plume dispersion would need to be evaluated. As designed, the bottom of the inlet duct to the SCR runs at the same elevation as the top hot-side precipitator, necessitating removal of the existing precipitator. Reusing the existing ductwork was evaluated and found not to be acceptable due to the increase in flue gas velocity. We also evaluated

using the top hot-side precipitator as a duct, but again the degradation of the equipment and flue gas velocities would not support the design.

- Catalyst Layers. To achieve the required NOx emission reductions on a consistent basis with ultra-low SO_2 to SO_3 conversion catalyst, three layers of catalyst, rather than the two layers specified for other similar projects, will be required for the SJGS SCRs. The SJGS SCRs would be designed to hold four layers of catalyst, with three layers being loaded initially. The additional layer of catalyst is needed to meet an enforceable NOx emission limit of 0.05 lb/mmBtu, which could not be met with two layers. The fourth layer of catalyst would be added to the SCR after approximately two years of operation. Furthermore, the ash content of the coal used at SJGS results in increased costs for the catalyst, as well as increased complexity and costs of the ash handling systems.

- Air Heater Modifications. Based on the temperatures expected for the SCR operation, it can be expected that the ammonia and the sulfur trioxide will react to form ammonium bisulfate in the intermediate section of the air heater. However, based on operating experience with low sulfur fuel containing calcium oxide, air heater plugging and corrosion is not expected on these units. Therefore, no costs were included for air heater modifications.

- Economizer Ash Handling System. The existing economizer ash handling system was taken out of service, and the top of the ash hoppers has been covered with a metal plate. To remove large particles of ash prior to the SCR, this abandoned system needs to be removed and a new system installed. The new system would consist of a dry ash chain conveyor that collects the economizer ash in a storage tank and uses the bottom ash system to sluice the ash to the existing dewatering bins. Installing this system also requires the demolition of the existing gas recirculation fans to make room for the ash collection tanks.

- Baghouse Ash Handling System. Baghouse control systems have been installed on all four units at SJGS. The ash handling system installed with the baghouses were designed to collect only a portion of the fly ash because up to 50% of the particulates fall out in the existing ESPs. Removing the existing ESPs, which is needed to install the SCR control systems, will increase particulate loading to the baghouses, and increase the quantity of ash handled by the baghouse ash handling system. This requires expanding the baghouse ash handling system to accommodate the additional ash flow.

- Sootblowers on SCR. The method of cleaning the fly ash that settles on the catalyst is extremely important to obtain the guaranteed life of the catalyst. For this reason, the use of steam sootblowers, in addition to sonic horns, is recommended for the SJGS units. Steam sootblowers will remove fly ash that settles on the catalyst and the sonic horns will keep the fly ash moving through the catalyst. Air sootblowers were also considered but, due to the high loss on ignition (LOI) at the plant, were determined to be a potential fire hazard. The top layer of catalyst will be provided with steam sootblowers. The balance of the catalyst layers will be cleaned using sonic horns. This system will require compressed air to operate. A separate compressor for each unit was assumed for the cost estimate.

- Large Particle Ash Screen. To collect the maximum amount of fly ash at the economizer hopper, a large particle ash screen will be installed at the exit of the economizer. This ash screen will be used to divert larger fly ash particles that can plug the SCR catalyst into the economizer ash hoppers. This may also eliminate the need for additional fly ash systems at the SCR inlet and outlet ductwork.

- SCR Catalyst Replacement. An elevator was included in the SCR cost estimate to replace spent catalyst at the end of the catalyst life.

- Dry Sorbent Injection. The SCR will increase the formation of SO_3 and SAM loading to downstream equipment. To meet the units' existing SAM emission limit with an SCR, require installation and operation of a DSI control system. Therefore, costs for a DSI control system were included in the SCR cost estimate.

- Ammonia System. The location of the ammonia system is dependent on the type of ammonia being used and whether each unit will have a separate ammonia storage facility. The SCR cost estimate was based on the assumption that all four units would share a single ammonia storage facility with the associated truck delivery and unloading facilities.

- Auxiliary Power Upgrades. Operation of the SCR control system will require upgraded fans and electrical systems to allow the plant to operate at full load with the additional pressure loss generated by the SCR. Fan modifications include replacement of the rotors and other fan modifications for the forced draft (FD) fans on all units, replacement of the induced draft (ID) fans and motors on all units, and addition of variable frequency drives to replace the existing fan inlet dampers. The existing electrical system of Units 1 and 2 may not be capable of handling the new fan loads required to operate the SCR control systems, and may require a new power line and related electrical equipment from the existing switchyard. Costs for these upgrades were included in the cost estimate.

- Structural Stiffening. Structural stiffening of the boiler, ductwork, and equipment downstream of the boiler will be required to operate the SCR control system and to operate the plant in a balanced draft configuration. These costs were included, along with the fan and electrical system upgrades, in the balanced draft conversion cost estimate. However, as discussed above, a majority of theses costs would be incurred (e.g., fan and electrical system upgrades) with the installation of SCR control systems and no concurrent balanced draft conversion. Therefore, these costs were split between the SCR and balanced draft projects by assigning 80% of the costs to the SCR and 20% to the additional needed for balance draft conversion.

- Control Systems. The existing DCS system will need to be expanded to accommodate the additional signals from the SCR system.

- Construction Costs and Special Cranes. A review of the site arrangement shows that the free space between the units is limited due to modifications to the plant with the addition of the baghouses and the coal conveyor running between the units. In order to have the lifting capacity that is required to install an SCR and accommodate the demolition that is required, special cranes are required. Construction difficulty is very high for this very tight site.

3.3 SNCR Cost Estimate Methodology

S&L used unit-specific SJGS operating data (e.g., fuel characteristics and consumption, flue gas flow rates and temperatures, and NOx emission rates) developed for previous PNM studies, as well as experience from similar SNCR control system studies, to develop capital and O&M costs for the SNCR control option. S&L also

contacted Fuel Tech, an SNCR Original Equipment Manufacturer (OEM) for preliminary equipment pricing estimates and BOP requirements. Fuel Tech's preliminary cost estimate was developed based on boiler-specific operation information provided by S&L. Equipment costs were provided for the major components, including urea handling system, injection lances, piping, pumps, etc. Due to similarities in size, it was assumed that costs would be similar for each 'sister' unit (e.g., Units 1 & 2 and for Units 3 & 4).

3.3.1 Factors Affecting the SNCR Design

Several site-specific factors affect the design and effectiveness of SNCR control systems. Based on a review of preliminary design information provided by Fuel Tech, primary design considerations affecting SNCR design include the carbon monoxide (CO) concentration in the boiler flue gas and NOx reduction requirements.

Carbon Monoxide and Combustion Controls: Fuel Tech's budgetary SNCR equipment cost estimate assumed a CO concentration in the flue gas at the furnace bull nose of 350 ppm for Units 1 & 2 and 300 ppm for Units 3 & 4. Based on a review of historian data available from the SJGS units, CO concentrations at the bull nose could be significantly greater than 350 ppm, and may be in the range of 3,000 ppm or more. Industry experience has shown that CO levels below 1,000 ppm at the bull nose are needed to obtain the highest SNCR NOx removal efficiency. If CO levels exceed 5,000 ppm at the bull nose, SNCR is not a viable technology due to a number of factors, including low urea utilization, low removal efficiency and high ammonia slip. The SNCR equipment cost estimate was developed based on the assumption that CO concentrations in each boiler at the bull nose can be controlled to a level that allows for effective NOx removal, and that the SNCRs can be designed to achieve NOx removal efficiencies of 25% to 30%.

Controlled NOx Emissions: Cost estimates provided herein are based on Fuel Tech's July 10, 2012 SNCR budgetary proposal. The July 2012 proposal was a revision of the proposal Fuel Tech submitted August 10, 2011 at the request of S&L, to assist in evaluating the viability of SNCR technology in meeting a controlled NOx emission limit of 0.23 lb/mmBtu. No technical specifications were developed for solicitation of this proposal, which is based primarily on Fuel Tech's experience in the industry.

The Fuel Tech proposal included several urea injector options, including options for retractable injectors, High Energy Reagent Technology (HERT) lances, and Multi-Nozzle Lance (MNL) injectors. Locating the urea injection lances within the appropriate temperature window within the boiler, and designing the lances to promote flue gas/urea mixing, are important design considerations for an SNCR control system.

Assuming an average uncontrolled NOx emission rate of 0.30 lb/mmBtu, the SNCR would have to achieve an average removal efficiency of approximately 25% to consistently achieve a controlled NOx emission rate

of 0.23 lb/mmBtu. Based on achieving a removal efficiency of 25%, S&L assumed the use of HERT injectors for the SNCR cost estimates. Boiler gas species mapping will need to be done before the SNCR OEM can supply PNM with a removal efficiency guarantee. Combustion tuning will likely be required to reduce the CO levels in the boilers. If additional removal is needed for NOx compliance, PNM would need to consider the MNL option.

Fugitive Emissions Control and Balanced Draft Conversion: As discussed above, PNM may be required to reduce existing fugitive emissions at the plant. Fugitive emissions from the existing boilers could be minimized or eliminated by converting the boilers to balanced draft operation. Balanced draft conversion would require the installation of new fans, boiler and ductwork stiffening, and upgrades to the existing electrical systems. However, unlike the SCR project, SNCR could be installed and operated on the units without these upgrades; therefore, balance draft costs were not included in the SNCR cost estimate.

3.3.2 Project-Specific SNCR Design Criteria and Assumptions

Based on a site-specific review of the NOx reduction requirements and retrofit challenges for the installation of SNCR control systems and associated plant changes at SJGS, the following project-specific issues were taken into consideration in the development of the SNCR cost estimates:

- Urea Delivery, Unloading, and Storage. The SNCR cost estimate is based on using urea as the reactant. Urea solution (50% aqueous urea by weight) would be delivered to the site via truck to either urea unloading area. Urea is a solid on its own, but when mixed with water it becomes a clear liquid solution. It would be delivered in this form and unloaded via onboard truck pumps into the FRP storage tanks. The total storage capacity is sized for 14 days of continuous operation per unit at full load. The tanks would be heat traced and insulated in order to keep the 50% urea solution above 80 °F to prevent precipitation of urea solids out of solution.
- Urea Circulation. The urea storage tanks would be cross tied and transfer the 50% urea solution from the storage area to the units via 2 x 100% centrifugal pumps. The urea solution would be transferred using stainless steel piping. A loop from the storage tanks to the unit metering modules and back to the storage tanks continuously circulates the 50% urea solution. Process heat trace is required to keep the urea solution above 80 °F.
- Urea Dilution and Metering. Dilution water would be pumped via 2 x 100% centrifugal pumps to the metering modules located in the unit, where it would mix with the 50% urea solution prior to injection into the boiler. Dilution of the urea solution to 5-10 wt% urea is required prior to injection. Variable frequency drives would be utilized to maintain a constant pressure of dilution water in response to changing flow demands. The metering modules provide flow and pressure control of the fluids used in the SNCR process.
- Diluted Urea Distribution and Injection. The distribution modules would provide diluted urea solution and atomizing air to individual injectors. The modules are typically located near the injectors on the

same elevation. Diluted urea solution is fed from the metering modules to the distribution modules. The distribution module outputs one (1) atomizing air line and one (1) urea solution line to each injector. The injectors are used for dispersion of diluted urea solution within targeted areas of the boiler. Design, quantity, type and placement of the injectors are critical to SNCR performance; furnace temperature, residence time, and droplet size are important design parameters controlled by injector placement. The exact locations of the injectors will be determined by the SNCR OEM based on computational fluid dynamics (CFD) modeling of the furnace. For the SNCR cost estimate, injector locations were selected based on S&L's industry experience, assuming the use of HERT injectors.

- Balance of Plant (BOP) Systems. Demands on the ancillary systems are influenced by the SNCR OEM's equipment design. BOP systems and costs included in this study are based on the Fuel Tech budgetary cost proposal provided for SJGS.

- Raw Water & Water Treatment. Raw water will be utilized for urea dilution water. A tie-in to the existing raw water line located below grade between Units 3 and 4 will be made to supply the required water. Based on a review of the station's existing water supply system, adequate pressure, flow and pump redundancy are currently available at this tie-in location. S&L also received a water analysis for the raw water, and reviewed the SNCR OEM dilution water quality requirements. In order to meet the dilution water quality requirement by the SNCR OEM, S&L added a common water treatment system. The water treatment system includes filters to remove suspended solids, zeolite softeners for the removal of hardness and a 10,000 gallon head tank for temporary dilution water storage.

- Plant and Instrument Air System. The addition of the SNCR system adds a large air user to each unit. To meet the air consumption requirements for the atomizing air, 2 x 100% capacity, oil-free compressors would be added per unit. These compressors would also provide compressed air to all new intermittent-user (valves, instruments, tools, etc.); therefore, no additional compressed air load would be added to the existing plant compressed air systems. All air would be dried to -40 °F dew point by implementing 2 x 100% regenerative desiccant dryers. Instrument air piping would be stainless steel.

- Air Heater Evaluation. The application of SNCR technology to coal-fired power plants creates a potential problem with the deposition of ammonia-sulfur salts in the air preheater. SO_3 is formed in the boiler from oxidation of sulfur in the coal. Urea that is injected in the boiler decomposes into ammonia and is not fully used, creating a slip stream of ammonia that exits through the economizer. If the concentration of ammonia is more than twice that of the SO_3 in the flue gas, the ammonia slip can react with SO_3 to form ammonium bisulfate (ABS). ABS will condense from the gas stream and form a sticky deposit on the heat transfer surface of the air heater at a temperature of 380 – 450 °F. Fly ash particles will tend to stick to the ABS resulting in the gradual pluggage of the air preheater (APH). Depending on the degree of formation, this could result in an increase in APH pressure drop (impacting ID fan capacity), as well as a loss in thermal efficiency for the plant. ABS is also corrosive (acidic in nature) and will corrode the mild steel or low alloy steel surfaces of the APH. The flue gas path at SJGS includes a hot-side ESP, which has been de-energized since the baghouse installation. This means that some of the particulate matter upon which the SO_3 and ammonia could condense will be removed prior to the temperature window for ABS formation. Removing solid particles from the flue gas stream prior to the APH should minimize the possibility of plugging due to flyash sticking to ABS in the APH. Because of this, it is not expected that coating of the APH baskets will be necessary at SJGS. However,

before knowing exactly how much gaseous SO_3 and ammonia will pass through the ESP and into the APH, the performance should be closely monitored.

- Fire Protection System. Fire protection for the new pre-engineered buildings would include alarm and detection, as well as fire extinguishers. It is anticipated no additional fire hydrants or a dispersion system will be required for the urea unloading area.

- Furnace Modifications. Penetrations in the boiler water wall will be required at the injector locations. To support the injector penetrations, water wall tubes will need to be removed and replaced with tubes curved around the penetration location, a boot and a flange. The injector(s) mount to the flange. In some instances additional structural reinforcement may be required to support the injectors.

- Lighting and Maintenance Power System. The cost estimate was based on the assumption that the lighting power system would consist of normal AC lighting, DC emergency lighting, and convenience receptacles, and that the lighting system would follow the lighting system at the existing plant.

- Grounding System. The cost estimate was based on the assumption that the station's grounding system would be extended with an interconnected network of bare copper conductors and copper ground rods. The systems would be designed to protect plant personnel and equipment from the hazards that can occur during power system faults and lightning strikes. The grounding system would be designed in accordance with applicable IEEE standards and would be installed in accordance with the NEC. Lightning protection design would be in accordance with NFPA 780.

- Process and Freeze Protection Heat Tracing System. Freeze protection system would be provided for outdoor piping (8" and smaller), instruments, and other devices subject to freezing in cold weather. The freeze protection system would be designed to accommodate both normal plant operations and extended plant shutdowns during cold weather. All urea piping and tanks would be process heat traced to a minimum temperature of 80 °F to avoid crystallization.

3.4 Plant Economic Assumptions

Cost estimates prepared for SJGS are conceptual in nature, based largely on budgetary equipment costs provided by equipment suppliers, costs incurred on similar projects, and S&L's experience with the design and installation of retrofit SNCR and SCR control systems. Allowances have been included, where necessary, to address site-specific retrofit issues and design assumptions described above. Contracting strategies and cost assumptions used as the basis for the SCR and SNCR cost estimates are summarized below:

- Contracting Strategy. The capital cost for the plant modifications are based on hiring an Engineer, Procure and Construct (EPC) contractor to provide a 'turn-key' air quality control system. Design of the control system would be performed by the EPC contractor. All equipment would be purchased directly by and installed by the EPC contractor.
- Equipment Costs. Equipment costs include only those costs for the manufactured equipment. For the SNCR control system these items include the SNCR system, compressors, water treatment, tanks, pumps, and motors. For the SCR control system these items include the SCR reactor vessel and catalyst

modules, economizer bypass and low load temperature control system, ammonia system, dry sorbent injection control system, and related ancillary equipment.

- Material Costs. Material costs include those costs for commodity-like materials, such as structural steel, concrete, piping, valves, cable, cable tray, and conduit. All material unit costs were estimated on the basis of S&L in-house data, vendor catalogs, and industry publications. Quantities of materials were developed based on the conceptual designs and general arrangement drawings prepared for each control system.
- Labor Costs. Union craft labor rates were developed for both projects for the Albuquerque, New Mexico area from the publication *RS Means*. Union rates were then incorporated into work crews appropriate for the activities by adding allowances for payroll taxes, worker's compensation, fringe benefits, incidentals, small tools, construction equipment, and site overheads to arrive at crew rates detailed in the cost estimate.
- Labor Incentives (SNCR). Labor incentives for the SNCR work are estimated based on 5 days x 10 hours/day work week for the non-outage work. The boiler tube insert modifications and scaffolding required for this work will be performed during an outage, and are estimated based on 6 days x 10 hours/day work schedule. The cost estimate reflects this assumption for overtime calculations. For common areas, is it assumed all work would be performed during pre-outage, and therefore reflects 5 days x 10 hours/day schedule.
- Labor Incentives (SCR). Labor incentives for the SCR work are estimated based on 5 days x 10 hours/day work week for the non-outage work. Outage labor incentives were estimated based on 7 days and two shifts of 12 hours/day.
- Labor Productivity. A 1.15 labor productivity factor was used in the estimates based on the regional labor productivity factor in the New Mexico area as published in Compass International Global Construction Cost and Reference Yearbook.
- Subsistence Pay. Cost estimates assume no subsistence pay.
- Project Indirect Costs. Project indirect costs assumed for the SCR and SNCR cost estimates include:

• Freight - Materials:	5% of Material Cost
• Freight – Equipment:	Included in equipment cost
• Consumables:	0.5% of Labor & Materials
• Sales Tax:	Not included
• EPC Engineering, Procurement and Project Services (SCR):	8% of total direct & construction indirect costs
• EPC Engineering, Procurement and Project Services (SNCR):	6% of total direct & construction indirect costs
• EPC Management Support (SCR)	3% of total direct & construction indirect costs
• Owners Engineering (SNCR):	2% of total direct & construction indirect costs
• Construction Management Support (SNCR):	2% of total direct & construction indirect costs
• Owners Engineering & Construction	

Management (SCR): 4% of total direct & construction indirect costs

- EPC Startup & Commissioning 1% of total direct & construction indirect costs
- EPC Fee: 15% of total direct & construction indirect costs

- Escalation. None. Escalation is typically included in cost estimates for major retrofit control projects and is intended to account for increases in equipment, material, and labor costs that occur during the duration of the project; however, escalation was not included in the SCR/SNCR cost estimates. Cost estimates attached to this report are shown in 2013 dollars.
- Contingency. Contingency is intended to represent unforeseeable elements of cost, particularly in fixed investment estimates, which previous experience has shown to be statistically likely to occur. Contingency is allowed by the Control Cost Manual approach, and should be based on the level of project definition (typically expressed as the percent of complete design). Contingency was included in both the SNCR and SCR cost estimates as follows:
  - Contingency (SNCR):
    - 10% of Equipment Costs
    - 20% of Material Costs
    - 20% of Labor Costs
    - 20% of Construction Indirect Costs
  - Contingency (SCR):
    - 20% of Total Direct and Indirect Construction Costs
- Allowance for Funds Used During Construction (AFUDC) or Interest During Construction (IDC). None. AFUDC and/or IDC were not included in the SCR/SNCR cost estimates. AFUDC accounts for the time value of money associated with the distribution of construction cash flows over the construction period, which for an SCR system could be spread over a construction period of 36+ months. TCI, as defined in the Control Cost Manual, includes all costs required to purchase equipment needed for the control system (purchased equipment costs), the costs of labor and materials for installing that equipment (direct installation costs), costs for site preparation and building, working capital, and off-site facilities.[12] Thus, the Control Cost Manual allows the time value of money, measured by the real discount rate, to be incorporated into the cost estimate. Although AFUDC can represent a significant cost that PNM will incur with and SCR project (estimated to be in the range of $38 to $45 million), AFUDC was excluded from the SCR and SNCR cost estimates.
- New Mexico Gross Receipt Tax. The New Mexico Gross Receipt Tax (NMGRT) of 6.3125% was applied to the total cost (i.e., purchased equipment and services performed) of both the SNCR and SCR projects.

[12] *OAQPS Control Cost Manual*, page 2-5.

3.5 Operating & Maintenance Cost Assumption

Annual O&M costs include both fixed and variable costs and indirect operating costs. Variable O&M costs are items that generally vary in proportion to the plant capacity factor. Variable costs associated with SCR and SNCR control systems include: reagent costs (e.g., urea or anhydrous ammonia); catalyst replacement costs (SCR); and auxiliary power costs associated with operating the equipment, water, and steam. Variable O&M costs can also include a boiler efficiency penalty if the control system results in reduce boiler efficiency (e.g., SNCR). Fixed costs are independent of the level of production, and would be incurred even if the control system were shut down and include costs such as maintenance labor and materials, administrative charges, property taxes, and insurance.

Both fixed and variable O&M costs were included in the SCR and SNCR cost estimates. Assumptions used to calculate annual O&M costs are listed in each of the cost estimate worksheets, respectively.

3.6 Cost Estimates

Conceptual cost estimates were developed for the SNCR and SCR control systems based on the design criteria and assumptions provided herein. Cost estimates prepared for the control systems include all costs associated with equipment, labor, freight, and the New Mexico Gross Receipts Tax related to the respective projects. Costs for the major system components were based on budgetary equipment quotes obtained from equipment vendors, S&L in-house data, vendor catalogs, industry publications (such as Means and Richardson), and costs from other similar projects. Cost estimates for the SJGS projects include the costs to install the control systems, as well as the associated ductwork and equipment modifications taking into account site-specific operating conditions and site constraints. Cost estimates include EPC engineering, procurement and project services; EPC construction management support; EPC commissioning; and an EPC fee, as well as costs for owner's engineering and management. Cost estimates do not include escalation for equipment, material, or labor that could occur over the time period necessary to complete construction, and do not include an allowance for funds used during construction (AFUDC). Capital cost estimates for the SNCR and SCR projects summarized in Attachments A, B, and C include the following:

Cost Estimates for SNCR Systems:

- Estimate 31803B: Unit 1 (and Unit 2) SNCR Conceptual Cost Estimate
- Estimate 31804B: Unit 3 (and Unit 4) SNCR Conceptual Cost Estimate
- Estimate 31807B: SNCR Common Equipment Conceptual Cost Estimate

Cost Estimates for SCR System:

- Estimate 31326C: Unit 1 SCR Conceptual Cost Estimate
- Estimate 31327C: Unit 2 SCR Conceptual Cost Estimate
- Estimate 31328C: Units 1 & 2 SCR Common Equipment Conceptual Cost Estimate
- Estimate 31329C: Unit 3 SCR Conceptual Cost Estimate
- Estimate 31330C: Unit 4 SCR Conceptual Cost Estimate
- Estimate 31331C: Units 1, 2, 3, & 4 SCR Common Equipment Conceptual Cost Estimate

3.6.1 SNCR Cost Estimates

The following costs are included in the SNCR conceptual cost estimates:

Units 1 (and Unit 2) Base Estimate (Estimate 31803B):

- SNCR equipment
- Boiler modifications and injection lance installation
- Urea unloading area consisting of two (2) FRP tanks
- Urea circulating skids, circulating pumps
- Compressed air and dryer system
- Metering modules

Units 3 (and Unit 4) Base Estimate (Estimate 31804B):

- SNCR equipment
- Boiler modifications and injection lance installation
- Urea unloading area consisting of three (3) FRP tanks
- Urea circulating skids, circulating pumps
- Compressed air and dryer system
- Metering modules

Units 1 & 3 Common Equipment Cost Estimate (Estimate 31807B):

- Dilution water treatment system

3.6.2 SCR Cost Estimates

The following costs are included in the SCR conceptual cost estimates:

Units 1 & 2 Base Estimate (Estimates 31326C & 31327C):

- SCR equipment & ductwork – each unit
- Demolition of upper hot-side ESP penthouse – each unit
- Demolition of ash handling system on economizer hoppers – each unit

- Demolition of seal air fan area on hot-side ESPs
- Dry flight chain conveyor system on economizer hopper with storage tank – each unit
- Sorbent injection unit for sulfuric acid control – each unit
- Sorbent silo & blowers for Units 1 & 2 (two silos total)
- Addition of a second ash handling system on the existing Units 1 & 2 baghouses. Hoppers have connections for equipment, but need new feeders, piping system and blowers to transport ash to existing silos
- Equipment and materials for gas path upgrades needed to handle pressure drop associated with SCR, as well as added scope for balanced draft conversion

Units 1 & 2 Common Equipment Cost Estimate (Estimate 31328C):

- Ammonia storage tank and tank equipment – one storage tank for two units
- Common elevator for Units 1 & 2

Units 3 & 4 Base Estimate (Estimates 31329C & 31330C):

- SCR equipment & ductwork – each unit
- Elevator – each unit
- Demolition of upper hot-side ESP penthouse – each unit
- Demolition of hot-side ESP electrical control room
- Demolition of ash handling system on economizer hoppers – each unit
- Demolition of Gas Recirculation fan (1 fan Unit 3 north side and 1 fan Unit 4 south side)
- Demolition of seal air fan area on hot-side ESPs
- Dry flight chain conveyor system on economizer hopper with storage tank – each unit
- Sorbent injection unit for sulfuric acid control – each unit
- Sorbent silo & blowers for Units 3 & 4 (two silos total)
- Ammonia storage tank – each unit
- Addition of a second ash handling system on the existing Units 3 & 4 baghouses. Hoppers have connections for equipment, but need new feeders, piping system and blowers to transport ash to existing silos
- Additional gallery on north side of units for dilution air skids
- Equipment and materials for gas path upgrades needed to handle pressure drop associated with SCR, as well as added scope for balanced draft conversion

Units 1, 2, 3 & 4 Common Equipment Cost Estimate (Estimate 31331C):

- Ammonia delivery (truck unloading station) & storage area
- Demolition of sulfuric acid storage tank & spare tank in acid storage area
- Demolition of stairs & platforms in tank area

- Saw cut wall on east side of containment area to redefine as a non-confinement space
- Modifications to existing mechanical systems (piping modifications)

4. SUMMARY

Based on the design parameters, costs, site constraints, and assumptions outlined above, capital and O&M costs estimates were prepared for retrofit SNCR and SCR controls on SJGS Units 1, 2, 3 & 4. The cost estimating methodology described above is consistent with the approach described in EPA's Control Cost Manual, and provides a conceptual cost estimate, or scoping-level estimate. Cost estimates prepared using default factors provided in the Control Cost Manual are directed toward a study-level estimate with a nominal accuracy of ±30%.[13] Study-level estimates are generally acceptable for regulatory development, because they represent a compromise between the less accurate order-of-magnitude and the more accurate, but more costly, estimate types.[14] However, the Control Cost Manual does not mandate a study-level cost estimate, and "offers the user an opportunity for greater accuracy than that used by regulators."[15] The methodology used by S&L to prepare the SCR and SNCR cost estimates provides a more accurate estimate of the costs that PNM would incur to install and operate SNCR and SCR control systems at SJGS.

Project-specific issues and key project elements affecting the cost of retrofit control technologies on the SJGS units were identified and accounted for in the development of the cost estimates. The most significant project-specific issue affecting the cost of installing SCR control systems is the tight site configuration available for SCR installation. As described in Section 3.2.1, site constraints will make SCR installation significantly more complex and expensive that similarly sized projects with adequate space. Other project related issues affecting control system costs include the NOx emission reduction requirements and the existing and anticipated permit limits for other regulated air pollutants.

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[13] *OAQPS Control Cost Manual*, page 2-3.

[14] *Id.*, at page 2-4.

[15] *Id,.* at page 2-3.

ATTACHMENT A.

SAN JUAN GENERATING STATION

UNITS 1, 2, 3, AND 4

SNCR COST ESTIMATES

Privileged & Confidential
San Juan Units 1 - 4
SNCR Cost Estimate

	Unit 1	Unit 2	Unit 3	Unit 4	
Capacity (MWg)	370	370	544	544	
Capacity (MWn)	327	327	497	507	
Maximum Heat Input (MMBtu/hr)	3707	3688	5758	5649	
Annual Capacity Factor (%)	85%	85%	85%	85%	
Baseline NOx Emission Rate (lb/MMBtu)	0.30	0.30	0.30	0.30	
Baseline NOx Emission Rate (lb/hr)	1112.1	1106.4	1727.4	1694.7	
Controlled NOx Emission Rate (lb/MMBtu)	0.23	0.23	0.23	0.23	
Controlled NOx Emission Rate (lb/hr)	852.6	848.2	1324.3	1299.3	

SNCR COST ANALYSIS

Cost Item	UNIT 1	UNIT 2	UNIT 3	UNIT 4	Remarks/Cost Basis
CAPITAL COST					
Direct Costs					
Purchased Equipment Costs					
SNCR System	$1,730,300	$1,730,300	$1,724,000	$1,724,000	Acct. Nos. 31-53-1
CFD Model Study	$150,000	$150,000	$150,000	$150,000	Acct. Nos. 31-53-2
Boiler Tuning	$150,000	$150,000	$150,000	$150,000	Acct. Nos. 31-53-3
Air Compressor & Accessories	$360,000	$360,000	$360,000	$360,000	Acct. Nos. 31-17
Steel	$129,100	$129,100	$113,500	$113,500	Acct. Nos. 23
Instrumentation and Control System	$145,000	$145,000	$145,000	$145,000	Acct. Nos. 44
Boiler Injection Ports	$83,000	$83,000	$83,000	$83,000	Acct. Nos. 31-99
Architectural	$352,500	$352,500	$352,500	$352,500	Acct. Nos. 24
Fire Protection	$3,600	$3,600	$3,600	$3,600	Acct. Nos. 31-45
Pumps	$30,000	$30,000	$30,000	$30,000	Acct. Nos. 31-75
Tanks	$22,500	$22,500	$22,500	$22,500	Acct. Nos. 31-83
Dilution Water Treatment System	$375,000	$375,000	$375,000	$375,000	Acct. Nos. 31-93
Subtotal capital cost (CC)	$3,531,000	$3,531,000	$3,509,100	$3,509,100	
Freight	$88,200	$88,200	$87,900	$87,900	Acct. Nos. 91-5
Total purchased equipment cost (PEC)	$3,619,200	$3,619,200	$3,597,000	$3,597,000	
Direct installation costs					
Handling & erection (includes labor costs)	$4,549,300	$4,549,300	$4,435,600	$4,435,600	Acct. Nos. 11 through 44 Labor Costs (excluding 31-99 Labor)
Foundation & supports	$257,100	$257,100	$295,800	$295,800	Acct. Nos. 21 and 22
Electrical	$615,650	$615,650	$610,350	$610,350	Acct. Nos. 41 through 43
Piping	$576,950	$576,950	$537,550	$537,550	Acct. Nos. 35
Insulation	$30,900	$30,900	$28,000	$28,000	Acct. Nos. 36
Painting	$10,500	$10,500	$700	$700	Acct. Nos. 27
Demolition and Relocation	$7,500	$7,500	$22,500	$22,500	Acct. Nos. 11
Scaffolding	$168,100	$168,100	$165,300	$165,300	Acct. Nos. 91-1
Boiler Port Installation	$393,400	$393,400	$402,200	$402,200	Acct. Nos. 31-99 (Labor)
Cost Due to Overtime	$726,900	$726,900	$718,000	$718,000	Acct. Nos. 91-2
Consumables	$33,650	$33,650	$33,050	$33,050	Acct. Nos. 91-4
Total direct installation costs (DIC)	$7,369,950	$7,369,950	$7,249,050	$7,249,050	
Total direct costs (DC) = (PEC) + (DIC)	$10,989,150	$10,989,150	$10,846,050	$10,846,050	
Indirect Costs					
Owner's Engineering	$219,800	$219,800	$217,000	$217,000	Acct. Nos. 93-1A
EPC Engineering, Procurement and Project Services	$659,300	$659,300	$650,800	$650,800	Acct. Nos. 93-1B
Owner's cost	$0	$0	$0	$0	Acct Nos. 93-4
Construction management	$219,800	$219,800	$217,000	$217,000	Acct. Nos. 93-2
Start-up and spare parts	$110,000	$110,000	$108,500	$108,500	Acct. Nos. 93-3
EPC Fee	$1,829,650	$1,829,650	$1,805,850	$1,805,850	Acct. Nos. 93-5
Total indirect costs (IC)	$3,038,550	$3,038,550	$2,999,150	$2,999,150	
New Mexico Gross Receipts Tax (GRT)	$885,000	$885,000	$874,000	$874,000	(DC + IC) X 6.3125%
Project Contingency (PC)	$2,478,900	$2,478,900	$2,444,300	$2,444,300	Acct. Nos. 95-1 through 95-4
Total Capital Investment (TCI)=(DC)+(IC)+(GRT)+(PC)	**$17,391,600**	**$17,391,600**	**$17,163,500**	**$17,163,500**	

Privileged & Confidential
San Juan Units 1 - 4
SNCR Cost Estimate

	Unit 1	Unit 2	Unit 3	Unit 4	
Capacity (MWg)	370	370	544	544	
Capacity (MWn)	327	327	497	507	
Maximum Heat Input (MMBtu/hr)	3707	3688	5758	5649	
Annual Capacity Factor (%)	85%	85%	85%	85%	
Baseline NOx Emission Rate (lb/MMBtu)	0.30	0.30	0.30	0.30	
Baseline NOx Emission Rate (lb/hr)	1112.1	1106.4	1727.4	1694.7	
Controlled NOx Emission Rate (lb/MMBtu)	0.23	0.23	0.23	0.23	
Controlled NOx Emission Rate (lb/hr)	852.6	848.2	1324.3	1299.3	

SNCR COST ANALYSIS

Cost Item	UNIT 1	UNIT 2	UNIT 3	UNIT 4	Remarks/Cost Basis
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Operating labor	$0	$0	$0	$0	Assumed no operating labor for the SNCR
Annual Maintenance Cost	$260,900	$260,900	$257,500	$257,500	TCI X 1.5% [EPA Cost Manual Section 4.2, Chapter 1, Eqn.1.21]
Total fixed annual costs	**$260,900**	**$260,900**	**$257,500**	**$257,500**	
Variable annual costs					
Reagent Consumption	$3,353,700	$3,353,700	$6,177,200	$6,177,200	Based on 225.2 gph (U1&U2, each) and 414.8 gph (U3&U4, each) (50% urea solution) per Fuel Tech Proposal 11-B-122, Rev.1, 07-10-2012. Assumes $2.0/gal and 85% CF.
Water Consumption	$134,000	$134,000	$150,100	$150,100	Based on 50 gpm (U1&U2, each) and 56 gpm (U3&U4, each) per Fuel Tech Proposal 11-B-122, Rev.1, 07-10-2012. Assumes $6/1000 gal and 85% CF.
Power Requirement	$42,700	$42,700	$51,000	$51,000	Based on 155 kW (U1&U2, each) and 185 kw (U3&U4, each) per per Fuel Tech Proposal 11-B-122, Rev.1, 07-10-2012 and S&L BOP estimate. Assumes $37/MWh and 85% CF.
Total variable annual costs	$3,530,400	$3,530,400	$6,378,300	$6,378,300	
Total direct annual costs (DAC)	$3,791,300	$3,791,300	$6,635,800	$6,635,800	
Indirect Annual Costs					
Cost for capital recovery	$1,609,000	$1,609,000	$1,588,000	$1,588,000	(TCI) X 9.25% CRF at 8.44% interest & 30 year life
Total indirect annual costs (IDAC)	$1,609,000	$1,609,000	$1,588,000	$1,588,000	
Total Annual Cost (TAC) = (DAC) + (IDAC)	$5,400,300	$5,400,300	$8,223,800	$8,223,800	
Emission Reductions (ton/yr)	966	961	1,501	1,472	Based on baseline NOx rate of 0.30 lb/MMBtu and controlled rate of 0.23 lb/MMBtu
Cost Effectiveness ($/ton)	**5,590**	**5,618**	**5,480**	**5,587**	
Cost ($/kW)	47.0	47.0	31.6	31.6	

Privileged & Confidential
San Juan Units 1 and 4
SNCR Cost Estimate

	Unit 1	Unit 4	
Capacity (MWg)	370	544	
Capacity (MWn)	327	507	
Maximum Heat Input (MMBtu/hr)	3707	5649	
Annual Capacity Factor (%)	85%	85%	
Baseline NOx Emission Rate (lb/MMBtu)	0.30	0.30	
Baseline NOx Emission Rate (lb/hr)	1112.1	1694.7	
Controlled NOx Emission Rate (lb/MMBtu)	0.23	0.23	
Controlled NOx Emission Rate (lb/hr)	852.6	1299.3	

SNCR COST ANALYSIS

Cost Item	UNIT 1	UNIT 4	Remarks/Cost Basis
CAPITAL COST			
Direct Costs			
Purchased Equipment Costs			
SNCR System	$1,730,300	$1,724,000	Acct. Nos. 31-53-1
CFD Model Study	$150,000	$150,000	Acct. Nos. 31-53-2
Boiler Tuning	$150,000	$150,000	Acct. Nos. 31-53-3
Air Compressor & Accessories	$360,000	$360,000	Acct. Nos. 31-17
Steel	$129,100	$113,500	Acct. Nos. 23
Instrumentation and Control System	$145,000	$145,000	Acct. Nos. 44
Boiler Injection Ports	$83,000	$83,000	Acct. Nos. 31-99
Architectural	$352,500	$352,500	Acct. Nos. 24
Fire Protection	$3,600	$3,600	Acct. Nos. 31-45
Pumps	$30,000	$30,000	Acct. Nos. 31-75
Tanks	$22,500	$22,500	Acct. Nos. 31-83
Dilution Water Treatment System	$375,000	$375,000	Acct. Nos. 31-93
Subtotal capital cost (CC)	$3,531,000	$3,509,100	
Freight	$88,200	$87,900	Acct. Nos. 91-5
Total purchased equipment cost (PEC)	$3,619,200	$3,597,000	
Direct installation costs			
Handling & erection (includes labor costs)	$4,549,300	$4,435,600	Acct. Nos. 11 through 91 Labor Costs
Foundation & supports	$257,100	$295,800	Acct. Nos. 21 and 22
Electrical	$615,650	$610,350	Acct. Nos. 41 through 43
Piping	$576,950	$537,550	Acct. Nos. 35
Insulation	$30,900	$28,000	Acct. Nos. 36
Painting	$10,500	$700	Acct. Nos. 27
Demolition and Relocation	$7,500	$22,500	Acct. Nos. 11
Scaffolding	$168,100	$165,300	Acct. Nos. 91-1
Boiler Port Installation	$393,400	$402,200	Acct. Nos. 31-99 (Labor)
Cost Due to Overtime	$726,900	$718,000	Acct. Nos. 91-2
Consumables	$33,650	$33,050	Acct. Nos. 91-4
Total direct installation costs (DIC)	$7,369,950	$7,249,050	
Total direct costs (DC) = (PEC) + (DIC)	$10,989,150	$10,846,050	
Indirect Costs			
Owner's Engineering	$219,800	$217,000	Acct. Nos. 93-1A
EPC Engineering, Procurement and Project Services	$659,300	$650,800	Acct. Nos. 93-1B
Owner's cost	$0	$0	Acct Nos. 93-4
Construction management	$219,800	$217,000	Acct. Nos. 93-2
Start-up and spare parts	$110,000	$108,500	Acct. Nos. 93-3
EPC Fee	$1,829,650	$1,805,850	Acct. Nos. 93-5
Total indirect costs (IC)	$3,038,550	$2,999,150	
New Mexico Gross Receipts Tax (GRT)	$885,000	$874,000	(DC + IC) X 6.3125%
Project Contingency (PC)	$2,478,900	$2,444,300	Acct. Nos. 95-1 through 95-4
Total Capital Investment (TCI)=(DC)+(IC)+(GRT)+(PC)	**$17,391,600**	**$17,163,500**	

Privileged & Confidential
San Juan Units 1 and 4
SNCR Cost Estimate

	Unit 1	Unit 4	
Capacity (MWg)	370	544	
Capacity (MWn)	327	507	
Maximum Heat Input (MMBtu/hr)	3707	5649	
Annual Capacity Factor (%)	85%	85%	
Baseline NOx Emission Rate (lb/MMBtu)	0.30	0.30	
Baseline NOx Emission Rate (lb/hr)	1112.1	1694.7	
Controlled NOx Emission Rate (lb/MMBtu)	0.23	0.23	
Controlled NOx Emission Rate (lb/hr)	852.6	1299.3	

SNCR COST ANALYSIS

Cost Item	**UNIT 1**	**UNIT 4**	**Remarks/Cost Basis**
ANNUAL COST			
Direct Annual Costs			
Fixed annual costs			
Operating labor	$0	$0	Assumed no operating labor for the SNCR
Annual Maintenance Cost	$260,900	$257,500	TCI X 1.5% [EPA Cost Manual Section 4.2, Chapter 1, Eqn.1.21]
Total fixed annual costs	**$260,900**	**$257,500**	
Variable annual costs			
Reagent Consumption	$3,353,700	$6,177,200	Based on 225.2 gph (Unit 1) and 414.8 gph (Unit 4) (50% urea solution) per Fuel Tech Proposal 11-B-122, Rev.1, 07-10-2012. Assumes $2.0/gal and 85% CF.
Water Consumption	$134,000	$150,100	Based on 50 gpm (Unit 1) and 56 gpm (Unit 4) per Fuel Tech Proposal 11-B-122, Rev.1, 07-10-2012. Assumes $6/1000 gal and 85% CF.
Power Requirement	$42,700	$51,000	Based on 155 kW (Unit 1) and 185 kw (Unit 4) per per Fuel Tech Proposal 11-B-122, Rev.1, 07-10-2012 and S&L BOP estimate. Assumes $37/MWh and 85% CF.
Total variable annual costs	$3,530,400	$6,378,300	
Total direct annual costs (DAC)	$3,791,300	$6,635,800	
Indirect Annual Costs			
Cost for capital recovery	$1,609,000	$1,588,000	(TCI) X 9.25% CRF at 8.44% interest & 30 year life
Total indirect annual costs (IDAC)	$1,609,000	$1,588,000	
Total Annual Cost (TAC) = (DAC) + (IDAC)	$5,400,300	$8,223,800	
Emission Reductions (ton/yr)	966	1,472	Based on baseline NOx rate of 0.30 lb/MMBtu and controlled rate of 0.23 lb/MMBtu
Cost Effectiveness ($/ton)	**5,590**	**5,587**	
Cost ($/kW)	47.0	31.6	

Detailed SNCR Cost Estimate Summary - San Juan Generating Station Unit 1

Basis:	S&L Cost Estimte 31803B (3/21/2012)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**Total**	**Notes**
DIRECT & CONSTRUCTION INDIRECT COST						
11	Demolition & Relocation		$0	$16,000	$16,000	
21	Civil Work			$15,100	$15,100	
22	Concrete		$140,100	$244,300	$384,400	
23	Steel		$129,100	$171,800	$300,900	
24	Architectural					
27	Painting & Coating		$10,000	$15,200	$25,200	
31-17, 31-53	Mechanical Equipment	$2,390,300	$0	$295,900	$2,686,200	
31-53-1	*SNCR System*	*$1,730,300*		*$267,400*	*$1,997,700*	
31-53-2	*CFD Model Study*	*$150,000*			*$150,000*	
31-53-3	*Boiler Tuning*	*$150,000*			*$150,000*	
31-17	*Air Compressor & Accessories*	*$360,000*		*$28,500*	*$388,500*	
35	Piping		$547,900	$1,859,500	$2,407,400	
36	Insulation		$28,800	$74,200	$103,000	
41	Electrical Equipment	$87,500	$149,400	$444,500	$681,400	
42	Raceway, Cable Tray & Conduit		$32,500	$53,500	$86,000	
43	Cable		$30,100	$105,100	$135,200	
44	Control & Instrumentation	$130,000		$131,100	$261,100	
	SUBTOTAL DIRECT & CONSTRUCTION INDIRECT COST	$2,607,800	$1,067,900	$3,426,200	$7,101,900	
	Other Direct & Construction Indirects					
91-1	Scaffolding			$122,800	$122,800	
31-99	Boiler Injection Port Installation	$60,000	$23,000	$393,400	$476,400	
91-2A	Overtime: 5 - 10 hr days			$449,700	$449,700	
91-2B	Overtime: 6 - 10 hr days			$125,900	$125,900	
91-4	Consumables			$24,600	$24,600	
91-5	Freight on Material		$54,500		$54,500	
	SUBTOTAL	$60,000	$77,500	$1,116,400	$1,253,900	
92	**TOTAL DIRECT & CONSTRUCTION INDIRECT COST**	**$2,667,800**	**$1,145,400**	**$4,542,600**	**$8,355,800**	

Detailed SNCR Cost Estimate Summary - San Juan Generating Station Unit 1

Basis:	S&L Cost Estimte 31803B (3/21/2012)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**Total**	**Notes**
INDIRECT COST						
93-1A	Owner's Engineering				$167,100	2% of Acct. No. 92
93-1B	EPC Engineering				$501,300	6% of Acct. No. 92
93-2	Construction Management				$167,100	2% of Acct. No. 92
93-3	Startup Commissioning				$83,600	1% of Acct. No. 92
93-4	Owner's Cost				$0	
93-5	EPC Fee (% of Total Directs, Indirects)				$1,391,200	15% of Acct. Nos. 92, 93-1 through 93-4
93	**TOTAL INDIRECT COST**				**$2,310,300**	
	Total Escalation					
	Contingency					
95-1	Contingency on Equipment				$266,800	10% of Acct. No. 92
95-2	Contingency on Material				$229,100	20% of Acct. No. 92
95-3	Contingency on Labor				$908,500	20% of Acct. No. 92
95-4	Contingency on Indirect				$462,100	20% of Acct. No. 93
95	**Total Contingency**				**$1,866,500**	
	TOTAL CONSTRUCTION COST				**$12,532,600**	
97	Interest During Construction				$0	
	TOTAL PROJECT COST				**$12,532,600**	

Detailed SNCR Cost Estimate Summary - San Juan Generating Station Unit 2

Basis:	S&L Cost Estimte 31803B (3/21/2011)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**Total**	**Notes**
DIRECT & CONSTRUCTION INDIRECT COST						
11	Demolition & Relocation		$0	$16,000	$16,000	
21	Civil Work			$15,100	$15,100	
22	Concrete		$140,100	$244,300	$384,400	
23	Steel		$129,100	$171,800	$300,900	
24	Architectural					
27	Painting & Coating		$10,000	$15,200	$25,200	
31-17, 31-53	Mechanical Equipment	$2,390,300	$0	$295,900	$2,686,200	
31-53-1	*SNCR System*	*$1,730,300*		*$267,400*	*$1,997,700*	
31-53-2	*CFD Model Study*	*$150,000*			*$150,000*	
31-53-3	*Boiler Tuning*	*$150,000*			*$150,000*	
31-17	*Air Compressor & Accessories*	*$360,000*		*$28,500*	*$388,500*	
35	Piping		$547,900	$1,859,500	$2,407,400	
36	Insulation		$28,800	$74,200	$103,000	
41	Electrical Equipment	$87,500	$149,400	$444,500	$681,400	
42	Raceway, Cable Tray & Conduit		$32,500	$53,500	$86,000	
43	Cable		$30,100	$105,100	$135,200	
44	Control & Instrumentation	$130,000		$131,100	$261,100	
	SUBTOTAL DIRECT & CONSTRUCTION INDIRECT COST	$2,607,800	$1,067,900	$3,426,200	$7,101,900	
	Other Direct & Construction Indirects					
91-1	Scaffolding			$122,800	$122,800	
31-99	Boiler Injection Port Installation	$60,000	$23,000	$393,400	$476,400	
91-2A	Overtime: 5 - 10 hr days			$449,700	$449,700	
91-2B	Overtime: 6 - 10 hr days			$125,900	$125,900	
91-4	Consumables			$24,600	$24,600	
91-5	Freight on Material		$54,500		$54,500	
	SUBTOTAL	$60,000	$77,500	$1,116,400	$1,253,900	
92	**TOTAL DIRECT & CONSTRUCTION INDIRECT COST**	**$2,667,800**	**$1,145,400**	**$4,542,600**	**$8,355,800**	

Detailed SNCR Cost Estimate Summary - San Juan Generating Station Unit 2

Basis:	S&L Cost Estimte 31803B (3/21/2011)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**Total**	**Notes**
INDIRECT COST						
93-1A	Owner's Engineering				$167,100	2% of Acct. No. 92
93-1B	EPC Engineering				$501,300	6% of Acct. No. 92
93-2	Construction Management				$167,100	2% of Acct. No. 92
93-3	Startup Commissioning				$83,600	1% of Acct. No. 92
93-4	Owner's Cost				$0	
93-5	EPC Fee (% of Total Directs, Indirects)				$1,391,200	15% of Acct. Nos. 92, 93-1 through 93-4
93	**TOTAL INDIRECT COST**				**$2,310,300**	
	Total Escalation					
	Contingency					
95-1	Contingency on Equipment				$266,800	10% of Acct. No. 92
95-2	Contingency on Material				$229,100	20% of Acct. No. 92
95-3	Contingency on Labor				$908,500	20% of Acct. No. 92
95-4	Contingency on Indirect				$462,100	20% of Acct. No. 93
95	**Total Contingency**				**$1,866,500**	
	TOTAL CONSTRUCTION COST				**$12,532,600**	
97	Interest During Construction				$0	
	TOTAL PROJECT COST				**$12,532,600**	

Detailed SNCR Cost Estimate Summary - San Juan Generating Station Unit 3

Basis:	S&L Cost Estimte 31804B (11/1/2012)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**Total**	**Notes**
DIRECT & CONSTRUCTION INDIRECT COST						
11	Demolition & Relocation		$15,000	$35,700	$50,700	
21	Civil Work			$16,600	$16,600	
22	Concrete		$178,800	$304,500	$483,300	
23	Steel		$113,500	$138,800	$252,300	
24	Architectural					
27	Painting & Coating		$200	$7,300	$7,500	
31-17, 31-53	Mechanical Equipment	$2,384,000	$0	$429,700	$2,813,700	
31-53-1	*SNCR System*	*$1,724,000*		*$401,200*	*$2,125,200*	
31-53-2	*CFD Model Study*	*$150,000*			*$150,000*	
31-53-3	*Boiler Tuning*	*$150,000*			*$150,000*	
31-17	*Air Compressor & Accessories*	*$360,000*		*$28,500*	*$388,500*	
35	Piping		$508,500	$1,586,800	$2,095,300	
36	Insulation		$25,900	$71,900	$97,800	
41	Electrical Equipment	$87,500	$135,200	$408,200	$630,900	
42	Raceway, Cable Tray & Conduit		$37,200	$60,200	$97,400	
43	Cable		$34,300	$121,700	$156,000	
44	Control & Instrumentation	$130,000		$131,100	$261,100	
	SUBTOTAL DIRECT & CONSTRUCTION INDIRECT COST	$2,601,500	$1,048,600	$3,312,500	$6,962,600	
	Other Direct & Construction Indirects					
91-1	Scaffolding			$120,000	$120,000	
31-99	Boiler Injection Port Installation	$48,000	$35,000	$402,200	$485,200	
91-2A	Overtime: 5 - 10 hr days			$431,300	$431,300	
91-2B	Overtime: 6 - 10 hr days			$135,400	$135,400	
91-4	Consumables			$24,000	$24,000	
91-5	Freight on Material		$54,200		$54,200	
	SUBTOTAL	$48,000	$89,200	$1,112,900	$1,250,100	
92	**TOTAL DIRECT & CONSTRUCTION INDIRECT COST**	**$2,649,500**	**$1,137,800**	**$4,425,400**	**$8,212,700**	

Detailed SNCR Cost Estimate Summary - San Juan Generating Station Unit 3

Basis:	S&L Cost Estimte 31804B (11/1/2012)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**Total**	**Notes**
INDIRECT COST						
93-1A	Owner's Engineering				$164,300	2% of Acct. No. 92
93-1B	EPC Engineering				$492,800	6% of Acct. No. 92
93-2	Construction Management				$164,300	2% of Acct. No. 92
93-3	Startup Commissioning				$82,100	1% of Acct. No. 92
93-4	Owner's Cost				$0	
93-5	EPC Fee (% of Total Directs, Indirects)				$1,367,400	15% of Acct. Nos. 92, 93-1 through 93-4
93	**TOTAL INDIRECT COST**				**$2,270,900**	
	Total Escalation					
	Contingency					
95-1	Contingency on Equipment				$265,000	10% of Acct. No. 92
95-2	Contingency on Material				$227,600	20% of Acct. No. 92
95-3	Contingency on Labor				$885,100	20% of Acct. No. 92
95-4	Contingency on Indirect				$454,200	20% of Acct. No. 93
95	**Total Contingency**				**$1,831,900**	
	TOTAL CONSTRUCTION COST				**$12,315,500**	
97	Interest During Construction				$0	
	TOTAL PROJECT COST				**$12,315,500**	

Detailed SNCR Cost Estimate Summary - San Juan Generating Station Unit 4

Basis:	S&L Cost Estimte 31804B (11/1/2012)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**Total**	**Notes**
DIRECT & CONSTRUCTION INDIRECT COST						
11	Demolition & Relocation		$15,000	$35,700	$50,700	
21	Civil Work			$16,600	$16,600	
22	Concrete		$178,800	$304,500	$483,300	
23	Steel		$113,500	$138,800	$252,300	
24	Architectural					
27	Painting & Coating		$200	$7,300	$7,500	
31-17, 31-53	Mechanical Equipment	$2,384,000	$0	$429,700	$2,813,700	
31-53-1	*SNCR System*	*$1,724,000*		*$401,200*	*$2,125,200*	
31-53-2	*CFD Model Study*	*$150,000*			*$150,000*	
31-53-3	*Boiler Tuning*	*$150,000*			*$150,000*	
31-17	*Air Compressor & Accessories*	*$360,000*		*$28,500*	*$388,500*	
35	Piping		$508,500	$1,586,800	$2,095,300	
36	Insulation		$25,900	$71,900	$97,800	
41	Electrical Equipment	$87,500	$135,200	$408,200	$630,900	
42	Raceway, Cable Tray & Conduit		$37,200	$60,200	$97,400	
43	Cable		$34,300	$121,700	$156,000	
44	Control & Instrumentation	$130,000		$131,100	$261,100	
	SUBTOTAL DIRECT & CONSTRUCTION INDIRECT COST	$2,601,500	$1,048,600	$3,312,500	$6,962,600	
	Other Direct & Construction Indirects					
91-1	Scaffolding			$120,000	$120,000	
31-99	Boiler Injection Port Installation	$48,000	$35,000	$402,200	$485,200	
91-2A	Overtime: 5 - 10 hr days			$431,300	$431,300	
91-2B	Overtime: 6 - 10 hr days			$135,400	$135,400	
91-4	Consumables			$24,000	$24,000	
91-5	Freight on Material		$54,200		$54,200	
	SUBTOTAL	$48,000	$89,200	$1,112,900	$1,250,100	
92	**TOTAL DIRECT & CONSTRUCTION INDIRECT COST**	**$2,649,500**	**$1,137,800**	**$4,425,400**	**$8,212,700**	

Detailed SNCR Cost Estimate Summary - San Juan Generating Station Unit 4

Basis:	S&L Cost Estimte 31804B (11/1/2012)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**Total**	**Notes**
INDIRECT COST						
93-1A	Owner's Engineering				$164,300	2% of Acct. No. 92
93-1B	EPC Engineering				$492,800	6% of Acct. No. 92
93-2	Construction Management				$164,300	2% of Acct. No. 92
93-3	Startup Commissioning				$82,100	1% of Acct. No. 92
93-4	Owner's Cost				$0	
93-5	EPC Fee (% of Total Directs, Indirects)				$1,367,400	15% of Acct. Nos. 92, 93-1 through 93-4
93	**TOTAL INDIRECT COST**				**$2,270,900**	
	Total Escalation					
	Contingency					
95-1	Contingency on Equipment				$265,000	10% of Acct. No. 92
95-2	Contingency on Material				$227,600	20% of Acct. No. 92
95-3	Contingency on Labor				$885,100	20% of Acct. No. 92
95-4	Contingency on Indirect				$454,200	20% of Acct. No. 93
95	**Total Contingency**				**$1,831,900**	
	TOTAL CONSTRUCTION COST				**$12,315,500**	
97	Interest During Construction				$0	
	TOTAL PROJECT COST				**$12,315,500**	

Detailed SNCR Cost Estimate Summary - San Juan Generating Station Common Areas (Units 1 & 3)

Basis:	S&L Cost Estimte 31807B (11/1/2011)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**Total**	**Notes**
DIRECT & CONSTRUCTION INDIRECT COST						
11	Demolition & Relocation		$15,000	$35,700	$50,700	
21	Civil Work	$195,000		$8,400	$203,400	
22	Concrete		$39,000	$67,600	$106,600	
23	Steel				$0	
24	Architectural		$705,000	$519,500	$1,224,500	
27	Painting & Coating		$1,000	$24,400	$25,400	
31	Mechanical Equipment	$855,000	$7,200	$158,500	$1,020,700	
31-45	*Fire Protection*		*$7,200*	*$3,000*	*$10,200*	
31-75	*Pumps*	*$60,000*		*$10,600*	*$70,600*	
31-83	*Tanks*	*$45,000*		*$7,900*	*$52,900*	
31-93	*Dilution Water Treatement System*	*$750,000*		*$137,000*	*$887,000*	
35	Piping		$58,100	$137,300	$195,400	
36	Insulation		$4,200	$10,300	$14,500	
41	Electrical Equipment	$117,600	$238,100	$382,800	$738,500	
42	Raceway, Cable Tray & Conduit		$149,700	$468,000	$617,700	
43	Cable		$126,900	$355,900	$482,800	
44	Control & Instrumentation	$30,000		$77,800	$107,800	
	SUBTOTAL DIRECT & CONSTRUCTION INDIRECT COST	$1,197,600	$1,344,200	$2,246,200	$4,788,000	
	Other Direct & Construction Indirects					
91-1	Scaffolding			$90,600	$90,600	
31-99	Boiler Injection Port Installation				$0	
91-2A	Overtime: 5 - 10 hr days			$302,600	$302,600	
91-2B	Overtime: 6 - 10 hr days				$0	
91-4	Consumables			$18,100	$18,100	
91-5	Freight on Material		$67,300		$67,300	
	SUBTOTAL	$0	$67,300	$411,300	$478,600	
92	**TOTAL DIRECT & CONSTRUCTION INDIRECT COST**	**$1,197,600**	**$1,411,500**	**$2,657,500**	**$5,266,600**	

Detailed SNCR Cost Estimate Summary - San Juan Generating Station Common Areas (Units 1 & 3)

Basis:	S&L Cost Estimte 31807B (11/1/2011)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**Total**	**Notes**
INDIRECT COST						
93-1A	Owner's Engineering				$105,300	2% of Acct. No. 92
93-1B	EPC Engineering				$316,000	6% of Acct. No. 92
93-2	Construction Management				$105,300	2% of Acct. No. 92
93-3	Startup Commissioning				$52,700	1% of Acct. No. 92
93-4	Owner's Cost				$0	
93-5	EPC Fee (% of Total Directs, Indirects)				$876,900	15% of Acct. Nos. 92, 93-1 through 93-4
93	**TOTAL INDIRECT COST**				**$1,456,200**	
	Total Escalation					
	Contingency					
95-1	Contingency on Equipment				$119,800	10% of Acct. No. 92
95-2	Contingency on Material				$282,300	20% of Acct. No. 92
95-3	Contingency on Labor				$531,500	20% of Acct. No. 92
95-4	Contingency on Indirect				$291,200	20% of Acct. No. 93
95	**Total Contingency**				**$1,224,800**	
	TOTAL CONSTRUCTION COST				**$7,947,600**	
97	Interest During Construction				$0	
	TOTAL PROJECT COST				**$7,947,600**	

ATTACHMENT B.

SAN JUAN GENERATING STATION

UNITS 1 & 2

SCR COST ESTIMATES

Privileged & Confidential
San Juan Units 1 & 2
SCR Cost Estimate

	Unit 1	Unit 2	
Capacity (MW-gross)	370	370	
Capacity (MW-net)	327	327	
Maximum Heat Input (MMBtu/hr)	3,707	3,688	
Annual Capacity Factor (%)	85%	85%	
Baseline NOx Emission Rate (lb/MMBtu)	0.30	0.30	Adjusted to match Dec. 2012 SNCR Cost Estimate
Baseline NOx Emission Rate (lb/hr)	1,112.1	1,106.4	
Controlled NOx Emission Rate (lb/MMBtu)	0.05	0.05	
Controlled NOx Emission Rate (lb/hr)	185.4	184.4	

SCR COST ANALYSIS

Cost Item	Unit 1	Unit 2	Remarks/Cost Basis
CAPITAL COST			S&L Cost Estaimtes 31326C (Unit 1 SCR); 31327C (Unit 2 SCR); 31328C (Unit 1 & 2 SCR Common Equipment). Common equipment costs were split equally between the two units.
Direct Costs			
Purchased Equipment Costs			
SCR and Economizer Bypass	$14,910,900	$14,910,900	Acct. Nos. A-31
Sorbent Injection System	$880,000	$880,000	Acct. Nos. B-31
Baghouse Handling System	$875,000	$875,000	Acct. Nos. C-33
Anhydrous Ammonia System	$601,500	$601,500	Acct. Nos. D-31
Electrical Equipment	$2,775,100	$2,775,100	Acct. Nos. E-41, E-42, E-43
Instrumentation and Control System	$1,039,000	$1,039,000	Acct. Nos. E-44
Substation and Switchyard Equipmenet	$200,000	$200,000	Acct. Nos. E-51
Flue Gas - Gas Pass Upgrades for SCR			
Mechanical Equipment	$2,768,100	$2,768,100	
Electrical Equipment	$5,777,800	$5,777,800	Applied 80% of Acct. Nos. F-31, F-41, F-42, F-43, F-44, and F-51 (Equipment and Material Costs) to gas pass upgrades required for the SCR Project.
Instrumentation & Controls	$392,000	$392,000	
345 kV Substation Modifications	$470,400	$470,400	
Balanced Draft Conversion			
Mechanical Equipment	$692,000	$692,000	Applied 20% of Acct. Nos. F-31, F-41, F-42, F-43, F-44, and F-51 (Equipment and Material Costs) to account for additional gas pass upgrades that would be required for Balanced Draft Conversion.
Electrical Equipment	$1,444,400	$1,444,400	
Instrumentation & Controls	$98,000	$98,000	
Subtotal Equipment Costs (EC)	$32,924,200	$32,924,200	
Freight on Materials	$1,138,600	$1,153,100	Acct. Nos. 91-5
Total Purchased Equipment Cost (PEC)	$34,062,800	$34,077,300	Equipment Costs + Freight
Direct Installation Costs			
Site Preparation			
SCR Area and Economizer Bypass	$785,100	$785,100	Acct. Nos. A-11 and A-21 (Demolition and Civil Work)
Sorbent Injection System	$27,000	$27,000	Acct. Nos. B-21 (Civil Work)
Baghouse Ash Handling System	$27,800	$24,700	Acct. Nos. C-21 (Civil Work)
Flue Gas - Gas Pass Upgrades for SCR	$22,000	$22,000	Applied 80% of Acct. Nos. F-21 and F-25 (Civil Work/Trenching) to SCR Project
Balanced Draft Conversion	$5,500	$5,500	Applied 20% of Acct. Nos. F-21 and F-25 (Civil Work/Trenching) to Balance Draft
Foundations & Supports			
SCR Area and Economizer Bypass	$14,259,500	$14,506,100	Acct. Nos. A-22 and A-23 (Concrete and Steel)
Sorbent Injection System	$24,600	$24,600	Acct. Nos. B-22 and B-23 (Concrete and Steel)
Baghouse Ash Handling System	$23,500	$18,000	Acct. Nos. C-23 (Steel)
Flue Gas - Gas Pass Upgrades for SCR	$118,200	$24,700	Applied 80% of Acct. Nos. D-22 and D-23 (Concrete/Steel) to SCR Project
Balanced Draft Conversion	$29,600	$6,200	Applied 20% of Acct. Nos. D-22 and D-23 (Concrete/Steel) to Balanced Draft
Handling & Erection (Includes Labor Costs)			
SCR Area and Economizer Bypass	$33,266,300	$44,433,200	Acct. Nos. A-11 through A-36 Labor Costs*
Sorbent Injection System	$122,400	$185,500	Acct. Nos. B-21 through B-36 Labor Costs
Baghouse Ash Handling System	$748,300	$753,500	Acct. Nos. C-21 through C-35 Labor Costs
Anhydrous Ammonia System	$229,700	$465,400	Acct. Nos. D-21 through D-35 Labor Costs
Electrical	$4,538,900	$4,538,900	Acct. Nos. E-41 through E-51 Labor Costs
Flue Gas - Gas Pass Upgrades for SCR	$5,223,500	$5,223,500	Applied 80% of Acct. Nos. F-21 through F-51 (Labor Costs) to SCR Project
Balanced Draft Conversion	$1,305,900	$1,305,900	Applied 20% of Acct. Nos. F-21 through F-51 (Labor Costs) to Balanced Draft
Piping	$186,200	$231,000	Acct. Nos. A-35, B-35, D-35
Insulation	$1,033,400	$1,034,500	Acct. Nos. A-36 and B-36
Scaffolding	$1,749,100	$2,022,000	Acct. Nos. 91-1
Cost Due to Overtime	$5,327,900	$6,527,600	Acct. Nos. 91-2A (working 5 - 10 hour days)
Cost Due to Overtime	$3,993,600	$4,892,900	Acct. Nos. 91-2B (working 7 -12 hour days during the tie-in)
Per Diem	$0	$0	Not Included
Consumables	$349,800	$404,400	Acct. Nos. 91-4
Contractor G&A Expenses	$0	$0	Included in EPC Fee
Contractor Profit	$0	$0	Included in EPC Fee
Total Direct Installation Costs (DIC)	$73,397,800	$87,462,200	
Total Direct Costs (DC) = (PEC) + (DIC)	$107,460,600	$121,539,500	

Privileged & Confidential
San Juan Units 1 & 2
SCR Cost Estimate

Indirect Costs			
EPC Engineering, Procurement and Project Services	$8,720,400	$9,788,900	Acct. Nos. 93-1
EPC Construction Management Support	$3,270,200	$3,670,900	Acct. Nos. 93-2
EPC Startup Commissioning	$1,090,100	$1,223,700	Acct. Nos. 93-3
EPC Fee	$18,312,800	$20,556,700	Acct. Nos. 93-4
Architectural	$250,000	$250,000	Acct. Nos. A-24
Owner's Engineer & Construction Management	$3,777,100	$3,777,100	Acct. Nos. 93-5-1
Performance Testing	$100,000	$100,000	Acct. Nos. 93-5-2
Total Indirect Costs (IC)	$35,520,600	$39,367,300	
New Mexico Gross Receipt Tax (GRT)	$9,025,700	$10,157,200	(DC + IC) X 6.3125%
Project Contingency (PC)	$28,854,900	$32,295,900	Acct. Nos. 95
Total Capital Investment (DC + IC + GRT + PC)	**$180,861,800**	**$203,359,900**	
ANNUAL COST			
Direct Annual Costs			
Fixed Annual Costs			
Operating Labor	$0	$0	Assumed no additional operating labor for the SCR
Maintenance Labor & Materials	$2,712,900	$3,050,400	TCI X 1.5% [EPA Cost Manual Section 4.2, Chapter 2, Eqn. 2.46]
Annual Emissions Testing	$25,000	$25,000	
Catalyst Activity Testing	$5,000	$5,000	
Fly Ash Sampling and Analysis	$20,000	$20,000	
Total Fixed Annual Costs	**$2,762,900**	**$3,100,400**	
Variable Annual Costs			
Reagent Consumption (Ammonia)	$1,051,000	$1,045,600	
Reagent Consumption (DSI)	$22,800	$22,800	
Auxiliary & ID Fan Power	$745,800	$728,600	See, O&M Cost Worksheet
Steam Cost	$72,400	$72,400	
Water Cost	$0	$0	
Catalyst Replacement Cost	$773,000	$773,000	
Total Variable Annual Costs	$2,665,000	$2,642,400	
Total Direct Annual Costs (DAC)	**$5,427,900**	**$5,742,800**	
Indirect Annual Costs			
Capital Recovery Factor (CRF)	0.0925	0.0925	Calculated using 8.44% interest and 30 year equipment life
Cost for Capital Recovery	$16,737,000	$18,819,000	TCI x CRF
Total Indirect Annual Costs (IDAC)	**$16,737,000**	**$18,819,000**	
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$22,164,900**	**$24,561,800**	
Baseline Annual Emissions (tpy)	4,140	4,119	
Project Post-Project Annual Emissions (tpy)	690	687	
Emission Reductions (ton/yr)	3,450	3,432	
Cost Effectiveness ($/ton)	**$6,425**	**$7,157**	
Cost ($/kW)	$489	$550	
Interest Rate	8.44%		
Equipment Economic Life	30		
CRF	0.0925		

*Note: A cost premium of approximately 40% was included in the Unit 2 SCR labor costs (sub-account A-23 including ductwork between the economizer outlet and SCR inlet, SCR outlet and AH inlet, SCR reactor boxes, and support framing) to account for the significant site restrictions and congestion around the Unit 2 SCR compared to the Unit 1 SCR.

SCR O&M Costs

		SJGS Unit 1	SJGS Unit 2
SCR Type		High Dust	High Dust
Plant Gross Capacity	MW	370.0	370.0
Capacity Factor	%	85.00	85.00
NOx Control Rate	lb/MMBtu	0.050	0.050
Average NOx Inlet	lb/MBtu	0.30	0.30
Current Technology		LNB/Neural Network	LNB/Neural Network
Required Efficiency (Average)	%	83.33	83.33
Fuel		New Mexico Bituminous	New Mexico Bituminous
Heat Input to Boiler at Full Load	Btu/hr	3.707E+09	3.688E+09
Fuel Heating Value	Btu/lb	9,502	9,502
Reagent		Anhydrous Ammonia	Anhydrous Ammonia
Average NH_3 Consumption	lb NH3/hr	360	358
Average Reagent Consumption	**tpy**	**1,339**	**1,332**
Ammonia Cost	$/dry ton	785	785
Auxiliary Power Cost	$/MWhr	37	37
Water Cost	$/1000 gal	6	6
Steam Cost	$/MMBtu	5	5
Catalyst replacement	$/$m^3$	8,000	8,000
Hydrated Lime Cost	$/ton	120	120
Initial Catalyst Volume	m^3	604	604
Initial Catalyst Layers		3	3
Catalyst replacement cycle	yrs	2	2
Flue Gas Flow	**acfm**	**2,056,400**	**1,999,900**
Pressure Drop	**in**	**8**	**8**
Increase in Auxiliary Power Consumption - Full Load	kW	2,707	2,645
Increase in Water Consumption	gph	0	0
Steam Usage	MMBtu/hr	1,556	1,556
Steam Quality	MMBtu/lb	1,249	1,249
Dry Sorbent Injection	lb/hr	51	51
Variable O&M Cost:			
Ammonia Cost	$/yr	$1,051,000	$1,045,600
Catalyst Replacement Future Worth Factor		0.48	0.48
Catalyst Replacement Cost*	$/yr	$773,000	$773,000
Auxiliary Power Cost	$/yr	$745,800	$728,600
Steam Cost	$/yr	$72,400	$72,400
Water Cost	$/yr	$0	$0
Dry Sorbent Cost	$/yr	$22,800	$22,800
Total variable O&M Cost	**$/yr**	**$2,665,000**	**$2,642,400**

* Catalyst replacement costs were calculated based on replacing 1 layer of catalyst (approx. 202 m3) once every two years. Catalyst costs were calculated by multiplying the volume of catalyst by the installed unit cost of $8,000/m3 and using a future worth factor of 0.48 calculated as follows:

FWF = i * [1 / (1 + i)y - 1];

where i = an assumed interest rate of 8.44% and y = 2 (i.e., replacing one layer every other year.

See, Control Cost Manual, Section 4.2, Chapter 2, pg. 2-47

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 1

Basis:	S&L Cost Estimte 31326C (10/14/2011 - 2011$)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 1**	**Notes**
A. SCR Area and Economizer Bypass						
A-11	Demolition	$100,000	$0	$1,985,300	$2,085,300	
A-21	Civil Work	$638,500	$46,600	$39,300	$724,400	
A-22	Concrete	$0	$77,000	$127,500	$204,500	
A-23	Steel	$0	$14,157,400	$25,544,300	$39,701,700	
A-31	Mechanical Equipment	$10,805,900	$4,030,000	$3,284,400	$18,120,300	
A-35	Piping	$0	$105,700	$363,300	$469,000	
A-36	Insulation	$0	$1,032,000	$1,821,700	$2,853,700	
	A. Total	**$11,544,400**	**$19,448,700**	**$33,165,800**	**$64,158,900**	
B. Sorbent Injection System						
B-21	Civil Work	$27,000	$0	$800	$27,800	
B-22	Concrete	$0	$6,600	$10,100	$16,700	
B-23	Steel	$0	$18,000	$45,700	$63,700	
B-31	Mechanical Equipment	$880,000	$0	$0	$880,000	
B-35	Piping	$0	$10,900	$63,500	$74,400	
B-36	Insulation	$0	$1,400	$2,300	$3,700	
	B. Total	**$907,000**	**$36,900**	**$122,400**	**$1,066,300**	
C. Baghouse Ash Handling System						
C-21	Civil Work	$0	$27,800	$41,500	$69,300	
C-23	Steel	$0	$23,500	$24,300	$47,800	
C-33	Material Handling Equipment	$875,000	$0	$682,500	$1,557,500	
C-35	Piping	$0	$0	$0	$0	
	C. Total	**$875,000**	**$51,300**	**$748,300**	**$1,674,600**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 1

Basis:	S&L Cost Estimte 31326C (10/14/2011 - 2011S)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 1**	**Notes**
D. Anhydrous Ammonia						
D-31	Mechanical Equipment	$181,000	$0	$16,300	$197,300	
D-35	Piping	$0	$69,600	$176,300	$245,900	
	D. Total	**$181,000**	**$69,600**	**$192,600**	**$443,200**	
E. Electrical						
E-41	Electrical Equipment	$1,194,500	$158,400	$711,500	$2,064,400	
E-42	Cable Tray	$0	$368,400	$999,700	$1,368,100	
E-43	Cable	$0	$1,053,800	$2,401,700	$3,455,500	
E-44	Control & Instrumentation	$1,039,000	$0	$426,000	$1,465,000	
E-51	Substation, Switchyard & Transmission Line	$200,000	$0	$0	$200,000	
	E. Total	**$2,433,500**	**$1,580,600**	**$4,538,900**	**$8,553,000**	
F. Balanced Draft Conversion						
F-21	Civil Work	$0	$27,200	$105,000	$132,200	
F-22	Concrete	$0	$116,900	$262,800	$379,700	
F-23	Steel	$0	$30,900	$29,700	$60,600	
F-31	Mechanical Equipment	$3,340,100	$120,000	$2,590,400	$6,050,500	
F-41	Electrical Equipment	$4,329,000	$1,053,200	$1,542,100	$6,924,300	
F-42	Raceway, Cable Tray & Conduit	$660,000	$0	$1,400,400	$2,060,400	
F-43	Medium Voltage Power Cable & Termination	$0	$114,900	$195,000	$309,900	
F-44	Control & Instrumentation	$490,000	$0	$84,000	$574,000	
	F. Total	**$8,819,100**	**$1,463,100**	**$6,209,400**	**$16,491,600**	
G. Construction Equipment Supplement						
	G. Total			**$1,757,600**	**$1,757,600**	
90	**Subtotal**	**$24,760,000**	**$22,650,200**	**$46,735,000**	**$94,145,200**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 1

Basis:	S&L Cost Estimte 31326C (10/14/2011 - 2011$)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 1**	**Notes**
91	**Other Direct & Construction Indirect Costs**					
91-1	Scaffolding			$1,734,600	$1,734,600	2.5% of Acct. No. 90 Labor & Materials
91-2A	Cost Due to overtime working 5 - 10 hour days			$5,276,200	$5,276,200	
91-2B	Cost Due to overtime working 7 - 12 hour days during the tie-in outage			$3,954,800	$3,954,800	
91-3	Per Diem				$0	Not Included
91-4	Consumables			$346,900	$346,900	0.5% of Acct. No. 90 Labor & Materials
91-5	Freight on materials		$1,132,500		$1,132,500	5% of Acct. No. 90 (Material Costs)
91-7	Sales Tax				$0	Not Included (See, Acct. No. 96A below)
91-9	Contractor G&A Expenses				$0	Included in EPC Fee
91-10	Contractor Profit				$0	Included in EPC Fee
	91. Subtotal	**$0**	**$1,132,500**	**$11,312,500**	**$12,445,000**	
92	**Total Direct & Construction Indirect Cost**	**$24,760,000**	**$23,782,700**	**$58,047,500**	**$106,590,200**	
93	**Indirect Costs**					
93-1	EPC Engineering, Procurement & Project Services				$8,527,200	8% of Acct. No. 92
93-2	EPC Construction Management Support				$3,197,700	3% of Acct. No. 92
93-3	EPC Startup Commissioning				$1,065,900	1% of Acct. No. 92
93-4	EPC Fee				$17,907,200	15% of Acct. Nos. 92, 93.1, 93.2, 93.3
93-5	Owner's Costs				$0	
93-5-1	Owner's Engineer & Construction Management				$3,777,100	By PNM
93-5-2	Performance Testing				$100,000	
93-5-3	Anhydrous Ammonia Risk Management & Training				$0	
	93. Total				**$34,575,100**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 1

Basis:	S&L Cost Estimte 31326C (10/14/2011 - 2011S)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 1**	**Notes**
94	Total Escalation					
95	Total Contingency				$28,233,000	20% of 92 + 93
96	Total Construction Cost				$169,398,300	
96A	New Mexico Gross Receipt Tax (NMGRT)				$10,693,300	
96B	Total Construction Cost with NMGRT				$180,091,600	
97	Interest During Construction					Not Included
97A	Lost Generation During Extended Outage					Not Included
98	**TOTAL PROJECT COST**				**$180,091,600**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 2

Basis: S&L Cost Estimate No. 31327C (10/14/2011 - 2011$)						
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 2**	**Notes**
A. SCR Area and Economizer Bypass						
A-11	Demolition	$100,000	$0	$1,985,300	$2,085,300	
A-21	Civil Work	$638,500	$46,600	$39,300	$724,400	
A-22	Concrete	$0	$77,000	$127,500	$204,500	
A-23	Steel	$0	$14,404,000	$36,711,200	$51,115,200	
A-31	Mechanical Equipment	$10,805,900	$4,030,000	$3,284,400	$18,120,300	
A-35	Piping	$0	$105,700	$363,300	$469,000	
A-36	Insulation	$0	$1,032,000	$1,821,700	$2,853,700	
	A. Total	**$11,544,400**	**$19,695,300**	**$44,332,700**	**$75,572,400**	
B. Sorbent Injection System						
B-21	Civil Work	$27,000	$0	$800	$27,800	
B-22	Concrete	$0	$6,600	$10,100	$16,700	
B-23	Steel	$0	$18,000	$64,000	$82,000	
B-31	Mechanical Equipment	$880,000	$0	$0	$880,000	
B-35	Piping	$0	$18,400	$106,600	$125,000	
B-36	Insulation	$0	$2,500	$4,000	$6,500	
	B. Total	**$907,000**	**$45,500**	**$185,500**	**$1,138,000**	
C. Baghouse Ash Handling System						
C-21	Civil Work	$0	$24,700	$36,900	$61,600	
C-23	Steel	$0	$23,500	$34,100	$57,600	
C-33	Material Handling Equipment	$875,000	$0	$682,500	$1,557,500	
C-35	Piping	$0	$0	$0	$0	
	C. Total	**$875,000**	**$48,200**	**$753,500**	**$1,676,700**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 2

Basis:	S&L Cost Estimate No. 31327C (10/14/2011 - 2011$)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 2**	**Notes**
D. Anhydrous Ammonia						
D-31	Mechanical Equipment	$181,000	$0	$16,300	$197,300	
D-35	Piping	$0	$106,900	$412,000	$518,900	
	D. Total	**$181,000**	**$106,900**	**$428,300**	**$716,200**	
E. Electrical						
E-41	Electrical Equipment	$1,194,500	$158,400	$711,500	$2,064,400	
E-42	Cable Tray	$0	$368,400	$999,700	$1,368,100	
E-43	Cable	$0	$1,053,800	$2,401,700	$3,455,500	
E-44	Control & Instrumentation	$1,039,000	$0	$426,000	$1,465,000	
E-51	Substation, Switchyard & Transmission Line	$200,000	$0	$0	$200,000	
	E. Total	**$2,433,500**	**$1,580,600**	**$4,538,900**	**$8,553,000**	
F. Balanced Draft Conversion						
F-21	Civil Work	$0	$27,200	$105,000	$132,200	
F-22	Concrete	$0	$116,900	$262,800	$379,700	
F-23	Steel	$0	$30,900	$29,700	$60,600	
F-31	Mechanical Equipment	$3,340,100	$120,000	$2,590,400	$6,050,500	
F-41	Electrical Equipment	$4,329,000	$1,053,200	$1,542,100	$6,924,300	
F-42	Raceway, Cable Tray & Conduit	$660,000	$0	$1,400,400	$2,060,400	
F-43	Medium Voltage Power Cable & Termination	$0	$114,900	$195,000	$309,900	
F-44	Control & Instrumentation	$490,000	$0	$84,000	$574,000	
	F. Total	**$8,819,100**	**$1,463,100**	**$6,209,400**	**$16,491,600**	
G. Construction Equipment Supplement						
	G. Total			**$912,900**	**$912,900**	
90	**Subtotal**	**$24,760,000**	**$22,939,600**	**$57,361,200**	**$105,060,800**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 2

Basis:	S&L Cost Estimate No. 31327C (10/14/2011 - 2011$)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 2**	**Notes**
91	**Other Direct & Construction Indirect Costs**					
91-1	Scaffolding			$2,007,500	$2,007,500	2.5% of Acct. No. 90 Labor & Materials
91-2A	Cost Due to overtime working 5 - 10 hour days			$6,475,900	$6,475,900	
91-2B	Cost Due to overtime working 7 - 12 hour days during the tie-in outage			$4,854,100	$4,854,100	
91-3	Per Diem				$0	Not Included
91-4	Consumables			$401,500	$401,500	0.5% of Acct. No. 90 Labor & Materials
91-5	Freight on materials		$1,147,000		$1,147,000	5% of Acct. No. 90 (Material Costs)
91-7	Sales Tax				$0	Not Included (See, Acct. No. 96A below)
91-9	Contractor G&A Expenses				$0	Included in EPC Fee
91-10	Contractor Profit				$0	Included in EPC Fee
	91. Subtotal	**$0**	**$1,147,000**	**$13,739,000**	**$14,886,000**	
92	**Total Direct & Construction Indirect Cost**	**$24,760,000**	**$24,086,600**	**$71,100,200**	**$119,946,800**	
93	**Indirect Costs**					
93-1	EPC Engineering, Procurement & Project Services				$9,595,700	8% of Acct. No. 92
93-2	EPC Construction Management Support				$3,598,400	3% of Acct. No. 92
93-3	EPC Startup Commissioning				$1,199,500	1% of Acct. No. 92
93-4	EPC Fee				$20,151,100	15% of Acct. Nos. 92, 93.1, 93.2, 93.3
93-5	Owner's Costs				$0	
93-5-1	Owner's Engineer & Construction Management				$3,777,100	By PNM
93-5-2	Performance Testing				$100,000	
93-5-3	Anhydrous Ammonia Risk Management & Training				$0	
	93. Total				**$38,421,800**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 2

Basis:	S&L Cost Estimate No. 31327C (10/14/2011 - 2011$)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 2**	**Notes**
94	Total Escalation					
95	Total Contingency				$31,674,000	20% of 92 + 93
96	Total Construction Cost				$190,042,600	
96A	New Mexico Gross Receipt Tax (NMGRT)				$11,996,400	
96B	Total Construction Cost with NMGRT				$202,039,000	
97	Interest During Construction					Not Included
97A	Lost Generation During Extended Outage					Not Included
98	**TOTAL PROJECT COST**				**$202,039,000**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Units 1 & 2 Common

Basis: S&L Cost Estimate No. 31327C (10/14/2011 - 2011$)						
Acct. No.	Description	Equipment Cost	Material Cost	Labor Cost	SJGS Units 1 & 2 Common	Notes
A. SCR Area and Economizer Bypass						
A-22	Concrete	$0	$13,300	$20,000	$33,300	
A-23	Steel	$0	$36,900	$43,300	$80,200	
A-24	Architectural	$500,000	$0	$123,200	$623,200	
A-31	Mechanical Equipment	$150,000	$0	$14,500	$164,500	
	A. Total	**$650,000**	**$50,200**	**$201,000**	**$901,200**	
D. Anhydrous Ammonia						
D-21	Civil Work	$0	$0	$0	$0	
D-22	Concrete	$0	$13,800	$23,000	$36,800	
D-31	Mechanical Equipment	$841,000	$0	$51,200	$892,200	
	D. Total	**$841,000**	**$13,800**	**$74,200**	**$929,000**	
F. Balanced Draft Conversion						
F-21	Civil Work	$0	$0	$0	$0	
F-25	Earthwork, Excavation, Trench	$0	$500	$2,300	$2,800	
F-35	Piping	$0	$0	$0	$0	
F-41	Electrical Equipment	$875,000	$79,100	$300,800	$1,254,900	
F-51	345kV Substation & Transmission Line	$1,075,300	$100,800	$336,800	$1,512,900	
	F. Total	**$1,950,300**	**$180,400**	**$639,900**	**$2,770,600**	
90	**Subtotal**	**$3,441,300**	**$244,400**	**$915,100**	**$4,600,800**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Units 1 & 2 Common

Basis:	S&L Cost Estimate No. 31327C (10/14/2011 - 2011$)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Units 1 & 2 Common**	**Notes**
91	**Other Direct & Construction Indirect Costs**					
91-1	Scaffolding			$29,000	$29,000	2.5% of Acct. No. 90 Labor & Materials
91-2A	Cost Due to overtime working 5 - 10 hour days			$103,300	$103,300	
91-2B	Cost Due to overtime working 7 - 12 hour days during the tie-in outage			$77,500	$77,500	
91-3	Per Diem				$0	Not Included
91-4	Consumables			$5,800	$5,800	0.5% of Acct. No. 90 Labor & Materials
91-5	Freight on materials		$12,200		$12,200	5% of Acct. No. 90 (Material Costs)
91-7	Sales Tax				$0	Not Included (See, Acct. No. 96A below)
91-9	Contractor G&A Expenses				$0	Included in EPC Fee
91-10	Contractor Profit				$0	Included in EPC Fee
	91. Subtotal	**$0**	**$12,200**	**$215,600**	**$227,800**	
92	**Total Direct & Construction Indirect Cost**	**$3,441,300**	**$256,600**	**$1,130,700**	**$4,828,600**	
93	**Indirect Costs**					
93-1	EPC Engineering, Procurement & Project Services				$386,300	8% of Acct. No. 92
93-2	EPC Construction Management Support				$144,900	3% of Acct. No. 92
93-3	EPC Startup Commissioning				$48,300	1% of Acct. No. 92
93-4	EPC Fee				$811,200	15% of Acct. Nos. 92, 93.1, 93.2, 93.3
93-5	Owner's Costs				$0	
93-5-1	Owner's Engineer & Construction Management				$0	Included in Units 1 & 2 Costs
93-5-2	Performance Testing				$0	Included in Units 1 & 2 Costs
93-5-3	Anhydrous Ammonia Risk Management & Training				$0	
	93. Total				**$1,390,700**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Units 1 & 2 Common

Basis:	S&L Cost Estimate No. 31327C (10/14/2011 - 2011$)					
Acct. No.	Description	Equipment Cost	Material Cost	Labor Cost	SJGS Units 1 & 2 Common	Notes
94	Total Escalation					
95	Total Contingency				$1,243,800	20% of 92 + 93
96	Total Construction Cost				$7,463,100	
96A	New Mexico Gross Receipt Tax (NMGRT)				$471,100	
96B	Total Construction Cost with NMGRT				$7,934,200	
97	Interest During Construction					Not Included
97A	Lost Generation During Extended Outage					Not Included
98	**TOTAL PROJECT COST**				**$7,934,200**	

ATTACHMENT C.

SAN JUAN GENERATING STATION

UNITS 3 & 4

SCR COST ESTIMATES

Privileged & Confidential
San Juan Units 3 & 4
SCR Cost Estimate

	Unit 3	Unit 4	
Capacity (MW-gross)	544	544	
Capacity (MW-net)	497	507	
Maximum Heat Input (MMBtu/hr)	5,758	5,649	
Annual Capacity Factor (%)	85%	85%	
Baseline NOx Emission Rate (lb/MMBtu)	0.30	0.30	Adjusted to match Dec. 2012 SNCR Cost Estimate
Baseline NOx Emission Rate (lb/hr)	1,727.4	1,694.7	
Controlled NOx Emission Rate (lb/MMBtu)	0.05	0.05	
Controlled NOx Emission Rate (lb/hr)	287.9	282.5	

SCR COST ANALYSIS

Cost Item	Unit 3	Unit 4	Remarks/Cost Basis
CAPITAL COST			S&L Cost Estaimtes 31329C (Unit 3 SCR); 31330C (Unit 4 SCR); 31331C (Units 1, 2, 3 & 4 SCR Common Equipment). Common equipment costs in estimate 31330C were split equally between the larger units (Units 3 & 4)
Direct Costs			
Purchased Equipment Costs			
SCR and Economizer Bypass	$21,436,700	$21,436,700	Acct. Nos. A-31
Sorbent Injection System	$880,000	$880,000	Acct. Nos. B-31
Baghouse Handling System	$810,000	$810,000	Acct. Nos. C-33
Anhydrous Ammonia System	$1,256,500	$1,256,500	Common Costs for all 4 SCR control systems, split equally between Units 3 & 4. Acct. Nos. D-31, D-41, D-42, D-43, D-44, D-51
Electrical Equipment	$2,314,200	$2,314,200	Acct. Nos. E-41, E-42, E-43
Instrumentation and Control System	$1,429,000	$1,429,000	Acct. Nos. E-44
Substation and Switchyard Equipmenet	$200,000	$200,000	Acct. Nos. E-51
Flue Gas - Gas Pass Upgrades for SCR			
Mechanical Equipment	$4,687,700	$4,687,700	
Electrical Equipment	$4,606,300	$4,606,300	Applied 80% of Acct. Nos. F-31, F-41, F-42, F-43, F-44, and F-51 (Equipment and
Instrumentation & Controls	$432,000	$432,000	Material Costs) to gas pass upgrades required for the SCR Project.
345 kV Substation Modifications	$6,000	$6,000	
Balanced Draft Conversion			
Mechanical Equipment	$1,171,900	$1,171,900	
Electrical Equipment	$1,151,600	$1,151,600	Applied 20% of Acct. Nos. F-31, F-41, F-42, F-43, F-44, and F-51 (Equipment and Material Costs) to account for additional gas pass upgrades that would be required
Instrumentation & Controls	$108,000	$108,000	for Balanced Draft Conversion.
345 kV Substation Modifications	$1,500	$1,500	
Subtotal Equipment Costs (EC)	$40,491,400	$40,491,400	
Freight on Materials	$1,572,600	$1,573,400	Acct. Nos. 91-5
Total Purchased Equipment Cost (PEC)	$42,064,000	$42,064,800	Equipment Costs + Freight
Direct Installation Costs			
Site Preparation			
SCR Area and Economizer Bypass	$146,600	$146,600	Acct. Nos. A-11 and A-21 (Demolition and Civil Work)
Sorbent Injection System	$89,500	$89,500	Acct. Nos. B-21 (Civil Work)
Baghouse Ash Handling System	$27,800	$15,500	Acct. Nos. C-21 (Civil Work)
Anhydrous Ammonia	$20,600	$20,600	Common Costs for all 4 SCR control systems, split equally between Units 3 & 4. Acct. Nos. D-11 and D-21 (Demolition and Civil Work)
Flue Gas - Gas Pass Upgrades for SCR	$1,300	$1,300	Applied 80% of Acct. No. F-21 (Civil Work) to SCR Project
Balanced Draft Conversion	$300	$300	Applied 20% of Acct. No. F-21 (Civil Work) to Balance Draft
Foundations & Supports			
SCR Area and Economizer Bypass	$21,283,200	$21,283,200	Acct. Nos. A-22 and A-23 (Concrete and Steel)
Sorbent Injection System	$24,600	$24,600	Acct. Nos. B-22 and B-23 (Concrete and Steel)
Baghouse Ash Handling System	$23,500	$23,500	Acct. Nos. C-23 (Steel)
Anhydrous Ammonia	$35,900	$35,900	Common Costs for all 4 SCR control systems, split equally between Units 3 & 4. Acct. Nos. D-22 and D-23 (Concrete and Steel)
Flue Gas - Gas Pass Upgrades for SCR	$52,200	$52,200	Applied 80% of Acct. Nos. F-22 and F-32 (Concrete/Steel) to SCR Project
Balanced Draft Conversion	$13,000	$13,000	Applied 20% of Acct. Nos. F-22 and F-32 (Concrete/Steel) to Balanced Draft
Handling & Erection (Includes Labor Costs)			
SCR Area and Economizer Bypass	$62,504,500	$47,632,300	Acct. Nos. A-11 through A-36 Labor Costs*
Sorbent Injection System	$191,000	$172,700	Acct. Nos. B-21 through B-36 Labor Costs
Baghouse Ash Handling System	$707,400	$679,200	Acct. Nos. C-21 through C-35 Labor Costs
Anhydrous Ammonia System	$1,227,500	$1,407,100	Acct. Nos. D-21 through D-35 Labor Costs
Electrical	$4,636,900	$4,636,900	Acct. Nos. E-41 through E-51 Labor Costs
Flue Gas - Gas Pass Upgrades for SCR	$1,114,600	$1,114,600	Applied 80% of Acct. Nos. F-21 through F-51 (Labor Costs) and F-51 (Construction Power) to SCR Project
Balanced Draft Conversion	$1,114,600	$1,114,600	Applied 20% of Acct. Nos. F-21 through F-51 (Labor Costs) and F-51 (Construction Power) to Balanced Draft Conversion
Construction Equipment Supplement (Labor)	$912,900	$277,800	Acct. Nos. G-61 (Labor)
Piping	$307,900	$336,300	Acct. Nos. A-35, B-35, C-35, D-35
Insulation	$1,589,000	$1,589,000	Acct. Nos. A-36 and B-36
Construction Equipment Supplement (Cranes)	$0	$1,479,800	Acct. Nos. G-61
Scaffolding	$2,680,000	$2,296,000	Acct. Nos. 91-1
Cost Due to Overtime	$8,570,900	$6,835,200	Acct. Nos. 91-2A (working 5 - 10 hour days)
Cost Due to Overtime	$6,327,200	$5,026,200	Acct. Nos. 91-2B (working 7 -12 hour days during the tie-in)
Per Diem	$0	$0	Not Included
Consumables	$536,100	$459,300	Acct. Nos. 91-4
Contractor G&A Expenses	$0	$0	Included in EPC Fee
Contractor Profit	$0	$0	Included in EPC Fee
Total Direct Installation Costs (DIC)	$114,139,000	$96,763,200	
Total Direct Costs (DC) = (PEC) + (DIC)	$156,203,000	$138,828,000	

Privileged & Confidential
San Juan Units 3 & 4
SCR Cost Estimate

Indirect Costs			
EPC Engineering, Procurement and Project Services	$12,803,500	$11,413,500	Acct. Nos. 93-1
EPC Construction Management Support	$4,801,300	$4,280,000	Acct. Nos. 93-2
EPC Startup Commissioning	$1,600,500	$1,426,700	Acct. Nos. 93-3
EPC Fee	$26,887,200	$23,968,200	Acct. Nos. 93-4
Architectural	$503,500	$503,500	Acct. Nos. A-24 and D-24
Owner's Engineer & Construction Management	$5,742,700	$5,742,700	Acct. Nos. 93-5-1
Performance Testing	$100,000	$100,000	Acct. Nos. 93-5-2
Total Indirect Costs (IC)	$52,438,700	$47,434,600	
New Mexico Gross Receipt Tax (GRT)	$13,170,500	$11,757,800	(DC + IC) X 6.3125%
Project Contingency (PC)	$42,395,600	$37,919,600	Acct. Nos. 95
Total Capital Investment (DC + IC + GRT + PC)	**$264,207,800**	**$235,940,000**	
ANNUAL COST			
Direct Annual Costs			
Fixed Annual Costs			
Operating Labor	$0	$0	Assumed no additional operating labor for the SCR
Maintenance Labor & Materials	$3,963,100	$3,539,100	TCI X 1.5% [EPA Cost Manual Section 4 2, Chapter 2, Eqn. 2.46]
Annual Emissions Testing	$25,000	$25,000	
Catalyst Activity Testing	$5,000	$5,000	
Fly Ash Sampling and Analysis	$20,000	$20,000	
Total Fixed Annual Costs	**$4,013,100**	**$3,589,100**	
Variable Annual Costs			
Reagent Consumption (Ammonia)	$1,632,500	$1,601,600	
Reagent Consumption (DSI)	$72,400	$72,400	
Auxiliary & ID Fan Power	$1,107,200	$1,101,800	See, O&M Costs Worksheet
Steam Cost	$108,500	$108,500	
Water Cost	$0	$0	
Catalyst Replacement Cost	$1,201,000	$1,201,000	
Total Variable Annual Costs	$4,121,600	$4,085,300	
Total Direct Annual Costs (DAC)	**$8,134,700**	**$7,674,400**	
Indirect Annual Costs			
Capital Recovery Factor (CRF)	0.0925	0.0925	Calculated using 8.44% interest and 30 year equipment life
Cost for Capital Recovery	$24,450,000	$21,834,000	TCI x CRF
Total Indirect Annual Costs (IDAC)	**$24,450,000**	**$21,834,000**	
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$32,584,700**	**$29,508,400**	
Baseline Annual Emissions (tpy)	6,431	6,309	
Project Post-Project Annual Emissions (tpy)	1,072	1,052	
Emission Reductions (ton/yr)	5,359	5,257	
Cost Effectiveness ($/ton)	**$6,080**	**$5,613**	
Cost ($/kW)	$486	$434	
Interest Rate	8.44%		
Lifetime	30		
CRF	0.0925		

*Note: A cost premium of approximately 40% was included in the Unit 3 SCR labor costs (sub-account A-23 including ductwork between the economizer outlet and SCR inlet, SCR outlet and AH inlet, SCR reactor boxes, and support framing) to account for the significant site restrictions and congestion around the Unit 3 SCR compared to the Unit 4 SCR.

SCR O&M Costs

		SJGS Unit 3	SJGS Unit 4
SCR Type		High Dust	High Dust
Plant Gross Capacity	MW	544.0	544.0
Capacity Factor	%	85.00	85.00
NOx Control Rate	lb/MMBtu	0.050	0.050
Average NOx Inlet	lb/MBtu	0.30	0.30
Current Technology		LNB/Neural Network	LNB/Neural Network
Required Efficiency (Average)	%	83.33	83.33
Fuel		New Mexico Bituminous	New Mexico Bituminous
Heat Input to Boiler at Full Load	Btu/hr	5.758E+09	5.649E+09
Fuel Heating Value	Btu/lb	9,502	9,502
Reagent		Anhydrous Ammonia	Anhydrous Ammonia
Average NH_3 Consumption	lb NH3/hr	559	548
Average Reagent Consumption	**tpy**	**2,080**	**2,040**
Ammonia Cost	$/dry ton	785	785
Auxiliary Power Cost	$/MWhr	37	37
Water Cost	$/1000 gal	6	6
Steam Cost	$/MMBtu	5	5
Catalyst replacement	$/m^3	8,000	8,000
Hydrated Lime Cost	$/ton	120	120
Initial Catalyst Volume	m^3	938	938
Initial Catalyst Layers		3	3
Catalyst replacement cycle	yrs	2	2
Flue Gas Flow	**acfm**	**3,206,400**	**3,191,200**
Pressure Drop	**in**	**8**	**8**
Increase in Auxiliary Power Consumption - Full Load	kW	4,019	3,999
Increase in Water Consumption	gph	0	**0**
Steam Usage	lb/hr	2,333	2,333
Steam Quality	MMBtu/lb	1,249	1,249
Dry Sorbent Injection	lb/hr	162	162
Variable O&M Cost:			
Ammonia Cost	$/yr	$1,632,500	$1,601,600
Catalyst Replacement Future Worth Factor		0.48	0.48
Catalyst Replacement Cost*	$/yr	$1,201,000	$1,201,000
Auxiliary Power Cost	$/yr	$1,107,200	$1,101,800
Steam Cost	$/yr	$108,500	$108,500
Water Cost	$/yr	$0	$0
Dry Sorbent Cost	$/yr	$72,400	$72,400
Total Variable O&M Cost	**$/yr**	**$4,121,600**	**$4,085,300**

* Catalyst replacement costs were calculated based on replacing 1 layer of catalyst (approx. 202 m^3) once every two years. Catalyst costs were calculated by multiplying the volume of catalyst by the installed unit cost of $8,000/m^3 and using a future worth factor of 0.48 calculated as follows:

FWF = i * [1 / (1 + i)y - 1];

where i = an assumed interest rate of 8.44% and y = 2 (i.e., replacing one layer every other year.

See, Control Cost Manual, Section 4.2, Chapter 2, pg. 2-47

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 3

Basis: S&L Cost Estimte 31329C (10/14/2011)						
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 3**	**Notes**
A. SCR Area and Economizer Bypass						
A-11	Demolition	$100,000	$0	$2,265,800	$2,365,800	
A-21	Civil Work	$0	$46,600	$36,500	$83,100	
A-22	Concrete	$0	$46,600	$72,200	$118,800	
A-23	Steel	$0	$21,236,600	$52,052,300	$73,288,900	
A-24	Architectural	$500,000	$0	$123,200	$623,200	
A-31	Mechanical Equipment	$15,236,800	$6,199,900	$4,636,200	$26,072,900	
A-35	Piping	$0	$154,200	$522,200	$676,400	
A-36	Insulation	$0	$1,584,000	$2,796,100	$4,380,100	
	A. Total	**$15,836,800**	**$29,267,900**	**$62,504,500**	**$107,609,200**	
B. Sorbent Injection System						
B-21	Civil Work	$89,500	$0	$800	$90,300	
B-22	Concrete	$0	$6,600	$10,100	$16,700	
B-23	Steel	$0	$18,000	$64,000	$82,000	
B-31	Mechanical Equipment	$880,000	$0	$0	$880,000	
B-35	Piping	$0	$18,600	$108,100	$126,700	
B-36	Insulation	$0	$5,000	$8,000	$13,000	
	B. Total	**$969,500**	**$48,200**	**$191,000**	**$1,208,700**	
C. Baghouse Ash Handling System						
C-21	Civil Work	$0	$27,800	$41,500	$69,300	
C-23	Steel	$0	$23,500	$34,100	$57,600	
C-33	Material Handling Equipment	$810,000	$0	$631,800	$1,441,800	
C-35	Piping	$0	$0	$0	$0	
	C. Total	**$810,000**	**$51,300**	**$707,400**	**$1,568,700**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 3

Basis: S&L Cost Estimte 31329C (10/14/2011)						
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 3**	**Notes**
D. Anhydrous Ammonia						
D-21	Civil Work	$0	$0	$0	$0	
D-22	Concrete	$0	$13,800	$23,000	$36,800	
D-31	Mechanical Equipment	$972,000	$0	$59,200	$1,031,200	
D-35	Piping	$0	$67,600	$169,000	$236,600	
	D. Total	**$972,000**	**$81,400**	**$251,200**	**$1,304,600**	
E. Electrical						
E-41	Electrical Equipment	$854,500	$168,400	$687,400	$1,710,300	
E-42	Conduit	$0	$352,300	$934,300	$1,286,600	
E-43	Control & Instrument Cable	$0	$939,000	$2,336,500	$3,275,500	
E-44	Control & Instrumentation	$1,429,000	$0	$678,700	$2,107,700	
E-51	Substation, Switchyard & Transmission Line	$200,000	$0	$0	$200,000	
	E. Total	**$2,483,500**	**$1,459,700**	**$4,636,900**	**$8,580,100**	
F. Balanced Draft Conversion						
F-21	Civil Work	$0	$1,600	$18,700	$20,300	
F-22	Concrete	$0	$20,500	$49,500	$70,000	
F-23	Steel	$0	$44,700	$43,000	$87,700	
F-31	Mechanical Equipment	$5,787,600	$72,000	$3,508,900	$9,368,500	
F-41	Electrical Equipment	$4,983,000	$0	$302,600	$5,285,600	
F-42	Raceway, Cable Tray & Conduit	$660,000	$0	$1,400,400	$2,060,400	
F-43	Medium Voltage Power Cable & Termination	$0	$114,900	$152,500	$267,400	
F-44	Control & Instrumentation	$540,000	$0	$90,000	$630,000	
F-51	Construction Power	$7,500	$0	$0	$7,500	
	F. Total	**$11,978,100**	**$253,700**	**$5,565,600**	**$17,797,400**	
G. Construction Equipment Supplement						
G-61	Construction Equipment	$0	$0	$912,900	$912,900	
	G. Total	**$0**	**$0**	**$912,900**	**$912,900**	
90	**Subtotal**	**$33,049,900**	**$31,162,200**	**$74,769,500**	**$138,981,600**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 3

Basis:	S&L Cost Estimte 31329C (10/14/2011)					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 3**	**Notes**
91	**Other Direct & Construction Indirect Costs**					
91-1	Scaffolding			$2,648,300	$2,648,300	2.5% of Acct. No. 90 Labor & Materials
91-2A	Cost Due to overtime working 5 - 10 hour days			$8,441,200	$8,441,200	
91-2B	Cost Due to overtime working 7 - 12 hour days during the tie-in outage			$6,327,200	$6,327,200	
91-3	Per Diem				$0	Not Included
91-4	Consumables			$529,700	$529,700	0.5% of Acct. No. 90 Labor & Materials
91-5	Freight on materials		$1,558,100		$1,558,100	5% of Acct. No. 90 (Material Costs)
91-7	Sales Tax				$0	Not Included (See, Acct. No. 96A below)
91-9	Contractor G&A Expenses				$0	Included in EPC Fee
91-10	Contractor Profit				$0	Included in EPC Fee
	91. Total	**$0**	**$1,558,100**	**$17,946,400**	**$19,504,500**	
92	**Total Direct & Construction Indirect Cost**	**$33,049,900**	**$32,720,300**	**$92,715,900**	**$158,486,100**	
93	**Indirect Costs**					
93-1	EPC Engineering, Procurement & Project Services				$12,678,900	8% of Acct. No. 92
93-2	EPC Construction Management Support				$4,754,600	3% of Acct. No. 92
93-3	EPC Startup Commissioning				$1,584,900	1% of Acct. No. 92
93-4	EPC Fee				$26,625,700	15% of Acct. Nos. 92, 93.1, 93.2, 93.3
93-5	Owner's Costs				$0	
93-5-1	Owner's Engineer & Construction Management				$5,668,138	By PNM
93-5-2	Performance Testing				$100,000	
93-5-3	Anhydrous Ammonia Risk Management & Training				$0	
	93. Total				**$51,412,238**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 3

Basis: S&L Cost Estimte 31329C (10/14/2011)						
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 3**	**Notes**
94	Total Escalation					
95	Total Contingency				$41,979,700	20% of 92 + 93
96	Total Construction Cost				$251,878,038	
96A	New Mexico Gross Receipt Tax (NMGRT)				$15,899,801	
96B	Total Construction Cost with NMGRT				$267,777,839	
97	Interest During Construction					Not Included
98	**TOTAL PROJECT COST**				**$267,777,839**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 4

Basis:	S&L Cost Estimate No. 31327C 10/14/2011					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 4**	**Notes**
A. SCR Area and Economizer Bypass						
A-11	Demolition	$100,000	$0	$2,265,800	$2,365,800	
A-21	Civil Work	$0	$46,600	$36,500	$83,100	
A-22	Concrete	$0	$46,600	$72,200	$118,800	
A-23	Steel	$0	$21,236,600	$37,180,100	$58,416,700	
A-24	Architectural	$500,000	$0	$123,200	$623,200	
A-31	Mechanical Equipment	$15,236,800	$6,199,900	$4,636,200	$26,072,900	
A-35	Piping	$0	$154,200	$522,200	$676,400	
A-36	Insulation	$0	$1,584,000	$2,796,100	$4,380,100	
	A. Total	**$15,836,800**	**$29,267,900**	**$47,632,300**	**$92,737,000**	
B. Sorbent Injection System						
B-21	Civil Work	$89,500	$0	$800	$90,300	
B-22	Concrete	$0	$6,600	$10,100	$16,700	
B-23	Steel	$0	$18,000	$45,700	$63,700	
B-31	Mechanical Equipment	$880,000	$0	$0	$880,000	
B-35	Piping	$0	$18,600	$108,100	$126,700	
B-36	Insulation	$0	$5,000	$8,000	$13,000	
	B. Total	**$969,500**	**$48,200**	**$172,700**	**$1,190,400**	
C. Baghouse Ash Handling System						
C-21	Civil Work	$0	$15,500	$23,100	$38,600	
C-23	Steel	$0	$23,500	$24,300	$47,800	
C-33	Material Handling Equipment	$810,000	$0	$631,800	$1,441,800	
C-35	Piping	$0	$0	$0	$0	
	C. Total	**$810,000**	**$39,000**	**$679,200**	**$1,528,200**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 4

Basis: S&L Cost Estimate No. 31327C 10/14/2011						
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 4**	**Notes**
D. Anhydrous Ammonia						
D-21	Civil Work	$0	$0	$0	$0	
D-22	Concrete	$0	$13,800	$23,000	$36,800	
D-31	Mechanical Equipment	$972,000	$0	$59,200	$1,031,200	
D-35	Piping	$0	$96,000	$348,600	$444,600	
	D. Total	**$972,000**	**$109,800**	**$430,800**	**$1,512,600**	
E. Electrical						
E-41	Electrical Equipment	$854,500	$168,400	$687,400	$1,710,300	
E-42	Conduit	$0	$352,300	$934,300	$1,286,600	
E-43	Cable	$0	$939,000	$2,336,500	$3,275,500	
E-44	Control & Instrumentation	$1,429,000	$0	$678,700	$2,107,700	
E-51	Substation, Switchyard & Transmission Line	$200,000	$0	$0	$200,000	
	E. Total	**$2,483,500**	**$1,459,700**	**$4,636,900**	**$8,580,100**	
F. Balanced Draft Conversion						
F-21	Civil Work	$0	$1,600	$18,700	$20,300	
F-22	Concrete	$0	$20,500	$49,500	$70,000	
F-23	Steel	$0	$44,700	$43,000	$87,700	
F-31	Mechanical Equipment	$5,787,600	$72,000	$3,508,900	$9,368,500	
F-41	Electrical Equipment	$4,983,000	$0	$302,600	$5,285,600	
F-42	Raceway, Cable Tray & conduit	$660,000	$0	$1,400,400	$2,060,400	
F-43	Medium Voltage Power Cable & Termination	$0	$114,900	$152,500	$267,400	
F-44	Control & Instrumentation	$540,000	$0	$90,000	$630,000	
F-51	Construction Power	$7,500	$0	$0	$7,500	
	F. Total	**$11,978,100**	**$253,700**	**$5,565,600**	**$17,797,400**	
G. Construction Equipment Supplement						
G-61	Construction Equipment	$1,479,800	$0	$277,800	$1,757,600	
	G. Total	**$1,479,800**	**$0**	**$277,800**	**$1,757,600**	
90	**Subtotal**	**$34,529,700**	**$31,178,300**	**$59,395,300**	**$125,103,300**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Unit 4

Basis:	S&L Cost Estimate No. 31327C 10/14/2011					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Unit 4**	**Notes**
91	**Other Direct & Construction Indirect Costs**					
91-1	Scaffolding			$2,264,300	$2,264,300	2.5% of Acct. No. 90 Labor & Materials
91-2A	Cost Due to overtime working 5 - 10 hour days			$6,705,500	$6,705,500	
91-2B	Cost Due to overtime working 7 - 12 hour days during the tie-in outage			$5,026,200	$5,026,200	
91-3	Per Diem				$0	Not Included
91-4	Consumables			$452,900	$452,900	0.5% of Acct. No. 90 Labor & Materials
91-5	Freight on materials		$1,558,900		$1,558,900	5% of Acct. No. 90 (Material Costs)
91-7	Sales Tax				$0	Not Included (See, Acct. No. 96A below)
91-9	Contractor G&A Expenses				$0	Included in EPC Fee
91-10	Contractor Profit				$0	Included in EPC Fee
	91. Total	**$0**	**$1,558,900**	**$14,448,900**	**$16,007,800**	
92	**Total Direct & Construction Indirect Cost**	**$34,529,700**	**$32,737,200**	**$73,844,200**	**$141,111,100**	
93	**Indirect Costs**					
93-1	EPC Engineering, Procurement & Project Services				$11,288,900	8% of Acct. No. 92
93-2	EPC Construction Management Support				$4,233,300	3% of Acct. No. 92
93-3	EPC Startup Commissioning				$1,411,100	1% of Acct. No. 92
93-4	EPC Fee				$23,706,700	15% of Acct. Nos. 92, 93.1, 93.2, 93.3
93-5	Owner's Costs				$0	
93-5-1	Owner's Engineer & Construction Management				$5,668,138	By PNM
93-5-2	Performance Testing				$100,000	
93-5-3	Anhydrous Ammonia Risk Management & Training				$0	
	93. Total				**$46,408,138**	
94	Total Escalation					
95	Total Contingency				$37,503,700	20% of 92 + 93
96	Total Construction Cost				$225,022,938	
96A	New Mexico Gross Receipt Tax (NMGRT)				$14,204,573	
96B	Total Construction Cost with NMGRT				$239,227,511	
97	Interest During Construction					Not Included
98	**TOTAL PROJECT COST**				**$239,227,511**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Units 3 & 4 Common

Basis:	S&L Cost Estimate No. 31327C 10/14/2011					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Units 3 & 4 Common**	**Notes**
D. Anhydrous Ammonia						
D-11	Demolition	$0	$0	$363,500	$363,500	
D-21	Civil Work	$0	$41,200	$60,000	$101,200	
D-22	Concrete	$0	$25,900	$40,700	$66,600	
D-23	Steel	$0	$18,200	$15,100	$33,300	
D-24	Architectural	$0	$7,000	$7,700	$14,700	
D-31	Mechanical Equipment	$90,000	$0	$10,800	$100,800	
D-35	Piping	$0	$134,900	$93,100	$228,000	
D-41	Electrical Equipment	$45,700	$71,900	$449,600	$567,200	
D-42	Raceway	$0	$109,500	$306,500	$416,000	
D-43	Cable	$0	$165,900	$471,000	$636,900	
D-44	Control & Instrumentation	$80,000	$0	$110,600	$190,600	
D-51	Substation, Switchyard & Transmission Line	$0	$6,000	$24,000	$30,000	
	D. Total	**$215,700**	**$580,500**	**$1,952,600**	**$2,748,800**	
90	**Subtotal**	**$215,700**	**$580,500**	**$1,952,600**	**$2,748,800**	
91	**Other Direct & Construction Indirect Costs**					
91-1	Scaffolding			$63,300	$63,300	2.5% of Acct. No. 90 Labor & Materials
91-2	Cost Due to overtime working 5 - 10 hour days			$259,400	$259,400	
91-3	Per Diem				$0	Not Included
91-4	Consumables			$12,700	$12,700	0.5% of Acct. No. 90 Labor & Materials
91-5	Freight on materials		$29,000		$29,000	5% of Acct. No. 90 (Material Costs)
91-7	Sales Tax				$0	Not Included (See, Acct. No. 96A below)
91-9	Contractor G&A Expenses				$0	Included in EPC Fee
91-10	Contractor Profit				$0	Included in EPC Fee
	91. Subtotal	**$0**	**$29,000**	**$335,400**	**$364,400**	
92	**Total Direct & Construction Indirect Cost**	**$215,700**	**$609,500**	**$2,288,000**	**$3,113,200**	

Detailed SCR Cost Estimate Summary - San Juan Generating Station Units 3 & 4 Common

Basis:	**S&L Cost Estimate No. 31327C 10/14/2011**					
Acct. No.	**Description**	**Equipment Cost**	**Material Cost**	**Labor Cost**	**SJGS Units 3 & 4 Common**	**Notes**
93	**Indirect Costs**					
93-1	EPC Engineering, Procurement & Project Services				$249,100	8% of Acct. No. 92
93-2	EPC Construction Management Support				$93,400	3% of Acct. No. 92
93-3	EPC Startup Commissioning				$31,100	1% of Acct. No. 92
93-4	EPC Fee				$523,000	15% of Acct. Nos. 92, 93.1, 93.2, 93.3
93-5	Owner's Costs				$0	
93-5-1	Owner's Engineer & Construction Management				$149,069	By PNM
93-5-2	Anhydrous Ammonia Risk Management & Training				$0	
	93. Total				**$1,045,669**	
94	Total Escalation					
95	Total Contingency				$831,700	20% of 92 + 93
96	Total Construction Cost				$4,990,569	
96A	New Mexico Gross Receipt Tax (NMGRT)				$315,030	
96B	Total Construction Cost with NMGRT				$5,305,599	
97	Interest During Construction					Not Included
98	**TOTAL PROJECT COST**				**$5,305,599**	

PNM EXHIBIT CMO-2 (Supplemental)

Consisting of 1,196 pages

PNM EXHIBIT CMO-3 (Supplemental)

Consisting of 1 page

New Mexico Regional Haze State Implementation Plan Revisions
September 5, 2013

List of Enclosures:

Chapter 10, Section 309 Revised State Implementation Plan
Appendix D – Revised New Mexico BART Determination for San Juan Generating Station

NMED Notice of Intent to Present Technical Testimony – August 16, 2013
- NMED Ex. 1 Clean Air Act § 169A and 169B
- NMED Ex. 2 40 C.F.R. § 51.308
- NMED Ex. 3 40 C.F.R. § 51.309
- NMED Ex. 4 BART Guidelines – Appendix Y to 40 C.F.R. Part 51 Published at 70 Fed. Reg. 39104
- NMED Ex. 5 "Term Sheet" between U.S. EPA, NMED, and PNM
- NMED Ex. 6 BART Analysis Addendum, PNM San Juan Generating Station, April 1, 2013
- NMED Ex. 7 Affidavits of publication of public hearing notices
- NMED Ex. 8 Public Comments Submitted by the U.S. Bureau of Land Management
- NMED Ex. 9 Public Comments Submitted by the National Park Service
- NMED Ex. 10 Testimony of Ted Schooley
- NMED Ex. 10a Resume of Ted Schooley
- NMED Ex. 11 Testimony of Elizabeth Bisbey-Kuehn
- NMED Ex. 11a Resume of Elizabeth Bisbey-Kuehn
- NMED Ex. 12 Testimony of Gi-Dong Kim
- NMED Ex. 12a Resume of Gi-Dong Kim
- NMED Ex. 13 Resume of Rita Bates
- NMED Ex. 14 NMED responses to comments of the National Park Service
- NMED Ex. 15 Proposed statement of reasons for adoption of regulatory changes

Public Service Company of New Mexico Notice of Intent to Present Technical Testimony – August 16, 2013

NMED Notice of Publication of Hearing Notice and Public Review Drafts – July 2, 2013
- Attachment 1 Chapter 10 Public Review Draft
- Attachment 2 Appendix D Public Review Draft
- Attachment 3 Redline/strikeout of Changes between NOI version and Public Review Draft of Chapter 10
- Attachment 4 Redline/strikeout of Changes between NOI version and Public Review Draft of Appendix D

Public Comments Received by the New Mexico Environmental Improvement Board
- EarthJustice/Western Environmental Law Center – September 3, 2013
- Alex J. and Felicity B. Gonzales – August 19, 2013
- EDL Consulting – August 23, 2013
- Irvin & Norma Jean Jones – undated
- Robert E. Reed – August 26, 2013

NMED Exhibit Presented at the September 5, 2013 Hearing
- NMED Ex. 16 Corrections to Chapter 10 and Appendix D

Transcript of Hearing – September 5, 2013

New Mexico Environmental Improvement Board Statement of Reasons for Adoption of SIP Revisions

PNM EXHIBIT CMO-4

Consisting of 1 pages

PNM TIMELINE FOR 177 MW
NATURAL GAS PEAKING FACILITY
AT SAN JUAN GENERATING STATION

Task	Date
File LGIA with FERC	February 2014
Issue RFP	April 2014
Responses to RFP Due	June 2014
Develop Short List of Bidders	July 2014
Select Successful Bidder	September 2014
File CCN with Commission	December 2014*
Final Contact with Successful Bidder	February 2015
CCN Approval and Air Permit Issues	May 2016
Gas Turbine Unit Ordered and Full Notice to Proceed	June 2016
Start Construction of Gas Pipeline	July 2016
Unit Delivered and Commencement of Construction	March 2017
Unit Commences Commercial Production	March 2018

*Actual date range for seeking CCN is between December 2014 and Spring 2015.

BEFORE THE NEW MEXICO PUBLIC REGULATION COMMISSION

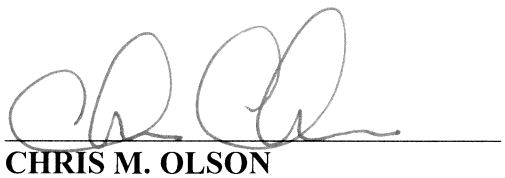
IN THE MATTER OF THE APPLICATION OF PUBLIC SERVICE COMPANY OF NEW MEXICO FOR APPROVAL TO ABANDON SAN JUAN GENERATING STATION UNITS 2 AND 3, ISSUANCE OF CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY FOR REPLACEMENT POWER RESOURCES, ISSUANCE OF ACCOUNTING ORDERS AND DETERMINATION OF RELATED RATEMAKING PRINCIPLES AND TREATMENT,	)	**Case No. 13-00390-UT**
PUBLIC SERVICE COMPANY OF NEW MEXICO,	)	
Applicant	)	

AFFIDAVIT

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

Chris M. Olson, Vice President, Generation, for Public Service Company of New Mexico, upon being duly sworn according to law, under oath, deposes and states: I have read the foregoing **Supplemental Direct Testimony of Chris M. Olson** and it is true and accurate based on my own personal knowledge and belief.

SIGNED this 4th day of February, 2014.



CHRIS M. OLSON

SUBSCRIBED AND SWORN to before me this 4th day of February, 2014.

Ronda Morehead

NOTARY PUBLIC IN AND FOR
THE STATE OF NEW MEXICO

OFFICIAL SEAL
Ronda Morehead
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires:

My Commission Expires:

7/5/15