Department of Environmental Quality

Amalgamated Sugar Company (TASCO)
Best Available Retrofit Technology Determinations

Revised December 23, 2011

Amalgamated Sugar Company (TASCO)
Best Available Retrofit Technology Determinations

1.1 BART Background 3
1.2 BART Process 4
1.3 BART Eligibility 4
1.4 BART Subject 5
1.5 BART Determinations 7
1.5.1 Particulate BART Control Technology Selection 9
1.5.2 SO_2 BART Control Technology Selection 10
1.5.3 NO_x BART Control Technology Selection 16
1.5.4 SO_2 BART Alternative 19
1.6 Natural Gas-Fired Operation 24
1.7 Conclusion 26

1.1 BART Background

The 1977 Clean Air Act (CAA) Amendments created Part C of the Act entitled Prevention of Significant Deterioration of Air Quality and includes Sections 160-169. The intent of the Prevention of Significant Deterioration (PSD) provisions is to maintain good air quality in areas that attain the national air quality standards and provide special protections for National Parks Wilderness Areas. Part C is divided into two subparts. Subpart 1 established the initial classification of Class I and Class II areas. Class I areas include: Section 162(a)

> *(1) International Parks,*
>
> *(2) National wilderness areas which exceed 5,000 acres in size,*
>
> *(3) National memorial parks which exceed 5,000 acres in size, and*
>
> *(4) National parks which exceed six thousand acres in size and which are in existence on the date of the enactment of the Clean Air Act Amendments of 1977 shall be Class I areas and may not be redesignated. . .*
>
> *(b) All areas in such State designated . . . as attainment or unclassifiable which are not established as class I under subsection (a) shall be class II areas . . .*

The Class I areas that met this criteria and were in existence on or before 1977 became known as "mandatory class I federal areas." Although states could designate other areas as Class I areas after 1977, PSD and other portions of the Regional Haze Rule focus on those Class I areas in existence on or before 1977.

Based on the classification of an area, the amount of allowable degradation which is from new or modified air pollution sources is determined. In National Parks and other Class I areas smaller amounts of degradation known as "increment" are allowed. The PSD program under Part C, Subpart 1 primarily focuses on emission from 1977 forward and will be further discussed in the chapters on Reasonable Progress and Long Term Strategies.

Visibility is called out much stronger in Part C, Subpart 2 and set the national goal of "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" (CAA Section 169(A). In an effort to remediate the existing impairments to visibility, the Section 169(A)(2)(A) includes "a requirement that each major stationary source which is in existence on the date of enactment of this section, but which has not been in operation for more than fifteen years as of such date, . . .emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area, shall procure, install and operate, as expeditiously as practicable (and maintain thereafter) the best available retrofit technology, as determined by the state."

To carry out Congress' intent to install BART on certain emission sources, EPA promulgated the "Regional Haze Rule" [64 FR 35714 (July 1, 1999)]. These rules were challenged, and on May 24, 2002, the U. S. Court of Appeals for the District of Columbia vacated the Regional Haze Rule and remanded the BART provisions in the Rule. Revisions to the rule were published on July 6, 2005 [70 FR 39104 (July 6, 2005)]. The BART rule can also be found under 40 CFR 51.308(e). As part of the July 6, 2005 rule revisions, EPA published Appendix Y guidance for the implementation of BART. The guidance can be found beginning at 70 FR 39156 (July 6, 2005).

In the spring of 2006, the Department of Environmental Quality (DEQ) went through a negotiated rulemaking process to develop rules for Regional Haze. During this process rules were negotiated for the implementation of BART and Reasonable Progress Goals. These rules pertaining to BART can be found

at IDAPA 58.01.01.668. During the negotiated rule making process, it was decided to follow EPA Appendix Y Guidance on the BART determination process but not incorporate the guidance into rule under IDAPA. A threshold of visibility impact of 0.5 deciviews in any Class I Federal Area was established through negotiated rulemaking as "contributing" to visibility impairment.

1.2 BART Process

The BART provision applies to "major stationary sources" from 26 identified source categories which have the potential to emit 250 tons per year or more of any air pollutant. The CAA requires that only sources which were built or in operation during a specific 15-year time interval be subject to BART. The BART provision applies to sources that existed as of the date of the 1977 CAA amendments (that is, August 7, 1977) but which had not been in operation for more than 15 years (that is, not in operation as of August 7, 1962). The first phase of the BART process is developing a list of BART "eligible" facilities which include those major facilities from the 26 identified source categories that have a potential to emit 250 tons per year of any light impairing pollutant.

The CAA requires BART analyses when any source meeting the above description "emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility" in any Class I area. In most cases, the determination of whether a facility is causing or contributing to visibility impairment is done through modeling. Any BART-eligible facility with an impact of one deciview is considered "causing" visibility impairment, and in Idaho the threshold for "contributing" to impairment is 0.5 deciviews.[1] Any BART-eligible facility causing or contributing to visibility impairment is BART "subject." BART subject facilities are required to go through a process to determine what if any controls will be required.

1.3 BART Eligibility

The source is *BART-eligible* if it falls into one of 26 sector categories, was built between 1962 and 1977, and annually emits more than 250 tons of a haze-causing pollutant. The Riley Boiler of The Amalgamated Sugar Company, LLC (TASCO) Sugar Plant in Nampa, Idaho has been determined to be BART-eligible. The Boiler is rated at 350 million BTUs per hour which meets the BART criteria as a fossil-fuel boiler of more than 250 million BTUs per hour heat input, was installed in 1969, and was put into service between August 7, 1962 and August 7, 1977.

The Riley Boiler's *Potential to Emit* (PTE) exceeds 250 tons per year (T/yr) for the haze-causing pollutants sulfur dioxide (SO_2, 2,770 T/yr), nitrogen oxide (NO_x, 1,708 T/yr), and particulate matter (PM, 55 T/yr), so this emission unit was eligible for inclusion in the subject-to-BART analysis of visibility impairment in Class I areas. Following this criteria, the Riley Boiler at the Nampa TASCO plant was BART-eligible.

[1] A deciview is a haze index derived from calculated light extinction, such that uniform changes in haziness correspond to uniform incremental changes in perception across the entire range of conditions—from pristine to highly-impaired. A deciview is the minimum perceptible change to the human eye.

1.4 BART Subject

The source is *subject to BART* if it is reasonably anticipated to cause or contribute to impairment of visibility in a Class I area. According to the Guidelines for Best Available Retrofit Technology (BART) Determinations contained in 40 CFR Part 51, Appendix Y, a source is considered to contribute to visibility impairment if the modeled 98th percentile change in *deciviews* (delta deciview)—a measure of visibility impairment—is equal to or greater than a contribution threshold of 0.5 deciviews. Although Appendix Y does provide for thresholds less than 0.5 deciviews and cumulative impacts, it was determined through negotiated rulemaking with industry, federal land management agencies, DEQ and the public that the "contribute" threshold for a single source would be established at 0.5 deciviews. (See IDAPA 58.01.01.668.02.b.) As suggested in Appendix Y guidance, the determination was made by modeling.

DEQ used the CALPUFF air dispersion modeling system (version 6.112) to determine if the 0.5 deciview threshold was exceeded by any of the BART-eligible sources in Idaho. The modeling of BART-eligible sources was performed in accordance with the *BART Modeling Protocol*,[2] which was jointly developed by the states of Idaho, Washington, and Oregon. Refer to the *BART Modeling Protocol* for details on the modeling methodology used in this subject-to-BART analysis.

The Idaho DEQ, in cooperation with Washington State Department of Ecology and Oregon Department of Environmental Quality contracted with Geomatrix Consultants to develop CALMET datasets to use for the CALPUFF BART modeling. The CALMET datasets were based on Penn State and National Center of Atmospheric Research Mesoscale Model (MM5) runs performed at University of Washington. There were two CALMET datasets produced--one using 12km mesh size and another using 4 km mesh size.[3]

As part of the contract, Geomatrix Consultants ran METSTAT to quantify the quality of the MM5 files used as the meteorological dataset in CALMET—used in the CALPUFF modeling. METSTAT pairs the MM5 forecasted data with meteorological observations and then performs various statistical manipulations and aggregates the results for output.[4]

Subject-to-BART analysis results for the TASCO Riley Boiler, Nampa are shown in Table 1, which highlights the following two threshold values for BART:

- 8th highest value for each of the years modeled (2003-2005), representing the 98th percentile (8/365 = 0.02) cutoff for delta deciviews in each year.
- 22nd highest value for the entire period from 2003 through 2005, representing the 98th percentile (22/1095 = 0.02) cutoff for delta deciviews over three years.

The determining criterion for both values is a delta deciview of at least 0.5 deciviews.

[2] Modeling Protocol for Washington, Oregon and Idaho: Protocol for the Application of the CALPUFF Modeling System Pursuant to the Best Available Retrofit Technology (BART) Regulation.

[3] Modeling Protocol for BART CALMET datasets, Idaho Oregon and Washington, Geomatrix Consultants Inc., July 12, 2006.

[4] INITIAL METSTAT REPORT CALMET Fields for BART Idaho, Oregon and Washington, Geomatrix Consultants.

These findings were based on the emission rates and other facility parameters provided by TASCO at the time of the analysis.[5] Based on the CALPUFF modeling analysis, the TASCO Riley Boiler impacted the following Class I areas with the 98th percentile highest delta-deciview impact greater than 0.5 over the years 2003 to 2005:

- Eagle Cap Wilderness, Oregon
- Hells Canyon National Recreation Area, Idaho
- Strawberry Mountain Wilderness, Oregon

Table 1 Visibility Impacts Compared to 20% Best Days Natural Background Condition

Class I Area	Delta-deciview impacts greater than contribution threshold (Δdv>0.5)							
	2003		2004		2005		2003-2005	
	8th highest[(a)]	Total days[(b)]	8th highest[(a)]	Total days[(b)]	8th highest[(a)]	Total days[(b)]	22nd highest[(c)]	Total days[(d)]
Craters of the Moon	0.161	2	0.224	2	0.153	0	0.196	2
Eagle Cap Wilderness, OR	0.87	20	1.355	46	1.302	46	1.325	112
Hells Canyon National Recreation Area, ID	0.772	13	1.031	27	0.9	21	0.936	61
Jarbidge Wilderness, NV	0.151	0	0.198	1	0.201	1	0.179	2
Sawtooth Wilderness, ID	0.239	2	0.294	4	0.265	0	0.271	6
Selway-Bitterroot Wilderness, ID and MT	0.186	0	0.305	1	0.264	2	0.243	3
Strawberry Mountain Wilderness, OR	0.782	12	0.639	13	1.596	31	0.943	56

(a) The 8th highest delta-deciview impact for the calendar year.
(b) Total number of days in the 1-year period that exceeded 0.5 delta deciviews.
(c) The 22nd highest delta-deciview impact for the 3-year period.
(d) Total number of days in the 3-year period that exceeded 0.5 delta deciviews.

In conclusion, the CALPUFF model predicted that emissions from the Riley Boiler at the TASCO Nampa Factory impacted visibility with the 98th percentile highest delta-deciview impact of more than 0.5 deciview on the Class I areas of Eagle Cap Wilderness, OR; Strawberry Mountain Wilderness, OR; and Hells Canyon Wilderness, ID for the years 2003 to 2005, primarily during winter time periods. Eagle Cap Wilderness area had the highest number of days (112 days in three years), with a delta-deciview impact greater than 0.5. The highest one-year 8th high delta-deciview impact (1.596, year 2005) was found in Strawberry Mountain Wilderness.

The major contributors to visibility deterioration from the Riley Boiler of the TASCO Nampa Factory are SO_2 and NO_2, precursors of sulfate and nitrate aerosols formed in winter under conditions of low temperature and high relative humidity. Modeled impacts were greatest when a high-pressure system persisted in the area for three to four days or more, the atmosphere was stagnant with poor dispersion, and the pollutants transported remained relatively undiluted.

The subject-to-BART analysis, which followed the *BART Modeling Protocol*, and additional extensive sensitivity analysis have demonstrated that the Riley Boiler of the TASCO Nampa Factory is subject to BART. TASCO was notified of the subject-to-BART findings by letter on July 19, 2007.

[5] The delta-deciview impact for each of the Class I areas identified in the Subject-to-BART analysis changed slightly in the final determination process due to refinements in facility parameters such as stack velocities as provided by TASCO.

1.5 BART Determinations

Error! Reference source not found.

BART control equipment was initially determined to be the existing baghouse for the control of PM emissions, a spray dry flue gas desulfurization (FGD) system for the control of SO_2 emissions, and a low NO_x burner system (LNB) with over-fired air for the control of NO_x emissions. BART emission limits, a BART alternative to the control NO_x, and other BART requirements were incorporated in Tier II Operating Permit No. T2-2009.0105, which was issued on September 7, 2010. On October 12, 2010, TASCO filed a contested case petition seeking review of the permit. During negotiations to resolve the contested case, TASCO provided additional information concerning the feasibility of SCR and over-fired air control technologies, requested revision of the initial BART determinations, and proposed a BART Alternative to the Spray Dry FGD control technology. The BART determinations in this document have been updated based on the revised BART determinations and the approved BART Alternative. The specific revisions to BART and to the BART Alternative, along with the supporting technical analyses, regulatory review, and a discussion of the revised permit conditions has been provided in the Statement of Basis to Tier II Operating Permit No. T2-2009.0105, Project 60867.

Error! Reference source not found..

(a) ***Table 2 BART DETERMINATIONS*** [a]**Error! Reference source not found.**This table summarizes each BART determination. The BART determination for NOx has been revised as described in this section.
(b) **Error! Reference source not found.**.
(c) **Error! Reference source not found.**
(d) Because the cost of the enhanced baghouse, dry ESP, and wet ESP options were determined to outweigh the improvement, BART was selected based on costs of compliance and the pollution control equipment in use (existing baghouse). Specific modeling of each PM control scenario was not analyzed.
(e) The "Base Case" represents continuous coal-fired operation of the **Error! Reference source not found.** (without controls).
(f) Wet FGD was not determined to be effective due to non-air quality environmental impacts of compliance related to wastewater treatment.
(g) SNCR was not considered feasible due to concerns that the flue gas would not have adequate residence time to achieve reliable control.
(h) **Error! Reference source not found.**
(i) ULNB was not considered feasible due to concerns that the boiler firebox would not be large enough to accommodate the full burner/flame management system required.
(j) **Error! Reference source not found.**

1.5.1 Particulate BART Control Technology Selection

In determining the "best" BART control technology for particulate controls on the Riley Boiler, DEQ used the five steps as described in EPA Appendix Y.

Step 1 – Identify all available retrofit emissions control techniques

In consultation with DEQ, the following particulate control technologies were identified:

- Existing baghouse
- Enhanced baghouse
- Wet Electrostatic Precipitator (Wet ESP)
- Dry Electrostatic Precipitator (Dry ESP)

Step 2 – Determine technically feasible options

In this step, DEQ relied heavily on TASCO engineers to provide the technical feasibility because of plant specific requirements and their familiarity with plant operations. DEQ reviewed the information as provided below:

Existing Baghouse - The existing baghouse efficiently reduces PM to very low levels. Measured PM emissions are 0.036 lb/MMBTU, well below the previously proposed industrial boiler MACT standard of 0.07 lb/MMBTU. Control efficiencies for baghouses are reported at 99.0 to 99.9%. For this analysis the control efficiency was assumed to be 99% efficient.

Enhanced Baghouse – The addition of a baghouse module could marginally improve the removal efficiency of the existing baghouse. This option would expand the number of modules from four to five resulting in reduced baghouse velocities and pressure drop. Adding another baghouse module to the Riley Boiler baghouse would be difficult and expensive because of physical space limitations near the existing baghouse. PM control efficiency for the additional baghouse was assumed to be 99.0%.

Wet Electrostatic Precipitator – A Wet ESP consists of a series of collection surfaces in the device that removes particulate using an electrical field. The plates are continuously or intermittently cleaned using a circulating water system. Control efficiencies for Wet ESP systems have been reported to be 99.0 to 99.9%. For the purposes of this evaluation, the control efficiency was assumed to be 99%.

Because of physical space limitations, the installation of the Wet ESP will require demolition and the removal of the existing baghouse and installation of the WET ESP in its place. In addition the system will produce saturated vapor conditions in the stack during some operation scenarios. A liner will be needed to be installed in the existing stack to protect the stack from corrosive conditions.

Dry Electrostatic Precipitator – A Dry ESP is very similar in operation to the Wet ESP option considered above. The particulate to be removed is charged in an electric field and attracted to a collection plate. Control efficiencies for Dry ESP system are reported at 99.0 to 99.9% efficient. For this evaluation the control efficiency is assumed to be 99.0%.

This information is summarized in Table 3 below.

Table 3 Technical Feasibility of PM Controls

Pollutant	Technology	Feasibility	Reason Not Feasible
PM	Existing Baghouse	Yes	None
	Enhanced Baghouse	Yes	None
	Wet ESP	Yes	None
	Dry ESP	Yes	None

In conclusion, all particulate technologies identified are technically feasible options for the Riley Boiler.

Step 3 – Evaluate technically feasible options

In this step, all of the technically feasible options were ranked in order of effectiveness of each control technology identified as technically feasible. Control effectiveness was based on manufacture's performance data, engineering estimates, and demonstrated effectiveness of the technology on the Riley Boiler. This data is summarized in Table 4.

Table 4 Evaluation of PM Controls

Pollutant	Control Option	BART Baseline Maximum Emissions (lb/hr)	BART Baseline Annual Average Emissions (T/yr)	Removal Efficiency (%)	Expected Maximum Emissions (lb/hr)	Expected Annual Emissions (T/yr)
PM	Existing Baghouse	12.4	34.5	99.0%	12.4	34.5
	Enhanced Baghouse	12.4	34.5	99.0%	12.4	34.5
	Dry ESP	12.4	34.5	99.0%	12.4	34.5
	Wet ESP	12.4	34.5	99.0%	12.4	34.5

Since all control technologies have the same removal efficiency no single control technology is ranked higher than the other for emissions removal.

Step 4 – Impact analysis

The use of the existing baghouse stands out as the best BART control technology since it will not require additional costs. The existing baghouse has the added environmental benefits of not requiring additional water or electricity. The benefit of adding an additional bag house is so small the benefits are outweighed by the costs. In conclusion, the best BART control technology for particulate is the existing baghouse.

Step 5 – Determine visibility impacts (improvements)

Since all control technologies have the same removal efficiency there was no merit in modeling specifically for the particulate control scenarios.

1.5.2 SO_2 BART Control Technology Selection

In determining the "best" BART control technology for sulfur dioxide (SO_2) controls on the Riley Boiler, DEQ used the five steps as described in EPA Appendix Y.

Step 1 – Identify all available retrofit emissions control techniques

- Low sulfur coal (LSC)
- Wet flue gas desulfurization (FGD)
- Spray dry FGD
- Dry lime FGD
- Dry Trona injection FGD

Step 2 – Determine technically feasible options

In this step, DEQ relied heavily on TASCO engineers to provide the technical feasibility because of plant specific requirements and their familiarity with plant operations. DEQ reviewed the information as provided below:

Low Sulfur Coal (LSC) – Currently the Nampa plant uses coal that is limited to 1% sulfur by weight to comply with the Rules for Control of Air Pollution in Idaho. The average actual percent sulfur for the baseline period is approximately 0.75%. This option will look at using 0.6% sulfur with an actual reduction of 15%.

Wet Flue Gas Desulfurization (Wet FGD) – A Wet FGD system typically consists of saturated absorber towers located downstream of a particulate control device. The absorbers are usually configured as a flooded tray system or spray tower. Flue gas entering the absorber reacts with slurred limestone or slaked lime to remove SO_2 at the liquid/gas surface boundary. The reaction forms insoluble products or solids that can be further treated with forced oxidation to convert to gypsum which is a marketable by product. The treated flue gas passes through a mist eliminator system to remove water droplets from the flue gas stream. The flue gas leaving the absorber is saturated with water vapor and can present a visible steam plume from the stack.

Wet FGD systems offer one of the highest SO_2 removal efficiencies of the available control technologies with a removal efficiency of 95% or greater. This is also a technology which EPA is heavily invested and supports. The Installation of Wet FGD will require significant modification of the facility. Key site-specific considerations are as follows:

Wet FGD results in saturated stack conditions during periods of Riley only operation (Shared stack operation during beet campaign with the B&W Boiler is not anticipated to result in saturated stack conditions). The resulting condensation formed in the stack is anticipated to have very low pH values that will require installation of a stack liner to protect the integrity of the stack. Condensed vapors will need to be neutralized. Installation of a stack liner is estimated at $2,000,000.

Since Wet FGD is a wet process, it will generate a wastewater stream. The actual wet process is expected to be contained within the Wet FGD system with a slip stream discharged for wastewater treatment.

Spray Dryer Flue Gas Desulfurization (Spray Dry FGD) – Spray Dry FGD consists of a spray dryer reactor to be located between the boiler exhaust and upstream of a particulate removal device (usually an electrostatic precipitator or baghouse). The reactor consists of a spray dryer absorber tower and support

equipment. Flue gas is introduced into a vessel and contacts an atomized spray pattern of lime slurry generated by either a set of dual fluid nozzles or a rotary atomizer. The reaction to remove SO_x occurs on lime slurry droplets as they are evaporated from the heat of the flue gas to form a dry particle.

Because the exit temperature of the reactor must be maintained at a set temperature above the adiabatic saturation temperature of the flue gas (controlled by slurry feed rate), the product removed from the system is in dry form. The emission control efficiency of the reactor increases as the exit flue gas temperature approaches the adiabatic saturation temperature of the flue gas. The approach temperature is typically set at 30-40° F above adiabatic saturation temperature (corresponding to removal efficiencies of 90-80% respectively). Recycling fly ash into the lime slurry feed mixture may increase emission control efficiency depending on the chemical characteristics of the ash.

For the purposes of this evaluation a control efficiency of 80% will be assumed (a higher temperature 40°F was assumed to protect the baghouse).

A spray Dry FGD retrofit project would require modifications to the TASCO Nampa facility. The particulate loading to the baghouse would increase as a result of installing a spray dryer. In addition to the ash entering the reactor with flue gas, the spent lime would contribute to overall particulate loading. Approximately 60% of the formed solids are predicted to drop out in the reactor while 40% would be carried to the baghouse for removal. The increase in particulate loading would likely require an additional baghouse module.

Error! Reference source not found.. With regard to affordability, TASCO has provided revised annualized operating cost estimates related to the installation, maintenance, and operation of this technology. With regard to non-air quality environmental impacts, TASCO has identified concerns related to the disposal of byproducts generated in the operation of this technology, and concerns related to the marketability of boiler fly ash for reuse activities.[6]

Dry Lime Injection Flue Gas Desulfurization (Dry Lime FGD) – Dry Lime FGD consists of injecting pulverized lime (milled to less than 10 microns) into the flue gas upstream of the baghouse. The emission control efficiency of a Dry Lime FGD is critically dependent upon:

Particle Size – The smaller the particle size, the greater the surface area for reaction. Lime is milled to less than 10 microns using a ball mill. The smaller size of the particles is also important to avoid downstream depositing of dust in the equipment and ductwork.

Temperatures – Reaction rates increase with increased temperatures of the flue gas.

Flue Gas Mixing – Good lime particle mixing with the flue gas is important to provide uniform distribution of lime reactant in the baghouse.

The control efficiency for DLIFGD is reported to vary between 45 to 55%. For the purposes of this evaluation, the control efficiency is assumed at 55%.

Dry Trona Injection Flue Gas Desulfurization (Dry Trona FGD) – Trona is a naturally occurring source of sodium carbonate that is available from mines in Wyoming. Similar to Dry Lime FGD, Dry Trona FGD consists of injecting pulverized Trona (milled to less than 10 microns) into the flue gas downstream of the existing baghouse and upstream of a new baghouse. The injection system requirements and technical characteristics are very similar to the Dry Lime FGD system discussed above.

The control efficiency for Dry Trona FGD is reported to range between 55 to 65%. For the purposes of this evaluation, the control efficiency is assumed at 65%.

This information is summarized in Table 5, below.

[6] Section 1.5.2 of Attachment #2 to "BART Alternative Submittal & Tier II Application", TASCO, May 4, 2011; and "FW: Attached 2 files for DEQ Emailing…", TASCO, October 27, 2011.

Table 5 Technical Feasibility of SO_2 Controls

Pollutant	Technology	Feasibility	Reason Not Feasible
SO_2	Low Sulfur Coal	Yes	None
	Wet FGD	Yes	None
	Spray Dry FGD	Yes	None
	Dry Lime FGD	Yes	None
	Dry Trona FGD	Yes	None

Step 3 – Evaluate technically feasible options

Based on the control efficiency rates listed above, TASCO determined the baseline maximum hourly emission rates, baseline average annual emission rate, anticipated control efficiency of emission controls, expected maximum hourly emission rate and expected annual emission rates. This data is summarized in Table 6, below.

Table 6 Evaluation of SO_2 Controls

Pollutant	Control Option	BART Baseline Maximum Emissions (lb/hr)	BART Baseline Annual Average Emissions (T/yr)	Removal Efficiency (%)	Expected Maximum Emissions (lb/hr)	Expected Annual Emissions (T/yr)
SO_2	Low Sulfur Coal	522	1457	15%	444	1238
	Dry Lime FGD	522	1457	55%	235	655
	Dry Trona FGD	522	1457	65%	183	510
	Spray Dry FGD	522	1457	80%	104	291
	Wet FGD	522	1457	95%	26	73

Step 4 – Impact analysis

TASCO did a cost evaluation for each of the control technologies analyzed. A complete cost evaluation can be found in Appendix D & E of "*Best Available Retrofit Technology (BART) Determination Analysis, 2009.* These findings were based on EPA fact sheets, engineering and performance test data, and information and discussions with equipment vendors. Table 7 summarizes those results.

Table 7 Impacts of SO_2 Controls

Control Scenario	Baseline Emissions (T/yr)	Removal Efficiency (%)	Annual Emissions Reduction (T/yr)	Total Reduction (T/yr)	Total Capital Cost ($x1,000)	Total Annual Cost ($x1,000)	Cost ($/T)	Incremental Cost ($/T)
Low Sulfur Coal	1,457	15%	219	219	0	$1,024	$4,685	$0
Dry Lime FGD	1,457	55%	801	801	$11,281	$2,687	$3,353	$2,857
Dry Trona FGD	1,457	65%	947	947	$11,281	$2,442	$2,557	-$1,678
Spray Dry FGD	1,457	80%	1,166	1,166	$12,970	$2,521	$2,163	$360
Wet FGD	1,457	95%	1,384	1,384	$22,006	$4,034	$3,353	$6,940

After reviewing TASCO's evaluation, DEQ has concerns with the installation of Wet FGD. In reviewing TASCO's BART Determination Analysis for the Riley Boiler, and specifically looking into wastewater treatment processes associated with Wet Flue Gas Desulfurization (Wet FGD), TASCO's submittal does not present technical specifications or much detail regarding the wastewater treatment process. It's not immediately clear that the costs of the wastewater treatment process are included in the estimates presented in their submittal; however, there appear to be many vendors who provide wastewater treatment processes as part of a Wet FGD project, so it is assumed that the cost of wastewater management is contained within the cost estimates provided for the Wet FGD process itself.

There are several variables that make it very difficult to speculate about the volume of wastewater that might be produced, or any constituent concentrations in wastewater from the process. The source and composition of (1) the coal fired in the boiler, and (2) the limestone used in the Wet FGD process will largely dictate the constituents and constituent concentrations in the wastewater, but there are likely to be significant concentrations of chlorides, fluorides, sulfate, arsenic, mercury, selenium, boron, cadmium, zinc, iron, aluminum, and inert fines that will require some sort of treatment prior to any discharge. Because the wastewater stream is saturated with calcium sulfate (i.e., gypsum), scaling is a major issue with operation and maintenance of process units and piping. The wastewater will also be hot, somewhat acidic, and will have high levels of total dissolved solids. There's also information available that indicates the presence of nitrates in the wastewater. Many of these constituents have primary or secondary quality standards in the *Ground Water Quality Rule*, and any proposal involving land application would almost certainly require impact assessments and/or permitting before DEQ would allow them to go forward.

It is entirely possible to design treatment units to manage and remove the majority of these constituents from the wastewater. The gypsum is a marketable product that would likely be precipitated out of solution and recovered as a commodity. The metals can also be precipitated, although many of these are regulated as hazardous wastes at relatively low concentrations (i.e., the hazardous waste program would probably want to be involved with management of these solids). There are also other processes that can be used to reduce residual levels of dissolved solids and nitrates in the final effluent, although it's important to note that more treatment generally means more cost and more oversight required. The potential volume and quality of the final, treated effluent is very difficult to speculate about without knowing more about the wastewater that will be produced by the Wet FGD process and the treatment processes that will be used to manage that wastewater.

With respect to TASCO's existing wastewater treatment system, the facility is presently treating most of its wastewater on site in an aerated lagoon and sending it to the municipal treatment plant operated by the City of Nampa during off-peak hours. To continue with this operation, a very high degree of wastewater treatment will be required, and substantial improvements to the existing treatment process will almost certainly be required. It would be expected that the city might have concerns about any potential increase in the volume of wastewater discharged to its system. This could mean that the City would need to expand its treatment system or that TASCO might look to land application to manage the new wastewater stream.

TASCO does still have a wastewater land application permit with DEQ, but the facility has only utilized land application for a very small fraction of its total wastewater load in recent years. The company land applied ~12MG in the 2005 season (6% of total WW generated), ~5MG in the 2006 season (3% of total WW generated), ~1MG in the 2007 season (1% of total WW generated), and no wastewater was land applied in the 2008 season. As a result of this reduction in land applied wastewaters, we have seen improving trends in its ground water monitoring wells. Historically, there were issues with nitrates, chlorides, and total dissolved solids concentrations in ground water around the site. While some exceedances of the associated ground water quality standards still exists, most monitoring wells have shown improving trends in ground water quality in recent years, and the DEQ Boise Regional Office is encouraging TASCO to continue to minimize wastewater land application at this time.

Although wastewater treatment processes are available to produce a high-quality effluent that could be successfully land applied under a permit from DEQ, these processes will be fairly complex and expensive, and will likely require dedicated staff to operate and maintain. **Additionally, the reduction in wastewater land application in recent years has improved historic issues with ground water quality that have generally been associated with TASCO's operation**, so any proposal to increase loading rates from a new source of wastewater would require a complete permit application that includes a ground water impact assessment showing no adverse impacts to existing ground water quality. We would issue a permit with enforceable limits and comprehensive monitoring/reporting requirements to ensure protection of ground water quality, assuming that the application and impact assessments can be technically verified and approved.

Step 5 – Determine visibility impacts (improvements)

Error! Reference source not found. below summarizes the modeling results for SO_2 controls.

Table 8 Visibility Improvement of SO_2 Controls - Change in Visibility Impacts Compared to 20% Best Days Natural Background Condition

Eagle Cap Wilderness, OR	Delta-deciview impacts greater than contribution threshold (Δdv>0.5)							
	2003		2004		2005		2003-2005	
	8th highest[a]	Total days[b]	8th highest[a]	Total days[b]	8th highest[a]	Total days[b]	22nd highest[c]	Total days[d]
Base Riley Boiler Plus Pulp Dryer Full Operation Scenario (wzi10469)	0.956	23	1.454	49	1.388	55	1.399	127
Base Riley Boiler Scenario (wzi10471)	0.721	15	1.086	41	1.109	41	1.086	97
SO_2 Control Scenario 1 Lower Sulfur Coal (wzi10475)	0.682	15	1.016	39	1.028	36	1.014	90
SO_2 Control Scenario 2 Dry Lime Injection (wzi10476)	0.586	9	0.814	28	0.806	29	0.806	66
SO_2 Control Scenario 3 Dry Trona Injection (wzi10477)	0.565	9	0.764	24	0.739	25	0.761	58
SO_2 Control Scenario 4 Spray Dryer FGD (wzi10478)	0.527	9	0.703	22	0.707	20	0.686	51
SO_2 Control Scenario 5 Wet FGD (wzi10479)	0.499	7	0.647	19	0.645	17	0.638	43

a) The 8th highest delta-deciview impact for the calendar year.
b) Total number of days in the 1-year period that exceeded 0.5 delta deciviews.
c) The 22nd highest delta-deciview impact for the 3-year period.
d) Total number of days in the 3-year period that exceeded 0.5 delta deciviews.

Since TASCO believed running the CALPUFF modeling for the various control technology scenarios would be costly, DEQ performed the CALPUFF modeling in-house and invited TASCO to have a contractor review the modeling if deemed necessary. Because each scenario can change the stack velocities and temperatures, it was important that DEQ work closely with TASCO. DEQ worked very closely with TASCO facility engineers to determine the modeling inputs for each of the scenarios.

Conclusion - As part of the impact analysis, non-air quality environmental concerns are to be taken into consideration. Although Wet FGD has a 15% greater removal efficiency over the next closest control of Spray Dry FGD, the potential for reversing the current trend of improvements to ground water due to TASCO land applying outweigh the environmental benefits. TASCO is currently sending pretreated wastewater to the City of Nampa. There is a high likelihood that an increase in TASCO's waste stream would be greater than the city can currently handle. This would more than likely lead to TASCO requesting to increase land application of waste water. For these reasons, DEQ will not be including Wet FGD in the control options even though the technology is technically feasible for improvements in air quality and visibility.

1.5.3 NO_x BART Control Technology Selection

In determining the "best" BART control technology for nitrogen oxides (NO_x) controls on the Riley Boiler, DEQ used the five steps as described in EPA Appendix Y.

Step 1 – Identify all available retrofit emissions control techniques

DEQ in consultation with TASCO identified the following control technologies appropriate for boilers:

- Low NO_x Burners (LNB)
- Low NO_x Burners with Over-fired Air (LNB/OFA)
- Ultra Low NO_x Burners (ULNB)
- Selective Catalytic Reduction (SCR)
- Selective Non-Catalytic Reduction (SNCR)

Step 2 - Determine technically feasible options

In this step, DEQ relied heavily on TASCO engineers to provide the technical feasibility because of plant specific requirements and their familiarity with plant operations. DEQ reviewed the information as provided below:

Low NO_x Burners - LNBs incorporate staged fuel or staged combustion air to control the flame temperature of the boiler. Several low NO_x burner systems are available with different levels of cost and performance capabilities. A guaranteed NO_x removal efficiency of 60.7% for the Riley Boiler was provided by the vendor.

Low NO_x Burners with Over-Fired Air – These systems inject a portion of the combustion air downstream of the fuel burner system to lower flame temperatures and the formation of NO_x. Over-fired air as a standalone retrofit technology can be difficult to control causing combustion issues with pulverized coal boiler, including water wall corrosion and reduced boiler efficiencies. When combined with a low NO_x burner and reasonable combustion air control, NO_x removal efficiencies can approach 65%.

In the initial BART determination (as described in the Statement of Basis to Tier II Operating Permit No. T2-2009.0105, issued September 7, 2010), it was determined based on technical analyses that low NO_x burners with over fired air were technically feasible. However, based on the results of an engineering design review of the Riley Boiler, it has subsequently been determined that over fired air (OFA) is not technically feasible for retrofit on the Riley Boiler.[7] **Error! Reference source not found.**

Ultra Low NO_x Burners – These systems are upgraded LNB designs which involve further control and staging of combustion air and fuel. ULNB was determined not technically feasible on the Riley Boiler. The boiler's existing firebox is not large enough to accept the full burner/flame management system required by the ULNB.

[7] **Error! Reference source not found.**

Selective Catalytic Reduction – SCR systems reduce NO_x by injecting ammonia and urea into the flue gas before it passes through a catalytic grid to reduce the NO_x to N_2. This technology requires the flue gas exhaust from the Riley baghouse to be heated to 500° C before injecting ammonia or urea and passing the hot gases through the selective catalytic grid. After treatment, heat is recovered in a heat exchanger to minimize operating costs to reheat the flue gas. This technology is capable of reducing NO_x emissions by 70% to 90%. For the purposes of this evaluation a control efficiency of 90% was assumed.

In the initial BART determination (as described in the Statement of Basis to Tier II Operating Permit No. T2-2009.0105, issued September 7, 2010), it was determined that SCR was technically feasible. However, based on the results of an engineering design review of the Riley Boiler, it has subsequently been determined that SCR is not technically feasible for retrofit on the Riley Boiler.[8] **Error! Reference source not found.**

Selective Non-Catalytic Reduction (SNCR) – SNCR consists of injecting ammonia or urea into boiler flue gases in a narrow temperature zone of 1550 to 1950° F. To achieve these temperatures, the injection point must be located between the Riley Boiler economizer and the air pre-heater. The process relies on good gas mixing in the narrow high temperature zone to reduce NO_x to N_2 as the flue gas moves through the ductwork. Boiler load swings can lead to temperature changes at the injection that can significantly reduce removal efficiencies. In addition, injection points can lead to "ammonia slip" or the condition where unreacted ammonia passes through downstream equipment, including the baghouse and discharges from the stack. The gas path for the Riley Boiler lacks the necessary residence time to reliably remove the NO_x. The results of upsets could lead to "ammonia slip."

This information is summarized in Table 9, below.

Table 9 Technical Feasibility of NO_x Controls

Pollutant	Technology	Feasibility	Reason Not Feasible
NO_x	Low NO_x Burners	Yes	None
	Low NO_x with Over-Fired Air	No	Insufficient vertical distance between the top burner elevation and the furnace nose arch to support OFA system.
	Ultra NO_x Low Burners	No	Boiler Firebox is not large enough to support the flame management system.
	Selective Catalytic Reduction	No	Catalyst fouling and erosion, or exhaust temperature too low
	Selective Non-Catalytic Reduction	No	Boiler gas path does not have adequate residence time for reliable control.

Step 3 – Evaluate technically feasible options

Based on the control efficiency rates listed above, TASCO determined the baseline maximum hourly emission rates, baseline average annual emission rate, anticipated control efficiency of emission controls, expected maximum hourly emission rate and expected annual emission rates. This data is summarized in Table 10, below.

[8] **Error! Reference source not found.**

Table 10 Evaluation of NO_x Controls

Pollutant	Control Option	BART Baseline Maximum Emissions (lb/hr)	BART Baseline Annual Average Emissions (T/yr)	Removal Efficiency (%)	Expected Maximum Emissions (lb/hr)	Expected Annual Emissions (T/yr)
NO_x	Low NO_x Burners	374	1,042	60.7%	147	410

Step 4 – Impact Analysis

The use of low NO_x burners was the top feasible control technology for minimizing NO_x emissions. Control options were not eliminated based on energy, environmental, or economic impacts.

Step 5 – Determine visibility impacts (improvements)

Since TASCO believed running the CALPUFF modeling for the various control technology scenarios would be costly, DEQ performed the CALPUFF modeling in-house and invited TASCO to have a contractor review the modeling if deemed necessary. Because each scenario can change the stack velocities and temperatures, it was important that DEQ work closely with TASCO. DEQ worked very closely with TASCO facility engineers to determine the modeling inputs for each of the scenarios.

Table 11 Visibility Improvement of NO_x Controls – Compared to 20% Best Days Natural Background Condition

Eagle Cap Wilderness, OR	Delta-deciview impacts greater than contribution threshold (Δdv>0.5)							
	2003		2004		2005		2003-2005	
	8th highest[(a)]	Total days[(b)]	8th highest[(a)]	Total days[(b)]	8th highest[(a)]	Total days[(b)]	22nd highest[(c)]	Total days[(d)]
Base Riley Boiler Scenario (wzl10471)	0.721	15	1.086	41	1.109	41	1.086	97
NOx Control Scenario 1 – LNB (wzl10496)	0.467	7	0.766	25	0.823	28	0.760	60

(a) The 8th highest delta-deciview impact for the calendar year.
(b) Total number of days in the 1-year period that exceeded 0.5 delta deciviews.
(c) The 22nd highest delta-deciview impact for the 3-year period.
(d) Total number of days in the 3-year period that exceeded 0.5 delta deciviews.

1.5.4 SO_2 BART Alternative

In addition to the control technologies reviewed, TASCO proposed a BART Alternative to provide greater reductions in visibility-impairing emissions and associated modeled visibility impacts than what would be expected with the use of Spray Dry FGD.

For the unique circumstances of this project, BART Alternative NO_x emission limits for the B&W Boilers and shutdown requirements for the pulp dryers were approved in lieu of the SO_2 emission control limits indicated by the BART analyses for SO_2 emissions. These combined measures were predicted to result in greater projected emission reductions and in greater visibility improvement.

As summarized in Table 12, the BART Alternative meets the "better-than-BART test" in accordance with 40 CFR 51.308(e)(3) and as provided in the BART Guidelines (Appendix Y to 40 CFR 51);

- Visibility does not decline in any Class I area, and
- There is an overall improvement in visibility, determined by comparing the average differences between BART and the alternative over all affected Class I areas.

Dispersion modeling was conducted to demonstrate that the BART Alternative will not result in a decline in visibility in any Class I area and will result in an overall improvement in visibility. Supporting information for this determination follows, and can be found in Appendix B.

Table 12 BART ALTERNATIVE GREATER REASONABLE PROGRESS DETERMINATION

Reasonable Progress Criteria	Benchmark	BART	BART Alternative	"Better-than-Baseline" Improvement	"Better-than-BART" Improvement
Visibility-Impairing Emissions (PM_{10} + NO_x + SO_2) – Rate in lb/hr					*Reductions in lb/hr*
BART Alternative Emission Units	1,929.2	1,277.6	1,276.6		+ 1.0 [(s)]
Class I Area Visibility – Number of Days Above 0.5 Δdv				*Number of Days Improved to Less Than 0.5 Δdv*	
Eagle Cap	195	149	126	+ 69 [(b)]	+ 41 [(c)]
Craters of the Moon	10	4	3	+ 7 [(b)]	
Hells Canyon	129	87	80	+ 49 [(b)]	
Jarbidge	8	5	5	+ 3 [(b)]	
Sawtooth	18	6	6	+ 12 [(b)]	
Selway-Bitterroot	15	3	4	+ 11 [(b)]	
Strawberry Mountain	80	62	51	+ 29 [(b)]	
Result				***No degradation in any Class I area*** [(c)]	***Overall improvement in visibility and Greater Reasonable Progress*** [(a,c)]

(a) BART Alternative results in greater emission reductions as described under 40 CFR 51.308(e)(3).
(b) For the BART Alternative, visibility does not decline in any Class I area, meeting the criteria in 40 CFR 51.308(e)(3)(i).
(c) For the BART Alternative, there is an overall improvement in visibility, determined by comparing the average differences between BART and the alternative over all affected Class I areas, meeting the criteria in 40 CFR 51.308(e)(3)(ii).

- **Error! Reference source not found.**

Evaluate emission reductions

TASCO has provided information relating to operational changes at the facility after the regional haze base years of 2000-2004. In 2006, TASCO installed a $20 million new pulp dryer system which better utilized current steam production and allowed three coal-fired pulp dryers to shut down. The pulp drying typically occurs during the fall and winter months when TASCO's emissions show the highest modeled impact on the 20% worst days. A summary of the emission reductions attributed to the shutdown of the pulp dryers is provided in Table 14. As part of the impact and visibility improvements TASCO requested that DEQ evaluate the visibility improvements resulting from the pulp dryer shutdowns and determine that the reductions from the new steam dryers could be used as part of an alternative to BART. Also as part of the BART Alternative, TASCO has proposed the installation and operation of low NOx burners on both of the **Error! Reference source not found.**. These steps have been proposed as the BART Alternative to the control of sulfur dioxide (SO_2) emissions.

Table 13 Error! Reference source not found. **Emission Reductions** [(a)]**Error! Reference source not found.**

Error! Reference source not found.

Table 14 Error! Reference source not found. **Emission Reductions***Error! Reference source not found.*

(a) **Error! Reference source not found.**

Error! Reference source not found. in Table 14 and Table 13, respectively. As provided in these tables, **Error! Reference source not found.**.

Determine visibility impacts (improvements)

Because each scenario can change the stack velocities and temperatures, DEQ utilized stack parameters and emission rate estimates provided by TASCO. As described above, for comparison each of the emission sources involved in the **Error! Reference source not found.** scenario were also included in the other scenarios evaluated.

Table 15 Visibility Improvement of Error! Reference source not found. **Scenario –Eagle Cap** [(a)]**Error! Reference source not found.Error! Reference source not found.Error! Reference source not found.**

Table 16 Error! Reference source not found. **Scenario Visibility ImprovementError! Reference source not found.Error! Reference source not found.Error! Reference source not found.**. DEQ is therefore approving the combination of the pulp dryer shutdowns and the installation and operation of low NO_x burners on the **Error! Reference source not found.** as an alternative to BART for the control of SO_2 emissions (i.e., as an alternative to the installation and operation of Spray Dry FGD).

1.6 Error! Reference source not found.

Error! Reference source not found. Error! Reference source not found.Error! Reference source not found.
Table 17 Visibility-Impairing Emissions by Fuel Type Error! Reference source not found.Table 18 Visibility Impacts by Fuel Type – Eagle Cap [(a)]Error! Reference source not found.Error! Reference source not found.Table 19 Visibility Impacts for Natural Gas [(a)]Error! Reference source not found.

Error! Reference source not found.Error! Reference source not found.

1.7 Conclusion

In conclusion, DEQ approves the **Error! Reference source not found.** control scenario – the combination of the existing baghouse and LNB on the Riley Boiler, LNB on both of the **Error! Reference source not found.**, and shutdown of the three coal-fired pulp dryers – as the "best" of BART technologies. **Error! Reference source not found.**, and the **Error! Reference source not found.**

BART and BART Alternative emission limits have been established in Permit Conditions 3.4 and 3.5 of Tier II Operating Permit No. **Error! Reference source not found.**. BART and BART Alternative operating, monitoring, compliance testing, recordkeeping, notification, and reporting requirements have been established in Permit Conditions 3.3, 3.6, 3.7, 3.8, 3.10, 3.11, 3.13, 3.14, 3.15, 3.16, and 4.1.

APPENDIX B – BART ALTERNATIVE VISIBILITY MODELING

APPENDIX C – INITIAL BART TIER II OPERATING PERMIT

APPENDIX D – BAGHOUSE O&M MANUAL