PACIFICORP
A BERKSHIRE HATHAWAY ENERGY COMPANY

August 31, 2021

Bryce C. Bird, Director
Chelsea Cancino, Environmental Scientist
Utah Division of Air Quality
195 North 1950 West
Salt Lake City, Utah 84114-4820

Re: **The State of Utah's Second Planning Period Analysis for Regional Haze that Impacts PacifiCorp's Hunter and Huntington Power Plants**

Dear Ms. Cancino and Mr. Bird:

The purpose of this letter is to provide additional information regarding the questions and issues raised in your June 16, 2021, letter regarding the four-factor analyses for the Hunter and Huntington power plants. Below are specific responses and information about those issues. PacifiCorp looks forward to meeting with the Division and discussing these matters in person.

Additional Information and Clarification:

1. **Incorrect interest rate:** UDAQ indicated that PacifiCorp's use of a 7.00% interest rate in its SNCR and SCR regional haze second planning period cost analyses is incorrect and suggested that 3.25% is a more appropriate interest rate. PacifiCorp disagrees and is providing information supporting use of a 7.303% rate. PacifiCorp provided similar information to EPA within the last year relating to the appropriate discount rate for SCR cost analysis. Based on this investigation, the 7% interest rate used by PacifiCorp in previous regional haze four-factor analyses is actually low and should be replaced by PacifiCorp's actual weighted average cost of capital, which is 7.303%, using EPA's Control Cost Manual total capital investment ("TCI") methodology. PacifiCorp understands that the interest rate should be set using this TCI methodology.
    a. PacifiCorp's discount rate, or actual weighted average cost of capital, has consistently exceeded 7% over the past several years.

b. The actual weighted average cost of capital is calculated using the rates approved by the six state regulatory authorities where PacifiCorp conducts business and the percentage of energy delivered by PacifiCorp to each of those states. *See* Attachment A. Thus, PacifiCorp's 7.303% actual average cost of capital rate is more appropriate than the 7% rate used by S&L.
c. PacifiCorp has recalculated costs using the 7.303% rate, and the new costs are provided in Attachment B.

2. **UDAQ methodology for SNCR calculations:** For purposes of comparison only, PacifiCorp recalculated Hunter and Huntington SNCR and SCR cost effectiveness using a 3.25% interest rate and a $30/MWh auxiliary power cost to align with Utah's methodology. PacifiCorp's SCR calculations closely match UDAQ's values; however, PacifiCorp's SNCR cost effectiveness values are significantly higher than UDAQ's values. Table 1 compares UDAQ's 3.25% interest rate cost effectiveness values to PacifiCorp's calculated value.

Table 1: PacifiCorp vs. UDAQ SNCR and SCR Cost Effectiveness

	SNCR Life (years) 20 Interest Rate 3.25%			SCR Life (years) 30 Interest Rate 3.25%		
	SNCR			**SCR**		
	PacifiCorp ($/ton)	UDAQ ($/ton)	Difference ($/ton)	PacifiCorp ($/ton)	UDAQ ($/ton)	Difference ($/ton)
Hunter 1	$5,752	$4,130	$1,622	$4,448	$4,449	$1
Hunter 2	$5,702	$4,171	$1,531	$4,423	$4,425	$2
Hunter 3	$4,906	$3,148	$1,758	$3,023	$3,024	$1
Huntington 1	$5,673	$3,987	$1,686	$4,077	$4,069	$8
Huntington 2	$5,783	$4,152	$1,631	$4,286	$4,277	$9

While SCR cost calculations generally align between PacifiCorp and UDAQ, PacifiCorp has conducted further analysis of differences with UDAQ calculations for SNCR. Based on this analysis, PacifiCorp suggests the following adjustments. First, some of UDAQ's estimates rely on default or general values or rather than site-specific information. PacifiCorp uses values from Sargent & Lundy's (S&L) engineering studies which were conducted for each plant. EPA's 2019 Guidance favors the use of source-specific cost estimates over default values when available, since site-specific information

produces more accurate results. *See* EPA, 2019 Control Cost Manual, Section 1, Ch. 1, 1-7.

With this in mind, PacifiCorp suggests replacing UDAQ's NOx control effectiveness rates (approximately 23% and varying slightly from unit to unit). PacifiCorp is uncertain how UDAQ arrived at these rates but finds it more appropriate to use a 20% NOx control effectiveness rate across all units. This is the anticipated control effectiveness rate for SNCR based on S&L's 2020 study. It is more conservative and slightly higher than the rates PacifiCorp used in its original analysis.

PacifiCorp also suggests that the capital and operation and maintenance cost estimates from the S&L studies be used in place of the default values used by UDAQ. As above, because these values were arrived at based on a site-specific engineering study, they are more appropriate and accurate than the default values from EPA's Control Cost Manual.

Finally, the updated "interest" rate of 7.303% should be used based on the reasoning presented in Response 1 above. All of these suggestions have been incorporated into a new cost calculation for SNCR, and PacifiCorp recommends using this cost calculation to determine the cost effectiveness of SNCR. *See* Attachment C.

3. **Control efficiency:** *See* no. 6 below – analysis of SCR/SNCR mitigating factors.

4. **EPM and auxiliary power:** In its review of PacifiCorp's Hunter and Huntington four-factor analyses, UDAQ notes that PacifiCorp used different O&M costs for auxiliary power in the SNCR and SCR cost effectiveness calculations; $50/MWh for SNCR auxiliary power and $30/MWh for SCR auxiliary power. In order to provide similar auxiliary power costs for both NOx control technologies, PacifiCorp has recalculated Hunter and Huntington SNCR cost effectiveness using the more conservative $30/MWh auxiliary power cost. Table 2 summarizes SNCR and SCR cost effectiveness using a 7.303% interest rate. Table 3 summarizes SNCR and SCR cost effectiveness using a 3.25% interest rate.

Table 2: Auxiliary Power Cost Effectiveness at 7.303% discount rate

	SNCR		SCR
	$50/MWh Auxiliary Power Cost	$30MWh Auxiliary Power Cost	$30/MWh Auxiliary Power Cost
7.303% Disc Rate	Cost ($/ton)	Cost ($/ton)	Cost ($/ton)
Hunter 1	$6,588	$6,536	$6,533
Hunter 2	$6,523	$6,469	$6,488
Hunter 3	$5,455	$5,417	$4,401
Huntington 1	$6,482	$6,431	$5,979
Huntington 2	$6,632	$6,579	$6,294

Table 3: Auxiliary Power Cost Effectiveness at 3.25% Interest Rate

	SNCR		SCR
	$50/MWh Auxiliary Power Cost	$30MWh Auxiliary Power Cost	$30/MWh Auxiliary Power Cost
3.25% Disc Rate	Cost ($/ton)	Cost ($/ton)	Cost ($/ton)
Hunter 1	$5,804	$5,752	$4,448
Hunter 2	$5,755	$5,702	$4,423
Hunter 3	$4,943	$4,906	$3,023
Huntington 1	$5,725	$5,673	$4,077
Huntington 2	$5,836	$5,783	$4,286

As indicated in Tables 2 and 3, the reduction of SNCR auxiliary power costs from $50/MWh to $30/MWh does not result in a substantial cost effectiveness reduction.

5. **Air preheater costs not justified:** In its June 16th letter regarding PacifiCorp's Huntington and Hunter SNCR cost analyses, UDAQ includes the statement "*the inclusion of an air-preheater for SNCR which may not be justified*". Note that the Huntington and Hunter units already utilize air preheaters; the S&L cost analyses indicate that the units' air preheater equipment may require material upgrades due to excess ammonia from the SNCR process which has a potential to corrode and/or plug the existing air preheater equipment. PacifiCorp believes its position is reasonable based on the analysis done by experts in the field.

6. **More analysis of factors weighing against SCR/SNCR:**

a. **SCR emissions rates:** In the analysis included with the June 16th letter, UDAQ indicated that the SCR emission rate should be lower than 0.05 lb/MMBtu. The indicated SCR NOx reductions are unit-specific incremental improvement estimates based on each specific unit's boiler operational characteristics and the existing installation of low-NOx burners with separated overfire air. The proposed 0.05 lb/MMBtu SCR emission rate is consistent with the lowest guaranteed emission rates that have been reported for SCR technology. The SCR emission rate of 0.05 lb/MMBtu is the rate that is reasonably achievable with these controls and is in the lower end range of what can be achieved with these technologies on an emission basis (lb/MMBtu), and is consistent with permit/design limits for similar systems.
b. EPA has found this rate to be appropriate for these specific units. *See* 85 FR 75860, 75868 ("Additionally, while the commenters cite actual annual emission rates found in the EPA's Air Markets Program Database (AMPD) to support their claim that an annual emission rate of 0.04 lb/MMBtu is achievable with SCR, a more thorough review of the data supports the EPA's conclusion that an annual emission rate no lower than 0.05 lb/MMBtu is representative of what can be achieved when retrofitting SCR to an existing boiler. . . . Notwithstanding the site-specific nature of SCR retrofits, these data support the conclusion that an annual emission rate of 0.05 lb/MMBtu is appropriate for the Utah BART units, and confirm that the assumption is relatively conservative because the majority of EGUs equipped with SCR have actual annual emission rates that are higher."). Utah has supported this position previously and should not change that position now.
c. EPA has found the 0.05 lb/MMBtu NOx emissions rate appropriate for many other regional haze-related SCR analyses. *See e.g.,* Arkansas, 81 FR 66332, 663837-38 (September 27, 2016) ("Regarding the Sierra Club's consultant's SCR control cost analysis, we do not believe that a NOX emission limit of 0.04 lbs/MMBtu has been maintained on a 30 boiler-operating-day average at other similar facilities. We conclude that, as we did in our New Mexico FIP, a 30 boiler-operating-day NOX average of 0.05 lbs/MMBtu is an appropriate assumption for SCR installation at the Flint Creek facility."); New Mexico, 79 FR 60978, 60984 (Oct. 9, 2014) ("We disagree that lower control rates needed to be evaluated for SCR. We evaluated the monthly emission data from these two facilities for the past several years (available at EPA's Air Market Program data Web site: www.epa.gov/ampd). All three units

have monthly emission rates that sometimes exceed 0.04 lb/MMBtu. Indeed, the Morgantown units have months where the monthly emission rate is 0.05 lb/MMBtu or higher. In promulgating the FIP, we evaluated the performance of both new and retrofit SCRs and determined that 0.05 lb/MMBtu on a 30-boiler-operating-day average was the appropriate emission limit for SCR at the SJGS units.").

d. **SCR Cost Impacts:** PacifiCorp anticipates that the financial consequences of a requirement to install SCR on any of the Hunter or Huntington units would be early retirement of the unit. Due to the substantial capital costs of SCR, the associated O&M costs, the parasitic load imposed by the SCR, the transmission constraints within which the Hunter and Huntington plants operate, and the increasingly competitive energy markets and regulatory restrictions that govern PacifiCorp's operations in Utah, an SCR determination for the Hunter or Huntington units would have such an onerous financial impact that PacifiCorp would be forced to retire the units rather than install the SCR.
e. Even where a control technology may be found cost effective, EPA's regulations allow decision makers to take a source's ability to afford a technology into account if "the installation of controls would affect the viability of continued plant operations." 40 CFR part 51, appendix Y, section IV.E.3.1.3. Such consideration is appropriate where "effects on product prices, the market share, and profitability of the source . . . are judged to have a severe impact on plant operations."
f. If UDAQ is seriously considering SCR as a requirement for any unit to fulfill second planning period requirements, PacifiCorp requests additional time to provide "an economic analysis that demonstrates, in sufficient detail for public review, the specific economic effects, parameters, and reasoning" to show such a requirement would have a severe impact on unit operations. *See, e.g.* 79 FR 5032, 5171 (2014) (discussion of an affordability analysis for the Laramie River plant in Wyoming); 76 FR 36334 (2011) (discussion of an affordability analysis for the TASCO facility in Idaho); 78 FR 79344, 79353-54 (2013) (using an affordability analysis to reject a BART control at the Intalco plant in Washington).

7. **More support for RPEL:** UDAQ requests additional information on methodology for selecting the RPEL allowable limits in the original four-factor analysis. This is provided below.

a. PALs: are voluntary permit limits that PacifiCorp proposed and UDAQ implemented. PALs were established so that the PAL pollutants (NOx and SO2) are exempt from future NSR/PSD permitting actions as long as emissions for the pollutants stay below the PALs. It is expected that PacifiCorp operate below the PALs, since a margin of safety/error is expected for permit limits. PacifiCorp believes it is important that companies not be "punished" for operating within a safe margin below their permit limits.
b. PacifiCorp used the following 4-step methodology to select the RPEL allowable limits put forth in its original four-factor analysis:
    i. First, each unit's maximum boiler heat input was multiplied by an SNCR-equivalent lb/MMBtu NOx emission rate to calculate the potential annual NOx emission rate for each unit (tons/year) if SNCR were implemented.
    ii. Second, the individual unit SNCR-equivalent annual NOx emissions were summed to determine the total facility potential NOx emissions if SNCR were implemented. For Hunter this value was 12,235 tons/year, and for Huntington it was 7,386 tons/year.
    iii. Third, each facility's PAL-permitted annual SO_2 emission limit was added to the SNCR-equivalent NOx emissions. Hunter has an SO_2 PAL limit of 5,537.5 tons/year and Huntington has an SO_2 PAL limit of 3,105 tons/year. Summing the SO_2 PALs with the SNCR-equivalent annual NOx emissions provides NOx + SO_2 values of 17,773 tons/year for Hunter, and 10,491 tons/year for Huntington.
    iv. Fourth, the summed values were rounded down to the nearest 1,000 ton/year value to ensure emission reductions below the potential SNCR values. This provided the proposed RPEL values of 17,000 tons/year for Hunter and 10,000 tons/year for Huntington.
c. PacifiCorp used this process to demonstrate that the proposed RPEL limits were both: (1) less that the plants' existing NOx + SO_2 PALs. (Hunter's current NOx + SO_2 PALs are equivalent to 20,632 tons/year and Huntington's are equivalent to 11,076 tons/year) and (2) less than reductions that would be achieved through installation of SNCR on all units.
d. UDAQ has also requested PacifiCorp to consider a revised RPEL or other options to address historical and recent actual emission trends.

PacifiCorp is currently analyzing options in response to this request and would like to discuss with the agency its concerns about UDAQ's approach. We would like to further discuss the appropriate ways to address these second planning period issues in light of the current Tenth Circuit mediation process for the first planning period SIP.

8. Visibility considerations
    a. Section 2.0 of UDAQ's analysis refers to the "four-factor" test for reasonable progress, but there is no mention of "visibility improvement". In previous reasonable progress determinations during the first planning period, EPA explicitly relied on modeled visibility impacts in addition to the four factors to determine appropriate emission reduction measures. *See North Dakota v. U.S. EPA*, 730 F.3d 750 (8th Cir. 2013) and *National Parks Conservation Assoc. v. U.S. EPA*, 788 F.3d 1134 (9th Cir. 2015). No changes have been made to the applicable statutes or rules that would mandate a different approach.
    b. PacifiCorp strongly urges UDAQ to give the visibility factor significant weight in its regional haze "visibility improvement" program. The statute that forms the legal basis for the Regional Haze Program declares that the goal of the program is "the prevention of any future, and the remedying of any existing, impairment of **visibility** in mandatory class I Federal areas which impairment results from manmade air pollution." *See* 42 U.S.C. § 7491(a)(1) (emphasis added); *see also* 86 FR 15104, 15105 ("The **regional haze** regulations require states to demonstrate reasonable progress toward meeting the national **goal** of restoring natural **visibility** conditions for Class I areas by 2064."); 85 FR 3558, ("Regional haze SIPs must assure reasonable progress toward the national goal of achieving **natural visibility conditions in Class I areas**, which, for the first implementation period, includes satisfying the BART requirements."). Therefore, any actions required by a state's regional haze SIP must prevent, or remedy existing, visibility impairment in Class I areas, and it is the state's burden to establish the same. EPA guidance therefore correctly allows states discretion to consider "visibility improvement" in their 2PP analysis.
        i. "EPA has also explained that, in addition to the four statutory factors, states have flexibility under the CAA and RHR to reasonably consider visibility benefits as an optional fifth factor alongside the four statutory factors. Here, again, the 2019

> Guidance provides recommendations for the types of information that can be used to characterize the four factors (with or without visibility), as well as ways in which states might reasonably consider and balance that information to determine which of the potential control options is necessary to make reasonable progress. See 2019 Guidance at 30-36." 86 FR 19793, 19798.

c. Given the goal of the Regional Haze Program, PacifiCorp urges UDAQ to review and apply the available modeling and "visibility benefit" data that the state and region have worked so hard to produce. Application of regional visibility modeling data to ensure appropriate regional haze controls is consistent with Utah's past practice for evaluating its Long-Term Strategies. *See* Subsection K, Projection of Visibility Improvement Anticipated From Long-Term Strategy, Utah State Implementation Plan, Section XX, Regional Haze. PacifiCorp believes that Utah should follow the same "Long-Term Strategy" methodology it used for its previous regional haze SIP because no new statutes or regulations have been adopted since Subsection K of Utah's Regional Haze SIP was adopted that would require, or even allow, a change in methodology.
d. Failure to apply visibility data would set a dangerous precedent that the regional haze program can require retrofit equipment and emission reductions with no evidence that such expenditures are necessary to improve visibility and fulfill the purpose of the statute.

PacifiCorp hopes this information is helpful and responds to the questions raised by UDAQ and would be happy to meet in person and discuss these matters in more detail.

Sincerely,

James Owen
Director, Environmental

CC: Jim Doak
Marie Durrant
Laren Huntsman
Blaine Rawson - Ray Quinney & Nebeker P.C

Attachment A

Discount Rate for SCR Control Costs at Hunter and Huntington

PacifiCorp's discount rate, or its actual weighted average cost of capital, is calculated using the rates approved by the six state regulatory authorities where PacifiCorp conducts business and the percentage of energy delivered by PacifiCorp to each of those states. PacifiCorp's actual weighted average cost of capital is 7.303% using an authorized return weighted by Year 2020 retail sales. *See* Exhibit A. This rate is historical and does not change dramatically from year to year.

According to EPA's updated Cost Control Manual, SCR costs should be estimated using the total capital investment ("TCI") methodology.[1] The TCI methodology accounts for financing costs, including interest rates. As EPA explains, "The interest rate at which a firm borrows is a key component in estimating the total costs of compliance"[2] with a government regulation, and EPA recommends using a source's actual borrowing rate when possible:

> Different firms may structure how they finance their purchases differently. Some may choose to finance their purchases through cash holding or other means of equity; some may choose to borrow to finance their investment. When firms choose to borrow, depending on the size of the investment, borrowing could be structured very differently at very different interest rates given the choices firms have for financing an investment. . . . For input to analysis of rulemakings, assessments of private cost should be prepared using firm-specific nominal interest rates if possible. . . . In assessing these private decisions, interest rates that face firms must be used, not social rates.[3]

PacifiCorp's interest rate for all capital investments, including required regulatory investments such as an SCR, is governed by its state regulators. PacifiCorp finances its capital expenditures using a mix of debt and common equity capital of approximately 48/52 percent, respectively, which aligns with the average capital structure approved in the six state jurisdictions where the company operates. State regulators also approve the cost of debt and cost of equity assigned to the components of the capital structure. The resulting interest rate, more commonly referred to as the weighted average cost of capital, is a weighting of the Company's cost of debt and cost of equity multiplied by the approved debt and equity components of the capital structure.[4]

---

[1] EPA, Cost Control Manual, Ch. 2 (Selective Catalytic Reduction), s. 2.4.1 (June 2019). *See also* 79 FR 5032, 5136-37 (Wyoming) (Jan. 30, 2014) (discussing that cost analysis for an SCR requirement is "related to government regulations" and involves a discount rate).

[2] EPA Cost Control Manual, Section 1, Ch. 2 (Cost Estimation: Concepts and Methodology), s. 2.5.1 (Nov. 2017), at 15.

[3] *Id*.

[4] PacifiCorp must maintain an average overall common equity component in excess of 52 percent to maintain its credit rating and finance the debt component of its capital structure at

Based on state orders currently in effect, PacifiCorp's interest rate (weighted average cost of capital) ranges from a low of 7.13% in Oregon to a high of 7.98% in Idaho. *See* Exhibit B. As stated by the Idaho Public Utilities Commission, "[T]he Commission has authorized PacifiCorp to maintain adequate equity and debt authority thereby allowing PacifiCorp to access capital markets at reasonable costs."[5] Using 2020 retail sales in megawatt hours from each of the six state jurisdictions where the company operates, the weighted interest rate for PacifiCorp is calculated at 7.303%. *See* Exhibit A.

---

the lowest reasonable cost to its customers. This capital structure enables the company's continued investment in infrastructure to provide safe and reliable service to its customers at reasonable costs.

[5] Idaho Public Utilities Commission, Case No. PAC-E-10-07, Order No. 32196, Feb. 28, 2011, at 12.

Exhibit A: Weighted Authorized Cost of Capital

	2020 Retail Sales MWH	Weighted Percent	Authorized Return	Weighed Authorized Return
CALIFORNIA	758,832	1.39%	7.622%	0.106%
OREGON	12,993,459	23.82%	7.137%	1.700%
WASHINGTON	4,065,151	7.45%	7.169%	0.534%
UTAH	24,850,549	45.55%	7.342%	3.344%
IDAHO	3,534,206	6.48%	7.980%	0.517%
WYOMING	8,357,790	15.32%	7.192%	1.102%
TOTAL	54,559,978	100.00%		**7.303%**

The weighted authorized return is calculated using authorized return weighted by Year 2020 retail sales (MWh)

Exhibit B: State Approved Cost of Capital Rates

The state findings establishing the cost of capital rates are summarized in the tables below:

Wyoming Public Service Commission, DOCKET No. 20000-578-ER-20 (RECORD No. 15464), July 15, 2021.

Par. 177: Based on our conclusions and findings, we have therefore determined RMP's capital structure and RORB [return on rate base] should be:

Component	Percent of Total	% Cost	Weighted Average
Long Term Debt	48.99%	4.79%	2.347%
Preferred Stock	0.01%	6.75%	0.001%
Common Equity Stock	51.00%	9.50%	4.845%
	100.000%		7.192%

Utah Public Service Commission, PacifiCorp dba Rocky Mountain Power 2021 General Rate Case, Docket No. 20-035-04, Dec. 30, 2020

Par. 51: Table 2 presents the final capital structure, ROE [return on equity], and overall rate of return we approve.

Ordered Cost of Capital			
	Capital Structure	Rate	Weighted Rate
Long Term Debt	47.50%	4.79%	2.275%
Preferred Stock	0.00%	0.00%	0.00%
Common Equity Stock	52.50%	9.65%	5.066%
	100.000%		7.342%

Oregon Public Utility Commission, Order No. 20-473 Dec. 18, 2020

Ordered Cost of Capital			
	Capital Structure	Embedded Cost	Weighted Rate
Debt %	49.99%	4.774%	2.387%
Preferred %	0.01%	6.750%	0.001%
Common Equity Stock	50.00%	9.500%	4.750%
	100.000%		7.137%

California Public Utilities Commission, Decision 20-02-025, Feb. 6, 2020

S. 4.0: We adopt a cost of capital of 7.622 percent . . . .

S. 4.3 Return on Equity

Adopted Capital Structure and Return		
	Capital Structure	Return
Long-Term Debt	48.02%	5.05%
Preferred Stock	0.02%	6.75%

Common Equity	51.96%	10.0%
[Weighted Rate]		[7.622%]

Idaho Public Utilities Commission, Case No. PAC-E-10-07, Order No. 32196, Feb. 28, 2011

"The Commission reaffirms . . . an overall weighted cost of capital and rate of return of 7.98% as approved in Interlocutory Order No. 32151." On page 2.

On page 12:

Component	**Percentage of Capital Structure**	**Cost**	**Weighted Cost**
Debt	47.6%	5.88%	2.80%
Preferred Stock	0.3%	5.42%	0.02%
Common Equity	52.1%	9.9%	5.16%
	100.00%		7.98%

. . . . This decision supports capitalization requirements by rejecting proposals to reduce equity balances. In separate security filings, the Commission has authorized PacifiCorp to maintain adequate equity and debt authority thereby allowing PacifiCorp to access capital markets at reasonable costs.

Washington Utilities and Transportation Commission, Order 09, 07, 12, Docket UE-191024, Dec 14, 2020

	Share	**Cost**	**Weighted Cost**
Equity	49.10%	9.50%	4.665%
LT Debt	50.88%	4.92%	2.503%
ST Debt	0.19%	1.73%	-----
Pf. Stock	0.02%	6.75%	0.01%
ROR			7.169%

Attachment B

Utah Regional Haze Second Planning Period SNCR and SCR Cost Analyses

SNCR COST EFFECTIVENESS	Unit 1 ($/ton)	Unit 2 ($/ton)	Unit 3 ($/ton)
Hunter	$6,536	$6,469	$5,417
Huntington	$6,431	$6,579	NA

SCR COST EFFECTIVENESS	Unit 1 ($/ton)	Unit 2 ($/ton)	Unit 3 ($/ton)
Hunter	$6,533	$6,488	$4,401
Huntington	$5,979	$6,294	NA

INPUTS

Interest Rate (i)	7.303%	(Input SNCR and SCR Cost of Capital Interest Rate)
SNCR Life (n) (years)	20	(Input SNCR Equipment Life)
CRF (SNCR)	0.09663	(Calculated CRF for given SNCR equipment life and interest rate)
SNCR Auxiliary Power Cost	$30	(Input SNCR auxiliary power cost $/MWh)
SNCR Removal Efficiency	20.0%	(Input SNCR Removal Efficiency)
SCR Life (n) (years)	30	(Input SCR Equipment Life)
CRF (SCR)	0.08305	(Calculated CRF for given SCR equipment life and interest rate)

Capital Recovery Factor (CRF): Capital Recovery Factor $i(1+i)^n / (1+i)^n - 1$

Capital Recovery Factor (CRF): Capital Recovery Factor $i(1+i)^n / (1+i)^n - 1$

SNCR COSTS	Unit 1 SNCR Capital Cost	Unit 2 SNCR Capital Cost	Unit 3 SNCR Capital Cost	Unit 1 SNCR Total Indirect Costs	Unit 2 SNCR Total Indirect Costs	Unit 3 SNCR Total Indirect Costs	Unit 1 SNCR Total Capital Investment (TCI)	Unit 2 SNCR Total Capital Investment (TCI)	Unit 3 SNCR Total Capital Investment (TCI)	Unit 1 SNCR Annualized Capital Cost	Unit 2 SNCR Annualized Capital Cost	Unit 3 SNCR Annualized Capital Cost	Unit 1 SNCR Annual O&M Cost	Unit 2 SNCR Annual O&M Cost	Unit 3 SNCR Annual O&M Cost	Unit 1 SNCR Total Annual Cost	Unit 2 SNCR Total Annual Cost	Unit 3 SNCR Total Annual Cost
Hunter	$7,574,000	$7,574,000	$7,574,000	$8,430,000	$8,430,000	$8,430,000	$16,004,000	$16,004,000	$16,004,000	$1,546,424	$1,546,424	$1,546,424	$2,168,400	$2,208,800	$3,176,600	$3,714,824	$3,755,224	$4,723,024
Huntington	$7,644,000	$7,644,000	NA	$8,508,000	$8,508,000	NA	$16,152,000	$16,152,000	NA	$1,560,724	$1,560,724	NA	$2,256,200	$2,156,000	NA	$3,816,924	$3,716,724	NA

SCR COSTS	Unit 1 SCR Capital Cost	Unit 2 SCR Capital Cost	Unit 3 SCR Capital Cost	Unit 1 SCR Total Indirect Costs	Unit 2 SCR Total Indirect Costs	Unit 3 SCR Total Indirect Costs	Unit 1 SCR Total Capital Investment (TCI)	Unit 2 SCR Total Capital Investment (TCI)	Unit 3 SCR Total Capital Investment (TCI)	Unit 1 SCR Annualized Capital Cost	Unit 2 SCR Annualized Capital Cost	Unit 3 SCR Annualized Capital Cost	Unit 1 SCR Annual O&M Cost	Unit 2 SCR Annual O&M Cost	Unit 3 SCR Annual O&M Cost	Unit 1 SCR Total Annual Cost	Unit 2 SCR Total Annual Cost	Unit 3 SCR Total Annual Cost
Hunter	$76,395,000	$76,395,000	$84,894,000	$69,797,000	$69,797,000	$77,538,000	$146,192,000	$146,192,000	$162,432,000	$12,141,691	$12,141,691	$13,490,472	$1,771,000	$1,807,000	$2,264,000	$13,912,691	$13,948,691	$15,754,472
Huntington	$75,707,120	$75,707,120	NA	$66,216,136	$66,216,136	NA	$141,923,256	$141,923,256	NA	$11,787,158	$11,787,158	NA	$1,763,000	$1,720,000	NA	$13,550,158	$13,507,158	NA

SNCR and SCR BASELINE EMISSIONS	Unit 1 Baseline Heat Input (MMBtu/year)	Unit 2 Baseline Heat Input (MMBtu/year)	Unit 3 Baseline Heat Input (MMBtu/year)	Unit 1 Baseline NOx Emission Rate (lb/MMBtu)	Unit 2 Baseline NOx Emission Rate (lb/MMBtu)	Unit 3 Baseline NOx Emission Rate (lb/MMBtu)	Unit 1 Baseline NOx Emissions (tons/year)	Unit 2 Baseline NOx Emissions (tons/year)	Unit 3 Baseline NOx Emissions (tons/year)
Hunter	28,482,643	30,101,030	31,182,279	0.200	0.193	0.280	2,842	2,902	4,359
Huntington	28,063,728	27,150,145	NA	0.212	0.208	NA	2,968	2,825	NA

SNCR EMISSIONS	Unit 1 Baseline Heat Input (MMBtu/year)	Unit 2 Baseline Heat Input (MMBtu/year)	Unit 3 Baseline Heat Input (MMBtu/year)	Unit 1 SNCR NOx Emission Rate (lb/MMBtu)	Unit 2 SNCR NOx Emission Rate (lb/MMBtu)	Unit 3 SNCR NOx Emission Rate (lb/MMBtu)	Unit 1 SNCR NOx Emissions (tons/year)	Unit 2 SNCR NOx Emissions (tons/year)	Unit 3 SNCR NOx Emissions (tons/year)
Hunter	28,482,643	30,101,030	31,182,279	0.160	0.154	0.224	2,273	2,322	3,487
Huntington	28,063,728	27,150,145	NA	0.169	0.166	NA	2,374	2,260	NA

SCR EMISSIONS	Unit 1 Baseline Heat Input (MMBtu/year)	Unit 2 Baseline Heat Input (MMBtu/year)	Unit 3 Baseline Heat Input (MMBtu/year)	Unit 1 SCR NOx Emission Rate (lb/MMBtu)	Unit 2 SCR NOx Emission Rate (lb/MMBtu)	Unit 3 SCR NOx Emission Rate (lb/MMBtu)	Unit 1 SCR NOx Emissions (tons/year)	Unit 2 SCR NOx Emissions (tons/year)	Unit 3 SCR NOx Emissions (tons/year)
Hunter	28,482,643	30,101,030	31,182,279	0.05	0.05	0.05	712	753	780
Huntington	28,063,728	27,150,145	NA	0.05	0.05	NA	702	679	NA

Utah Regional Haze Second Planning Period SNCR and SCR Cost Analyses

SNCR COST EFFECTIVENESS	Unit 1 ($/ton)	Unit 2 ($/ton)	Unit 3 ($/ton)
Hunter	$5,752	$5,702	$4,906
Huntington	$5,673	$5,783	NA

SCR COST EFFECTIVENESS	Unit 1 ($/ton)	Unit 2 ($/ton)	Unit 3 ($/ton)
Hunter	$4,448	$4,423	$3,023
Huntington	$4,077	$4,286	NA

INPUTS

Interest Rate (i)	3.250%	(Input SNCR and SCR Cost of Capital Interest Rate)
SNCR Life (n) (years)	20	(Input SNCR Equipment Life)
CRF (SNCR)	0.06878	(Calculated CRF for given SNCR equipment life and interest rate)
SNCR Auxiliary Power Cost	$30	(Input SNCR auxiliary power cost $/MWh)
SNCR Removal Efficiency	20.0%	(Input SNCR Removal Efficiency)
SCR Life (n) (years)	30	(Input SCR Equipment Life)
CRF (SCR)	0.05268	(Calculated CRF for given SCR equipment life and interest rate)

Capital Recovery Factor (CRF): $\frac{i(1+i)^n}{(1+i)^n - 1}$

Capital Recovery Factor (CRF): $\frac{i(1+i)^n}{(1+i)^n - 1}$

SNCR COSTS	Unit 1 SNCR Capital Cost	Unit 2 SNCR Capital Cost	Unit 3 SNCR Capital Cost	Unit 1 SNCR Total Indirect Costs	Unit 2 SNCR Total Indirect Costs	Unit 3 SNCR Total Indirect Costs	Unit 1 SNCR Total Capital Investment (TCI)	Unit 2 SNCR Total Capital Investment (TCI)	Unit 3 SNCR Total Capital Investment (TCI)	Unit 1 SNCR Annualized Capital Cost	Unit 2 SNCR Annualized Capital Cost	Unit 3 SNCR Annualized Capital Cost	Unit 1 SNCR Annual O&M Cost	Unit 2 SNCR Annual O&M Cost	Unit 3 SNCR Annual O&M Cost	Unit 1 SNCR Total Annual Cost	Unit 2 SNCR Total Annual Cost	Unit 3 SNCR Total Annual Cost
Hunter	$7,574,000	$7,574,000	$7,574,000	$8,430,000	$8,430,000	$8,430,000	$16,004,000	$16,004,000	$16,004,000	$1,100,737	$1,100,737	$1,100,737	$2,168,400	$2,208,800	$3,176,600	$3,269,137	$3,309,537	$4,277,337
Huntington	$7,644,000	$7,644,000	NA	$8,508,000	$8,508,000	NA	$16,152,000	$16,152,000	NA	$1,110,917	$1,110,917	NA	$2,256,200	$2,156,000	NA	$3,367,117	$3,266,917	NA

SCR COSTS	Unit 1 SCR Capital Cost	Unit 2 SCR Capital Cost	Unit 3 SCR Capital Cost	Unit 1 SCR Total Indirect Costs	Unit 2 SCR Total Indirect Costs	Unit 3 SCR Total Indirect Costs	Unit 1 SCR Total Capital Investment (TCI)	Unit 2 SCR Total Capital Investment (TCI)	Unit 3 SCR Total Capital Investment (TCI)	Unit 1 SCR Annualized Capital Cost	Unit 2 SCR Annualized Capital Cost	Unit 3 SCR Annualized Capital Cost	Unit 1 SCR Annual O&M Cost	Unit 2 SCR Annual O&M Cost	Unit 3 SCR Annual O&M Cost	Unit 1 SCR Total Annual Cost	Unit 2 SCR Total Annual Cost	Unit 3 SCR Total Annual Cost
Hunter	$76,395,000	$76,395,000	$84,894,000	$69,797,000	$69,797,000	$77,538,000	$146,192,000	$146,192,000	$162,432,000	$7,701,646	$7,701,646	$8,557,197	$1,771,000	$1,807,000	$2,264,000	$9,472,646	$9,508,646	$10,821,197
Huntington	$75,707,120	$75,707,120	NA	$66,216,136	$66,216,136	NA	$141,923,256	$141,923,256	NA	$7,476,761	$7,476,761	NA	$1,763,000	$1,720,000	NA	$9,239,761	$9,196,761	NA

SNCR and SCR BASELINE EMISSIONS	Unit 1 Baseline Heat Input (MMBtu/year)	Unit 2 Baseline Heat Input (MMBtu/year)	Unit 3 Baseline Heat Input (MMBtu/year)	Unit 1 Baseline NOx Emission Rate (lb/MMBtu)	Unit 2 Baseline NOx Emission Rate (lb/MMBtu)	Unit 3 Baseline NOx Emission Rate (lb/MMBtu)	Unit 1 Baseline NOx Emissions (tons/year)	Unit 2 Baseline NOx Emissions (tons/year)	Unit 3 Baseline NOx Emissions (tons/year)
Hunter	28,482,643	30,101,030	31,182,279	0.200	0.193	0.280	2,842	2,902	4,359
Huntington	28,063,728	27,150,145	NA	0.212	0.208	NA	2,968	2,825	NA

SNCR EMISSIONS	Unit 1 Baseline Heat Input (MMBtu/year)	Unit 2 Baseline Heat Input (MMBtu/year)	Unit 3 Baseline Heat Input (MMBtu/year)	Unit 1 SNCR NOx Emission Rate (lb/MMBtu)	Unit 2 SNCR NOx Emission Rate (lb/MMBtu)	Unit 3 SNCR NOx Emission Rate (lb/MMBtu)	Unit 1 SNCR NOx Emissions (tons/year)	Unit 2 SNCR NOx Emissions (tons/year)	Unit 3 SNCR NOx Emissions (tons/year)
Hunter	28,482,643	30,101,030	31,182,279	0.160	0.154	0.224	2,273	2,322	3,487
Huntington	28,063,728	27,150,145	NA	0.169	0.166	NA	2,374	2,260	NA

SCR EMISSIONS	Unit 1 Baseline Heat Input (MMBtu/year)	Unit 2 Baseline Heat Input (MMBtu/year)	Unit 3 Baseline Heat Input (MMBtu/year)	Unit 1 SCR NOx Emission Rate (lb/MMBtu)	Unit 2 SCR NOx Emission Rate (lb/MMBtu)	Unit 3 SCR NOx Emission Rate (lb/MMBtu)	Unit 1 SCR NOx Emissions (tons/year)	Unit 2 SCR NOx Emissions (tons/year)	Unit 3 SCR NOx Emissions (tons/year)
Hunter	28,482,643	30,101,030	31,182,279	0.05	0.05	0.05	712	753	780
Huntington	28,063,728	27,150,145	NA	0.05	0.05	NA	702	679	NA

Attachment C

Differences Between Utah's and PacifiCorp's Calculations of SNCR Cost Effectiveness

One of the key sources of discrepancies between PacifiCorp's and UDAQ's SNCR cost effectiveness values is UDAQ's reliance on the SNCR Cost Calculation Spreadsheet which is included in the EPA Air Pollution Cost Control Manual (CCM). This results in a significant discrepancy in capital costs for SNCR between UDAQ's and PacifiCorp's analyses. For example, UDAQ's capital cost for Hunter Unit 1 is approximately $11M, while PacifiCorp's is approximately $16M. The large discrepancy is primarily the result of UDAQ's reliance on the generic estimate in EPA's CCM SNCR spreadsheet vs. S&L's site-specific engineering estimate. The CCM spreadsheet includes EPA's disclaimer that "*actual costs may vary from those calculated here due to site-specific conditions, such as the boiler configuration and fuel type. Selection of the most cost-effective control option should be based on a* ***detailed engineering study and cost quotations from system suppliers***." EPA, Air Pollution Control Cost Estimation Spreadsheet For Selective Non-Catalytic Reduction (SNCR) Excel workbook, June 2019, Read Me tab. In other words, EPA's CCM SNCR guidance indicates that specific, detailed engineering and cost estimates, such as that developed by PacifiCorp, are preferable to the generic SNCR cost estimate based on the CCM.

The cost analysis provided by PacifiCorp and S&L is a detailed engineering study based on site-specific conditions and quotations from system suppliers as recommended by the CCM. PacifiCorp's cost estimate is a more accurate representation of the cost effectiveness of SNCR at the Hunter and Huntington units than the cost effectiveness values provided by using the CCM spreadsheet. The resulting differences are significant. For example, for Hunter Unit 1 the UDAQ analysis calculates a total capital investment (TCI) of $11,272,568 and a direct annual cost (O&M) of $1,705,334 per year. The PacifiCorp estimate calculates a TCI value of $16,004,000 and an annual O&M cost of $2,168,400. This is after adjusting PacifiCorp's costs by using UDAQ's 3.25% interest rate and $30/MWh electrical power cost.

Specific discrepancies between PacifiCorp's unit specific and UDAQ's more generalized analysis are outlined below.

1. **NOx Control Rate:** UDAQ and PacifiCorp used different NOx control efficiencies for SNCR. UDAQ used SNCR NOx control efficiencies ranging from 21.1% to 23.0%. PacifiCorp originally used its anticipated SNCR-controlled rates based on boiler firing configurations, baseline NOx rates and anticipated NOx emission limits following the implementation of SNCR. These rates are within the typical range for units of similar size and baseline NOx rates. However, PacifiCorp has subsequently revised its cost effectiveness determinations using a 20% NOx reduction rate, which is a typical manufacturer-guaranteed performance rate for similar boilers. Using this rate is more conservative and is consistent with the methodology used for the SCR cost effectiveness calculations.

2. **Heat Input:** UDAQ's estimated heat input values as calculated using the CCM methodology are much lower than PacifiCorp's actual boiler heat input values (excluding Hunter Unit 3). Further, the CCM spreadsheet is designed to utilize a ***net*** boiler heat input rate. UDAQ miscalculated the boiler heat input values by using annual Acid Rain ***gross*** generation data from CAMD (averaged from 2015-2020) to calculate unit heat rates. Net

and gross rates cannot be used interchangeably. These heat rate values were then multiplied by ***inaccurate net*** generation (in MW) values – instead of multiplying by the units' net ratings at full load capacity (net dependable capacity) – to determine boiler heat input.

Table 1 summarizes PacifiCorp's current net heat input rates and net dependable capacities for each unit. This is the data that should be used to calculate the correct boiler heat input values for use in the CCM spreadsheet.

Table 1: PacifiCorp Net Generation and Heat Rate Values

PacifiCorp Unit	Net Dependable Capacity (MW)	Net Heat Rate (Btu/kWh)	PacifiCorp Calculated Boiler Heat Input (MMBtu/hour)	UDAQ Calculated Boiler Heat Input (MMBtu/hour)
Hunter Unit 1	446	10,502	4,684	3,996
Hunter Unit 2	446	10,334	4,609	4,171
Hunter Unit 3	471	10,067	4,742	4,939
Huntington Unit 1	459	10,218	4,690	4,064
Huntington Unit 2	450	10,595	4,768	4,421

3. **Capacity Factor:** To calculate each unit's capacity factor, UDAQ used the Acid Rain ***gross*** generation and boiler heat input data to calculate gross unit heat rates. However, the CCM spreadsheet requires use of *net* heat rate values. Furthermore, UDAQ utilized incorrect unit-specific net MW ratings instead of current maximum dependable capacity net MW ratings. The use and application of these inaccurate values in the CCM spreadsheet resulted in calculations of incorrect unit capacity factors.

   Table 2 summarizes the Acid Rain average gross generation data (in MWh) and the inaccurate net generation values UDAQ used to calculate unit-specific capacity factors. Table 3 summarizes PacifiCorp's unit-specific annual capacity factors used to determine the average 2015-2019 values, which were calculated by actual heat input divided by rated heat input rate.

Table 2: UDAQ Calculated 2015-2019 Average Capacity Factors

	UDAQ			
	Average 2015-2019 CAMD Gross Generation (MWh)	Net Generation (MW)	Maximum Annual Generation (MWh)	Calculated Capacity Factor (%)
Hunter-1	3,062,197	430	3,766,800	81.3%
Hunter-2	3,103,568	430	3,766,800	82.4%
Hunter-3	3,217,127	510	4,467,600	72.0%
Huntington-1	3,043,166	440	3,854,400	79.0%
Huntington-2	2,796,838	455	3,985,800	70.2%

Table 3: PacifiCorp Actual 2015-2019 Capacity Factors

	PacifiCorp Actual Annual Capacity Factors					
	2015	2016	2017	2018	2019	Average
Hunter-1	82.3%	72.5%	51.2%	65.1%	76.7%	69.6%
Hunter-2	77.8%	70.8%	55.9%	72.0%	72.3%	69.8%
Hunter-3	81.8%	61.5%	58.1%	72.2%	70.4%	68.8%
Huntington-1	82.7%	63.9%	54.9%	60.6%	70.5%	66.5%
Huntington-2	67.6%	74.1%	49.9%	68.1%	52.3%	62.4%

4. **Operating and Maintenance Costs:** In general, UDAQ's use of generic CCM values resulted in O&M costs which were lower than the engineering estimates provided by S&L which were based on site-specific data (i.e. $1.7M vs. $2.2M O&M for Hunter Unit 1). PacifiCorp submits that the site-specific cost effectiveness determinations submitted for annualized capital and O&M costs are more accurate and 'real world' than the cost effectiveness values provided by the CCM.

Summary

PacifiCorp proposes UDAQ make the following adjustments to obtain a more representative cost effectiveness value for the installation of SNCR at the Hunter and Huntington plants:

- Utilize an SNCR NOx control efficiency of 20% for the Hunter and Huntington boilers, which is expected to be achievable based on unit size and firing configuration;
- Utilize capital and O&M costs provided by S&L which are site specific and more accurate than the generalized costs provided by the CCM model;
- Utilize PacifiCorp's actual weighted average cost of capital of 7.303% as the interest rate in the model instead of the 3.25% rate originally used by UDAQ;
- Utilize the current and accurate net MW generation rates and net unit heat rate provided in Table 1 to calculate boiler heat input; and lastly;
- Utilize the actual 2015-2019 average annual capacity factors in Table 3 instead of the rates included in Table 2, which are inaccurate.

PacifiCorp believes that use of the S&L capital and O&M cost data when combined with an SNCR 20% control efficiency and 7.303% interest rate will provide an accurate representation of unit-specific cost effectiveness. This is demonstrated by UDAQ's and PacifiCorp's SCR cost effectiveness determinations which provide essentially equivalent dollar-per-ton values.

The following tables provide a summary of PacifiCorp's revised SNCR cost effectiveness values for the Hunter and Huntington plants applying these adjustments. The estimates are based on a systemwide SNCR control efficiency of 20% and an interest rate of 7.303%. Note that the provided values do not incorporate minor changes in annualized capital and O&M costs which will occur when the April 9, 2020, S&L studies are updated to incorporate the current 7.303% interest rate and use of the 20% SNCR NOx control efficiency versus the studies' original use of a 7% interest rate and anticipated SNCR-controlled permit limit emission rates.

Table 4: PacifiCorp Updated Hunter SNCR Cost Effectiveness

COST EFFECTIVENESS	Hunter Unit 1	Hunter Unit 2	Hunter Unit 3
Baseline			
Baseline Heat Input (MMBtu/year)	28,482,643	30,101,030	31,182,279
Baseline NOx Emission Rate (lb/MMBtu)	0.200	0.193	0.280
Baseline NOx Emissions (tons/year)	2,842	2,902	4,359
NOx Emissions with SNCR (20% control efficiency)			
Controlled NOx Emission Rate (lb/MMBtu)	0.160	0.154	0.224
Controlled NOx Emissions (tons/year)	2,273	2,322	3,487
SNCR Annual NOx Removal (tons/year)	**568**	**580**	**872**
SNCR Cost Effectiveness (7.303% interest rate)			
Annualized Capital Costs (20-year life)	$1,546,424	$1,546,424	$1,546,424
Total Annual O&M Costs	$2,168,400	$2,208,800	$3,176,600
Total Annual Cost ($/year)	**$3,714,824**	**$3,755,224**	**$4,723,024**
COST EFFECTIVENESS ($/TON)	**$6,536**	**$6,469**	**$5,417**

Table 5: PacifiCorp Updated Huntington SNCR Cost Effectiveness

COST EFFECTIVENESS	Huntington Unit 1	Huntington Unit 2
Baseline		
Baseline Heat Input (MMBtu/year)	28,063,728	27,150,145
Baseline NOx Emission Rate (lb/MMBtu)	0.212	0.208
Baseline NOx Emissions (tons/year)	2,968	2,825
NOx Emissions with SNCR (20% control efficiency)		
Controlled NOx Emission Rate (lb/MMBtu)	0.169	0.166
Controlled NOx Emissions (tons/year)	2,374	2,260
SNCR Annual NOx Removal (tons/year)	**594**	**565**
SNCR Cost Effectiveness (7.303% interest rate)		
Annualized Capital Costs (20-year life)	$1,560,724	$1,560,724
Total Annual O&M Costs	$2,256,200	$2,156,000
Total Annual Cost ($/year)	**$3,816,924**	**$3,716,724**
COST EFFECTIVENESS ($/TON)	**$6,431**	**$6,579**

In conclusion, PacifiCorp submits that Tables 4 and 5 use of accurate annualized capital and O&M costs when combined with an appropriate SNCR NOx control efficiency of 20% provide reasonable SNCR cost effectiveness determinations for the Hunter and Huntington units. PacifiCorp has requested that S&L update their April 9, 2020, studies to utilize the current interest rate of 7.303% and the more conservative SNCR NOx control efficiency of 20% for all Hunter and Huntington units. These updates are currently being finalized and are not anticipated to materially impact the data provided here. PacifiCorp will notify UDAQ if any material changes occur.