Preliminary Responses to Department of Ecology and SWCAA on the January 2008 TransAlta, Centralia Power Plant BART Analysis

May 23, 2008

CH2M Hill has prepared this preliminary response to the Department of Ecology's April 25, 2008 questions and comments regarding the Centralia Power Plant BART Analysis (Jan. 2008) ("BART Analysis").

Ecology overall comment:

The baseline emission rate for all analyses (visibility and cost improvement) is the maximum 24 hour emissions level achieved during the 2003-2005 time period utilizing the LNC3 system installed per the SWCAA RACT Order, No. 97-2057. All emission reductions are applied against this baseline emission rate, all on a 24 hour rate basis. The potential annual average emissions from the future flexible fuels project are not suitable for use as baseline emissions. The BART analysis should be revised to reflect the correct baseline emissions rate, which will affect all analyses based on the difference between baseline emissions and potential future conditions.

Response:

Visibility modeling for the BART Analysis uses the maximum 24 hour emissions level achieved during the 2003-2005 time period. The BART Analysis used the projected Flex Fuel Project emission rates for the cost-effectiveness baseline because they are considered to be the most likely future emission rates after 2009. As requested, the BART Analysis will be revised based on EPA's and Ecology's guidance concerning establishment of the cost-effectiveness baseline for power plants. Ecology's June 12, 2007 "Best Available Retrofit Technology Determinations under the Federal Regional Haze Rule," p. 21, states:

> *"In the case of a fossil fueled power plant, the actual emissions for SO_2 and NOx emissions for each BART eligible unit will be based on the emissions during the most recent 8 calendar quarters reported to the EPA Clean Air Markets Division. A different time period may be used for a unit if the plant can demonstrate that one of those years was not representative of normal operation."*

In accordance with this guidance, the baseline emission rates for the cost-effectiveness analyses will be changed to reflect the emissions reported by the Centralia Power Plant (CPP) to the EPA Clan Air Markets Division for the eight quarters of 2006 and 2007.

For 2006 and 2007, Centralia's reported the SO_2 and NOx rates listed below.

Unit ID	YEAR	Operating Time hr	SO2 Rate lb/MMBtu	SO2 tons	NOX Rate lb/MMBtu	NOx Tons	Heat Input MMBtu
BW21	2006	1953.58	0.0321	171.24	0.261	1,381	10,655,302
BW21	2006	144.88	0.0465	14.7	0.311	94	631,744
BW21	2006	2014.49	0.0466	325.786	0.272	1,902	13,977,671
BW21	2006	2128.06	0.0482	355.735	0.287	2,080	14,759,392
		6,241	0.0433	867	0.273	5,457	40,024,109
BW21	2007	2016.44	0.0274	147.347	0.273	1,471	10,773,910
BW21	2007	1625.91	0.0227	115.199	0.278	1,412	10,155,726
BW21	2007	2143.57	0.0473	357.558	0.267	2,020	15,131,951
BW21	2007	2098.77	0.0426	314.161	0.266	1,961	14,744,849
		7,885	0.0368	934	0.270	6,863	50,806,436
Unit 1 Total 2006 - 2007			0.0397	1,802	0.271	12,320	90,830,545
BW22	2006	2002.68	0.0400	236.41	0.226	1,348	11,821,220
BW22	2006	166.5	0.0432	27.333	0.267	169	1,266,032
BW22	2006	1188.71	0.0664	243.175	0.254	901	7,325,872
BW22	2006	2140.73	0.0411	289.28	0.256	1,790	14,067,178
		5,499	0.0462	796	0.244	4,209	34,480,302
BW22	2007	1863.46	0.0365	196.809	0.223	1,201	10,772,627
BW22	2007	1650.35	0.0655	329.392	0.237	1,191	10,050,867
BW22	2007	2184.85	0.0401	286.111	0.211	1,505	14,261,888
BW22	2007	2047.48	0.0536	380.78	0.209	1,484	14,203,551
		7,746	0.0484	1,193	0.218	5,381	49,288,933
Unit 2 Total 2006 - 2007			0.0475	1,989	0.229	9,590	83,769,235
Average Units 1 & 2 2006 - 2007			0.0436	1,896	0.250	10,955	87,299,890

Specific comments

1. The Table of Contents for Appendix B should include all the tables in that section (Table 3-3 is missing from the Table of Contents).

Response: *This will be corrected.*

2. Page ES-2, NOx Emission Control, While the discussion on inapplicability of the ROFA and Rotamix controls technologies are adequate for the executive summary of this document, there needs to be a more detailed discussion later in the report on these control technologies.

Response: *A more detailed discussion will be included in the revised BART Analysis.*

3. Page ES-3, BART Modeling Analysis. The listing and discussion of the modeling cases appears to be incomplete. 5 cases are listed, yet the modeling files indicate that modeling was performed for 6 different cases, including for the correct baseline emissions based on actual operations in the 2003-2005 period. The listed Case 1 reflecting the expected emissions of the future Flex Fuel Project is not the baseline case against which the other options should be evaluated. *See* Overall Comment, above.

Response: We will clarify the differences between the Cases used for the modeling analysis and the control technology analysis and develop a consistent numbering system to avoid confusion. As explained in the Overall Comment, the 2006-2007 baseline rates will be substituted for the Flex Fuel Project baseline.

4. Page ES-4: The report includes the following description of the maximum potential visibility improvement in Mount Rainier National Park attributable to the installation of BART controls at the Centralia Power Plant: "In addition, the modeling results indicate that the greatest potential improvement would be in the Mount Rainier National Park of about 2 dv, a level that might not be perceptible by humans." If you leave this statement in the executive summary, you should add a statement that the deciview scale was designed such that a single deciview represents a change in visibility that would be noticeable to most people. "A one deciview change in haziness is a small but noticeable change in haziness under most circumstances when viewing scenes in mandatory Class I Federal areas." (62 FR 41145, July 31, 1997)

Response: The EPA in the July 31, 1997 Federal Register claimed that "A one deciview change in haziness is a small but noticeable change in haziness under most circumstances when viewing scenes in mandatory Class I Federal areas." The actual level of visibility improvement that can be reliably perceived in the Pacific Northwest is a matter of debate but is generally recognized to be somewhere between 1 and 3 dv. The deciview scale was designed to be linear with respect to perceived visual changes over its entire range according to it developers Pitchford and Malm.

In addition, Pitchford and Malm state: "A 1 dv change is about a 10% change in extinction coefficient, which is a small but perceptible scenic change under many circumstances." In an April 2003 article reviewing the Pitchford and Malm work, the National Park Service's IMPROVE Newsletter stated that a "1 to 2 dv difference corresponds to a small, visibly perceptible change in scene appearance where the assumptions used to develop the dv scale are met." However, Henry[1] *using actual data notes: "The deciview scale is not uniform in perception over a wide range of visibility conditions. In fact, the change in deciviews needed to be noticeable varies greatly depending on the optical distance of the landscape feature and its inherent colorfulness." Henry also notes: "A 1-deciview change is never noticeable." Furthermore, in the Washington Department of Ecology's December 5, 1997 response to EPA's July 31, 1997 proposed rulemaking Ecology's Air Quality Program Manager, Joseph Williams, stated that*

> *"Our initial analysis suggests that, for Washington, the "one deciview" rate of progress would be undetectable because of statistical variation. In our recent review of our visibility SIP we examined data from two of our best sites (in terms of valid data recovery and length of record). We found that even using summertime afternoon hours to minimize statistical "noise", and using a very modest 50% confidence interval, the variance exceeds the "one deciview" reasonable progress target. Indeed, at these best sites, during their least noisy periods, the minimum trend detectable with a 50% confidence interval is 2 - 3 dv/decade."*

This clarification will be added to the revised BART Analysis.

5. Section 2, Present Unit Operation. Page 2.1 The third paragraph on this page indicates that an equipment lifetime of 10 years is used as recommended by Ecology's annotations on EPA's BART Guidance. However, Ecology's guidance actually states that 10 years is the *default* time unless a different control equipment lifetime is listed in the EPA Control Cost Manual or another different lifetime applies to a particular control (i.e. catalyst bed lifetime for an SCR system)[2]. For an SNCR system, the Control Cost Manual indicates an equipment lifetime of 20 years (6th edition of the Control Cost Manual, EPA/452/B-02-001, January 2002, Section 4, page 1-37). This contrasts with the catalyst portion of an SCR system with a rated bed life of 1 – 4 years and the balance of the equipment with a 20 year lifetime (Control Cost Manual, EPA/452/B-02-001, Section 4, page 2-48). In its 2007 Investor Day presentations, TransAlta lists the 'book lifetime' of this facility extending to 2030 (5 years longer than the BART analysis's statement on this page of "both units operating at least until

[1] Henry, Ronald C. 2002. "Just-Noticeable Differences in Atmospheric Haze." *Journal of the Air and Waste Management Association* 52:1238-1243

[2] "Unless there is a characteristic of the control technology that requires a different lifetime or the Control Cost Manual lists a different equipment lifetime, utilize a control equipment lifetime of at least 10 years. If a different lifetime is used, document your rationale for the use of the different lifetime.", Page 20 of 40 of the Ecology Annotated EPA BART guidance.

2025”). Since TransAlta proposes a life extension project to add another 10 years of plant lifetime beyond that date, the report should focus its analysis on longer equipment lifetimes for NOx control systems.

Response: The economic analysis will be adjusted to an expected operation to at least 2030.

The 5th paragraph on this page mentions a Flex Fuel Project to modify the coal boilers to accommodate Powder River Basin and similar coals. What is being done at the plant as part of this project? Are the reduced emissions of NOx that are anticipated to occur at the conclusion of the project enforceable?

Response: In light of the change to the 2006 – 2007 baseline, the BART Analysis will delete references to the Flex Fuel Project.

6. Page, 2-2, Table 2-1. Table 2-1 should clearly indicate that the "Stack Exit ID" and "Exit Area" value is the effective diameter and cumulative area of both stacks (Unit #1 and Unit #2) combined.

   Stack parameters listed in Table 2-1 do not match the stack parameters listed in Table 3-3 of Appendix B. For example, the stack velocity is listed as 57 feet per second in Table 2-1 and 15 meters per second (~50 feet per second) in Table 3-3 of Appendix B. Temperatures listed in each table also differ slightly. These differences should be reconciled. Please describe the methodology used to establish the velocity and provide the data used in your analysis

Response: The BART Analysis will correct or justify any differences in the two tables and add a description of how the parameters were determined.

Please supply the calculations and other supporting information for the boiler heat input rate, and the electric generation heat rate. The heat input rate and heat rate are different than can be calculated from the actual plant operating information in your plant’s federal acid rain program submittals. See also our similar comment regarding Appendix B, Tables 2-1 and 2-2.

The quarterly heat input rates are provided in the Response to the Overall Comment other calculations and supporting information will be provided in the revised BART Analysis.

7. Maximum 24 hour NOx emission rate (lb/MMBtu) during the 2003 – 2005 baseline period is given for each unit. Please include the other operating parameters that went along with those rates such as power output, heat input rate (24 hour averages), basis of emissions (e.g., CEM, stack test, calculated potential). Please provide the spreadsheets or detailed calculation methodology to show how the values for "NO_X Removed per year" was obtained in Table 3-2.

Response: The other operating parameters for the 2003 – 2005 baseline period will be provided in the revised BART Analysis. The values for "NOx Removed per year" will be revised based on the 2006 -2007 baseline. The quarterly emissions of SO_2 and NOx in lb/MMBtu and tons during the 2006 and 2007 baseline period are shown in the response to the Overall Comment. Also shown in the table are the hours of operation and heat input for each unit for each quarter in the baseline. The calculation methodology will be provided.

8. Page 3-2, 6th paragraph on the page. We are uncertain about the meaning of the last sentence in paragraph 6, related to LNBs, sub-bituminous coal, and NO_x formation kinetics. Can you please clarify in the report?

Response: The revised BART Analysis will clarify.

9. Page 3-3, Section 3.2.2, In the last paragraph of this page is a discussion of the Mobotec ROFA and Rotamix technologies. The report concludes that the technologies are technically infeasible because they have not been applied to this exact type of boiler. This statement does not demonstrate that the ROFA technology is technically infeasible. Based on research into the technology by SWCAA and Ecology, we consider it to be technically feasible absent an expanded review and demonstration by TransAlta that it is technically infeasible. As such, the cost analysis section of the report should include the ROFA technology or the report should provide an expanded analysis of why the technology is infeasible.

Response: The BART Analysis will include a more detailed description of the technical infeasibility.

10. Page 3-4, Table 3-1. The correct baseline emissions rate line is missing, please insert it. Please remove the reference that the Flex Fuel Project is baseline. *See* Overall Comment.

Response: See Response to Overall Comment.

11. Page, 3-4, in Section 3.2.3. In the listing at the bottom of the page, item 3. notes that the variability in uncontrolled NOx is a consideration to apply to the ability of a given emission control to be successfully implemented. Please describe the variability in NOx emissions over the past year since Centralia coal has no longer been available for use.

Response: The table submitted in response to the Overall Comments shows the variability in NOx emissions by quarter for the baseline period.

12. Page 3-6 The control effectiveness of SNCR is listed as a range (20 – 40% as realistic, up to 60% having been achieved in practice), then a value of 25%, near the low end of the range, is selected for the remaining evaluations. The cost-effectiveness of the SNCR option in Appendix A is calculated using a control efficiency of 24.9%. You must justify the selection of the 24.9% (25%) control efficiency chosen for the BART analysis. In addition, your analysis needs to include an estimate of the rate of ammonia slip.

Response: The control effectiveness of SNCR is a function of many variables including the uncontrolled emissions concentrations, physical conditions, and operational conditions. The greatest control effectiveness is generally achieved with high uncontrolled NOx concentrations, on new units that have been specifically designed for SNCR, and at a specific load. For new units, it is often common to install several levels of ammonia injection to accommodate different boiler loads. At the CPP, NOx levels are already low because the plant has installed Low-NOx burners, the boilers were not specifically designed for SNCR, and we do not believe that it would be physically practical to install all the ammonia injection ports necessary to accommodate all the expected operating loads. In addition, a study by Harmon[3] indicates that a large coal fired tangentially fired unit equipped with a low NOx SNCR has the potential to reduce NOx emissions by only 20-25 percent with an ammonia slip of less than 10 ppm. After considering the above factors and a reasonable safety factor on the expectation that the projected emission levels could become an enforceable emission limit, a 25 percent control effectiveness was selected.

We will add this justification to the revised BART Analysis, as well as additional discussion of ammonia slip.

13. Page 3-6. At the end of the discussion on the ability to implement SNCR and the costs associated with retrofitting the boilers with SNCR equipment, the report mentions an "extremely tight boiler outlet ductwork configuration". Please explain what you mean by extremely tight. In addition to this information, please provide analysis of where ammonia or urea injection would occur in the boiler along with an estimate of reaction time within the proper temperature window. Would a single level of injection be required or would multiple levels be necessary to minimize NOx and ammonia slip? Scale drawings (plan and profile) of the location where SCR [or SNCR?] system might be inserted may be useful here to demonstrate the 'tightness" issues. Would injection occur in the heat transfer section of the boiler after the superheater or are the appropriate temperatures only available between the boiler and the first ESP?

Response: More detail explanation will be provided in the revised BART Analysis

14. Page 3-6. Again at the end of the discussion on SCR, to the report mentions the "extremely tight boiler outlet ductwork configuration". Please explain the problem, if any, with the boiler outlet configuration related to the addition of a SCR catalyst section. Would it be possible to use a separate large reactor to contain the SCR catalyst (as mentioned in the first paragraph of the SCR discussion)? If not, why not? Scale drawings (plan and profile) of the location where SCR system might be inserted may be useful here to demonstrate the 'tightness" issues.

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[3] *Harmon, A., et al., "Evaluation of SNCR Performance on Large-Scale Coal-Fired Boilers," Institute of Clean Air Companies (ICAC) Forum on Cutting NOx Emissions, Durham, NC, March 1998.*

As an alternate to achieving the maximum reduction possible by use of the SCR process, how much SCR catalyst could be inserted in the boiler exhaust after the economizer and before the air preheater? How much NOx reduction (% reduction) could be implemented with this much catalyst and an ammonia slip of less than 10 ppm? What would be the cost of such a less than "full deal' installation of SCR?

Response: The revised BART Analysis will provide a more detailed explanation.

15. Page 3-7, Presumptive BART discussion. 40 CFR 50, Appendix Y, Section V requires that the averaging time in a BART permit for Electrical Generating Units be a 30-day rolling average. The same section directs reviewing agencies to "consider allowing sources to "average" emissions across any set of BART-eligible emission units within a fenceline…" Your report analyzed the cost-effectiveness of "Presumptive BART" on the basis of averaging emissions across one unit equipped with SCR, and one unit without any new controls. Compliance with the 30-day rolling average emissions limit could be difficult if the SCR-equipped unit operates fewer days than the unit without any new controls. Your report should indicate how this would be addressed and include the potential effect on the cost-effectiveness of this control option.

Response: If this control option is determined to be BART, CPP will propose an annual averaging across both units.

16. Page 3-8, Table 3-2. Please adjust all calculations for the correct emissions baseline. The Flex Fuel project is not the correct emission baseline. As noted above, the baseline emissions are based on the highest 24 hour emissions that occurred in the 2003-2005 baseline period. *See* Overall Comment.

Response: See response to Overall Comment.

17. Page 3-11, Section 3.2.3 Step 4, Other air quality Impacts. Please describe how ammonia slip could generate a visible plume. Does this potential exist if the SCR/SNCR system is followed by an ESP and a <u>wet</u> FGD system?

    If the possibility of ammonia emissions exceeding an ASIL exists then please calculate how much slip would have to occur for the ASIL to be exceeded. Your calculation should include the effects of the wet FGD system, stack height, and dispersion.

    Response: We will reevaluate the ammonia slip issue.

18. Page 3-11, Non-Air quality Impacts. You note that the use of SCR or SNCR may affect wastewater at the plant due to ammonia in the ash. Please describe with specificity how this would occur at this plant.

Response: The BART Analysis will further describe the possible effects of ammonia on the wastewater.

19. Page 3-11, Economic impacts. The cost analysis is based on tracked CH2M Hill project costs and vender project/performance quotations. The EPA has developed a similar cost estimating tool for general use called CUECost. Please explain why the 2 cost estimating methods result in significantly different capital cost estimates.

Response: The capital costs are based on cost information gathered by CH2M Hill over the past 3 years for BART analyses developed for a number of utilities in the western U.S. The costs were adjusted upwards to account for the difficult retrofit requirements for the CPP units. The EPA CUECost model was developed by Raytheon Engineers & Constructors and the Eastern Research Group in 1998. The cost estimates generated by CUECost are based on 10 year old design and cost data that do not consider the large price increases that have occurred in the industry during this time period or the CPP's difficult retrofit requirements.

20. Page 4-2, Table 4-2, in addition to the average number of days per year with modeled impacts of greater than 0.5dV, it would be beneficial to include the total days in the 3 year modeled period that are above the 0.5 dV value from Appendix B, Table 4-1. Similarly, a review of the seasonality of the days with impacts would be useful – do most of the impacted days at a given Class I area occur on the same days/months of each of the 3 years modeled? This seasonality information could be provided by replicating the baseline modeled case (as depicted in Appendix B, figure 4-1) for each Class I area impacted. Related to this, please include a brief discussion concerning what weather patterns contribute to visibility impairment due to the Centralia Power Plant in each of the Class I areas evaluated.

Response: As requested, the revised BART Analysis will include the total days above the 0.5 dV value in the 3 year modeled period and provide a figure similar to Figure 4-1 for each Class I area. The revised BART Analysis will also review the weather pattern that contribute to visibility impairment due to CPP; however, please note that there are Class I areas in every direction around Centralia except to the southwest.

21. Page 4-4, Tables 4-4 through 4-9. Please double check your math here, as it appears that the report incorrectly calculates the $/dV of improvement values. Also, please explain how a dV improvement of greater than 8 can result in a $/dV value higher than the annual cost.

Response: The math is correct. The cost-effectiveness is based on the visibility improvements from the control scenarios compared with the results of the Flex Fuel Project scenario (which was used as the baseline). The 8 dV improvement referred to is the difference between Pre-NOx

Controls and the Flex Fuel Project estimated emission rate. The revised BART Analysis will use the 2006 – 2007 baseline for the cost-effectiveness comparison.

22. Page, 5-1, First paragraph. Please note that the emissions from the Flex Fuel project are not the baseline emissions for evaluations of cost or visibility improvements. *See* Overall Comment.

Response: See response to Overall Comment.

23. Appendix A, Economic analysis, please provide an electronic copy of all spreadsheets involved in the analysis, with formulas intact and functional. Vender quotes and other information utilized to estimate capital costs of control options should be provided. If you believe this information constitutes confidential business information, you may state this belief and submit the information separately from the rest of the report, with such a declaration attached to the information.
    Also, this appendix would be an excellent location to describe the physical constraints of these boilers and their existing emission controls that may tend to limit the effectiveness or ability to implement a particular NOx control.

Response: CPP will provide electronic copies of the spreadsheets, and the physical constraints will be identified in the main body of the revised BART Analysis.

24. Appendix A, Page 3 of 7. Please note the title of this page seems to have been retained from a prior usage of the spreadsheet.

Response: The oversight will be corrected.

25. Appendix B, Modeling report. Tables 2-1 and 2-2. In these 2 tables, 8 different heat input rates are given for the plant, with different values for each unit except in the modeling for cost of controls in appendix A. Other Centralia reports and design references provide yet different heat input rates. As part of the BART analysis report (not necessarily part of the modeling report), please explain the origin of the different heat input rates and why the 7049 MMBtu/hr rate used in the capital cost analysis is the appropriate one to utilize.

Response: In light of the use of the 2006 – 2007 baseline some of the heat inputs will change, and the reasons for any differing heat inputs will be addressed.

26. Appendix B Modeling Report. The report states that SO2 emissions were reduced to account for the condensable SO_4 (included in PM). However, SO_2 emissions are measured by CEM. This reduction of SO_2 would be acceptable only if the SO_2 emission rates were calculated on a mass balance basis, not if they were derived using CEM data. Therefore, please clarify whether the baseline 2003- - 2005 base case emission came from CEM monitoring or from

estimates. If the SO_2 emissions are from the CEM results, and there is a reason to remodel a proposed control scenario or model another control scenario based on the above comments and questions, then the treatment of the SO_2 should be addressed correctly in revised baseline modeling and control scenario modeling.

Response: The modeling baseline SO_2 emissions for 2003 – 2005 were based on CEM data. The remodeling will correctly treat SO_2.