Comments on the Enchant/Farmington July 9, 2020 Submittal to the New Mexico Environment Department on Nitrogen Oxide Air Pollution Controls at San Juan Units 1 and 4 to Make Reasonable Progress Towards the National Visibility Goal

By Victoria R. Stamper

September 2, 2020

Prepared for

National Parks Conservation Association and Sierra Club

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Introduction

These comments to the New Mexico Environment Department (NMED) concern the July 9, 2020 Enchant/Farmington Four-Factor Analysis for San Juan Generating Station Units 1 and 4. I previously prepared a cost effectiveness analyses of reasonable progress controls to reduce nitrogen oxide (NOx) emissions from these two electrical generating units (EGUs), as well as for Escalante Generating Station, that was submitted to NMED on December 19, 2019. Below, I provide comments on the SCR cost analysis set forth by Enchant/Farmington in their July 9, 2020 report and I also provide additional cost estimates of SCR for San Juan Units 1 and 4 for NMED's consideration, using EPA's SCR Cost spreadsheet and taking into account some of the assumptions used in the Enchant/Farmington SCR cost analysis for San Juan Units 1 and 4.

I. Comments on Enchant/Farmington's July 9, 2020 Four-Factor Analysis for San Juan Generating Station Units 1 & 4 Regarding the Evaluation of Selective Catalytic Reduction Technology

In my December 2019 report, I evaluated the cost effectiveness of SCR to achieve a 0.04 lb/MMBtu annual average NOx rate at San Juan Unit 1 and 4, based on EPA's SCR cost calculation spreadsheet that it made available with its June 12, 2019 update to its SCR chapter of the EPA Control Cost Manual.[1] The only changes I made to EPA's spreadsheet were to account for the use of anhydrous ammonia, which is generally less expensive than the aqueous ammonia or urea options provided in EPA's SCR cost spreadsheet, and to revise parameters in the spreadsheet to be specific to San Juan Units 1 and 4 (such as generating capacity of the unit, typical operating parameters, elevation, and coal type and characteristics).

Enchant/Farmington submitted a July 9, 2020 four-factor analysis report prepared on their behalf by Sargent & Lundy of pollution controls at San Juan Units 1 & 4, including an analysis of SCR. I reviewed that report for San Juan Units 1 and 4 to evaluate their SCR cost effectiveness analysis assumptions and costs.

The Enchant/Farmington report calculated cost effectiveness of SCR to achieve a 0.05 lb/MMBtu NOx rate at San Juan Units 1 and 4 to be $12,227/ton and $11,021/ton, respectively, based on a 20-year life, and $19,508/ton and $17,540/ton, respectively, based on a 7-year life.[2] Based on the data reported in my December 2019 report, the use of EPA's SCR cost spreadsheet indicated a cost effectiveness of SCR at San Juan Unit 1 to meet a 0.04 lb/MMBtu annual average NOx emission rate with SCR (86% removal) of $4,321/ton assuming a 30-year

[1] *See* SCR Cost Calculation Spreadsheet, available at https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution.

[2] July 9, 2020 San Juan Four-Factor Analysis, Executive Summary at 4 (Table E-4).

life and of $5,109/ton assuming a 20-year life."[3] I also calculated the cost of SCR at San Juan Unit 4 to achieve an annual average 0.04 lb/MMBtu NOx rate (85% NOx removal) of $3,482/ton assuming a 30-year life and of $4,544/ton assuming a 20-year life."[4]

Clearly, there are some significant differences between Enchant/Farmington's cost evaluation and my December 2019 evaluation, and the following highlights several of those differences and provides comments on some of the assumptions used in the Enchant/Farmington cost effectiveness analysis of SCR at San Juan Units 1 and 4.

A. Comments on Enchant/Farmington's Assumed Costs of SCR at San Juan Units 1 and 4

The Enchant/Farmington report indicates that SCR costs for San Juan are "generally based on cost estimates prepared for the 2011 BART Evaluation, modified based on changes to the facility since that time (e.g., balanced draft conversion and installation of BJFF baghouses) and escalated to 2020-dollars assuming 3% annual on material, equipment, and labor."[5] The submittal does not make clear whether the cost estimates are derived from the Public Service Company of New Mexico (PNM) cost analysis for SCR or from EPA's revised cost analysis for SCR which EPA put forth with its 2011 Federal Implementation Plan (FIP).[6] Based on some of the costs referenced in the July 9, 2020 Enchant/Farmington Report, it appears that the costs may be based on PNM's SCR cost analysis for the 2011 NOx BART determination for San Juan Units 1-4 and not on EPA's revised costs.

There are several reasons why it is not appropriate to rely on PNM's SCR cost analysis from the 2011 BART determination in evaluating the cost effectiveness of SCR now. Those reasons include the following:

1) **The Enchant/Farmington SCR Costs Are Based on a Prior SCR Cost Assessment Which EPA Found Had Overstated the Costs of SCR at the San Juan Units.**

   In the 2011 regional haze rulemaking for New Mexico, EPA critiqued several assumptions used in PNM's SCR cost analysis in its evaluation of BART for San Juan Units 1-4, and EPA ultimately refined the SCR cost analysis put forth by PNM because EPA "found the costs projected by PNM to be high in comparison to other SCR retrofits…."[7] EPA also found that PNM did not follow the EPA Control Cost Manual in its cost

[3] *See* 12/18/19 Stamper report at 13 (Table 1) and 14 (Table 2). Note that this analysis assumed the EPA default 5.5% interest rate.
[4] *Id.* at 18 (Tables 3 and 4).
[5] July 9, 2020 San Juan Four-Factor Analysis at 32.
[6] See 76 Fed. Reg. 491 (Jan. 5, 2011) at 499 ("NMED questioned [Public Service Company of New Mexico's (PNM's)] cost estimate for the installation of SCR but accepted it as cost effective. We too questioned PNM's cost estimate for SCR, and hired a consultant to undertake an accurate assessment of the cost of SCR….") and at 502.
[7] *See* 76 Fed. Reg. 491 (Jan. 5, 2011) at 502; 76 Fed. Reg. 52,388 (Aug. 22, 2011) at 52,391-52,402.

analysis.[8] Indeed, EPA's calculation of total capital costs for SCR at San Juan Units 1 and 4 were less than half of the total capital costs of SCR put forth by PNM.[9] EPA has documented all of its critiques of the PNM SCR cost analyses in the record for its 2011 FIP. Thus, NMED should not rely on Enchant's SCR cost analysis to the extent it is based on the PNM analysis that EPA found to be significantly inflated and/or not justified.

2) The Enchant/Farmington SCR Costs Assume Higher Costs Due to Retrofit Complexity but the Higher Costs are Based on When San Juan Units 2 and 3 were in Operation.

PNM's SCR cost analyses for San Juan Units 1 and 4 from the 2011 BART determination included additional costs to deal with limited free space (i.e., retrofit difficulty)[10] due to the congested site at San Juan. However, PNM conducted its cost analysis when Units 2 and 3 were still operating. San Juan Units 2 and 3 have not been in operation since 2017.[11] As a result, the retrofit challenges of SCR likely have changed from the cost analysis done for the 2011 BART determination.

In addition, even when Units 2 and 3 were still operating, EPA questioned the use of any complexity factors or retrofit factors for SCRs at San Juan Units 1 – 4 in its 2011 BART FIP.[12] EPA stated that the constraints that PNM claimed would apply to SCR installation at San Juan Units 1-4 were similar to SCR retrofits at other coal-fired power plants, stating that "[f]inding space for and retrofitting SCRs at all sites is challenging, not just at [San Juan Generating Station]."[13]

While EPA ultimately used PNM's costs for structural steel for the SCR systems in its cost effectiveness analysis, including the use of a complexity factor of 1.2 for Units 1 and 4,[14] that decision was made when Units 2 and 3 at San Juan were still operating. The units have not been in operation since 2017 and it is not clear how much of the units will be physically at the site when SCR construction would occur on Units 1 and 4. A 2019 news article indicated that the "skeletons of two units at the San Juan Generating Station remain standing" and that "[s]ome of the parts from the closed units are being sent to

[8] 76 Fed. Reg. 491 (Jan. 5, 2011) at 502.
[9] See Exhibit 1 to EPA Complete Response to Comments for NM Regional Haze/Visibility Transport FIP, Docket ID EPA-R06-OAR-2010-0846-0128 (available at www.regulations.gov), row 67 at tabs for "Unit 1 @ 0.05" and "Unit 4 @ 0.05."
[10] *See* EPA, Complete Response to Comments for NM Regional Haze/Visibility Transport FIP, Docket No. EPA-R06-OAR-2010-0846, 8/5/2011, at 31
[11] *See* December 20, 2017 PNM News Release, PNM Completes Shutdown of Units 2 and 3 of San Juan Generating Station, available at https://www.pnm.com/112017-sjgs-units2and3.
[12] EPA, Complete Response to Comments for NM Regional Haze/Visibility Transport FIP, Docket Number EPA-R06-OAR-2010-0846-0127, available at www.regulations.gov, at 29-30.
[13] *Id.*at 29.
[14] *Id.*at 30.

coal-fired power plants in other parts of the country."[15] Given that Units 2 and 3 are no longer operating and parts are being dismantled and/or sold, it seems that the units will not pose as much of a space/site constraints to the installation of SCR at Units 1 and 4 as was previously anticipated in the SCR cost analysis for the 2011 BART determination when all four units were operating. For these reasons, it is likely not appropriate to use the same retrofit factor as previously applied in PNM's prior BART analysis when calculating costs for SCR at San Juan Units 1 and 4.

3) The Enchant/Farmington SCR Cost Analysis Included Costs for Control of Sulfuric Acid Mist Without Adequate Justification.

PNM's SCR cost analysis for the 2011 BART determination assumed that dry sorbent injection (DSI) would be needed to address the increased formation of SO3 and sulfuric acid mist (SAM). The July 9, 2020 Enchant/Farmington San Juan Analysis also states that DSI will be necessary to "meet the units' existing SAM emission limit when operating without carbon capture…" and thus included costs for DSI in the SCR cost analysis for San Juan Units 1 and 4.[16] A review of the most recent Title V permit available on the NMED's website for San Juan Generating Station indicates that neither Unit 1 nor Unit 4 is currently subject to an emission limit on sulfuric acid mist. Each unit is subject to a total PM10 and PM2.5 limit (which would include condensable particulate matter like SAM) of 0.034 lb/MMBtu, as well as specific pound per hour total PM limits (126.0 lb/hr total PM10/PM2.5 for Unit 1 and 192.1 lb/hr total PM10/PM2.5 for Unit 4).[17] While SAM is a component of total PM10 and total PM2.5, NMED should not accept any claim that DSI will be needed to control SAM to comply with these PM10/PM2.5 emission limits if SCR is installed without detailed and documented information on a) the actual total PM10/PM2.5 emissions from each Unit 1 and 4 over the past few years, b) the amount of the total PM10/PM2.5 that is due to SAM, c) an estimate of the increase in SAM due to installation of SCR at each unit, d) a demonstration that the increase in SAM due to the SCR would threaten the units' compliance with the total PM10/PM2.5 limits, and e) an evaluation of how much dry sorbent injection would be needed to ensure compliance with the total PM10/PM2.5 emission limits. No such justification for the use of DSI was included in the Enchant/Farmington report.

[15] Grover, Hannah, "Looking forward: PNM employees are preparing for the closure of San Juan Generating Station," September 28, 2019, Farmington Daily Times, available at https://www.daily-times.com/story/news/local/2019/09/28/pnm-san-juan-generating-station-coal-power-plant-closure/3789521002/.

[16] July 9, 2020 San Juan Four-Factor Analysis at 33.

[17] Title V Operating Permit No. P062-R3M2 at A12-A13 (Table 106.A).

4) The Enchant/Farmington SCR Cost Analysis Improperly Escalated Costs from 2011 to 2020 In a Manner Which Would Overstate Costs of SCR.

The July 9, 2020 Enchant/Farmington San Juan Analysis escalated costs prepared for the 2011 BART evaluation by 3% per year on material, equipment and labor.[18] However, the Enchant/Farmington report did not provide any basis for the assumed increase in costs of 3% per year. EPA's Control Cost Manual indicates that the Chemical Engineering Plant Cost Index (CEPCI) has been used "extensively by EPA for escalation purposes."[19] EPA's Control Cost Manual recommends use of industry equipment cost indices, rather than the Consumer Price Index (CPI) or the Gross Domestic Product (GDP).[20] A review of the CEPCI indices for 2011 to 2019 shows that the CEPCI index increased by 3.7% across this entire 8 year time period, as opposed to the 3% per year assumed in the July 9, 2020 San Juan Four-Factor Analysis.[21] Thus, the manner in which cost estimates for the SCRs at San Juan Units 1 and 4 were escalated from 2011 to 2020 likely significantly overestimated costs for material, equipment, and labor.

Moreover, EPA's Control Cost Manual recommends against escalating costs more than five years because "the accuracy associated with escalation…declines the longer the time period which this is done."[22] EPA advises to obtain new price quotes for pollution controls if cost data is more than five years old.[23]

For all of these reasons, the SCR costs provided in the Enchant/Farmington July 9, 2020 report should not be relied upon for determining whether SCR will be a cost-effective control for San Juan Unit 1 or Unit 4, as it very likely overstates the capital and operational costs of SCR at these two units.

[18] July 9, 2020 San Juan Four-Factor Analysis at 32.
[19] EPA Control Cost Manual, Section 1, Chapter 2 Cost Estimation: Concepts and Methodology, at 19, available at https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution.
[20] *Id.*at 18-19.
[21] The CEPCI rate for 2011 was 585.7 and the CEPCI index for 2019 was 607.5, which reflects a 3.7% increase over this 8-year period.
[22] *Id.*at 19.
[23] *Id.*

B. Comments on the SCR Cost Effectiveness Calculations Presented by Enchant/Farmington in its July 2020 Four-Factor Analysis

In addition to the issues identified above with the overestimate of costs of SCR at San Juan Units 1 and 4, there are other deficiencies in the cost estimates, as follows:

1) **The Enchant/Farmington Four-Factor Analysis Improperly Assumed a Shortened Useful Life of the SCR Systems, Without Citing to Enforceable Limitations to Justify a Reduced Useful Life of SCR.**

   The Enchant/Farmington analysis assumed two periods of SCR equipment life in its SCR cost effectiveness analysis: 7 years and 20 years.[24] The 7-year life is based on an assumption that the facility "may not be able to run economically beyond" the year 2035 because 2035 is the date the IRS section 45Q tax credit for the carbon capture system would expire.[25] These assumptions are speculative and should not form the basis for defining the useful life of the SCR controls in a cost effectiveness analysis, unless there is an enforceable requirement for the units to shut down in 2035.

   With respect to the other assumption of a 20-year life, the Enchant/Farmington analysis simply assumes the equipment life of an SCR is 20 years and did not identify any enforceable limit associated with the 20-year life assumption. EPA states in its current Control Cost Manual that the equipment lifetime of an SCR system at a power plant is assumed to be 30 years, based on several sources of information.[26] EPA also assumed a 30-year life of an SCR system in its cost analysis for the 2011 BART FIP for San Juan Generating Station.[27] Further, EPA found in 2011 that "there was nothing in the record to support a 20 year lifetime for the SCR and [EPA believes] a 30 year lifetime is justified."[28]

2) **The Enchant/Farmington SCR Analyses Assumed Too High of an Interest Rate in Evaluating Annualized Costs of SCR.**

   The Enchant/Farmington analysis assumed a 7% interest rate in determining annual costs of control,[29] but did not provide any basis for such a high assumed interest rate. The cost analysis presented in my December 2019 report used the 5.5% interest rate specified in EPA's SCR cost spreadsheet. EPA's SCR Cost Spreadsheets state that the

[24] July 9, 2020 San Juan Four-Factor Analysis, Executive Summary at 3.
[25] *Id.* at 38.
[26] *See* EPA Control Cost Manual, Section 4, Chapter 2 Selective Catalytic Reduction, June 2019, at pdf page 80 (available at https://www.epa.gov/sites/production/files/2017-12/documents/scrcostmanualchapter7thedition_2016revisions2017.pdf).
[27] 76 Fed. Reg. 52,388 at 52,401-52,402 (Aug. 22, 2011).
[28] 76 Fed. Reg. 52,388 (Aug. 22, 2011) at 52,402.
[29] July 9, 2020 San Juan Four-Factor Analysis at 31.

"User should enter current bank prime rate (available at https://www.federalreserve.gov/releases/h15/)." The current bank prime rate as of August 27, 2020 is 3.25%,[30] which is considerably lower than the 5.5% interest rate in EPA's SCR cost spreadsheet that I left unchanged for the cost analyses presented in my December 2019 report.

In a recent four-factor cost effectiveness analysis for reasonable progress controls, the owner of Craig Power Plant in Colorado (Tri-State Generation & Transmission) used an interest rate of 4.7%.[31] That tracks closely with the 4.75% interest rate that was in place before the global COVID-19 pandemic. Thus, a 4.7% interest rate seems like the highest bank prime interest rate (and it will likely be lower) that could be in place in the next year when NMED adopts reasonable progress controls. Enchant/Farmington's use of an 7% interest rate is unreasonably high and results in overestimating the cost effectiveness of SCR.

3) The Enchant/Farmington Four-Factor Analysis Calculated Cost Effectiveness from an Emissions Baseline Reflective of Operation of Selective Non-Catalytic Reduction (SNCR) at Each San Juan Unit.

The Enchant/Farmington analysis used current emissions with operation of SNCR at San Juan Units 1 and 4 to reflect baseline emissions for determining cost effectiveness of SCR, even though the analysis states that SNCR would no longer be operated if SCR was installed.[32] In my December 2019 cost effectiveness analysis for SCR installation, I used a baseline NOx emission rate that reflected emissions without the operation of SNCR, because taking into account a lower emission rate with SNCR in calculating cost effectiveness of SCR understates the true cost effectiveness of SCR (which would replace SNCR). Enchant/Farmington's use of a NOx rate reflective of SNCR results in its SCR cost effectiveness determination seeming less cost effective than its true cost effectiveness, because it results in fewer tons of NOx reduced by the SCR.

4) The Enchant/Farmington SCR Cost Effectiveness Analysis Calculated Annual Tons of NOx Reduced Based on an Unreasonably High Annual NOx Emission Rate of 0.05 lb/MMBtu.

The Enchant/Farmington SCR cost effectiveness calculations were based on SCR reducing NOx levels to 0.05 lb/MMBtu.[33] Although the Enchant/Farmington report does not specify the assumed averaging time of the assumed achievable NOx rate with SCR, it was used to calculate annual NOx reductions and thus reflects an assumed annual

[30] https://www.federalreserve.gov/releases/h15/.
[31] *See* December 6, 2019 Tri-State Four-Factor Analysis Craig Station Units 2 and 3, Appendix C, available at https://www.colorado.gov/pacific/cdphe/regional-haze under 2021 Regional Haze Source-Specific Four-Factor Analyses and Additional Documentation.
[32] July 9, 2020 San Juan Four-Factor Analysis at pages 3-6 of the Executive Summary and at 14, 27-29, and 47-48.
[33] *Id.*at page 4 of Executive Summary at 4 and at 20.

average NOx rate. In my cost effectiveness analysis, I assumed a 0.04 lb/MMBtu NOx rate was achievable on an annual average basis for the SCR cost effectiveness analysis. In its recent regional haze revision for the Laramie River Station in Wyoming, EPA assumed 0.04 lb/MMBtu would be achieved with SCR on an annual average basis under a 0.06 lb/MMBtu NOx limit applicable on a 30-day average basis.[34] EPA had previously imposed a 0.05 lb/MMBtu NOx limit on a 30-day rolling average basis in its BART FIP for San Juan Units 1 and 4.[35] Thus, use of an annual average NOx rate of 0.04 lb/MMBtu in determining the annual NOx reductions from SCR seems very reasonable for San Juan Units 1 and 4.

II. Revised Cost Effectiveness Analyses of SCR Based on EPA's SCR Cost Spreadsheet for San Juan Units 1 and 4.

As explained above, the Enchant/Farmington SCR cost analysis is based largely on an outdated analysis that PNM conducted for the first regional haze plan. To take into account some of the differences between the Enchant/Farmington SCR cost effectiveness analyses and the cost effectiveness analyses presented in my December 2019 report, I revised the cost effectiveness analyses of SCR at San Juan Units 1 and 4 using EPA's SCR cost spreadsheet made available with its Control Cost Manual. The methodology used in EPA's SCR cost spreadsheet is consistent with the methodology of EPA's Control Cost Manual and is also "based on the U.S. EPA's Clean Air Markets Division (CAMD)'s Integrated Planning Model (IPM) (version 6)."[36] The EPA's IPM Model SCR Cost Development Methodology, which was last updated in January 2017, was prepared by Sargent & Lundy (the same consultants that prepared the Enchant/Farmington reasonable progress analysis for San Juan Units 1 and 4), and the cost algorithms of the model are "based primarily on a statistical evaluation of cost data available from various industry publications as well as Sargent & Lundy's proprietary database…."[37] I prepared additional SCR cost effectiveness analyses to address some of the assumptions and/or claims made in the Enchant/Farmington SCR cost effectiveness analysis for San Juan Units 1 and 4. The analyses presented below made the following assumptions:

1) I used a 4.7% interest rate for calculated annualized capital costs because, as discussed above, 4.7% is likely the highest bank prime interest rate that could be in place in the next year when NMED adopts reasonable progress controls (and the current bank prime interest rate is lower than 4.7%).

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[34] 83 Fed. Reg. 51,403 at 51,408 (Oct. 11, 2018).
[35] 76 Fed. Reg. 52,388 at 52,439 (Aug. 22, 2011).
[36] *See* EPS's SCR Cost Manual Spreadsheet at "Read Me" tab, available for download at https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution.
[37] *See* Sargent & Lundy, IPM Model – Updates to Cost and Performance for APC Technologies, SCR Cost Development Methodology, Final, January 2017, at 1, available at https://www.epa.gov/airmarkets/ipm-v6-emission-control-technologies-attachment-5-3-scr-cost-development-methodology.

2) I calculated annualized capital costs assuming two time periods for the remaining useful life: a) a 30-year life of an SCR system, based on EPA's instructions in the Cost Control Manual and 2) a 20-year life, as a conservative sensitivity analysis, given Enchant/Farmington's use of a 20-year life. As explained in my December 2019 report, without a legally enforceable requirement for San Juan to retire by a certain date, a 30-year life should be used for SCR.

3) I assumed that anhydrous ammonia would be used as the SCR reagent, as I assumed in my December 2019 report.[38] I used a cost for anhydrous ammonia of $280/ton, based on the U.S. Geological Survey's average cost for 2018.[39] Enchant/Farmington assumed a much higher cost for ammonia of $785/ton, but provided no support for that assumption.[40]

4) I calculated cost effectiveness using two controlled emission rates: a 0.04 lb/MMBtu annual average NOx rate or a 0.05 lb/MMBtu annual average NOx rate. As stated above and as discussed in my December 2019 report, an annual average NOx rate of 0.04 lb/MMBtu which reflects 85-86% NOx reduction across the SCR at San Juan Units 1 and 4 has been shown to be achievable with SCR.[41] An assumed 0.05 lb/MMBtu annual average NOx rate with SCR reflects 81-82% reduction in NOx across the SCR at San Juan Units 1 and 4.

5) I used Enchant/Farmington's baseline NOx emissions to calculate tons of NOx reduced for input into the cost effectiveness of SCR, although I used the pre-SNCR baseline NOx lb/MMBtu rates for estimating the costs to reduce NOx.[42] This ensured that the EPA spreadsheet did not underestimate the capital or operating costs needed to achieve the 0.04 or 0.05 lb/MMBtu NOx emission rate, because the SCR will have to reduce NOx from the pre-SNCR emission rate. I calculated the tons reduced from an SNCR baseline at each unit and divided those NOx reductions into the annual costs calculated by the EPA spreadsheet to determine cost effectiveness of SCR from an SNCR baseline. Enchant/Farmington assumed an 87% projected capacity factor for each San Juan unit and I assumed the same projected capacity factor both in EPA's SCR cost spreadsheet

[38] *See* December 2019 Stamper Report at 9-10.
[39] *See* USGS Minerals Commodities Summaries, 2019, available at https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/atoms/files/mcs-2019-nitro.pdf. Note that the USGS costs for ammonia in 2019 were $230/ton, even lower than what I assumed, but I retained the 2018 cost numbers to be conservative.
[40] July 9, 2020 San Juan Four-Factor Analysis, Appendix B at 2 and 5 (pdf pages 62 and 65).
[41] *See* December 2019 Stamper Report at 7-8.
[42] Specifically, I assumed a NOx rate at the inlet to the SCR of 0.28 lb/MMBtu and 0.27 lb/MMBtu for estimating SCR capital and operational costs using the EPA SCR Cost Spreadsheet for San Juan Units 1 and 4, respectively.

for estimating the costs of SCR and in determining the annual tons of NOx removed from the current SNCR baseline NOx rate at each unit.

6) I calculated SCR costs using the EPA cost spreadsheet in two ways: a) assuming an average retrofit difficult (retrofit factor of 1) for each unit, and b) assuming a retrofit factor of 1.2 for each unit. I found that EPA applied a "complexity factor" of 1.2 to some – but not all – of the capital costs of SCR in its 2011 BART FIP for San Juan Units 1-4.[43] Specifically, EPA applied a 1.2 complexity factor to the estimates for structural steel.[44] When a retrofit factor of 1.2 is applied in the EPA SCR cost spreadsheet, the capital costs of SCR are increased by 20% across the board. It is doubtful that the retrofit difficulty will be at the same level as was assumed for the EPA's 2011 BART determination, given that San Juan Units 2 and 3 are no longer operating and are being dismantled as discussed above. Further, given that even in 2011 when all four San Juan units were operating, EPA did not apply a 20% complexity factor to all of the capital costs of SCR, use of a 1.2 retrofit factor in the EPA SCR cost spreadsheet very likely provides a very conservative (likely overestimate) of the capital costs for SCR installation at San Juan Units 1 and 4.

7) No costs were included for dry sorbent injection in my revised cost analyses presented below, in contrast to the Enchant/Farmington SCR cost analysis, because there was no documentation provided in the Enchant/Farmington SCR cost analysis to support their claim that dry sorbent injection would be necessary to reduce sulfuric acid mist in order for the units to comply with existing emission limits.

8) The costs of SCR calculated from EPA's SCR Cost Spreadsheet were escalated from 2016 dollars to 2019 dollars using the Chemical Engineering Plant Cost Index (CEPCI).[45]

The tables below present the results of these revised cost analyses. Also, for comparison, Table 3 lists the Enchant/Farmington SCR cost effectiveness numbers for San Juan Units 1 and 4 based on their assumptions of a 20-year life and a 7% interest rate.

[43] EPA. Complete Response to Comments for NM Regional Haze/Visibility Transport FIP, Docket No. EPA-R06-OAR-2010-0846, 8/5/2011, at 28-29.
[44] *Id.*at 29. *See also* Exhibit 1 to EPA's Complete Response to Comments (RTC Revised Costs Spreadsheet), Fox Row 22.
[45] Specifically, the CEPCI indices for 2016 and 2019 were 541.7 and 607.5, respectively.

Table 1. Cost Effectiveness of SCR at San Juan Units 1 and 4 Using EPA's SCR Cost Spreadsheet and Assuming a 30-Year Life of Controls and a 4.7% Interest Rate.[46]

San Juan Unit	NOx Rate with SCR (Annual Avg), lb/MMBtu	Retrofit Factor (1=average retrofit)	Total Annual Cost of SCR, 2019$	NOx Reduced from SNCR-Baseline, tpy	Cost Effectiveness of SCR, 2019$
1	0.04	1	$11,394,512	2,557	$4,456/ton
1	0.05	1	$11,287,056	2,417	$4,670/ton
1	0.04	1.2	$13,411,039	2,557	$5,245/ton
1	0.05	1.2	$13,287,626	2,417	$5,498/ton
4	0.04	1	$16,954,055	3,834	$4,422/ton
4	0.05	1	$16,809,052	3,627	$4,634/ton
4	0.04	1.2	$20,000,768	3,834	$5,217/ton
4	0.05	1.2	$19,830,816	3,627	$5,468/ton

Table 2. Cost Effectiveness of SCR at San Juan Units 1 and 4 Using EPA's SCR Cost Spreadsheet and Assuming a 20-Year Life of Controls and a 4.7% Interest Rate.[47]

San Juan Unit	NOx Rate with SCR (Annual Avg), lb/MMBtu	Retrofit Factor (1=average retrofit)	Total Annual Cost of SCR, 2019$	NOx Reduced from SNCR-Baseline, tpy	Cost Effectiveness of SCR, 2019$
1	0.04	1	$13,682,643	2,557	$5,351/ton
1	0.05	1	$13,557,081	2,417	$5,609/ton
1	0.04	1.2	$16,156,796	2,557	$6,319/ton
1	0.05	1.2	$16,011,655	2,417	$6,625/ton
4	0.04	1	$20,411,127	3,834	$5,324/ton
4	0.05	1	$20,237,815	3,627	$5,580/ton
4	0.04	1.2	$24,149,254	3,834	$6,299/ton
4	0.05	1.2	$23,945,331	3,627	$6,602/ton

[46] *See* Ex. 1 spreadsheet entitled "Summary SCR Costs for San Juan Units 1&4 Using EPA SCR Cost Spreadsheet and Various Assumptions," at tab "30YrLife_SNCR BL."
[47] *Id*. at tab "20YrLife_SNCR BL."

Table 3. SCR at San Juan Units 1 and 4 - Comparison of Costs to Meet a 0.05 lb/MMBtu Annual Average NOx Rate Using EPA's SCR Cost Spreadsheet, a 20-Year Life, a 4.7% Interest Rate, and a 1.2 Retrofit Factor[48] to Enchant/Farmington's Cost Effectiveness of SCR at 20-Year Life and 7% Interest Rate[49]

San Juan Unit	Capital Costs of SCR Using EPA Cost Spreadsheet, 2019$	Annual Operating Costs of SCR Using EPA Cost Spreadsheet	Cost Effectiveness of SCR Using EPA Cost Spreadsheet, 2019$	Enchant & Farmington Capital Costs of SCR, 2020$	Enchant & Farmington Annual Operating Costs of SCR, 2020$	Enchant & Farmington Cost Effectiveness of SCR, 2020$
1	$176,885,028	$2,166,005	$6,625 per ton	$193,045,300	$11,330,000	$12,227 per ton
4	$267,176,328	$3,033,484	$6,602 per ton	$259,358,600	$15,491,000	$11,021 per ton

Table 3 makes clear that a large part of the difference in SCR costs between those calculated with the EPA spreadsheet and the Enchant/Farmington costs pertains to the annual operating costs of SCR. The Enchant/Farmington operating costs are 5 times the operating costs calculated by EPA's SCR cost spreadsheet. A close review of some of the costs in the Enchant/Farmington analysis compared to the costs calculated by EPA's SCR Spreadsheet made available with its Control Cost Manual indicates the Enchant/Farmington estimate of SCR operational costs overstate the costs of operating SCR for the following reasons, among others:

1) **Labor Costs.** Enchant/Farmington's operating labor costs reflect 1 operator per shift for 24 hours per day at $60/hour.[50] EPA's Control Cost Manual states the following regarding labor to operate an SCR system: "In general, operation of an SCR system requires only minimal, operating or supervisory labor. The SCR reactor is a stationary device with no moving parts. Further, the SCR system incorporates only a few pieces of rotating equipment (e.g., pumps, motors). The IPM [reference omitted] estimates operating labor time as 4 hours per day."[51] The EPA SCR spreadsheet estimates the administrative charges which include operating labor for SCR at Unit 1 and 4 to be $13,241 and $18,659 per year,[52] respectively, compared to Enchant/Farmington's estimates of $526,000 per year per unit.

[48] *See* Ex. 1 spreadsheet entitled "Summary SCR Costs for San Juan Units 1&4 Using EPA SCR Cost Spreadsheet and Various Assumptions," at tab "20YrLife_SNCR BL."
[49] *See* July 9, 2020 San Juan Four-Factor Analysis, Executive Summary at 3-4.
[50] *Id.*, Appendix B at 2.
[51] EPA Control Cost Manual, Section 4, Chapter 2, at pdf page 75.
[52] Note that EPA took into account supervisory labor in these costs. *Id.*at pdf pages 75 and 80-81.

The Enchant/Farmington SCR cost estimate also included "Administration" costs of $3,861,000 per year for SCR at Unit 1 and $5,187,000 for SCR at Unit 4.[53] It is not clear what is included in Enchant/Farmington's "Administration" costs. Although the Enchant/Farmington report cites to EPA's Control Cost Manual, Section 1, Chapter 2 for these costs which indicates administrative costs of 2% of total capital investment, EPA's chapter on SCR costs does not apply the same formula for administrative charges.[54] EPA states that "[t]he cost of overhead for an SCR system is also considered to be zero" and that "[b]ecause this procedure assumes that no additional labor is needed in operation of an SCR system, payroll overhead is zero and plant overhead is considered to be negligible."[55]

2) **Property Taxes & Insurance.** The Enchant/Farmington cost analysis includes annual charges for property taxes and insurance each at 1% of the total capital investment (based on EPA's Control Cost Manual, Section1, Chapter 2), adding $3,860,000 per year to the operating costs of SCR at Unit 1 and $5,188,000 per year to the operating costs of SCR at Unit 4.[56] Yet, EPA's SCR chapter of its Control Cost Manual does not include costs for property taxes or insurance for an SCR, stating that "[i]n many cases, property taxes do not apply to capital improvements such as air pollution control equipment" and that "[a]n SCR system is not viewed as a risk-increasing hardware…[c]onsequently, insurance on an SCR system is on the order of a few cents per thousand dollars annually."[57] Thus, EPA's SCR cost spreadsheet does not include annual costs for property taxes or insurance.

3) **SCR Catalyst Replacement & Disposal Costs.** Enchant/Farmington's costs for SCR catalyst replacement and disposal at each unit was much higher than calculated using the default Method 1 in EPA's SCR cost spreadsheet. Method 1 of EPA's SCR cost spreadsheet is based on the application of a future worth factor to the costs of catalyst for replacement, which essentially amortizes the cost of catalyst which is purchased every few years rather than accounting for catalyst replacement cost all in one year.[58] The EPA SCR cost spreadsheets calculated the annual SCR catalyst replacement costs to meet a 0.05 lb/MMBtu annual average NOx rate to be $377,847 per year and $605,657 per year at San Juan Units 1 and 4, respectively. In comparison, Enchant/Farmington's annual costs to meet the same NOx emission rate for "Catalyst Replacement and

[53] *See* July 9, 2020 San Juan Four-Factor Analysis, Appendix B at 2.
[54] EPA Control Cost Manual, Section 4, Chapter 2, at pdf page 80 (Equation 2.69).
[55] *Id.*
[56] *See* July 9, 2020 San Juan Four-Factor Analysis, Appendix B at 2.
[57] EPA Control Cost Manual, Section 4, Chapter 2, at pdf page 80 (Equation 2.69).
[58] *Id.*at pages 79-80.

Disposal Costs (net change)" were $1,164,000 per year and $1,807,000 per year at San Juan Units 1 and 4, respectively. [59]

4) **Maintenance Material Costs.** Not only did the Enchant/Farmington SCR cost analysis assume much higher catalyst replacement costs, but the Enchant/Farmington SCR cost analysis also assumed costs for "maintenance materials" at 1.5% of total direct costs ($1.7 million per year for Unit 1 and $2.3 million per year for Unit 4) which also include the cost of maintenance labor.[60] EPA's Control Cost Manual SCR spreadsheet does not account for any such "maintenance materials" aside from catalyst replacement. Chapter 2 of Section 1 of EPA's Control Cost Manual (which is a general chapter and not specific to SCR systems) states that maintenance materials are normally small and that one reference suggests a factor of 100% of the maintenance labor to cover maintenance material costs.[61] The EPA SCR cost spreadsheet calculates annual maintenance cost as 0.5% of the total capital investment,[62] and the EPA's SCR cost chapter states that this includes nozzle tip replacement.[63] Enchant/Farmington's SCR estimate assumes maintenance costs of 1.5% of total direct costs.[64] Thus, Enchant/Farmington seem to have greatly overstated maintenance material costs and have not provided justification for such high costs.

5) **Ammonia Costs.** As previously stated, Enchant/Farmington assumed an ammonia cost of $785/ton[65] compared to the $280/ton cost used in my calculations with the EPA SCR Cost spreadsheet, which was based on the U.S. Geological Survey's average cost for 2018.[66]

For these reasons, Enchant/Farmington's estimate of annual operating expenses of SCR seem greatly overstated compared to the annual operating costs calculated with EPA's Control Cost Manual spreadsheet for SCR costs.

[59] *See* July 9, 2020 San Juan Four-Factor Analysis, Appendix B at 2.
[60] *Id.*
[61] EPA Control Cost Manual, Section 1, Chapter 2 at 32.
[62] EPA SCR Cost Spreadsheet, in Cost Estimate tab, row 79.
[63] EPA Control Cost Manual, Section 4, Chapter 2, at pdf pages 75-76.
[64] *See* July 9, 2020 San Juan Four-Factor Analysis, Appendix B at 2.
[65] *Id.*
[66] *See* USGS Minerals Commodities Summaries, 2019, available at https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/atoms/files/mcs-2019-nitro.pdf. Note that the USGS costs for ammonia in 2019 were $230/ton, even lower than what I assumed, but I retained the 2018 cost numbers to be conservative.

Summary

The Enchant/Farmington cost analysis for SCR at San Juan Units 1 and 4 greatly inflated the cost effectiveness of SCR at San Juan Units 1 and 2 above that calculated with EPA's SCR cost spreadsheet provided with its Control Cost Manual. As shown in Tables 1 and 2, the cost effectiveness of SCR at San Juan Units 1 and 4 using a current SNCR baseline and based on the above-listed assumptions ranges from $4,456 to $6,625/ton at Unit 1 and from $4,422 to $6,602/ton at Unit 4. However, the upper end of the range of cost effectiveness is based on a shortened useful life of SCR to 20 years, application of a 1.2 retrofit factor which increased all capital costs of SCR by 20%, and the assumption that the SCR could only achieve a 0.05 annual average NOx rate. Thus, the high end of these cost numbers should be considered to represent worst-case cost effectiveness of SCR at San Juan Units 1 and 4. Further, an annual average NOx rate of 0.04 lb/MMBtu, which EPA has stated reflects the expected annual average NOx rate under a 0.06 lb/MMBtu NOx 30-day average limit[67] and which is higher than the 0.05 lb/MMBtu 30-day average limit that EPA previously imposed under the BART FIP, should be achievable with SCR at San Juan Units 1 and 4. Thus, the cost effectiveness of SCR should be evaluated based on the costs to meet a 0.04 lb/MMBtu annual average NOx rate, and not a 0.05 lb/MMBtu annual average NOx rate. As shown in Table 2 above, the worst-case cost effectiveness to achieve an annual average 0.05 lb/MMBtu NOx rate with SCR, assuming a 20-year life and a 1.2 retrofit factor, is approximately $6,300 per ton at each San Juan unit.

These cost effectiveness numbers that are based on reductions from current emissions (i.e., with SNCR) do not reflect that there will be a reduction in annual costs at San Juan Units 1 and 4 from no longer operating SNCR. The Enchant/Farmington SCR cost analysis indicates the SNCR reagent costs for dry urea that would no longer be incurred would be $529,000 and $852,000 per year at San Juan Units 1 and 4, respectively, and that there would also be net decreases in water and auxiliary power costs when operating SCR instead of SNCR.[68] The above cost effectiveness numbers in Tables 1 and 2 do not take into account the reduced costs from no longer operating SNCR, but it is an additional factor that should be considered in determining whether SCR is cost effective for San Juan Units 1 and 4. Based on these analyses with EPA's SCR cost spreadsheet and even assuming a shortened 20-year life of SCR and a 1.2 retrofit factor, SCR should be considered a cost effective control for San Juan Units 1 and 4 to achieve reasonable progress towards the national visibility goal.[69]

[67] 83 Fed. Reg. 51,403 at 51,408 (Oct. 11, 2018).
[68] *Id.*, Appendix B at 2 and 5 (pdf pages 62 and 65).
[69] *See* December 2019 Stamper Report at 22-24 for discussion of costs of controls considered reasonable under the regional haze program for EGUs.