TransAlta Centralia Generation LLC
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August 8, 2011

Mr. Alan Newman
Washington Department of Ecology
Air Quality Program
P.O. Box 47600
300 Desmond Drive
Lacey, WA 98504-7600

Re: TransAlta Centralia Generation LLC's Comments on Proposed Revisions to BART Order to Address SNCR

Dear Mr. Newman:

TransAlta Centralia Generation LLC ("TransAlta") has reviewed the Department of Ecology's proposed revisions to the Implementation Order that was issued in June of 2010 ("BART Order") and we would like to provide the following comments. The issues of concern are described in this letter and suggested changes to address these concerns are made in attached red-line version of the draft BART Order.

Nitrogen Oxides Limit (Condition 1.1.1)
The draft Order proposes a nitrogen oxides ("NOx") emission limit of 0.18 lb/MMBtu based on a presumed reduction factor of 25% of the Flex Fuels Project emission rate. However, for the following reasons, the 25% factor does not necessarily apply and is unlikely to be achieved in practice.

As background, the CH2M Hill "BART Analysis for Centralia Power Plant," p.3-6 (rev. July 2008) cites a study by Harmon (1998) concluding that tangentially fired boilers are able to achieve a 20 to 25 percent reduction with the application of SNCR. Based on the study and other information, CH2M Hill's 2008 BART Analysis applied the high end of the range, 25 percent, to the baseline emission rate of 0.30 lb/MMBtu to derive an estimated emission rate of 0.228 or 0.23 lb/MMBtu for the purpose of modeling visibility benefits from SNCR. (See Case 3 SNCR estimated emissions of 0.228 in 2008 BART Analysis).

Ecology's BART Determination Support Document (rev. April 2010) concurred that the 25 percent reduction factor was a reasonable assumption. TransAlta's May 2008 response to Ecology's comments on the January 2008 BART Analysis report reiterated the Harmon findings and implicitly acknowledged that the high end of the range from adding SNCR to existing LNC3 and Flex Fuels is 25%:

> "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 … In addition, a study by Harmon 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…."

The conclusion that 25 percent reduction is highest likely reduction is supported by PGE's "Alternative BART Analysis for the Boardman Power Plant," p. 3-4 (Aug. 27, 2010) concludes that SNCR achieves "emissions reduction levels of 15 to 25 percent for retrofit applications." At Ecology's request, in March 2010 TransAlta modeled the visibility benefits from adding SNCR to Flex Fuels. Based on the previous 25 percent reduction factor from the 2008 BART Analysis report, the 2010 visibility modeling assumed an emission rate of 0.18 lb/MMBtu based on the Flex Fuel Project rate of 0.24 lb/MMBtu. It is important to note that the 25 percent assumption was not based on an engineering study or a vendor estimate. The emission reduction was not intended to be relied upon as a potential enforceable limit but only as an approximation of the visibility benefits.

TransAlta did not begin to develop SNCR emission rates for use as an enforceable BART limit until the passage of SB 5769 earlier this year. In recent months TransAlta selected and is currently working with a SNCR system vendor to determine what NOx reduction efficiency and emission rates will be achievable with the proposed SNCR systems when they are installed on the TransAlta units. A computational fluid dynamics (CFD) model of each of the two Centralia furnaces must be generated as the first step in designing the optimal emissions reduction systems. This modeling and design must be completed before a construction contract for the systems can be issued and a warranty for the projected NOx reduction efficiency is obtained from the vendor.

The creation and verification of CFD models allow the vendor's technical experts to predict temperature distribution, gas flow paths and concentration and distribution of constituents including O2, CO, NOx, and unburned carbon within the boilers. The model is used to select the size, location and design of the SNCR system components and capabilities. The first step in the CFD modeling process is to generate a model based on the Plant's engineering drawings for each boiler. The next step is to develop a baseline simulation at low & high boiler loads on each Centralia unit. This requires gathering operational data on temperature distribution, gas flow paths and concentration and distribution of constituents including O2, CO, NOx, and unburned carbon during operation of the units at different production levels. Since both units

were off-line from early March through late July, the testing to gather the required data is currently scheduled for August 2011.

The data gathered in August will be used to calibrate the CFD models developed for each unit and estimate potential NOx reductions achievable over the anticipated operating range of the units. The information obtained from the CFD modeling will allow the selected vendor to finalize the design of the SNCR system equipment and warranty the design NOx removal efficiency of the SNCR systems in October 2011.

Prior to completion of the CFD modeling and based on current information, the limit that can be achieved with reasonable assurance would be 0.22 lb/MMBtu, which is already a reduction of more than 25% from the pre-BART baseline emission levels. The study by Srivastava et al, Table 3, cited in the draft Determination Support Document lists 20 plants with SNCR that had emission rates ranging from 0.274 to 0.755, significantly higher than the 0.22 lb/MMBtu rate that TransAlta is proposing for Centralia. Although the removal rates may be higher, TransAlta understands that SNCR has diminishing efficiency at lower levels of baseline emissions, such as the Flex Fuel Project rates of the Centralia Plant.

An emission rate of 0.22 lb/MMBtu is substantially lower than the median emission rate of 0.27 for all the SNCR systems proposed as BART in the Western United States (see attached table). The attached table and the Department's own draft BART Determination Support Document show that no coal-fired plant in the Western United States has been determined to be capable of achieving a BART emission rate less than 0.19 lb/MMBtu with SNCR technology and LNC3 combustion controls combined.

Based on the foregoing information and TransAlta's operating experience with LNC3 technology, an emission rate of 0.22 lb/MMBtu should be achievable with the addition of SNCR technology to the current LNC3 technology and an ammonia slip of less than 5 ppm. This would result in a greater than 25 percent reduction from the pre-BART emissions. Operating experience will determine whether an additional emission reduction to a level of 0.20 lb/MMBtu (a 33% reduction from 0.30 and 17% reduction from 0.24) is achievable with optimization of an SNCR system. However, as explained in the CH2M Hill BART Analysis, the reduction achievable depends upon many factors, including higher ammonia slip than the proposed limit. Achieving the Department's proposed emission rate of 0.18 is considered very unlikely (see attached discussion). A discussion of the unique factors that influence NOx the installation of SNCR for NOx reduction in the TransAlta units is attached in the letter from the Centralia Plant engineer.

In conclusion, it is necessary to complete the study required by Section 5 of the order to determine the lowest level that SNCR can reasonably achieve before a limit lower than 0.22 lb/MMBtu is set. TransAlta proposes that, at the conclusion of the study required by Section 5, a lower emission limit (as low as 0.20 lb/MMBtu) will be requested if it is shown to be achievable by the result of the study. If the plant is able to optimize the systems to reach 0.20 lb/MMBtu, this level would be among the lowest achieved by any plant in the Western U.S. utilizing SNCR with LNC3 technology.

Ammonia Emissions Limit

Compliance with the ammonia emissions limit must be determined on the same 30-day rolling average time frame as the NOx limit. Without the flexibility to adjust ammonia addition rates as needed to operate the SNCR system optimally, we cannot assure that we can achieve compliance with the 0.22 lb/MMBtu NOx limit.

Ammonia Emissions Monitoring

We have not been able to find any CEMS for ammonia that will provide the required accuracy and repeatability on our plants when controlled by SNCR. A recent review of the technology confirms this (http://www.ladco.org/about/general/Emissions_Meeting/Greaves_032510.pdf). NDIR/FTIR ammonia analyzers have proven to be unreliable and inaccurate for measuring ammonia slip in the 5 ppm range. UV ammonia analyzers have also proven to be inaccurate for measuring ammonia slip in the desired range. TDLAS in-situ analyzers cannot be used on the saturated stack following the SO_2 scrubber.

The Differential NOx/NH3 Converter Method described on slide 8 of the presentation is the only technology that might be effective; however this type of system only works accurately when NOx emissions are at very low levels. For our process with SNCR the full scale of the analyzers must be set at levels approximately 200 ppm. The allowable 2.5% daily drift on an analyzer with a full scale of 200 ppm is 5 ppm. Since two analyzers are used to determine the ammonia concentration, the allowable drift of the two analyzers could compound the potential error to 10 ppm which is double the proposed limit for ammonia and would be unable to pass the proposed certification requirements. Based upon this review, it has been determined that monitors for ammonia that can be certified as CEMS are not available for our units.

While we intend to install some type of process monitoring equipment on the SNCR system to provide necessary ammonia data for optimizing the SNCR operation, as we described above, the current technology cannot meet requirement for use as a CEMS. We therefore propose removing the ammonia monitoring requirements from the Order and replacing them with an annual compliance test. Once we determine the best system to monitor ammonia levels for the ammonia optimization study and where it can be installed to provide the most useful information (with assistance from the SNCR system supplier), we will include that information in the study plan required by condition 5.2.

Greenhouse Gas Emissions

Including SB 5769's greenhouse gas (GHG) emission limitations is inappropriate. The GHG requirements are unrelated to the BART Order and the requirements of the Regional Haze SIP. SB 5769 provides that these requirements will be incorporated in an enforceable agreement between TransAlta and the State. There is no implication in the statute that the GHG limits should be incorporated in a BART determination. To the extent necessary to support the timelines used for the cost benefit calculations in the BART determination Support Document, State law establishes the enforceability of those timelines for EPA.

TransAlta believes that completely removing this section is appropriate; however, we have proposed alternative language if the Department cannot rely on State law to establish the enforceability of the timelines. The proposed language utilizes the language "cease burning coal" similar to the EPA approved Oregon BART language.

Operating Days and Startup/Shutdown (Section 8.3)
Removal of the 360 MW minimum operating rate references in the BART Order has essentially eliminated the startup/shutdown allowance from the existing Order. There must be an allowance for partial operating days or startups and shutdowns in the Order because the limits are based upon operation of the SNCR systems. These systems cannot operate under startup and shutdown conditions. EPA concurs that BART determinations may take into account higher emissions during startup and shutdown. (Letter from EPA Region 8 to South Dakota Department of Environment and Natural Resources, Sept. 13, 2010, p. 2, attached). If Ecology does not concur with the 360 MW minimum operating rate approach, then one alternative would be that an operating day with less than 8 hours of operation would have to be eliminated from the 30-day average since it will represent either startup or shutdown conditions. We propose that section 8.3 reflect that only days with 8 or more hours of firing coal would be averaged into the 30-day average. This is similar to the 8-hour startup allowance in our Title V permit condition M9 and we believe would exclude a portion of emissions that occur only during the beginning of a startup or ending of a shutdown from the 30-day average.

BART Determination Support Document (Section 4.2 and Appendix I)
We request that Ecology leave the BART determination as LNC3 and Flex Fuels. The installation of SNCR could be based on the technology needed to meet the State's Visibility Reasonable Progress goals. This approach would avoid the need to issue a new BART Order but would still accomplish the goal of setting a lower enforceable limit to improve visibility.

Please contact Brian Brazil or Rick Griffith if you have any questions regarding these comments.

Sincerely,

Bob Nelson
Director, Centralia Operations
TransAlta Centralia Generation LLC

cc: Clint Lamoreaux, Southwest Clean Air Agency
Rick Griffith

SNCR BART/RFP Determinations for Western Coal Plant Sources					
Emission Unit	**Assumed NOx Control Type**	**NOx Emission Limit**	**Assumed SO_2 Control Type**	**SO_2 Emission Limit**	**Reasonable Progress NOx Controls**
Alaska (http://www.dec.state.ak.us/air/anpms/rh/rhdoc/Section III.K.6.pdf)					
GVEA Healy Unit 1	existing LNB with OFA, SNCR required to be added	**0.20 lb/MMBtu**	existing dry sorbent injection system	0.30 lb/MMBtu	Will be evaluated if not shut down by 2024
Colorado (http://www.cdphe.state.co.us/ap/regionalhaze.html)					
CENC Unit 5	new LNB with SOFA, and SNCR	**0.19 lb/MMBtu Or** 0.26 lb/MMBtu Average for Units 4 & 5 (30-day rolling)	None	1.0 lb/MMBtu (30-day rolling)	no
TSG&T Craig Unit 1	new SNCR System	0.28 lb/MMBtu (30-day rolling)	Wet Limestone scrubber	0.11 lb/MMBtu (30-day rolling)	**BART is 0.27**, 0.28 allowed with SCR on Unit 2
TSG&T Craig Unit 2	(SNCR is BART) new SCR System for RP	0.08 lb/MMBtu (30-day rolling)	Wet Limestone scrubber	0.11 lb/MMBtu (30-day rolling)	**BART is 0.27,** 0.08 required for reasonable progress goal
Nevada (http://deq.state.wy.us/aqd/308 SIP/309(g) SIP 1-7-11 Clean Final.pdf)					
NVE Reid Gardner Units 1 & 2	ROFA with Rotamix	**0.20 lb/MMBtu** (12-month rolling)	existing wet soda ash FGD	0.15 lb/MMBtu (24-hr)	no
NVE Reid Gardner Unit 3	ROFA with Rotamix	**0.28 lb/MMBtu** (12-month rolling)	existing wet soda ash FGD	0.15 lb/MMBtu (24-hr)	no
North Dakota (http://www.ndhealth.gov/AQ/RegionalHaze/Regional Haze Link Documents/Main SIP Sections 1-12.pdf)					
BEPC Leland Olds Unit 1	new LNB with SOFA and SNCR	**0.19 lb/MMBtu** (30-day rolling)	new Wet Limestone scrubber	0.15 lb/MMBtu (30-day rolling)	no
BEPC Leland Olds Unit 2	new LNB with ASOFA and SNCR	**0.35 lb/MMBtu** (30-day rolling)	new Wet Limestone scrubber	0.15 lb/MMBtu (30-day rolling)	no
GRE Stanton Unit 1	new LNB with OFA and SNCR	0.29 or **0.23 lb/MMBtu** (30-day rolling)	new Wet Limestone scrubbers	0.24 or 0.16 lb/MMBtu (30-day rolling)	Note: limits on lignite and subbituminous
MPC Milton R.Young Unit 1	new LNB with ASOFA and SNCR	**0.36 lb/MMBtu** (30-day rolling)	new Wet Limestone scrubber	0.15 lb/MMBtu (30-day rolling)	no
MPC Milton R.Young Unit 2	new LNB with ASOFA and SNCR	**0.35 lb/MMBtu** (30-day rolling)	existing Wet Limestone scrubber	0.15 lb/MMBtu (30-day rolling)	no

Average SNCR BART Limit	0.26 lb/MMBtu
Median SNCR BART Limit	0.27 lb/MMBtu
Lowest SNCR BART Limit	0.19 lb/MMBtu

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July 28, 2011

Mr. Brian Brazil

Re: Selective Non Catalytic Reduction (SNCR) Technology implementation at Centralia Plant

Brian:

Station #1 & #2 boilers were retrofitted with Low NOx Burners (LNB) in 2002 and 2001, respectively. This modification, which included installation of Separate Over Fire Air (SOFA) and Close Coupled Over Fire Air (CCOFA) injection ports, allowed the NOx emissions to be lowered to 0.30 lbs/mm BTU. In 2008 as part of conversion to PRB fuels which are inherently lower in nitrogen content, and additional fine tuning of the boilers, the achievable NOx level was further reduced to 0.24 lbs/mm BTU.

Earlier this year, we embarked on installation of SNCR technology on both boilers for additional reduction of NOx. In SNCR systems, a reagent is injected into the flue gas in the furnace within an appropriate temperature window. The reagent generates ammonia and the process reaction converts NOx to nitrogen and water vapor. The performance of an SNCR system depends on a variety of factors such as the furnace baseline oxygen and carbon monoxide concentrations, injected reagent quantity and distribution, residence time, and flue gas temperature.

The influence of these parameters can have a significant impact on the performance of an SNCR system. The theoretical reduction for SNCR reaction is one mole of NOx to one mole of ammonia. However, experience has shown that a portion of ammonia can exit the boiler and cause numerous environmental and operational concerns such as formation of detached plumes, corrosion and boiler component pluggages. The unreacted ammonia reacts with other compounds in the flue gas to form ammonia compound such as NH4 HSO4 or NH4 Cl. These compounds are corrosive and can create blockages of the air preheater baskets that will lead to forced unit outages. Free ammonia also has the potential to contaminate the captured fly ash and the station SO2 control system's by-products creating additional problem.

Since the PRB fuels conversion at the plant we have had numerous issues unique to our boilers. These fireboxes, which were originally designed for combusting the native fuel from

the mine next door, are too short to allow sufficient heat adsorption from PRB fuels which generate higher radiant heat. This has resulted in excessive furnace exit gas temperature leading to non stratified isothermal planes. The excessive heat also generates fluid slag (due to high sodium PRB ash) on the walls that plug up observation ports and instrumentation taps on the boiler walls. The SOFA injection can also create pocket of high CO gas and unpredictable mixing zones for the reaction between the SNCR reagent and the NOx in the flue gas stream. These issues would significantly affect the performance of SNCR systems relying on injection above the furnace.

The SNCR systems using multi nozzle lances injecting at the superheater pendant positions, rely on rotary insertion systems identical to our long lance IK soot blowers. These lances are unreliable, experience routine failures from clinker falls, and remain out of service on a regular basis. The long term viability of any SNCR system relying on multi nozzle lances is questionable.

We have had multiple conversations with potential suppliers of SNCR technology and there appears to be a significant reluctance to offer an ironclad guarantee regarding the removal efficiency and the free ammonia slip stream at the boiler outlet. One of the contributors to this issue is the fact that we are already operating with extremely low NOx levels (0.24 lbs/mm BTU) that the actual realized system performance may be hard to predict.

We are currently working with a SNCR system vendor to determine what NOx reduction efficiency and emission rates will be achievable with their proposed design of SNCR systems. We have also retained the services of an independent consulting firm specializing in modeling of SNCR components and their interaction with various parameters within a boiler. The outcome of these models will provide additional insight as to the performance of the SNCR system.

The above mentioned concerns and due to the fact that the actual long term performance of any SNCR system can only be verified by post commissioning optimization, we do not anticipate to be able to achieve more than 19-20% NOX removal efficiency. However, it is our intention to push our system to its highest sustainable capability.

Please feel free to contact me if you have any questions regarding these comments.

Sincerely,

Jim Khorsand, P.E.
Plant Lead Engineer

cc: Trevor Ebl

Implementation of NH3 measurement on Post Combustion NOx Reduction Systems.

LADCO WORKSHOP

March 24-25th, 2010

Public Review Draft

Ammonia Slip Measurement

Post Combustion NO_x Reduction:

- Selective non-catalytic reduction (SNCR)
- Selective catalytic reduction (SCR)
- Common requirement: introduction of NH_3

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$

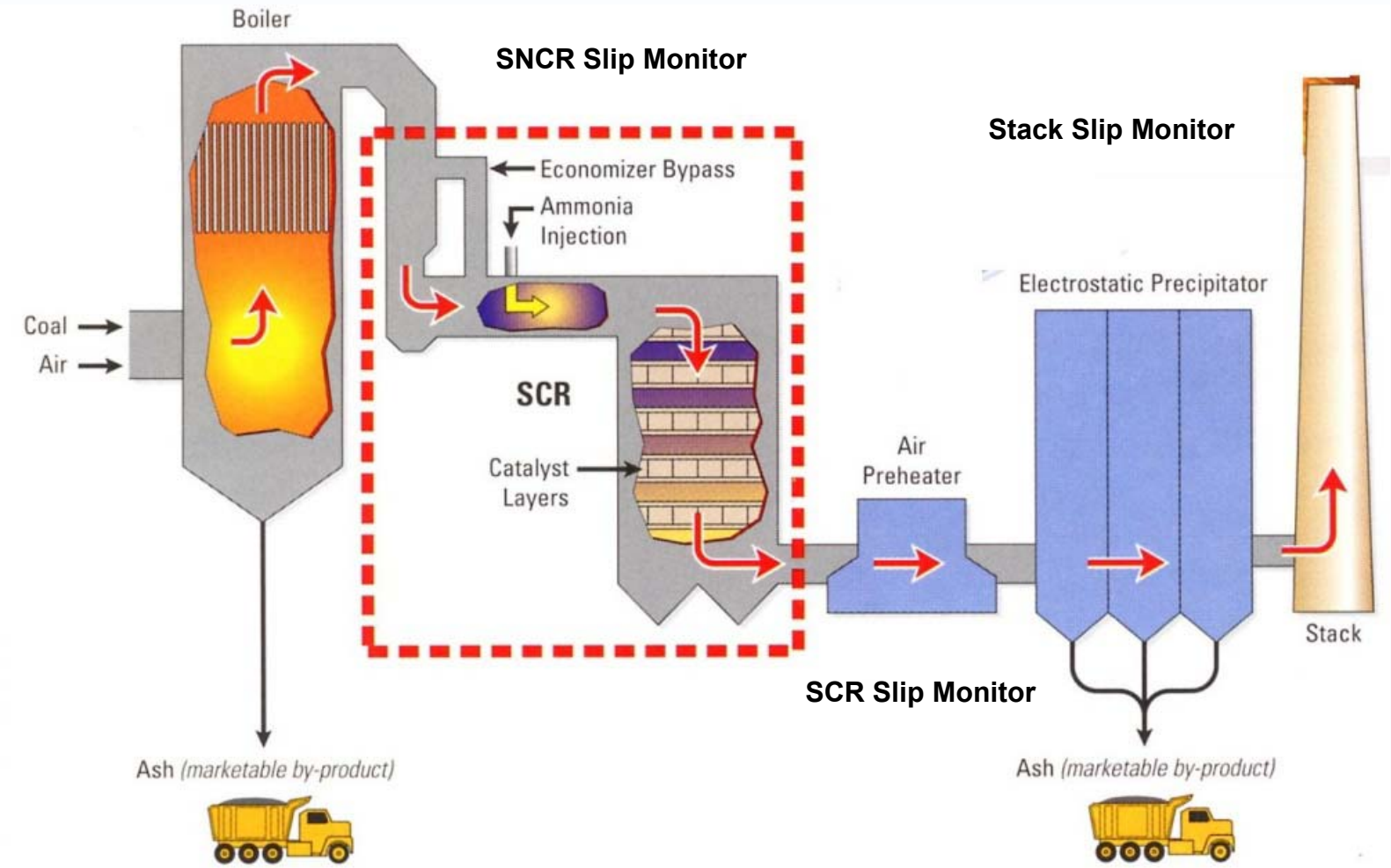
$$2NO_2 + 4NH_3 + O_2 \rightarrow 3N_2 + 6H_2O$$

Ammonia Slip Measurement

Consequences of Ammonia Slip:

- If over-titrated NH3 escapes – pollutes and wastes
- Violates permit limit if applicable
- If due to incomplete mixing – NOx escapes
- With high sulfur fuels ammonia sulfate and bisulphate formed – can foul air pre-heater
- Ammonia contaminates fly ash making it hazardous

Ammonia Slip Measurement



Public Review Draft

Ammonia Slip Measurement

Monitoring Methods:

- FULLY EXTRACTIVE (DRY BASIS)
- FULLY EXTRACTIVE (HOT-WET BASIS)
- DILUTION EXTRACTIVE (WET BASIS)
- IN-SITU (CROSS STACK or PROBE)

Measurement Types:

- Chemiluminescence ,UV Absorption, FTIR, DOAS,
- (TDLAS)

Ammonia Slip Measurement

- **Analyzer Glossary**
- **Chemiluminescence:** (Chemical Light) a measurement technique for NO/NOx that measures the light given off as a result of the reaction between NO and Ozone. The light output is proportional to the concentration of NO. NO_2 is converted to NO using a high temperature catalytic converter. NO_2 does not react with Ozone so it must be converted to NO.
- **UV Absorption:** a measurement technique that uses a UV spectrometer to measure a particular wavelength where the gas of interest absorbs (measurement) and a wavelength where the gas of interest does not absorb (reference). Most often used for SO_2 measurement in high concentrations.
- **Tunable Diode Laser Absorption Spectroscopy (TDLAS):**By scanning across a very narrow bandwidth in the IR region where no cross interferences occur, the absorption of the IR source by the targeted gas is proportional to the target gas concentration.
- **Fourier Transform-Infrared Spectroscopy (FTIR):** This technique measures the absorption of infrared radiation by the sample gas versus wavelength. The infrared absorption bands identify molecular components.
- **Differential Optical Absorption Spectroscopy (DOAS):** is a method to determine concentrations of trace gases by measuring their specific narrow band absorption structures in the UV and visible spectral region

Ammonia Slip Measurement

Inlet/Outlet Differential NOx Method

- First method is based on the calculation of ammonia slip using the inlet/outlet differential NOx method along with ammonia flow rate and stack flow calculation. This method has been employed successfully in many EPA permitted CEMS, the SCAQMD and many other AQMD's for control and compliance monitoring. This method is reliable and low in cost for sources where SCR inlet monitoring is a requirement.

- The inlet/outlet method is used where SCR control is also a requirement since both the SCR inlet NOx and SCR outlet NOx are measured on a continuous basis. The outlet measurement is usually the CEMS compliant system. The inlet system requires a second probe mounted on the duct before the SCR and a second NOx analyzer.

- The NOx and NH3 react on a 1:1 basis. Therefore, the amount of NH3 reacted is equal to the amount of NOx reduced in the SCR. The simplified formula is:

$$NH_3\ slip = NH_3\ fed - (NO_x\ in - NO_x\ out)$$

Ammonia Slip Measurement

Differential NOx/NH3 Converter Method:

- An alternate ammonia method using direct measurement of differential NOx on the stack. This method utilizes two (2) NOx analyzers on the outlet (stack) CEMS. An ammonia converter is included at the stack probe which converts NH3 slip to NOx. The sample line includes an additional sample tube to transport the NH3 converted sample stream to an additional NOx analyzer.
- One analyzer is used to measure NOx emissions and the second is installed to measure the converted stream which includes the NOx and ammonia converted to NOx for the ammonia slip calculations. The NOx analyzers are identical – range, manufacturer, model number.
- A special probe Is used to catalytically convert NH3 into NOx. The increase in NOx that results is NH3 slip. The probe contains an electrically heated oxidation catalyst where NH3 is oxidized with oxygen on the catalyst surface into nitric oxide (NO) and water, as follows:

$$4\ NH_3 + 5\ O_2 = 4\ NO + 6\ H_2O$$

- The NH3 conversion process has an efficiency of 90-98% depending on the sample flowrates, age of converter, and NH3 concentrations. Conversion efficiencies of 95%+ can be expected on typical combustion turbine applications.

NH3 slip (ppm) = NOx (ppm) (total converted) – NOx (ppm) (unconverted)

Ammonia Slip Measurement

Direct measurement of NH3:

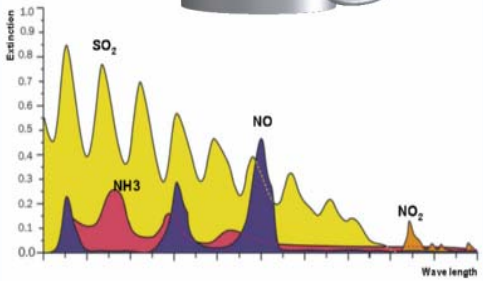
- This can be done using several methods, both across the stack or duct measurement or Insitu probe type systems.
- Typical across duct measurements use the Tunable Diode Laser method, or DOAS monitor.

Ammonia Slip Measurement

In-Situ…Advantages:

No gas transport
: Fast response time
: No loss of components in a sample system
: No filters, sample lines, pumps to clean

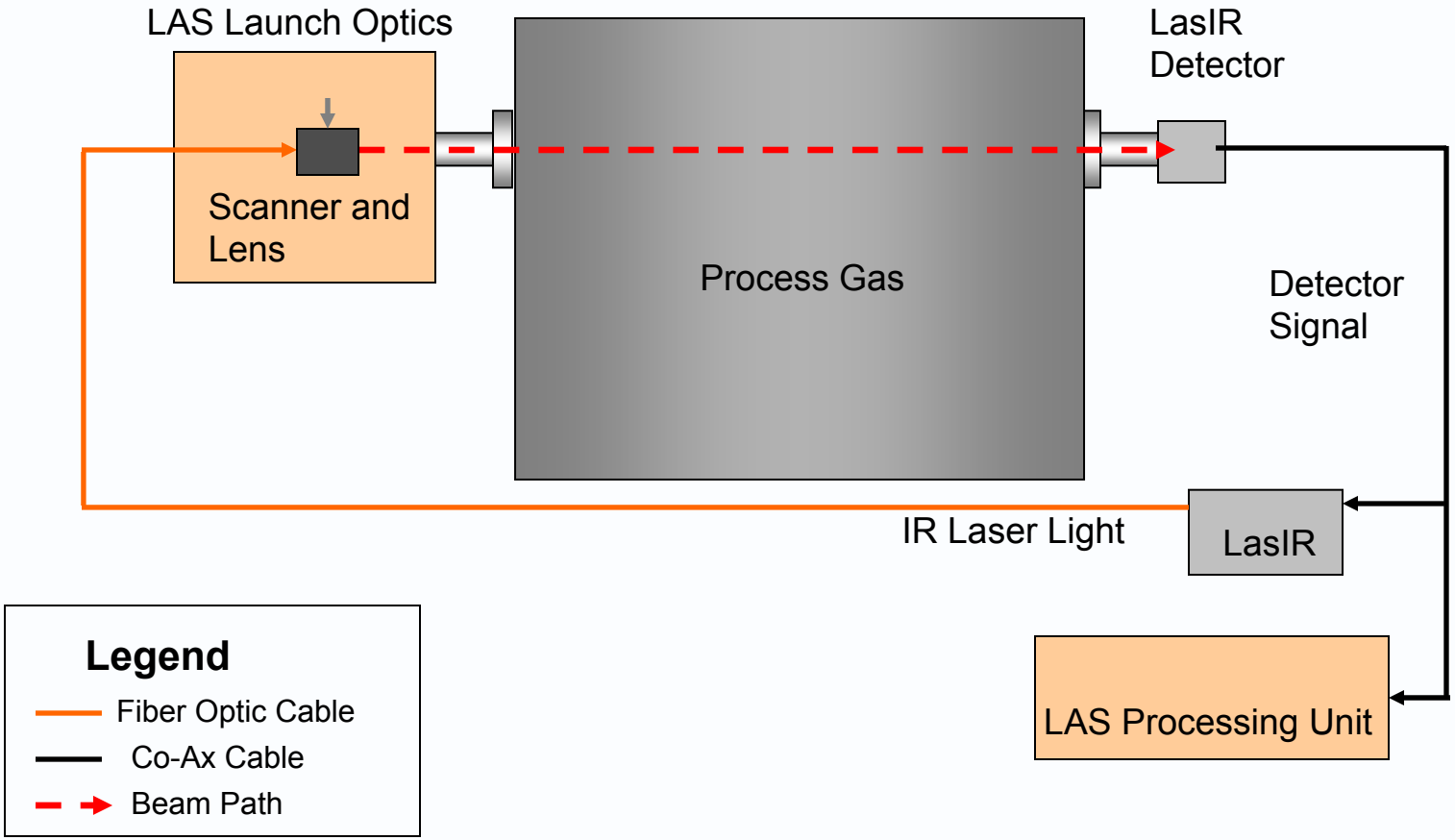
Lower planning expenses
: Support for heated sample gas lines
: Analysis container
: Disposal of sample gas and condensate



Lower installation and operation cost
: No Heated sample gas lines ($50/ft)
: Larger component Inventory and Replacement requirements
: Cost for shelter or space in existing analyzer rooms.

Public Review Draft

Ammonia Slip Measurement



Tunable Diode Laser Analyzer

Ammonia Slip Measurement

TDLAS Ammonia slip Monitoring:

- In-situ measurement avoids loss of sample integrity, to Minimize NH3 Slip
- Single Indicator of direct measurement of Slip for compliance or performance of DeNOx system
- Fast response better then 60 seconds allows better feedback for control, less violations.

Ammonia Slip Measurement

EXTRACTIVE :

- Sample delivered to analyzer mounted in typical cabinet , possibly integrated with CEMS.
- Useful for Dirty Applications such as certain Coal Fired Plants.
- Measurement type: Chemiluminescence, UV Absorption, FTIR
- Minimal performance at low concentrations
- Easy to calibrate, since standard calibration gas procedures are incorporated.
- Not the most cost effective when equipment, install and maintenance costs are accounted for.

Ammonia Slip Measurement

UV photometer

DEFOR

For measurement of

1 to 3 UV components

Includiing O_2

Public Review Draft

Ammonia Slip Measurement

Certification of NH3 Slip Measurements

- There are no performance standards against which NH3 monitors can be certified, and there are no adopted methodologies for the certification of continuous NH3 monitoring.
- CTM-027 defines how best to obtain representative stack test samples for verification of stack conditions, against which any analyzer system would be referenced,.
- In addition, there are no NIST traceable Protocol calibration gases for NH3 at lower levels. The most accurate calibration gas for NH3 is a working class gas with an accuracy of +/- 5%. Also, the lowest level that can be commercially obtained is 7 ppm.
- Spiking is an accepted method by which relative accuracy data can be obtained but once again no standards are set on how to achieve this.
- Most Insitu analyzers have built in calibration standards either by filters or calibration gas cells. All have the ability to do self check zero and span, and most can be checked against a standard gas at a higher value working class

Ammonia Slip Measurement

SUMMARY:

- Until a clear acceptable method for accurate measurement of NH3 at the lowest concentrations now seen (less than 2ppm) is commercially available, and one that can be applied to all applications, then Industry must rely on the vendors to assist in meeting their needs whether it be permit verification or process optimization.
- Insitu while giving the best accuracy will be considered the front runner for most applications, but without the ability to do all applications at the low level measurements will struggle for acceptability.
- Extractive surrogate measurements will continue to dominate the Utility market for now because of the ease of acceptability as part of a CEMS.
- Tunable Diode Laser technology is proving to be the most accurate method, but will have to wait until a suitable calibration methood has been defined and accepted.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

IN THE MATTER OF AN	]	
ADMINISTRATIVE ORDER AGAINST:	]	
	]	FIRST REVISION:
TransAlta Centralia Generation LLC	]	ORDER NO. 6426
	]	

TO: Mr. Bob Nelson,
TransAlta Centralia Generation LLC
913 Big Hanaford Road
Centralia, WA 98531

This is an Administrative Order requiring your company to comply with WAC 173-400-151 by taking the actions that are described below. Chapter 70.94 RCW authorizes the Washington State Department of Ecology's Air Quality Program (Ecology) to issue Administrative Orders to require compliance with the requirements of Chapter 70.94 RCW and regulations issued to implement it.

Ecology has determined that portions of your facility are subject to the provisions of the state visibility protection program (WAC 173-400-151), which is implemented consistent with the requirements of the federal visibility protection program (40 CFR Part 51, Subpart P). The rules require that the State determine what technologies and level of emission control constitute Best Available Retrofit Technology (BART) for the eligible emission units at your facility. The rules also require the installation and use of those emission controls on the BART-eligible emission units. The emission controls are to be installed as expeditiously as possible, but in no event may the State allow them to start operation later than five years after the State's Regional Haze SIP amendment is approved by the United States Environmental Protection Agency (EPA).

FINDINGS

A. The TransAlta Centralia Generation LLC ("TransAlta") Centralia Power Plant is a coal fired power plant larger than 750 MW output subject to BART.

B. BART emission limitations for sulfur dioxide and particulate matter were determined by the Environmental Protection Agency in 2003. The Centralia Power Plant's Operating Permit incorporates the BART emission limitations determined by EPA.

C. BART for nitrogen oxides at the Centralia Power Plant is based on:

   a. Use of low NO_x burners with separated and close coupled over fire air systems (aka LNC3).

   b. Use of a sub-bituminous Powder River Basin coal or other coal that will achieve similar emission rates.

Deleted: <#>Use of selective noncatalytic reduction for nitrogen oxides control. Either urea or ammonia will be the reagent used. ¶

c. Use and installation of additional boiler heat recovery equipment and boiler tube cleaning equipment to maximize the extraction of fuel energy into boiler steam.

D. Reduction of nitrogen oxides at the Centralia Power Plant for reasonable progress in visibility improvement beyond the BART level of 0.24 lb/MMBtu is based on installation and use of selective noncatalytic reduction (SNCR) for nitrogen oxides control. Either urea or ammonia will be the reagent used.

E. RCW 80.80.040 was amended in 2011 (Chapter 180, Laws of 2011) adding greenhouse gas emission requirements applicable to this facility that reduce the remaining useful life of each coal fired unit at the plant to 8 and 13 years, starting from June 2011. The greenhouse gas emission requirements are:

a. Amendments to Chapter 80.80, Revised Code of Washington passed in 2011 require both coal fired units at the Centralia Power Plant to comply with the greenhouse gas emission performance standard requirements of Revised Code of Washington 80.80.040. One unit is required to comply by December 31, 2020. The other unit is required to comply by December 31, 2025. The plant owner, the Governor's office, and environmental organizations anticipate that compliance will be by decommissioning or replacing the units.
b. The requirement to meet the greenhouse gas emission performance standard does not apply if the Department of Ecology determines that a state or federal requirement requires the installation of selective catalytic reduction for NOx control on either coal unit.

Additional information and analysis is available in the BART Determination Support Document for the Centralia Power Plant, by the Washington State Department of Ecology, November 2008 (revised April 2010 and May 2011); and the BART Analysis for the Centralia Power Plant, June 2008 and the BART Analysis Supplement, December 2008, and supplemental information dated March 2010; and Chapter 180, Laws of 2011.

YOU ARE ORDERED: To install and operate in accordance with the following conditions:

BART Emission Limitations

1. Nitrogen Oxides Emissions

1.1. Maximum emissions of nitrogen oxides from the two coal-fired utility steam generating units at the Centralia Power Plant are limited to:

1.1.1. From the date of issuance of this Order, until December 31, 2012, the nitrogen oxides emission limitation is 0.24 lb/MMBtu, 30 operating day rolling average, both units averaged together, using procedures in Section 8.

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1.1.2. Beginning January 1, 2013, nitrogen oxide emissions limitation is 0.22 lb/MMBtu, 30 operating day rolling average, both units averaged together, using procedures in Section 8.

1.1.3. In the event that during a given 30 operating day period, only one unit operated, the average of both units will be the 30 operating day average emission rate for the operating boiler.

1.1.4. Determination of compliance with the rolling 30 operating day average nitrogen limitation in Section 1.1.2 will commence at midnight on the 30th operating day after January 1, 2013.

1.1.5. Beginning January 1, 2013, injection of ammonia or urea (reagent) to control nitrogen oxides from a specific boiler must:

1.1.5.1. Commence when the flue gas at the point(s) of injection in that boiler has reached the minimum operating temperature for the process.

1.1.5.2. End no sooner than the time coal is no longer introduced to the furnace of that boiler or the flue gas temperature at the injection point(s) is below the minimum SNCR operating temperature.

1.1.6. Nitrogen oxides emissions will be optimized with ammonia emissions as required in Condition 6.

1.2. Compliance will be determined by use of a continuous emission monitoring system meeting the requirements of 40 CFR Part 75.

1.3. Coal used is required to be a sub-bituminous coal from the Powder River Basin or other coal that will achieve similar emission rates.

1.4. Nitrogen oxides emission reduction through the use of SNCR will be optimized as required in Condition 5.

2. Ammonia emissions

2.1. Starting no later than the date in Condition 3, emissions of ammonia from the two coal-fired utility steam generating units at the Centralia Power Plant are limited to a maximum of:

2.1.1. 5 parts per million, dry volume (ppmdv) 30 operating day rolling average, both units averaged together.

2.1.2. In the event that during a given day, only one unit operated, the average of both units will be the calendar day average of the operating boiler.

Comment [ARN1]: Still to be determined based on analysis of the actual emissions from the plant and negotiations.
This could be a 25% reduction from the Flex Fuels based value (0.180), or a 25% reduction from the high 30 day rolling average limitation for the Oct – Dec 2010 time period (0.75 * 0.227 = 0.170). The 0.17 value contains no compliance margin, but is based on the highest value for the time period evaluated.
An alternative approach is to use the lower bound of expected NOx reduction – 20%. This results in a NOx limit of 0.19 lb/MMBtu. A re review of the available reporting on SNCR removal on this scale facility indicates that this is a realistic expectation of minimum removal.
The visibility improvement modeling provided by TransAlta is based on a 25% reduction from the Flex Fuels level.
All of the control effectiveness documentation in the BART analyses and modeling reports have assumed a 25% reduction for SNCR.
See appendix to TSD for additional analysis

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Comment [ARN2]: Check if I need additional citations for this.

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Comment [ARN3]: Now proposing 5 ppm on a 30 day rolling average basis. Based on review of coal fired utility permits in the EPA RBLC, the alternate might reasonable be a daily maximum of 41 ppm.

2.1.3. Determination of compliance with the rolling 30 operating day average ammonia limitation will commence at midnight on the 30th operating day after January 1, 2013.

2.2. Ammonia emission resulting from the use of SNCR will be optimized as required in Condition 6.

Schedule for Compliance

3. Compliance with the 30 operating day rolling average emission limitations begin:

3.1. nitrogen oxides emission limitations begin on July 19, 2010.

3.2. ammonia emission limitations begin on January 31, 2013.

4. The two coal fired units at the Centralia Power Plant must cease burning of coal as fuel according to the following schedule:

4.1. One coal fired unit must permanently cease burning of coal no later than December 31, 2020.

4.2. The second coal fired unit must permanently cease burning of coal no later than December 31, 2025.

4.3. Conditions 4.1 and 4.2 do not apply in the event the Department of Ecology determines as a requirement of state or federal law or regulation that the selective catalytic reduction technology must be installed on either coal fired unit.

Nitrogen Oxides and Ammonia Reduction Optimization

5. The operation of the selective noncatalytic reduction system for control of nitrogen oxides will be optimized to produce the lowest nitrogen oxides emission rate and the lowest ammonia emission concentration reasonably achievable for a reagent cost not to exceed $2 million dollars per year.

5.1. The nitrogen oxides control system will be optimized to with the goal of reducing nitrogen oxides to less than 0.20 lb/MMBtu 30 operating day average and achieving the lowest 30-day average concentration of ammonia in the flue gas that is reasonably achievable with the reagent cost requirements of Condition 5 without significant adverse effect on mercury capture, boiler cleaning processes (aka soot blowing), plant wastewater discharges, or byproduct salability.

5.2. To achieve the goal of Condition 5.1, the owner of the Centralia Power Plant will:

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Comment [ARN4]: To mimic the requirements in amended 80.80.040(3)

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Starting no later than the dates in Condition 5, emissions of greenhouse gases from the two coal-fired utility steam generating units at the Centralia Power Plant will meet the lower of the greenhouse gas emission performance standard in Revised Code of Washington 80.80.040(1)(a) or in regulation developed pursuant to RCW 80.80.040(1)(b) and 80.80.050. ¶

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Comment [ARN5]: ES2E5769 Section 103(3)(c)(i), amending RCW 80.80.040(3)

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Comment [ARN6]: ES2E5769 Section 103(3)(c)(ii), amending RCW 80.80.040(3)

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5.2.1. Develop an optimization plan and submit it by June 30, 2013 to Ecology and the SWCAA for their review and acceptance. The plan will be deemed to be accepted and the owner will implement the plan if Ecology and/or SWCAA do not respond by July 31, 2013.

5.2.2. The plan will provide for all optimization testing to be complete by December 31, 2015.

5.2.3. Using the accepted optimization plan, the plant owner will adjust ammonia/urea injection rates to determine the injection rates that produce the lowest ammonia emissions and nitrogen oxides emission rates consistent with good operating practices. [Does this make technical sense to reduce both rates to the lowest levels? The assumption of the requirement is that at a certain injection rate both ammonia and NOx emissions will be at their lowest levels. Is it possible for example that increasing injection rates may reduce NOx but increase ammonia? Does this requirement still need to be clearer?]

5.2.4. Within 90 days of completion of the optimization program, the owner will submit a report of the optimization process which reports the results of the testing and determines the operating parameters which produce the lowest nitrogen oxides and ammonia emissions. The report will be submitted to Ecology and SWCAA.

5.2.5. Upon acceptance by Ecology and SWCAA, (or 60 days after its submittal if Ecology and SWCAA do not respond within 60 days), the plant operations and maintenance manual(s) will be amended to include the optimum operating parameters developed.

5.2.6. Within 120 days of completion of the optimization program, the owner will submit a request to Ecology and SWCAA to reduce the emission limit in Condition 1.1.2 of this Order to the nitrogen oxides emission rate found to be reasonably achievable by the optimization program or 0.20 lb/MMBtu, whichever is higher. In any event, the requested emission rate limit will not exceed 0.22 lb/MMBtu.

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Monitoring and Recordkeeping Requirements

6. Nitrogen Oxides and Ammonia:

6.1. Nitrogen oxides emissions in units of lb/MMBtu shall be quantified utilizing a continuous nitrogen oxides and diluent monitoring system in accordance with the requirements of 40 CFR Part 75, except that missing data shall be substituted in accordance with Condition 7 of this Order.

6.2. Ammonia emissions will be monitored by annual ammonia slip testing utilizing BAAQMD Method ST1B.

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Deleted: means of a continuous emission monitoring system. This system may also be the system used to control ammonia or urea injection rate. If a separate monitor is used to determine compliance, it will be located in the stack after the wet scrubber. The continuous ammonia monitoring system used for compliance will meet the monitor location requirements contained in 40 CFR Part 60 Appendix B, Performance Specification 1, and the quality assurance and quality control requirements of 40 CFR Part 60 Appendix F.

6.3. The NOx continuous monitoring system must meet the requirements of 40 CFR Part 75 applicable to monitor location, quality assurance and quality control requirements and monitoring system certification requirements.

7. Missing data requirements for nitrogen oxides emission monitoring required by this order

7.1. For a unit with less than 12 continuous hours of missing CEM data, the substituted hourly emission rate will be the higher of (a) the average of emissions during the hour before and the hour after the period of missing data or (b) the average of emissions from the previous 720 operating hours of quality-assured data.

7.2. For a unit with 12 or more continuous hours of missing CEM data, the substituted hourly emission rate will be based on the 90th percentile of the previous 720 operating hours of quality-assured data.

7.3. Those 30 day periods which include substitute data for calculating 30 day averages must be indicated in the emissions information reported in Condition 14.

8. Nitrogen oxides emissions calculation procedure

8.1. The hourly average emissions for both units will be calculated from the CEM data for each unit. The hourly average value will be based on each unit's's heat input and measured emissions. If during a given operating hour only one unit is operated, the average emissions value for both units for that hour will be the hourly emissions for the operating unit. A unit is considered to be in operation during any clock hour that coal is being combusted in the boiler.

8.2. The 30 operating day rolling average is determined by calculating the arithmetic average of all hourly emissions for the 30 successive [is it clear what "successive" means?] operating days, including substituted data per Condition 7.

8.3. A boiler operating day is any 24 hour period commencing at 00:00 hours during which coal is combusted in at least one unit for at least eight clock hours.

8.4. Operating hours utilized to calculate the 30 day average will not include data recorded during monitoring system malfunctions or out of control periods, repairs associated with monitoring system malfunctions or out of control periods, or required monitoring system quality assurance or control activities (including calibration checks and required zero and span adjustments), unless valid data is collected representing three of the four 15-minute periods in a given clock hour. For hours with insufficient valid data, hourly averages shall be substituted per Section 7.

9. Coal Quality Monitoring

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Comment [ARN7]: This paragraph now parallels recently adopted state regulation on data quality.

9.1. Coal nitrogen and sulfur content will be determined by taking a sampling coal conveyed by the transfer belt between the coal pile and coal silos. An alternate location that provides a sample representative of the coal fired by the boilers may be proposed to Ecology by TransAlta for approval for use.

9.2. A sample of coal for nitrogen and sulfur content analysis will be taken at least once per week when at least one coal fired boiler is in operation. The sample must be taken following ASTM Method D2234/D2234M-07.

9.3. Coal nitrogen and sulfur content will be determined using ASTM Method D3176-89 (as reapproved in 2002). Note, other ASTM methods related to sample collection and preparation may need to be followed in order to perform this test.

9.4. As an alternate to coal nitrogen and sulfur content testing at the plant, certified results of testing by the coal mine operator of coal actually sent to the Centralia Power Plant may be used. Testing frequency should be no less frequent than required above.

Reporting Requirements

10. Reporting of achievement of each compliance date in the schedule in Condition 4 must be submitted to Ecology, SWCAA, and the Washington State Governor within 30 days of achieving the milestone.

11. Malfunction of the emission control systems must, at a minimum, be documented in writing and submitted to SWCAA and Ecology with the emissions monitoring data per Condition 14. Additional recordkeeping and notifications related to excess emissions may also be required by SWCAA or Ecology regulation.

12. Continuous emission monitoring data will be reported to Ecology and to the SWCAA.

12.1. The reports will be submitted within 30 days after the end of each calendar quarter, the following information:

12.1.1. The 30 operating day rolling average lb. NOx/MMBtu for each operating day in the reporting period. The 30 day rolling average nitrogen oxides emission rate shall be reported in units of lb/MMBtu, utilizing at least 2 significant figures;

12.1.2. The cumulative short tons of NOx per unit and combined that has been emitted during the current calendar year. The cumulative tons shall be rounded to the nearest ton.

12.2. The submittal will be sent electronically in a format acceptable to the SWCAA. Reporting to Ecology under this condition will end January 1, 2018.

Deleted: Greenhouse Gas Monitoring Requirements¶
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The future compliance with the greenhouse gas emission performance standard under RCW 80.80.040 will be determined by the methods in Part II of Chapter 173-407, Washington Administrative Code.¶

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13. Coal nitrogen and sulfur content information must be submitted to SWCAA and Ecology within 30 days of the end of each calendar quarter.

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13.1. Coal nitrogen and sulfur reporting must include the date each coal sample is taken, the nitrogen and sulfur content of each coal sample analyzed, the running average sulfur and nitrogen concentrations, and the maximum and minimum concentrations found.

13.2. After June 30, 2011, the report will include the rolling annual averages for nitrogen and sulfur content plus the maximum and minimum concentrations in the prior year.

13.2.1. The weekly coal sample test results will be retained for at least 5 years and available for review by Ecology or SWCAA upon request.

13.2.2. Coal quality reporting to Ecology will end the earlier of January 1, 2018, upon submission of a permit limit change application under Condtion 5.2.6, or upon the decommissioning of either unit BW21 or BW22.

Failure to comply with this Order may result in the issuance of civil penalties or other actions, whether administrative or judicial, to enforce the terms of this Order. Ecology shall enforce the terms of this Order only until such time as SWCAA incorporates the terms of the Order into the Centralia Power Plant's Air Operating Permit or except as provided by RCW 70.94.785.

You have a right to appeal this Order. To appeal you must:

- File your appeal with the Pollution Control Hearing Board within 30 days of the "date of receipt" of this document. Filing means actual receipt by the Board during regular office hours.
- Serve your appeal on the Department of Ecology within 30 days of the "date of receipt" of this document. Service may be accomplished by any of the procedures identified in WAC 371-08-305(10). "Date of receipt" is defined at RCW 43.21B.001(2).

If you appeal you must:

- Include a copy of this document with your Notice of Appeal.
- Serve and file your appeal in paper form; electronic copies are not accepted.

To file your appeal with the Pollution Control Hearing Board:

Mail appeal to:		Deliver your appeal in person to:
The Pollution Control Hearings Board PO Box 40903 Olympia, WA 98504-0903	OR	The Pollution Control Hearings Board 4224–6th Avenue SE Rowe Six, Bldg 2 Lacey, WA 98503

To serve your appeal on the Department of Ecology:

Mail appeal to:

Department of Ecology
Appeals Coordinator
PO Box 47608
Olympia, WA 98504-7608

OR

Deliver your appeal in person to:

Department of Ecology
Appeals Coordinator
300 Desmond Drive SE
Lacey, WA 98503

And send a copy of your appeal packet to:

Alan Newman
Department of Ecology
Air Quality Program
PO Box 47600
Olympia, WA 98504-7600

For additional information, go to the Environmental Hearings Office website at http://www.eho.wa.gov.

To find laws and agency rules, go to the Washington State Legislature website at http://www1.leg.wa.gov/CodeReviser.

Your appeal alone will not stay the effectiveness of this Order. Stay requests must be submitted in accordance with RCW 43.21B.320. These procedures are consistent with Chapter 43.21B RCW.

DATED this ___ day of _____, 2011__ at Olympia, Washington.

_____
Jeff Johnston, Ph.D.
Manager, Science and Engineering Section
Department of Ecology
Air Quality Program