Table 1. Turbines: Natural Gas Fired: NOx BACT (Units TUR1 to TUR4)

	Control Technologies →→→			
	Selective Catalytic Reduction (SCR)[a]	**Low NOx Burners[b]**	**Good Combustion Practices (GCP)**	**Water/Steam Injection[c]**
Identified Air Pollution Control Technologies	**Applicant:** Nitrogen-based reagent (e.g., NH3, urea) is injected into exhaust stream downstream of combustion unit. The reagent reacts selectively with NOx to produce N2 and water in a reactor vessel containing a metallic or ceramic catalyst. Temps 480 - 800 °F (variations ± 200 °F); inlet NOx concentration as low as 20 ppm (efficiency improves with increased concentration up to 150 ppm). Unreacted reagent may form ammonium sulfates which may plug or corrode downstream equipment. Particulate-laden streams may blind the catalyst and may necessitate the application of a sootblower.	**Applicant:** NOx control from Low NOx burners is based on combustion modification techniques. Precise mixing of fuel and air is used to keep the flame temperature low and to dissipate heat quickly through the use of low excess air, off stoichiometric combustion and combustion gas recirculation. Low NOx burners reduce NOx by accomplishing the combustion process in stages. Staging partially delays the combustion process, resulting in a cooler flame which suppresses thermal NOx formation.	**Applicant:** NOx emissions are caused by oxidation of nitrogen gas in the combustion air during fuel combustion. This occurs due to high combustion temperatures and insufficiently mixed air and fuel in the cylinder where pockets of excess oxygen occur. These effects can be minimized through air-to-fuel ratio control, ignition timing reduction, and exhaust gas recirculation.	**Applicant:** Injected water or steam acts as a heat sink, lowering combustion zone peak temperatures, resulting in a decrease in thermal NOx. **ABQ:** With water injection, there is an additional benefit of absorbing latent heat of vaporization from the flame zone.
Feasibility Evaluations	**Applicant:** Included in RBLC for the control of NOx emissions from natural gas-fired turbines. Technically feasible.	**Applicant:** Included in RBLC for the control of NOx emissions from natural gas-fired turbines. Technically feasible.	**Applicant:** Included in RBLC for the control of NOx emissions from large natural gas-fired turbines.	**Applicant:** Included in RBLC for the control of NOx emissions from large natural gas-fired turbines.
Technically Feasible?	**Yes**	**Yes**	**Yes**	**Yes**
Other	AQB: The proposed BACT limit of 2 ppmv NOx @ 15% O_2 is a commonly selected limit in RBLC for large natural gas-fired turbines. In this case it is based on the manufacture specifications.	**ABQ:** Low NOx burners can be paired with SCR. There are examples in the RBLC of low NOx burners and SCR being used in tandem.	**Applicant:** Base case.	**AQB:** Applicant did not include a discussion of whether this control device is suitable for their specific turbine make/model.
Evaluate Energy, Environment, Indirect economic	**Applicant:** 70-90+% control efficiency	**Applicant:** 80% control efficiency	N/A, base case, is BACT	**AQB:** Water or steam injection may reduce NOx by 60% or higher. It results in an efficiency penalty of 2-3% but an increase in power output of 5-6%. CO and VOC emissions are increased by water injection.
Economic analysis	**AQB:** For a large gas turbine (defined as 75 MW), the cost per ton of pollutant removed is $3,000-6,000. The proposed turbines are 120 MW. This technology is considered to be significantly more costly than other control options such as Low NOx burners.	**AQB:** Considered to be one of the cheaper technologies that can achieve a high destruction efficiency.	N/A	**Applicant:** None provided.
BACT Selection	**Yes; BACT limit of 2 ppmv NOx @ 15%O_2**	**No**	**Yes**	**No**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Selective Catalytic Reduction (SCR))," EPA-452/F-03-032.
b. U.S. EPA, Office of Air Quality Planning Standards, "Technical Bulletin Nitrogen Oxides (NOx), Why and How They are Controlled," EPA 456/F-99-006R.
c. U.S. EPA, AP-42 Section 3.1 "Stationary Gas Turbines."
All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 2. Turbines: Natural Gas Fired: CO BACT (Units TUR1 to TUR4)

Table 2. Turbines: Natural Gas Fired: CO BACT (Units TUR1 to TUR4)

	Control Technologies →→→			
	Regenerative Thermal Oxidizer[a,b]	**Recuperative Thermal Oxidizer**[b,c]	**Catalytic Oxidation**[d]	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Oxidizes combustible materials by raising the temperature of the material above auto-ignition point in presence of O2 and maintaining the high temp for sufficient time to complete combustion[a]. At temps of 1,400 - 1,500 °F[b] ; inlet flow rate 5,000 - 500,000 scfm[b] ; inlet CO concentration as low as 100 ppmv or less[b]. Ceramic media store heat and additional fuel needed for waste gas stream.	**Applicant:** Oxidizes combustible materials by raising the temperature of the material above auto-ignition point in presence of O2 and maintaining the high temp for sufficient time to complete combustion.a At temps of 1,100 - 1,200 °F[c] ; inlet flow rate 500 - 50,000 scfm[c] ; inlet CO concentration as low as 100 ppmv or less[b]. **AQB:** The applicant made a citation mistake for CO at 100 ppmv. This is the cite for regenerative TO. The correct cite for recuperative CO is 1500-3000 ppmv[c].	**Applicant:** Similar to thermal incineration; waste stream is heated and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. At temps of 600 - 800 °F (not to exceed 1,250 °F). Inlet flow rate 700 - 50,000 scfm. Inlet CO concentration as low as 1 ppmv. Oxidation efficiency depends on exhaust flow, compostion, and residence time (at the active sites of the catalyst).	**Applicant:** Continued operation of the engine at the appropriate oxygen range and temperature to promote complete combustion and minimize CO formation. **AQB:** This approach implements the guidelines published by USEPA.
Feasibility Evaluations	**Applicant:** Not included in RBLC for the control of CO emissions from large natural gas-fired turbines.	**Applicant:** Not included in RBLC for the control of CO emissions from large natural gas-fired turbines.	**Applicant:** Included in RBLC for the control of CO emissions from large natural gas-fired turbines.	**Applicant:** Included in RBLC for the control of CO emissions from large natural gas-fired turbines.
Technically feasible?	**No**	**No**	**Yes**	**Yes**
Other	**Applicant:** Thermal oxidizers do not reduce emissions of CO from properly operated natural gas combustion units without the use of a catalyst. Not technically feasible.	**Applicant:** Thermal oxidizers do not reduce emissions of CO from properly operated natural gas combustion units without the use of a catalyst. Not technically feasible.	**Applicant:** Sulfur and other compounds may foul the catalyst, leading to decreased efficiency.	**Applicant:** Base case.
Evaluate Energy, Environment, Indirect economic	N/A, not technically feasible	N/A, not technically feasible	**Applicant:** Control efficiency of 70-90% (min. 2 ppmv).	**Applicant:** Proposed BACT limit of 2 ppmv CO @ 15% O_2. **AQB:** This limit is commonly used in RBLC for large natural gas-fired turbines. The limit is verified in the manufacture specifications.
Economic analysis	N/A, not technically feasible	N/A, not technically feasible	**AQB**: Cost effectiveness is $105 to $5,500 per metric ton ($100 to $5,000 per short ton), annualized cost per ton per year of pollutant controlled. If pollutant concentrations are less than 100 ppmv, the cost per ton removed may increase thousands of dollars.	N/A
BACT Selection	**No**	**No**	**Yes; BACT limit of 2 ppmv CO @ 15% O_2**	**Yes; BACT limit of 2 ppmv CO @ 15% O_2**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Thermal Incinerator)," EPA-452/F-03-022.
b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Regenerative Incinerator)," EPA-452/F-03-021.
c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Recuperative Incinerator)," EPA-452/F-03-020.
d. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Catalytic Incinerator)," EPA-452/F-03-018.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 3. Turbines: Natural Gas Fired: VOC BACT (Units TUR1 to TUR4)

Table 3. Turbines: Natural Gas Fired: VOC BACT (Units TUR1 to TUR4)

	Control Technologies →→→			
	Regenerative Thermal Oxidizer[a,b]	**Recuperative Thermal Oxidizer**[a,c]	**Catalytic Oxidation**[d]	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Oxidizes combustible materials by raising the temperature of the material above auto-ignition point in presence of O2 and maintaining the high temp for sufficient time to complete combustion[a]. At temps of 1,400 - 1,500 °F[b] ; inlet flow rate 5,000 - 500,000 scfm[b] ; inlet VOC concentration as low as 100 ppmv or less[b]. Ceramic media store heat to preheat inlet stream.	**Applicant:** Oxidizes combustible materials by raising the temperature of the material above auto-ignition point in presence of O2 and maintaining the high temp for sufficient time to complete combustion.a At temps of 1,100 - 1,200 °F[c] ; inlet flow rate 500 - 50,000 scfm[c] ; inlet VOC concentration as low as 100 ppmv or less[b]. **AQB:** The applicant made a citation mistake for VOC at 100 ppmv. This is the cite for regenerative TO. The correct cite for recuperative VOC is 1500-3000 ppmv[c].	**Applicant:** Similar to thermal incineration; waste stream is heated and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. At temps of 600 - 800 °F (not to exceed 1,250 °F). Inlet flow rate 700 - 50,000 scfm. Inlet VOC concentration as low as 1 ppmv. Oxidation efficiency depends on exhaust flow, compostion, and residence time (at the active sites of the catalyst).	**Applicant:** Operation of the units at the appropriate oxygen range and temperature to promote complete combustion and minimize VOC formation. **AQB:** Applicant incorrectly stated "CO formation," instead of "VOC formation" (typographical error, controls are similar for both pollutants).
Feasibility Evaluations	**Applicant:** Not included in RBLC for the control of VOC emissions from large natural gas-fired turbines. Not technically feasible.	**Applicant:** Not included in RBLC for the control of VOC emissions from large natural gas-fired turbines. Not technically feasible.	**Applicant:** Included in RBLC for the control of VOC emissions from large natural gas-fired tuebines. Technically feasible.	**Applicant:** Included in RBLC for the control of VOC emissions from natural gas-fired turbines (base case).
Technically feasible?	**No**	**No**	**Yes**	**Yes**
Other	**Applicant:** Oxidizers not recommended for controlling gases with sulfur containing compounds due to formation of highly corriosive acid gases[a]. Thermal oxidizers do not reduce emissions of VOC from properly operated natural gas combustion units without the use of a catalyst. Not technically feasible.	**Applicant:** Oxidizers not recommended for controlling gases with sulfur containing compounds due to formation of highly corriosive acid gases[a]. Thermal oxidizers do not reduce emissions of VOC from properly operated natural gas combustion units without the use of a catalyst. Not technically feasible.	**Applicant:** Sulfur and other compounds may foul the catalyst, leading to decreased efficiency.	**Applicant:** Base case.
Evaluate Energy, Environment, Indirect economic	**Applicant:** Additional fuel is required to reach the ignition temperature of the waste gas stream.	**Applicant:** Additional fuel is required to reach the ignition temperature of the waste gas stream.	**Applicant:** Control efficiency of 20-40%. **AQB:** Although VOC destruction of 95% or more can be achieved depending on temperature and catalyst bed volume[d], the manufacture specifications/test data provided demonstrate a 37% reduction in VOC emissions in this case.	**Applicant:** Proposed BACT limit of 4.6 ppmv VOC @ 15 O_2 based on manufacture specifications. **AQB:** Applicant incorrectly stated that this was the CO limit, when the manufacturer VOC limit was found and identified elsewhere in their application and analysis (Sections 6 and 7 of application). The manufacturer specification sheet/test data provided by the applicant shows 4.0 ppmv VOC @ 15% O2 (for molecular weight of formaldehyde and of methane).
Economic analysis	N/A; not technically feasible	N/A; not technically feasible	**AQB**: Cost effectiveness is $105 to $5,500 per metric ton ($100 to $5,000 per short ton), annualized cost per ton per year of pollutant controlled. If VOC concentrations are less than 100 ppmv, the cost per ton removed may increase thousands of dollars.[d]	N/A, is BACT
BACT Selection	**No**	**No**	**Yes, BACT limit of 4.0 ppmv VOC @ 15% O_2**	**Yes, BACT limit of 4.0 ppmv VOC @ 15% O_2**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Thermal Incinerator)," EPA-452/F-03-022.
b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Regenerative Incinerator)," EPA-452/F-03-021.
c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Recuperative Incinerator)," EPA-452/F-03-020.
d. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Catalytic Incinerator)," EPA-452/F-03-018.
All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 4. Turbines: Natural Gas Fired: PM-10/PM2.5 Filterable BACT (Units TUR1 to TUR4)

Table 4. Turbines: Natural Gas Fired: PM-10/PM2.5 Filterable BACT (Units TUR1 to TUR4)

	Control Technologies →→→	**Control Technologies →→→**			
	Baghouse / Fabric Filter[a]	**Electrostatic Precipitator (ESP)[b,c,d]**	**Cyclone[e]**	**Pipeline Quality Natural Gas[f]**	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Process exhaust gas passes through a tightly woven or felted fabric arranged in sheets, cartridges, or bags that collect PM via sieving and other mechanisms. The dust cake that accumulates on the filters increases collection efficiency. Various cleaning techniques include pulse-jet, reverse-air, and shaker technologies. Up to 500 °F (Typical); inlet flows 100 - 100,000 scfm (Standard), 100,000 - 1,000,000 scfm (Custom); inlet PM concentration 0.5 - 10 gr/dscf (Typical), 0.05 - 100 gr/dscf (Achievable)	**Applicant:** Electrodes stimulate the waste gas and induce an electrical charge in the entrained particles. The resulting electrical field forces charged particles to collector walls from which the material may be mechanically dislodged and collected in dry systems or washed with water deluge in wet systems. Up to 1,300 °F (dry), Lower than 170 - 190 °F (wet); inlet flow 1,000 - 100,000 scfm (Wire-Pipe), 100,000 - 1,000,000 scfm (Wire-Plate); inlet PM concentration 0.5 - 5 gr/dscf (Wire-Pipe), 1 - 50 gr/dscf (Wire-Plate)	**Applicant:** Centrifugal forces drive particles in the gas stream toward the cyclone walls as the waste gas flows through the conical unit. The captured particles are collected in a material hopper below the unit. Up to 1,000 °F; inlet flow 1.1 - 63,500 scfm (single) up to 106,000 scfm (in parallel); inlet PM concentration 0.44 - 7,000 gr/dscf	**Applicant:** Use of pipeline quality natural gas results in minimal emissions. **AQB:** Combusting only natural gas, which has an inherently low sulfur content, rather than higher sulfur content fuels alone or in combination with natural gas.	**Applicant:** Operate and maintain the equipment in accordance with good combustion practices.
Feasibility Evaluations	**Applicant:** Not included in RBLC for the control of PM emissions for large natural gas-fired turbines. Natural-gas fired turbines generate low PM emissions and have large exhaust flowrates, resulting in very low concentrations of PM. Add-on control devices would not provide any measurable emission reduction.	**Applicant:** Not included in RBLC for the control of PM emissions for large natural gas-fired turbines. Natural-gas fired turbines generate low PM emissions and have large exhaust flowrates, resulting in very low concentrations of PM. Add-on control devices would not provide any measurable emission reduction.	**Applicant:** Not included in RBLC for the control of PM emissions for large natural gas-fired turbines. Natural-gas fired turbines generate low PM emissions and have large exhaust flowrates, resulting in very low concentrations of PM. Add-on control devices would not provide any measurable emission reduction.	**Applicant:** Included in RBLC for the control of PM emissions from large natural gas-fired turbines.	**Applicant:** Included in RBLC for the control of PM emissions from large natural gas-fired turbines.
Technically feasible?	**No**	**No**	**No**	**Yes**	**Yes**
Other	**Applicant:** Fabric filters are susceptible to corrosion and blinding by moisture. Appropriate fabrics must be selected for specific process conditions.	**Applicant:** Dry ESP efficiency varies significantly with dust resistivity. Air leakage and acid condensation may cause corrosion. Not typically suitable for highly variable processes. Equipment footprint often substantial.	**Applicant:** Cyclones exhibit lower efficiencies when collecting smaller particles. High-efficiency units may require substantial pressure drop.	**Applicant:** Base case.	**Applicant:** Base case. **AQB:** This approach goes in tandem with pipeline quality natural gas. Bact limit of 0.00786 lb/MMBtu based on manufacutre specification sheet.
Evaluate Energy, Environment, Indirect economic	N/A, not technically feasible	N/A, not technically feasible	N/A, not technically feasible	N/A, is BACT	N/A, is BACT
Economic analysis	**Applicant:** None provided, since not technically feasible. **AQB:** EPA has performed cost analyses procedures.	N/A, not technically feasible	N/A, not technically feasible	N/A, is BACT	N/A, is BACT
BACT Selection	**No**	**No**	**No**	**Yes**	**Yes; BACT limit of 0.00786 lb/MMBtu**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Fabric Filter - Pulse-Jet Cleaned Type)," EPA-452/F-03-025.
b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Dry Electrostatic Precipitator (ESP) - Wire-Pipe Type)," EPA-452/F-03-027.
c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Dry Electrostatic Precipitator (ESP) - Wire-Plate Type)," EPA-452/F-03-028.
d. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Wet Electrostatic Precipitator(ESP) - Wire-Pipe Type)," EPA-452/F-03-029.
e. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Cyclone)," EPA-452/F-03-005.
f. Pipeline quality natural gas is defined as gas having sulfur content of 5 gr/100 scf or less.
All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 5. Turbines: Natural Gas Fired: PM-10/PM2.5 Condensable BACT (Units TUR1 to TUR4)

	Control Technologies →→→			
	Thermal Incineration	Catalytic Oxidation[d]	Pipeline Quality Natural Gas	Good Combustion Practices (GCP)
Identified Air Pollution Control Technologies	**Applicant:** Did not address condensable PM from the turbines. **AQB:** Oxidizes some particulate matter commonly composed as soot, which is formed as a result of incomplete combustion of hydrocarbons, by raising the temperature of the material above the auto-ignition point in the presence of O2 and maintaining the high temp for sufficient time to complete combustion[a]. Temp 1,100 - 1,200 °F[c] ; inlet flow 500 - 50,000 scfm[c] ; inlet PM concentration as low as 100 ppmv or less[b]	**Applicant:** Did not address condensable PM from the turbines. **AQB:** Similar to thermal incineration; waste stream is heated by a flame and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. Temp 600 - 800 °F (not to exceed 1,250 °F); inlet flow 700 - 50,000 scfm; inlet PM concentration as low as 1 ppmv. The emergency generators will see limited use and BACT will be GCP and pipeline quality natural gas.	**Applicant:** Did not address condensable PM from the turbines. **AQB:** Combusting pipeline quality natural gas, which has an inherently low sulfur content, rather than higher sulfur content fuels alone or in combination with natural gas.	**Applicant:** Did not address condensable PM from the turbines. **AQB:** Operate and maintain the equipment in accordance with good air pollution control practices and with good combustion practices.
Feasibility Evaluations	**AQB:** Not included in RBLC for the control of condensable PM emissions from large natural gas-fired turbines.	**AQB:** Not included in RBLC for the control of condensable PM emissions from large natural gas-fired turbines.	**AQB:** Included in RBLC for the control of PM emissions from large natural gas-fired turbiens.	**AQB:** Included in RBLC for the control of PM emissions from large natural gas-fired turbines.
Technically feasible?	**No**	**No**	**Yes**	**Yes**
Other	**AQB:** The majority of PM emissions from turbines are filterable, not condensible.	N/A	**AQB:** Base case.	**AQB:** Base case. This approach goes in tandem with pipeline quality natural gas.
Evaluate Energy, Environment, Indirect economic	**AQB:** Thermal incinerators used to control PM emissions have varying efficiencies, between 25-99%.[a] The cost of utilizing this control is not worth the reduction in PM emissions.	**AQB:** While catalytic oxidation is not considered feasible for control of PM, this control is being selected as BACT for CO and VOC emissions from the turbines.	N/A, is BACT	BACT for condensible PM will be GCP and pipeline quality natural gas, matching the BACT selection for filterable PM.
Economic analysis	N/A	N/A	N/A, is BACT	N/A, is BACT
BACT Selection	**No**	**No**	**Yes**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Thermal Incinerator)," EPA-452/F-03-022.
b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Regenerative Incinerator)," EPA-452/F-03-021.
c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Recuperative Incinerator)," EPA-452/F-03-020.
d. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Catalytic Incinerator)," EPA-452/F-03-018.
All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 6. Turbines: Natural Gas Fired: SO2 BACT (Units TUR1 to TUR4)

	Control Technologies →→→		
	Flue Gas Desulfurization[a]	**Electrostatic Precipitator (ESP)**[b,c,d]	**Pipeline Quality Natural Gas**[e]
Identified Air Pollution Control Technologies	**Applicant:** Acid gas is contacted with an alkaline reagent, which results in the formation of neutral salts. Wet systems employ reagents using packed or spray towers and generate wastewater streams, while dry systems inject slurry reagent into the exhaust stream to react, dry and be removed downstream by particulate control equipment. Temps 300 - 700 °F (wet), 300 - 1,830 °F (dry). Typical inlet concentration 2,000 ppmv. **AQB:** Note that applicant BACT analysis focused on acida gas or H2SO4, while AQB is evaluating SO2 as well.	**Applicant:** Electrodes stimulate the waste gas and induce an electrical charge in the entrained particles. The resulting electrical field forces charged particles to collector walls from which the material may be mechanically dislodged and collected in dry systems or washed with water deluge in wet systems. Up to 1,300 °F (dry), Lower than 170 - 190 °F (wet); inlet flow 1,000 - 100,000 scfm (Wire-Pipe), 100,000 - 1,000,000 scfm (Wire-Plate); inlet pollutant concentration 0.5 - 5 gr/dscf (Wire-Pipe), 1 - 50 gr/dscf (Wire-Plate) **AQB:** The citations the applicant lists do not mention the use of this method for SO_2/H_2SO_4.	**Applicant:** Combusting only natural gas, which has an inherently low sulfur content, rather than higher sulfur content fuels alone or in combination with natural gas.
Feasibility Evaluations	**Applicant:** Technology has not been applied to natural gas turbines due to very low H2SO4 emissions. Controls would not provide any measurable emission reduction. **AQB:** Not included in RBLC for the control of SO2 or H2SO4 for large natural gas-fired combined cycle turbines.	**Applicant:** Natural-gas fired turbines generate low H2SO4 emissions and have large exhaust flowrates, resulting in very low concentrations of H2SO4. Add-on control devices would not provide any measurable emission reduction. AQB: Not included in RBLC for the control of SO2 or H2SO4 for large natural gas-fired combined cycle turbines. Applicant's statements were made in reference only to H2SO4 but they apply also to SO2.	**Applicant:** Included in RBLC for the control of H2SO4 from large natural gas-fired turbines. **AQB:** Is also included in RBLC for control of SO2 for this equipment.
Technically feasible?	**No**	**No**	**Yes**
Other	**Applicant:** Chlorine emissions can result in salt deposition within the absorber and in downstream equipment. Wet systems may require flue gas re-heating downstream of the absorber to prevent corrosive condensation. Inlet streams for dry systems must be cooled as appropriate, and dry systems require use of particulate controls to collect the solid neutral salts.	**Applicant:** Dry ESP efficiency varies significantly with dust resistivity. Air leakage and acid condensation may cause corrosion. Not typically suitable for highly variable processes. Equipment footprint often substantial.	**Applicant:** Proposed BACT limit of 0.75 gr S/scf. **AQB: Applicant used 0.75 gr/100 scf in all calculations, so this will be implemented as BACT. Clarified the limit to state 0.75 grains total sulfur/100 scf.**
Evaluate Energy, Environment, Indirect economic	Disposal of waste products significantly increases cost and non-air environmental impact. Wet systems may result in a visible plume.	N/A, not technically feasible	N/A is BACT
Economic analysis	N/A not technically feasible	N/A, not technically feasible	N/A is BACT
BACT Selection	**No**	**No**	**Yes, BACT limit of 0.75 grains total sulfur/100 scf**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Flue Gas Desulfurization)," EPA-452/F-03-034.
b. U.S. EPA, Offi b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Dry Electrostatic Precipitator (ESP) - Wire-Pipe Type)," EPA-452/F-03-027.
c. U.S. EPA, Offi c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Dry Electrostatic Precipitator (ESP) - Wire-Plate Type)," EPA-452/F-03-028.
d. U.S. EPA, Offi d. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Wet Electrostatic Precipitator(ESP) - Wire-Pipe Type)," EPA-452/F-03-029.
e. Pipeline quality natural gas is defined as gas having sulfur content of 5 gr/100 scf or less.
All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 7. Turbines: Natural Gas Fired: GHG BACT (Units TUR1 to TUR4)

	Control Technologies →→→	
	Carbon Capture and Sequestration (CCS)	**Good Combustion Practices (GCP) using Pipeline Quality Natural Gas**
Identified Air Pollution Control Technologies	**Applicant:** CCS for the turbines would involve post-combustion capture of CO2 emissions, likely using low pressure scrubbing of CO2 from the exhaust stream with solvents (monoethanolamine (MEA) is the solvent most commonly used). One possibility would be to use the captured CO2 for enhanced oil recovery. **AQB:** See GHG BACT for Amine units for more detailed discussion from the applicant of other potential uses of captured CO2, including Class II AGI wells.	**Applicant:** Good combustion and operating practives are a potential control option by improving fuel efficiency. GCPs also include proper mainenance and tune-up of the units as recommended by the manufacturer. Fuels containing less carbon have lower potential CO2 and CH4 emissions. **AQB:** The applicant identified the use of pipeline natural gas fuel and implementation of good combustion practices as seperate air pollution control technologies. The AQB intends to combine these under good combustion practices per EPA guidance[m].
Feasibility Evaluations	**Applicant:** Not technically feasible. CO2 capture has been used on coal-fired power plants and other industrial applications with high concentrations of CO2 in the flue gas (12-15%), compared to the lower concentration of CO2 (3-4%) resulting from the natural gas combined cycle (NGCC) turbines. No post-combustion CO2 capture technologies have been demonstrated for full-scale NGCC plants.[a] CCS is still in the pilot stage and cannot be considered available for BACT review. In particular for the proposed gas plant, an integrated CCS application is technically infeasible due to the short and long-term uncertainty and risks surrounding the design, installation and operation of a CCS project; the dependence upon a third party commercial contract for CO2 disposition, i.e., enhanced oil recovery, for the life of the proposed plant; and the absence of regulatory infrastructure to oversee and regulate long-term CO2 storage.	**Applicant:** Natural gas has a relatively low carbon content compared to other possible fuels. Decreasing GHG emissions beyond the proposed design by switching fuels is not technically feasible as natural gas is already the fuel of choice. **AQB:** Both good combustion practices and the use of natural gas fuel are feasible.
Technically feasible?	**Potential possibility for consideration**	**Yes**
Other	**AQB:** Class II wells are designed to protect ground water resources. NMOCD regulations on Class II wells are thorough with the intent to geologically sequester CO2 (more discussion below). AQB certainly considers Class II wells an existing and readily accessible type of CCS that could be used for this facility. Research and advancement of geologic sequestration methods have been on-going for years, and moving towards practical implementation (Class VI). Tracer studies would be definitive for determining control efficiency (i.e., that gases do not get pulled out via another well operation), but these have been primarily implemented in research studies.[e] AGI examples for New Mexico are: Zia II, Linum Ranch, Monument, and Jal#3[d]. There is a body of knowledge that existing UIC programs are existing and available[b, c, d, f, g].	N/A
Evaluate Energy, Environment, Indirect economic	**AQB:** At present NM does not have primacy for permitting Class VI wells, meaning applicant would have to go through EPA, but EMNRD is exploring the possibilities. Class VI are designed for larger and purer CO2 streams[h] but this technology is expanding rapidly. Both Class VI and Class II wells are designed to protect ground water resources. NMOCD regulations on Class II wells are thorough with the intent to geologically sequester acid gases[b,c,d]. Knowledge of subsurface geologic features, the types of layers and potential existence of fractures is implemented in the determination of ground water protection, and 100% entrapment of acid gases is the intended goal.	**Applicant:** Proposes a BACT limit of 117 lb of CO2e/MMBtu. The proposed emission limit represents maximum emissions across all load conditions and ambient temperatures.
Economic analysis	**AQB:** Applicant did not provide any economic analyis for carbon capture as a control for turbines. The Carbon Capture Coalition (CCC) has worked towards implementing the 45Q federal tax credit, which can range from $35/MT for EOR to $50/MT for saline storage.[i,j,k] CCC and sponser Great Plains Institute (GPI) have also evaluated that existing NM gas plants Zia II, Linam Ranch, and Jal#3 could all qualify for the 45Q tax credit and each of these facilities emits just a fraction (6-12%) of what Husky will potentially emit. Economic perspectives (RCCDI): 3 gas-fired turbines could feed 2 million MT/yr of CO2 capture, and carbon capture from natural gas processing can be as low as $15-29/MT.[l] Hence, the $18.18/ton CO2e based on 29-mile pipeline appears feasible under 45Q. This method of GHG control has reasonable feasibility potential for the Husky Gas Plant facility.	N/A is BACT
BACT Selection	**Potential Consideration - See amine unit discussion**	**Yes, BACT limit of 117 lb CO_2e/MMBtu**

a. NETL CCS Database available at: https://www.netl.doe.gov/coal/carbon-storage/worldwide-ccs-database

b. Class II Well Facts: New Mexico's Underground Injection Control (UIC) Program, NMEMNRD, Oil Conservation Division (OCD).

c. "A Blueprint for the Regulation of Geologic Sequestration of Carbon Dioxide in New Mexico," NMEMNRD, Pursuant to Executive Order 2006-69. Fesmire, Rankin, Brooks, and Jones. Dec. 1, 2007

d. Chapter 1: Acid Gas Injection in the Permian and San Juan Basins: Recent Case Studies from New Mexico. Lescinsky, A. Gutierrez, Hunter, J. Gutierrez, and Bentley (of Geolux, Inc, and Carbon Free Corp), 2nd International Acid Gas Injection Symposium, Calgary, Sept. 27-30, 2010. 29 pgs.

e. Intergovernmental Panel on Climate Change (IPCC), 2005. Carbon Dioxide Capture and Storage. Cambridge University Press.

f. The North American Carbon Storage Atlas (NACSA) 2012. www.nacsap.org

g. Title 19, Chapter 5, Part 26, Oil and Gas Injection (19.15.26 NMAC).

h. Federal Requirements Under the Underground (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells; Final Rule. 40 CFR Parts 124, 144, 145, et al. FR Vol 75, No. 237, pgs 77230-77303, Dec. 10, 2010.

i. Carbon Capture Coalition: https://carboncapturecoalition.org/wp-content/uploads/2019/06/BluePrint-Compressed-Updated.pdf

j. Better Energy: https://www.betterenergy.org/wp-content/uploads/2019/06/45Q_Primer_May_2019.pdf

k. IRS 45Q procedure document: Part III, Administrative, Procedural, and Miscellaneous, 26 CFR 601.105, Rev. Proc. 2020-12.

l. Regional Carbon Capture Deployment Initiative (RCCDI): Western Regional Meeting, Denver, CO, Nov 12-13, 2019.

m. USEPA Guidance Document on Good Combustion Practices.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 8. Emergency Generators (RICE): Natural Gas Fired: NOx BACT (Units GEN1 to GEN8)

	Control Technologies →→→			
	Selective Catalytic Reduction (SCR)[a]	**Non-Selective Catalytic Reduction (NSCR)**	**Clean Burn Technology**	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Nitrogen-based reagent (e.g., NH3, urea) is injected into exhaust stream downstream of combustion unit. The reagent reacts selectively with NOx to produce N2 and water in a reactor vessel containing a metallic or ceramic catalyst. Temps 480 - 800 °F (variations ± 200 °F); inlet NOx concentration as low as 20 ppm (efficiency improves with increased concentration up to 150 ppm). Unreacted reagent may form ammonium sulfates which may plug or corrode downstream equipment. Particulate-laden streams may blind the catalyst and may necessitate the application of a sootblower.	**Applicant:** This technique uses residual hydrocarbons and CO in rich-burn engine exhaust as a reducing agent for NOx. In an NSCR, hydrocarbons and CO are oxidized by O2 and NOx. The excess hydrocarbons, CO, and NOx pass over a catalyst (usually a noble metal such as platinum, rhodium, or palladium) that oxidizes the excess hydrocarbons and CO to H2O and CO2, while reducing NOx to N2[b].	**Applicant:** Natural gas fueled engines that operate with a fuel-lean air/fuel ratio are capable of low NOx emissions. **AQB:** "Clean burn" technology means low NOx, "lean burn" as in NSPS Subpart JJJJ. The fuel/air ratio is kept well below ideal stoichiometric level to limit NOx.	**Applicant:** NOx emissions are caused by oxidation of N2 in the combustion air during fuel combustion. This occurs due to high combustion temperatures and insufficiently mixed air and fuel in the cylinder where pockets of excess oxygen occur. These effects can be minimized through air-to-fuel ratio control, ignition timing reduction, and fuel quality analysis and fuel handling. **AQB:** This approach implements the guidelines published by USEPA.
Feasibility Evaluations	**Applicant:** Not included in RBLC for the control of NOx emissions from large natural gas-fired lean-burn stationary internal combustion engines. Technically infeasible for engines operating at variable loads.	**Applicant:** Not included in RBLC for the control of NOx emissions from large natural gas-fired lean-burn stationary internal combustion engines. NSCR is limited to engines with normal exhaust oxygen levels of 4% or less including 4SRB naturally aspirated and 4SRB turbo-charged. Lean-burn engine cannot be retroffited with NSCR due to reduced exhaust temperatures. Technically infeasible.	**Applicant:** Included in RBLC for the control of NOx emissions from large stationary combustion emergency engines. The application provided a figure of 1.0 g/hp-hr for NOx for the eight Caterpillar 3448 hp engines (GEN1 to GEN8).	**Applicant:** Included in RBLC for the control of NOx emissions from large stationary combustion emergency engines.
Technically Feasible?	**No**	**No**	**Yes**	**Yes**
Evaluate Energy, Environment, Indirect economic	N/A, not technically feasible	N/A, not technically feasible	**AQB:** Consideration: These 8 generator engines are emergency engines and will only run as needed during loss of commercial power. Cold starts and short run times are expected, which may result in less NOx per hp-hr compared to fully warmed-up continuously running engine. For Zia II Gas Plant, 0.5 g/hp-hr was implemented. AQB notes that TCEQ implements 0.5 g/hr-hr without identifying any exceptions for emergency engines.[c]	N/A is BACT
Economic analysis	N/A, not technically feasible	N/A not technically feasible	N/A is BACT	N/A is BACT
BACT Selection	N/A, not technically feasible	N/A, not technically feasible	**Yes.** BACT Floor: NSPS JJJJ provides a NOx limit of 2.0 g/hp-hr (160 ppmvd) per Table 1 for emergency engines. **BACT Limit of 0.5 g/hp-hr**[c] for all engines, Caterpillar, 3448 hp, **Units GEN1 to GEN8**. Also for all engines: at 15% O2 utilizing lean burn technology and good combustion practices.	**AQB: Yes.** This approach goes in tandem with clean burn technology.

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Selective Catalytic Reduction (SCR))," EPA-452/F-03-032.

b. U.S. EPA, AP-42, Section 3.2 "Natural Gas-Fired Reciprocating Engines"

c. Texas Commission on Environmental Quality (TCEQ) Combustion Sources: Current best available control technology (BACT) guidelines, 2019. http://www.tceq.texas.gov/permitting/air/nav/air_bact_combustsources.html

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 9. Emergency Generators (RICE): Natural Gas Fired: CO BACT (Units GEN1 to GEN8)

Table 9. Emergency Generators (RICE): Natural Gas Fired: CO BACT (Units GEN1 to GEN8)

	Control Technologies →→→			
	Regenerative Thermal Oxidizer	**Recuperative Thermal Oxidizer**	**Catalytic Oxidation[d]**	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Oxidizes combustible materials by raising the temperature of the material above auto-ignition point in presence of O2 and maintaining the high temp for sufficient time to complete combustion[a]. At temps of 1,400 - 1,500 °F[b] ; inlet flow rate 5,000 - 500,000 scfm[b] ; inlet CO concentration as low as 100 ppmv or less[b]. Ceramic media store heat and additional fuel needed for waste gas stream.	**Applicant:** Oxidizes combustible materials by raising the temperature of the material above auto-ignition point in presence of O2 and maintaining the high temp for sufficient time to complete combustion[a]. At temps of 1,100 - 1,200 °F[c] ; inlet flow rate 500 - 50,000 scfm[c] ; inlet CO concentration as low as 100 ppmv or less[b]. Additional fuel required. **AQB:** The citation for CO at 100 ppmv is for regenerative TO. The correct cite for recuperative CO is 1500-3000 ppmv[c].	**Applicant:** Similar to thermal incineration; waste stream is heated and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. At temps of 600 - 800 °F (not to exceed 1,250 °F). Inlet flow rate 700 - 50,000 scfm. Inlet CO concentration as low as 1 ppmv. Oxidation efficiency depends on exhaust flow, compostion, and residence time (at the active sites of the catalyst).	**Applicant:** Continued operation of the engine at the appropriate oxygen range and temperature to promote complete combustion and minimize CO formation. **AQB:** This approach implements the guidelines published by USEPA.
Feasibility Evaluations	**Applicant:** Not included in RBLC for the control of CO emissions from large natural gas-fired lean-burn stationary internal combustion engines (including emergency).	**Applicant:** Not included in RBLC for the control of CO emissions from large natural gas-fired lean-burn stationary internal combustion engines (including emergency).	**Applicant:** Included in RBLC for the control of CO emissions from large natural gas-fired lean-burn stationary internal combustion engines (including emergency).	**Applicant:** Included in RBLC for the control of CO emissions from internal combustion engines. Proposed CO limit of 1.5 g/hr-hr.
Technically feasible?	**No**	**No**	**Yes**	**Yes**
Other	**Applicant:** Thermal oxidizers do not reduce emissions of CO from properly operated natural gas combustion units without the use of a catalyst. Not technically feasible	**Applicant:** Thermal oxidizers do not reduce emissions of CO from properly operated natural gas combustion units without the use of a catalyst. Not technically feasible	**Applicant:** Engines already meet NSPS JJJJ limits based on manufacturer specifications. The limited hours of operation, use of catalyst does not provide enough reduction (efficiency: 70-90%). Proposed CO limit of 1.5 g/hr-hr.	**AQB:** BACT Floor: NSPS JJJJ provides a CO limit of 4 g/hp-hr (540 ppmvd) for emergency engines when burning natural gas (Table 1). TCEQ has BACT limits of 3.0 g/hp-hr through good combustion practices.[e]
Evaluate Energy, Environment, Indirect economic	N/A, not technically feasible	N/A, not technically feasible	**AQB:** Technically feasible, CO emissions per unit of time will tend to be higher for emergency engines due to cold start and shorter run times.	**AQB:** **<u>BACT limit will be 1.5 g/hr-hr through good combustion practices</u>.**
Economic analysis	N/A, not technically feasible	N/A, not technically feasible	**AQB**: Permittee will meet limits much lower (≥ 50% lower) than NSPS JJJJ and TCEQ.	N/A, is BACT
BACT Selection	**No**	**No**	**No**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Thermal Incinerator)," EPA-452/F-03-022.
b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Regenerative Incinerator)," EPA-452/F-03-021.
c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Recuperative Incinerator)," EPA-452/F-03-020.
d. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Catalytic Incinerator)," EPA-452/F-03-018.
e. Texas Commission on Environmental Quality (TCEQ) Combustion Sources: Current best available control technology (BACT) guidelines, 2019. http://www.tceq.texas.gov/permitting/air/nav/air_bact_combustsources.html
All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 10. Emergency Generators (RICE): Natural Gas Fired: VOC BACT (Units GEN1 to GEN8)

	Control Technologies →→→			
	Regenerative Thermal Oxidizer	**Recuperative Thermal Oxidizer**	**Catalytic Oxidation**[d]	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Oxidizes combustible materials by raising the temperature of the material above auto-ignition point in presence of O2 and maintaining the high temp for sufficient time to complete combustion[a]. At temps of 1,400 - 1,500 °F[b] ; inlet flow rate 5,000 - 500,000 scfm[b] ; inlet VOC concentration as low as 100 ppmv or less[b]. Ceramic media store heat and additional fuel needed for waste gas stream.	**Applicant:** Oxidizes combustible materials by raising the temperature of the material above auto-ignition point in presence of O2 and maintaining the high temp for sufficient time to complete combustion.a At temps of 1,100 - 1,200 °F[c] ; inlet flow rate 500 - 50,000 scfm[c] ; inlet VOC concentration as low as 100 ppmv or less[b]. **AQB:** The applicant made a citation mistake for VOC at 100 ppmv. This is the cite for regenerative TO. The correct cite for recuperative VOC is 1500-3000 ppmv[c].	**Applicant:** Similar to thermal incineration; waste stream is heated and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. At temps of 600 - 800 °F (not to exceed 1,250 °F). Inlet flow rate 700 - 50,000 scfm. Inlet VOC concentration as low as 1 ppmv. Oxidation efficiency depends on exhaust flow, compostion, and residence time (at the active sites of the catalyst).	**Applicant:** Continued operation of the engine at the appropriate oxygen range and temperature to promote complete combustion and minimize VOC formation. **AQB:** This approach implements the guidelines published by USEPA.
Feasibility Evaluations	**Applicant:** Not included in RBLC for the control of VOC emissions from large natural gas-fired lean-burn stationary internal combustion engines (including emergency).	**Applicant:** Not included in RBLC for the control of VOC emissions from large natural gas-fired lean-burn stationary internal combustion engines (including emergency).	**Applicant:** Included in RBLC for the control of VOC emissions from large natural gas-fired lean-burn stationary internal combustion engines (including emergency).	**Applicant:** Included in RBLC for the control of VOC emissions from natural gas-fired stationary internal combustion engines. Proposed VOC limit of 0.21 g/hr-hr.
Technically feasible?	**No**	**No**	**Yes**	**Yes**
Other	**Applicant:** Thermal oxidizers do not reduce emissions of VOC from properly operated natural gas combustion units without the use of a catalyst. Not technically feasible	**Applicant:** Thermal oxidizers do not reduce emissions of VOC from properly operated natural gas combustion units without the use of a catalyst. Not technically feasible	**Applicant:** Engines already meet NSPS JJJJ limits based on manufacturer specifications. The limited hours of operation, use of catalyst does not provide enough reduction (efficiency: 20-40%). Proposed VOC limit of 0.21 g/hr-hr.	**AQB:** BACT Floor: NSPS JJJJ provides a VOC limit of 1.0 g/hp-hr (86 ppmvd) for emergency engines when burning natural gas (Table 1). TCEQ has BACT limits of 1.0 g/hp-hr through good combustion practices.[e]
Evaluate Energy, Environment, Indirect economic	**Applicant:** Additional fuel is required to reach the ignition temperature of the waste gas stream. **AQB:** These are emergency generators with limited use. VOC emissions from each of GEN1 to GEN8 will be < 1 tpy (0.24 tpy).	**Applicant:** Additional fuel is required to reach the ignition temperature of the waste gas stream. **AQB:** These are emergency generators with limited use. VOC emissions from each of GEN1 to GEN8 will be < 1 tpy (0.24 tpy).	**AQB:** Technically feasible, VOC emissions per unit of time will tend to be higher for emergency engines due to cold start and shorter run times.	**AQB:** **BACT limit will be 0.21 g/hr-hr through good combustion practices.**
Economic analysis	Not practical for the low emission figures.	Not practical for the low emission figures.	**AQB:** Permittee will meet limits much lower (≥ 50% lower) than NSPS JJJJ and TCEQ.	N/A, is BACT
BACT Selection	**No**	**No**	**No**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Thermal Incinerator)," EPA-452/F-03-022.

b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Regenerative Incinerator)," EPA-452/F-03-021.

c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Recuperative Incinerator)," EPA-452/F-03-020.

d. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Catalytic Incinerator)," EPA-452/F-03-018.

e. Texas Commission on Environmental Quality (TCEQ) Combustion Sources: Current best available control technology (BACT) guidelines, 2019. http://www.tceq.texas.gov/permitting/air/nav/air_bact_combustsources.html

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 11. Emergency Generators (RICE): Natural Gas Fired: PM-10/PM2.5 Filterable BACT (Units GEN1 to GEN8)

	Control Technologies →→→				
	Baghouse / Fabric Filter[a]	**Electrostatic Precipitator (ESP)[b,c,d]**	**Cyclone[e]**	**Pipeline Quality Natural Gas[f]**	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Process exhaust gas passes through a tightly woven or felted fabric arranged in sheets, cartridges, or bags that collect PM via sieving and other mechanisms. The dust cake that accumulates on the filters increases collection efficiency. Various cleaning techniques include pulse-jet, reverse-air, and shaker technologies. Up to 500 °F (Typical); inlet flows 100 - 100,000 scfm (Standard), 100,000 - 1,000,000 scfm (Custom); inlet PM concentration 0.5 - 10 gr/dscf (Typical), 0.05 - 100 gr/dscf (Achievable)	**Applicant:** Electrodes stimulate the waste gas and induce an electrical charge in the entrained particles. The resulting electrical field forces charged particles to collector walls from which the material may be mechanically dislodged and collected in dry systems or washed with water deluge in wet systems. Up to 1,300 °F (dry), Lower than 170 - 190 °F (wet); inlet flow 1,000 - 100,000 scfm (Wire-Pipe), 100,000 - 1,000,000 scfm (Wire-Plate); inlet PM concentration 0.5 - 5 gr/dscf (Wire-Pipe), 1 - 50 gr/dscf (Wire-Plate)	**Applicant:** Centrifugal forces drive particles in the gas stream toward the cyclone walls as the waste gas flows through the conical unit. The captured particles are collected in a material hopper below the unit. Up to 1,000 °F; inlet flow 1.1 - 63,500 scfm (single) up to 106,000 scfm (in parallel); inlet PM concentration 0.44 - 7,000 gr/dscf	**Applicant:** Combusting only natural gas, which has an inherently low sulfur content, rather than higher sulfur content fuels alone or in combination with natural gas.	**Applicant:** Operate and maintain the equipment in accordance with good air pollution control practices and with good combustion practices.
Feasibility Evaluations	**Applicant:** Not included in RBLC for the control of PM emissions for natural gas-fired stationary internal combustion engines. Natural-gas fired internal combustion engines generate low PM emissions and have large exhaust flowrates, resulting in very low concentrations of PM. Add-on control devices would not provide any measurable emission reduction.	**Applicant:** Not included in RBLC for the control of PM emissions for natural gas-fired stationary internal combustion engines. Natural-gas fired internal combustion engines generate low PM emissions and have large exhaust flowrates, resulting in very low concentrations of PM. Add-on control devices would not provide any measurable emission reduction.	**Applicant:** Not included in RBLC for the control of PM emissions for natural gas-fired stationary internal combustion engines. Natural-gas fired internal combustion engines generate low PM emissions and have large exhaust flowrates, resulting in very low concentrations of PM. Add-on control devices would not provide any measurable emission reduction.	**Applicant:** Included in RBLC for the control of PM emissions from large natural gas-fired lean-burn stationary internal combustion engines.	**Applicant:** Included in RBLC for the control of PM emissions from large natural gas-fired lean-burn stationary internal combustion engines.
Technically feasible?	**No**	**No**	**No**	**Yes**	**Yes**
Other	**Appicant:** Fabric filters are susceptible to corrosion and blinding by moisture. Appropriate fabrics must be selected for specific process conditions.	**Applicant:** Dry ESP efficiency varies significantly with dust resistivity. Air leakage and acid condensation may cause corrosion. Equipment footprint often substantial.	**Applicant:** Cyclones exhibit lower efficiencies when collecting smaller particles. High-efficiency units may require substantial pressure drop.	PM10/PM2.5 **BACT Limit is 7.71E-05 lb/MMBtu** by implementing good combustion practices and use of pipeline quality natural gas. Limit will apply to all **Units GEN1 to GEN8**. Pipeline quality natural gas is **5 gr total sulfur/100 scf** .	**AQB:** This approach goes in tandem with pipeline quality natural gas.
Evaluate Energy, Environment, Indirect economic	Applicant:	N/A, not technically feasible	N/A, not technically feasible	N/A, is BACT	N/A, is BACT
Economic analysis	**Applicant:** None provided. **AQB:** EPA has performed cost analyses procedures[a].	N/A, not technically feasible	N/A, not technically feasible	N/A, is BACT	N/A, is BACT
BACT Selection	**No**	**No**	**No**	**Yes**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Fabric Filter - Pulse-Jet Cleaned Type)," EPA-452/F-03-025.
b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Dry Electrostatic Precipitator (ESP) - Wire-Pipe Type)," EPA-452/F-03-027.
c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Dry Electrostatic Precipitator (ESP) - Wire-Plate Type)," EPA-452/F-03-028.
d. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Wet Electrostatic Precipitator(ESP) - Wire-Pipe Type)," EPA-452/F-03-029.
e. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Cyclone)," EPA-452/F-03-005.
f. Pipeline quality natural gas is defined as gas having sulfur content of 5 gr/100 scf or less.
All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 12. Emergency Generators (RICE): Natural Gas Fired: PM-10/PM2.5 Condensable BACT (Units GEN1 to GEN8)

	Control Technologies →→→			
	Thermal Incineration	**Catalytic Oxidation**[d]	**Pipeline Quality Natural Gas**	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Did not address condensable PM from the emergency generators. **AQB:** Oxidizes some particulate matter commonly composed as soot, which is formed as a result of incomplete combustion of hydrocarbons, by raising the temperature of the material above the auto-ignition point in the presence of O2 and maintaining the high temp for sufficient time to complete combustion[a]. Temp 1,100 - 1,200 °F[c] ; inlet flow 500 - 50,000 scfm[c] ; inlet PM concentration as low as 100 ppmv or less[b]	**Applicant:** Did not address condensable PM from the emergency generators. **AQB:** Similar to thermal incineration; waste stream is heated by a flame and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. Temp 600 - 800 °F (not to exceed 1,250 °F); inlet flow 700 - 50,000 scfm; inlet PM concentration as low as 1 ppmv. The emergency generators will see limited use and BACT will be GCP and pipeline quality natural gas.	**Applicant:** Did not address condensable PM from the emergency generators. **AQB:** Combusting pipeline quality natural gas, which has an inherently low sulfur content.	**Applicant:** Did not address condensable PM from the emergency generators. **AQB:** Operate and maintain the equipment in accordance with good air pollution control practices and with good combustion practices.
Feasibility Evaluations	**AQB:** Not included in RBLC for the control of condensable PM emissions from large natural gas-fired lean-burn stationary internal combustion engines.	**AQB:** Not included in RBLC for the control of condensable PM emissions from large natural gas-fired lean-burn stationary internal combustion engines.	**AQB:** Included in RBLC for the control of PM emissions from large natural gas-fired lean-burn stationary internal combustion engines.	**AQB:** Included in RBLC for the control of PM emissions from large natural gas-fired lean-burn stationary internal combustion engines.
Technically feasible?	**No**	**No**	**Yes**	**Yes**
Other	N/A	N/A	N/A	**AQB:** This approach goes in tandem with pipeline quality natural gas.
Evaluate Energy, Environment, Indirect economic	**AQB:** Emergency generators will see limited use and allowable emissions will be 0.21 pph and 0.01 tpy and BACT will be GCP and pipeline quality natural gas.	**AQB:** Emergency generators will see limited use and allowable emissions will be 0.21 pph and 0.01 tpy and BACT will be GCP and pipeline quality natural gas.	N/A, is BACT	N/A, is BACT
Economic analysis	N/A	N/A	N/A, is BACT	N/A, is BACT
BACT Selection	**No**	**No**	**Yes**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Thermal Incinerator)," EPA-452/F-03-022.
b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Regenerative Incinerator)," EPA-452/F-03-021.
c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Recuperative Incinerator)," EPA-452/F-03-020.
d. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Catalytic Incinerator)," EPA-452/F-03-018.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 13. Emergency Generators (RICE): Natural Gas Fired: SO2 BACT (Units GEN1 to GEN8)

Table 13. Emergency Generators (RICE): Natural Gas Fired: SO2 BACT (Units GEN1 to GEN8)

	Control Technologies →→→	
	Flue Gas Desulfurization[a]	**Pipeline Quality Natural Gas**[b]
Identified Air Pollution Control Technologies	**Applicant:** Did not address SO2 from the emergency generators. **AQB:** Absorption of SO2 is accomplished by the contact between the exhaust and an alkaline reagent, which results in the formation of neutral salts. Wet systems employ reagents using packed or spray towers and generate wastewater streams, while dry systems inject slurry reagent into the exhaust stream to react, dry and be removed downstream by particulate control equipment. Temps 300 - 700 °F (wet), 300 - 1,830 °F (dry). Typical inlet SO2 concentration 2,000 ppmv.	**Applicant:** Did not address SO2 from the emergency generators. **AQB:** Combusting pipeline quality natural gas, which has an inherently low sulfur content. The emergeny engines will see limited use and have low SO2 emissions (0.05 pph and 0.0026 tpy). Pipeline quality natural gas is often defined at the level of 5 gr/100 scf.
Feasibility Evaluations	**AQB:** Wet systems may require flue gas re-heating downstream of the absorber to prevent corrosive condensation. Inlet streams for dry systems must be cooled as appropriate, and dry systems require use of particulate controls to collect the solid neutral salts. Not included in RBLC for the control of SO2 emissions for natural gas-fired stationary internal combustion engines.	**AQB:** Included in RBLC for the control of SO2 from natural gas-fired stationary internal combustion engines.
Technically feasible?	**No**	**Yes**
Other	N/A	SO2 BACT Floor Limit would be typical figure of 5 gr total sulfur/100 scf in the fuel inlet by utilizing pipeline quality natural gas.
Evaluate Energy, Environment, Indirect economic	**AQB:** SO2 emissions from the emergency generators have been calculated to be 0.05 pph and 0.0026 tpy, hence allowable annual limits will be set at 0.0 tpy. This control method is not practical based on the very low emissions.	**AQB: Applicant used 0.75 gr total S/100 scf in emissions calculations, hence this will be implemented figure as BACT**
Economic analysis	N/A not technically feasible	N/A is BACT
BACT Selection	**No**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Flue Gas Desulfurization)," EPA-452/F-03-034.

b. Pipeline quality natural gas is defined as gas having sulfur content of 5 gr/100 scf or less.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 14. Emergency Generators (RICE): Natural Gas Fired: GHG BACT (Units GEN1 to GEN8)

Table 14. Emergency Generators (RICE): Natural Gas Fired: GHG BACT (Units GEN1 to GEN8)

	Control Technologies →→→	
	Carbon Capture and Sequestration (CCS)	**Good Combustion Practices (GCP) using Pipeline Quality Natural Gas**
Identified Air Pollution Control Technologies	**Applicant:** Provided a CCS assessment for the turbines and amine units for this this facility (the biggest GHG emitters). **AQB:** CCS may be described variously, through several steps, but first involves the capture of CO2 from the engine exhaust stream, transport (short or long distance through pipeline), then sequestration or storage in some location or form where it is prevented from entering the atmosphere. Sequestration could take various forms such as use of CO2 in other chemical processes or geologic storage where the CO2 is pumped into a subsurface geological formation (e.g., saline formations) for permanent storage.[a, b, c, d]	**Applicant:** Operating practices to maintain combustion efficiency of the engines, proper maintenance and tune-up of engines per manufacturer's specifications. **AQB:** The applicant identified natural gas fuel selection. The AQB intends to combine all of the following under good combustion practices per EPA guidance[e] : pipeline quality natural gas, air/fuel ratio, and efficient engine design (lean burn).
Feasibility Evaluations	N/A	**Applicant:** Feasible.
Technically feasible?	**No**	**Yes**
Other	N/A	N/A
Evaluate Energy, Environment, Indirect economic	**AQB:** These are emergency generators to be used during the loss of commercial power and will experience limited use. At this time CCS would not be practical for limited use equipment. CCS technology is better used on higher volume, higher concentration CO2 streams, and that are running continuously.	**Applicant:** Has proposed a BACT limit of 117 lb/MMBtu of CO2 for the emergency engines. The limit will be achieved through the selection of fuel-efficient engines, use of natural gas fuel, and implementation of good combustion practices. **AQB:** These are emergency engines with limited use and **GCP is BACT and the limit will be 117 lb CO2e/MMBtu** of fuel (**equivelant to 379 g CO2/hp-hr**).
Economic analysis	N/A	N/A is BACT
BACT Selection	**No**	**Yes**

a. USEPA website: https://archive.epa.gov/epa/climatechange/carbon-dioxide-capture-and-sequestration-overview.html#sources

b. The North American Carbon Storage Atlas (NACSA) 2012. www.nacsap.org

c. USEPA Federal Requirements under the Underground Injection Control (UIC) Program for Carbon Storage (CO2) Geologic Sequestration Wells, Final Rule (40 CFR Parts 124, 144, 145, et al). Federal Register Vol. 75, No. 237, pgs. 77230-77303, Dec. 10, 2010.

d. Intergovernmental Panel on Climate Change (IPCC), 2005. Carbon Dioxide Capture and Storage. Cambridge University Press.

e. USEPA Guidance Document on Good Combustion Practices.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 15. Heaters: Natural Gas Fired: NOx BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

Table 15. Heaters: Natural Gas Fired: NOx BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

	Control Technologies →→→				
	Selective Catalytic Reduction (SCR)[a]	**Selective Non-Catalytic Reduction (SNCR)[b]**	**Ultra Low NOx Burners[c]**	**Low NOx Burners[d]**	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Nitrogen-based reagent (e.g., NH_3, urea) is injected into exhaust stream downstream of combustion unit. The reagent reacts selectively with NOx to produce N_2 and water in a reactor vessel containing a metallic or ceramic catalyst. Temps 480 - 800 °F (variations ± 200 °F); inlet NOx concentration as low as 20 ppm (efficiency improves with increased concentration up to 150 ppm). Unreacted reagent may form ammonium sulfates which may plug or corrode downstream equipment. Particulate-laden streams may blind the catalyst and may necessitate the application of a sootblower.	**Applicant:** Nitrogen-based reagent (e.g., NH_3, urea) is injected into exhaust stream downstream of combustion unit. The reagent reacts with NOx to produce N_2 and water. However, unlike SCR, this reaction is non-catalyzed as the NOx reduction reaction is favored for a specific temperature range in the presence of O_2. Temps 1600 - 2400 °F; inlet NOx concentration above 200 ppm.	**AQB:** The applicant did not evaluate this option. AQB is retaining it as a consideration because it has been evaluated previously for BACT (Zia II Gas Plant in 2013-2014). Burners are designed to recirculate flue gas from the flame back into the combustion zone which reduces the average oxygen content within the flame without reducing the flame temperature below the optimum combustion zone. According to the EPA document cited[c] , ultra low also means burners using staging techniques similar to staged-fuel low-NOx.	**Applicant:** NOx control from these burners is based on combustion modification techniques. Precise mixing of fuel and air is used to keep the flame temperature low and to dissipate heat quickly through the use of low excess air, off stoichiometric combustion and combustion gas recirculation.	**Applicant:** Operation of the appropriate oxygen range and temperature to promote complete combustion and minimize NOx formation.l quality analysis and fuel handling. **AQB:** GCP addresses the applicants comment through such things as combustion temperature, air-to-fuel ratio control, ignition timing reduction, fuel quality analysis, and fuel handling. Although fuel handling applies more to variable composition fuels, rather than pipeline quality natural gas. GCP implements the guidelines published by USEPA.
Feasibility Evaluations	**Applicant:** Not included in RBLC for the control of NOx emissions from natural gas-fired heaters (< 100 MMBtu/hr). Technically infeasible. Not implemented on heaters of this size.	**Applicant:** Not included in RBLC for the control of NOx emissions from natural gas-fired heaters (< 100 MMBtu/hr). Technically infeasible. Not implemented on heaters of this size.	**AQB:** Included in RBLC for the control of NOx emissions from natural gas fired-heaters in all capacity ranges (< 100 MMBtu/hr to > 100 MMBtu/hr). Hence, in RBLC there is poor correlation between unit capacity and use of the words "ultra" and "low." Rather, the reported emission limits are important.	**Applicant:** Included in RBLC for the control of NOx emissions from natural gas-fired heaters (< 100 MMBtu/hr). **AQB:** Again, the use of the word "low" by itself shall be taken with caution, as RBLC shows "low" used with a variety of heater capacities. Rather, the reported emission limits are important.	**Applicant:** Included in RBLC for the control of NOx emissions from natural gas-fired heaters (< 100 MMBtu/hr). **AQB:** Applies to **all sizes**, < 10 MMBtu/hr to > 100 MMBtu/hr.
Technically feasible?	**No**	**No**	**Yes**	**Yes - for all**	**Yes - for all**
Other	N/A, not technically feasible	N/A, not technically feasible	N/A	**Applicant: 80% control efficiency.** Applicant provided a range of 0.036 lb/MMBtu to 0.045 lb/MMBtu). And has proposed 0.0267 lb/MMBtu for the heaters with capacities of 64.83 MMBtu/hr and 39.14 MMBtu/hr; and 0.034 lb/MMBtu for the larger heaters at 103.99 MMBtu/hr.	XTO will utilize pipeline quality natural gas.
Evaluate Energy, Environment, Indirect economic	N/A, not technically feasible. **AQB Comment:** Regarding heater capacity, the 3 largest heaters are just barely over 100 MMBtu/hr at 103.99 MMBtu/hr.	N/A, not technically feasible. **AQB Comment:** Regarding heater capacity, the 3 largest heaters are just barely over 100 MMBtu/hr at 103.99 MMBtu/hr.	N/A, is BACT for heaters. The difference in the use of the word "ultra" vs. "low" is not a clear point, it is the actual limit. BACT limits being implemented for Husky Gas Plant are lower than BACT implemented for Zia II Gas Plant in 2013.	BACT Floor for heaters > 100 MMBtu/hr per NSPS Db: 0.1 lb/MMBtu. BACT limits even for the large heaters will be much less than Db standard. BACT limits being implemented for Husky Gas Plant are lower than BACT implemented for Zia II Gas Plant in 2013. **BACT Limits will be: • 0.0267 lb/MMBtu** for **heaters RHTR1-3 and SHTR1-12** (units < 100 MMBtu/hr); **• 0.034 lb/MMBtu** for **heaters CHTR1-3** (units > 100 MMBtu/hr).	N/A is BACT, will be used in conjunction with low NOx burners.
Economic analysis	N/A, not technically feasible	N/A, not technically feasible	**Applicant:** None provided. **AQB:** Per EPA: "Ultra-low-NOx burner cost effectiveness is lower than low-NOx in all cases because the additional reduction efficiency more than offsets the additional cost (EPA[c]). The lowest cost effectiveness is achieved with ultra-low and the highest with SCR for each model heater. The range of cost effectiveness for each of the five types of model heaters at a capacity factor of 0.9 are (1) $981/ton to $16,200/ton for natural draft natural gas-fired heaters, (2) $813/ton to $10,600/ton for mechanical draft natural gas-fired heaters[c]."	N/A is BACT	N/A is BACT
BACT Selection	**No**	**No**	**No**	**Yes**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Selective Catalytic Reduction (SCR))," EPA-452/F-03-032.

b. U.S. EPA, Office of Air Quality Planning and Standards, "EPA Air Pollution Control Cost Manual - Section 4 - NOx: Controls: Chapter 1 - Selective Non-Catalytic Reduction (Revised)"

c. U.S. EPA, Office of Air Quality Planning and Standards, "Alternative Control Techniques Document - NOx Emissions from Process Heaters (Revised)" EPA-453/R-93-034

d. U.S. EPA, Office of Air Quality Planning and Standards, "Technical Bulletin Nitrogen Oxides (NOx), Why and How They are Controlled" EPA 456/F-99-006R

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 16. Heater: Natural Gas Fired: CO BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

	Control Technologies →→→	
	Catalytic Oxidation[a]	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Waste stream is heated by a flame and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. Temps 600 - 800 °F (not to exceed 1,250 °F); inlet flow 700 - 50,000 scfm; inlet CO concentration as low as 1 ppmv.	**Applicant:** Continued operation at the appropriate oxygen range and temperature to promote complete combustion and minimize CO formation.
Feasibility Evaluations	**Applicant:** Not listed in RBLC. Not implemented on heaters of this size.	**Applicant:** Included in RBLC for the control of CO emissions from natural gas fired-heaters < 100 MMBtu/hr. **AQB:** Applies to **All sizes**, < 10 MMBtu/hr to > 100 MMBtu/hr).
Technically feasible?	**Not sure - for 100 to 250 MMBtu/hr but not typically used; No - for units < 100 MMBtu/hr**	**Yes - for all**
Other	**Applicant:** Oxidation efficiency depends on exhaust flow rate and composition. Residence time required for oxidation to take place at the active sites of the catalyst may not be achieved if exhaust flow rates exceed design specifications.	XTO will utilize pipeline quality natural gas and has proposed implementing BACT Limits of: • **0.0163 lb/MMBtu** for all of the heaters.
Evaluate Energy, Environment, Indirect economic	Not clear if technically feasible on the larger heaters, but they are just slightly over 100 MMBtu/hr.	BACT limits being implemented for Husky Gas Plant are lower than BACT implemented for Zia II Gas Plant in 2013. **BACT Limits will be:** • **0.0163 lb/MMBtu for all heaters**: RHTR1-3 and SHTR1-12 (units < 100 MMBtu/hr) and CHTR1-3 (units > 100 MMBtu/hr).
Economic analysis	**Applicant:** None provided. **AQB:** Based on the EPA document cited[a] , "As a rule, smaller units controlling a low concentration waste stream will be much more expensive (per unit volumetric flow rate) than a large unit cleaning a high pollutant load flow. Capital cost: \$47,000 to \$191,000 per sm^3/sec (\$22 to \$90 per scfm)" [a]	N/A is BACT
BACT Selection	**No**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Catalytic Incinerator)," EPA-452/F-03-018.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 17. Heater: Natural Gas Fired: VOC BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

	Control Technologies →→→	
	Catalytic Oxidation[a]	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Waste stream is heated by a flame and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. Temps 600 - 800 °F (not to exceed 1,250 °F); inlet flow 700 - 50,000 scfm; inlet VOC concentration as low as 1 ppmv.	**Applicant:** Continued operation at the appropriate oxygen range and temperature to promote complete combustion and minimize VOC formation.
Feasibility Evaluations	**Applicant:** Not listed in RBLC. Not implemented on heaters of this size.	**Applicant:** Included in RBLC for the control of CO emissions from natural gas fired-heaters < 100 MMBtu/hr. **AQB:** Applies to **All sizes**, < 10 MMBtu/hr to > 100 MMBtu/hr).
Technically feasible?	**Not sure - for 100 to 250 MMBtu/hr units; and No - for units < 100 MMBtu/hr**	**Yes - for all**
Other	**Applicant:** Oxidation efficiency depends on exhaust flow rate and composition. Residence time required for oxidation to take place at the active sites of the catalyst may not be achieved if exhaust flow rates exceed design specifications.	XTO will utilize pipeline quality natural gas and has proposed implementing BACT Limits of: • **0.0064 lb/MMBtu** for all of the heaters.
Evaluate Energy, Environment, Indirect economic	Not clear if technically feasible on the larger heaters, but they are just slightly over 100 MMBtu/hr.	BACT limit that was implemented for **Zia II Gas Plant in 2013 (was 0.0054 lb/MMBtu**). Heaters there ranged in capacity from < 10 MMBtu/hr to 114 MMBtu/hr and the same BACT was applied to all. Hence, AQB is proposing to implement the same BACT for the Husky Gas Plant as well, as it will be a new facility and able to meet previous BACT for Zia II. Further, the 0.0054 lb/MMBtu figure is the most commonly reported figure in the RBLC. Hence, **AQB plans to implement BACT Limits at: • 0.0054 lb/MMBtu for all heaters**: RHTR1-3 and SHTR1-12 (units < 100 MMBtu/hr) and CHTR1-3 (units > 100 MMBtu/hr).
Economic analysis	**Applicant:** None provided. **AQB:** Based on the EPA document cited[a] , "As a rule, smaller units controlling a low concentration waste stream will be much more expensive (per unit volumetric flow rate) than a large unit cleaning a high pollutant load flow. Capital cost: \$47,000 to \$191,000 per sm^3/sec (\$22 to \$90 per scfm)" [a]	N/A is BACT
BACT Selection	**No**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Catalytic Incinerator)," EPA-452/F-03-018.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 18. Heater: Natural Gas Fired: PM-10/PM-2.5 Filterable BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

Table 18. Heater: Natural Gas Fired: PM-10/PM-2.5 Filterable BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

	Control Technologies →→→				
	Electrostatic Precipitator (ESP)[a, b, c]	**Baghouse / Fabric Filter[d]**	**Cyclone[e]**	**Pipeline Quality Natural Gas[f]**	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Electrodes stimulate the waste gas and induce an electrical charge in the entrained particles. The resulting electrical field forces charged particles to collector walls from which the material may be mechanically dislodged and collected in dry systems or washed with water deluge in wet systems. Up to 1,300 °F (dry), Lower than 170 - 190 °F (wet); inlet flow 1,000 - 100,000 scfm (Wire-Pipe), 100,000 - 1,000,000 scfm (Wire-Plate); inlet PM concentration 0.5 - 5 gr/dscf (Wire-Pipe), 1 - 50 gr/dscf (Wire-Plate)	**Applicant:** Process exhaust gas passes through a tightly woven or felted fabric arranged in sheets, cartridges, or bags that collect PM via sieving and other mechanisms. The dust cake that accumulates on the filters increases collection efficiency. Various cleaning techniques include pulse-jet, reverse-air, and shaker technologies. Up to 500 °F (Typical); inlet flows 100 - 100,000 scfm (Standard), 100,000 - 1,000,000 scfm (Custom); inlet PM concentration 0.5 - 10 gr/dscf (Typical), 0.05 - 100 gr/dscf (Achievable)	**Applicant:** Centrifugal forces drive particles in the gas stream toward the cyclone walls as the waste gas flows through the conical unit. The captured particles are collected in a material hopper below the unit. Up to 1,000 °F; inlet flow 1.1 - 63,500 scfm (single) up to 106,000 scfm (in parallel); inlet PM concentration 0.44 - 7,000 gr/dscf	**Applicant:** Use of pipeline quality natural gas results in lower emissions.	**Applicant:** Operate and maintain the equipment in accordance with with good combustion practices.
Feasibility Evaluations	**Applicant:** Not included in RBLC for the control of PM emissions for natural gas-fired heaters (< 100 MMBtu/hr).	**Applicant:** Not included in RBLC for the control of PM emissions for natural gas-fired heaters (< 100 MMBtu/hr).	**Applicant:** Not included in RBLC for the control of PM emissions for natural gas-fired heaters (< 100 MMBtu/hr).	**Applicant:** Included in RBLC for the control of PM emissions from natural gas fired-heaters (< 100 MMBtu/hr).	**Applicant:** Included in RBLC for the control of PM emissions from natural gas fired-heaters (< 100 MMBtu/hr).
Technically feasible?	**No**	**No**	**No**	**Yes**	**Yes**
Other	**Applicant:** Dry ESP efficiency varies significantly with dust resistivity. Air leakage and acid condensation may cause corrosion.	**Applicant:** Fabric filters are susceptible to corrosion and blinding by moisture. Appropriate fabrics must be selected for specific process conditions.	**Applicant:** Cyclones typically exhibit lower efficiencies when collecting smaller particles. High-efficiency units may require substantial pressure drop. **AQB:** PM emissions from natural gas fuel are mostly, if not all, comprised of PM2.5 and smaller. Cylcones are not effective on this size of PM.	BACT floor is pipeline quality natural gas defined as **5 gr S/100 scf in the fuel inlet**.	Applicant: Proposed a BACT Limit of **0.0134 lb/MMBtu** for all heaters.
Evaluate Energy, Environment, Indirect economic	**Applicant:** Equipment footprint is often substantial.	Applicant:	N/A not technically feasible	N/A is BACT	**AQB:** The BACT Limit implemented for Zia II Gas Plant was **0.0075 lb/MMBtu** (7.4 lb/MMscf) for heaters of all size classes: < 10 MMBtu/hr to > 100 MMBtu/hr. This is half of what XTO has proposed. As a new facility, AQB is expecting Husky to be able to achieve the 0.0075 lb/MMBtu figure that is commonly reported in the RBLC. Hence, **AQB is planning to implement BACT Limits at: • 0.0075 lb/MMBtu for all heaters:** RHTR1-3 and SHTR1-12 (units < 100 MMBtu/hr) and CHTR1-3 (units > 100 MMBtu/hr).
Economic analysis	N/A not technically feasible	**Applicant:** None provided. **AQB:** EPA has performed cost analyses procedures[d].	N/A not technically feasible	N/A is BACT	N/A is BACT
BACT Selection	**No**	**No**	**No**	**Yes**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Dry Electrostatic Precipitator (ESP) - Wire-Pipe Type)," EPA-452/F-03-027.
b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Dry Electrostatic Precipitator (ESP) - Wire-Plate Type)," EPA-452/F-03-028.
c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Wet Electrostatic Precipitator(ESP) - Wire-Pipe Type)," EPA-452/F-03-029.
d. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Fabric Filter - Pulse-Jet Cleaned Type)," EPA-452/F-03-025.
e. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Cyclone)," EPA-452/F-03-005.
f. Pipeline quality natural gas is defined as gas having sulfur content of 5 gr/100 scf or less.
All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 19. Heater: Natural Gas Fired: PM-10/PM-2.5 Condensable BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

Table 19. Heater: Natural Gas Fired: PM-10/PM-2.5 Condensable BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

	Control Technologies →→→			
	Thermal Incineration[a]	**Catalytic Oxidation[c]**	**Pipeline Quality Natural Gas**	**Good Combustion Practices (GCP)**
Identified Air Pollution Control Technologies	**Applicant:** Did not evaluate condensable PM. **AQB:** Oxidizes some particulate matter commonly composed as soot, which is formed as a result of incomplete combustion of hydrocarbons, by raising the temperature of the material above the auto-ignition point in the presence of O2 and maintaining the high temp for sufficient time to complete combustion. Temp 1,100 - 1,200 °F ; inlet flow 500 - 50,000 scfm ; inlet concentration as low as 100 ppmv or less[b].	**Applicant:** Did not evaluate condensable PM. **AQB:** Similar to thermal incineration; waste stream is heated by a flame and then passes through a catalyst bed that increases the oxidation rate more quickly and at lower temperatures. Temp 600 - 800 °F (not to exceed 1,250 °F); inlet flow 700 - 50,000 scfm; inlet PM concentration as low as 1 ppmv.	**Applicant:** Did not evaluate condensable PM. **AQB:** Combust only pipeline quality natural gas, which has an inherently low sulfur content.	**Applicant:** Did not evaluate condensable PM. **AQB:** Operate and maintain the equipment in accordance with with good combustion practices.
Feasibility Evaluations	**AQB:** The RBLC results generally includes total PM or filterable, and not condensable alone for heaters < 250 MMBtu/hr.	**AQB:** The RBLC results generally includes total PM or filterable, and not condensable alone for heaters < 250 MMBtu/hr.	**AQB:** Included in RBLC for the control of PM emissions from natural gas fired-heaters (of all sizes, < 10 MMBtu to > 100 MMBtu/hr).	**Applicant:** Included in RBLC for the control of PM emissions from natural gas fired-heaters (of all sizes, < 10 MMBtu to > 100 MMBtu/hr).
Technically feasible?	**No**	**No**	**Yes**	**Yes**
Other	N/A	N/A	BACT floor pipeline quality natural gas defined as **5 gr S/100 scf in the fuel inlet**.	N/A
Evaluate Energy, Environment, Indirect economic	N/A not technically feasible	N/A not technically feasible	N/A is BACT	N/A is BACT
Economic analysis	N/A not technically feasible	N/A not technically feasible	N/A is BACT	N/A is BACT
BACT Selection	**No**	**No**	**Yes**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Thermal Incinerator)," EPA-452/F-03-022.
b. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Regenerative Incinerator)," EPA-452/F-03-021.
c. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Catalytic Incinerator)," EPA-452/F-03-018.
All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 20. Heater: Natural Gas Fired: SO2 BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

	Control Technology
	Pipeline Quality Natural Gas
Identified Air Pollution Control Technologies	**Applicant:** Did not address SO2 from the heaters. **AQB:** Combust only pipeline quality natural gas, which has an inherently low sulfur content. Applicant used 0.75 gr S/100 scf for emissions calculations.
Feasibility Evaluations	**AQB:** Included in RBLC for the control of SO2 emissions from natural gas fired heaters (all sizes < 10 MMBtu/hr to > 100 MMBtu/hr).
Technically feasible?	**Yes**
Other	BACT Floor is pipeline quality natural gas defined as **5 gr S/100 scf in the fuel inlet**. **Emissions are based on 0.75 gr total S/100 scf as implemented BACT**
BACT Selection	**Yes**

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 21. Heater: Natural Gas Fired: Greenhouse Gas (GHG) BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

Table 21. Heater: Natural Gas Fired: Greenhouse Gas (GHG) BACT (Units CHTR1-3, RHTR1-3, and SHTR1-12)

	Control Technologies →→→	
	Carbon Capture and Sequestration (CCS)	**Good Combustion Practices (GCP) using Pipeline Quality Natural Gas**
Identified Air Pollution Control Technologies	**Applicant:** For the heaters, CCS would involve post combustion capture of the CO2 from the engines and sequestration of the CO2 in some fashion. **AQB:** CCS may be described variously, through several steps, but first involves the capture of CO2 from the engine exhaust stream, transport (short or long distance via pipeline), then sequestration or storage in some location or form where it is prevented from entering the atmosphere. Sequestration could take various forms such as use of CO2 in other chemical processes or geologic storage where the CO2 is pumped into a subsurface geological formation (e.g., saline formations) for permanent storage.[a,b,c,d]	**Applicant:** Operating practices to maintain fuel efficiency of the heaters, proper air-fuel ratio, proper maintenance and tune-up of heaters at least annually per manufacturer's specifications. XTO will be installing all brand new heater equipment. **AQB:** Fuel selection (i.e., pipeline quality natural gas), efficient heater design (including air/fuel ratio and intelligent flame controls), and heat integration (heat transfer) are all part of good combustion practices per EPA guidance[e].
Feasibility Evaluations	**Applicant:** Carbon capture could be accomplished with low pressure scrubbing of CO2 from the exhaust stream with solvents (e.g., amines and ammonia), solid sorbents, or membranes. However, only solvents have been used to-date on a commercial (yet slip stream) scale and solid sorbents and membranes are considered to be in the research and development phase.	**Applicant:** Use of pipeline quality natural gas fuel, heat integration, and GCP. CO2 and CO2e calculations performed monthly, using a 12-month rolling average per 40 CFR Part 98.
Technically feasible?	**Possibly under No CoGen scenario (see AQB summary below)** **Probably not practical under CoGen scenario**	**Yes**
Other	**Applicant:** A number of post-combustion carbon capture projects have taken place on slip streams at coal-fired power plants. Although these projects have demonstrated the technical feasibility of small-scale CO2 capture on a slipstream of a power plant's emissions using various solvent based scrubbing processes, until these post-combustion technologies are installed fully on a power plant, they are not considered "available" in terms of BACT.	**Applicant has proposed BACT of Limits for CO2e at 117 lb/MMBtu** for all heaters at the facility.
Evaluate Energy, Environment, Indirect economic	**AQB:** Under the No CoGen operating scenario (no turbines, and more heaters operating), the heaters (18 total) will account for 64% of all GHG emissions (64% of 968,755 tpy of GHG). Under the CoGen operating scenario, there will be far fewer heaters (just 5 heaters) and these will only contribute 5% of total GHG emissions.	**AQB:** The proposed BACT limits are equivalent to those implemented for Zia II Gas Plant here in New Mexico. Other monitoring implemented for Zia II included: heaters tuned once per year, or more frequently, per manufacturer recommendations; high heat values of the fuel were be determined semi-annually (at minimum); and fuel combusted in the heaters measured and recorded using an operational non-resettable elapsed flow meter calibrated annually. AQB is again requesting to apply these parameters. **BACT Limits for CO2e will be 117 lb/MMBtu (115,623 lb/MMscf)** for all heaters CHTR1-3, RGTR1-3, and SHTR1-12.
Economic analysis	**AQB:** Husky Gas Plant is potentially a large enough CO2 emitting facility to qualify for a 45Q tax credit for implementing carbon capture and sequestration (at least under CoGen scenario).[f, g]	N/A is BACT
BACT Selection	**No for the heaters - under CoGen** **Something to consider for the heaters under the No CoGen operating scenario**	**Yes**

a. USEPA website: https://archive.epa.gov/epa/climatechange/carbon-dioxide-capture-and-sequestration-overview.html#sources

b. The North American Carbon Storage Atlas (NACSA) 2012. www.nacsap.org

c. USEPA Federal Requirements under the Underground Injection Control (UIC) Program for Carbon Storage (CO2) Geologic Sequestration Wells, Final Rule (40 CFR Parts 124, 144, 145, et al). Federal Register Vol. 75, No. 237, pgs. 77230-77303, Dec. 10, 2010.

d. Intergovernmental Panel on Climate Change (IPCC), 2005. Carbon Dioxide Capture and Storage. Cambridge University Press.

e. USEPA Guidance on Good Combustion Practices.

f. Carbon Capture Coalition: https://carboncapturecoalition.org/wp-content/uploads/2019/06/BluePrint-Compressed-Updated.pdf

g. Better Energy: https://www.betterenergy.org/wp-content/uploads/2019/06/45Q_Primer_May_2019.pdf

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 22. Amine Sweetening Still Vent: VOC BACT (Units AU1-AU3)

Table 22. Amine Sweetening Still Vent: VOC BACT (Units AU1-AU3)

	Control Technologies →→→	
	Thermal Incineration/Oxidation and Best Practices	**Acid Gas Injection (AGI)**
Identified Air Pollution Control Technologies	**Applicant:** A high temperature control device is utilized for disposing of waste gas streams. This control option offers 99% control of VOC emissions.	**Applicant:** Did not discuss this option. **AQB:** Since this control method was implemented for the Zia II Gas Plant, AQB will discuss this option. This method injects the acid gas still vent stream (VOC and CO2) from the amine units into a Class II well that would be regulated by New Mexico's Oil Conservation Division (NMOCD). AGI stores the acid gas in an isolated subsurface reservoir. The acid gas stream would include all entrained VOC from the amine unit as well.
Feasibility Evaluations	**Applicant:** Feasible.	**AQB:** There are a number of Class II injection wells in New Mexico, which is a good indication of availability and consequently, implementation of AGI for this project.
Technically feasible?	**Yes**	**Yes**
Other	**Applicant:** This control option offers 99% control of VOC emissions.	**AQB:** This control option offers 100% control of emissions. Class II wells are designed to protect ground water resources. NMOCD regulations on Class II wells are thorough with the intent to geologically sequester acid gases[a,b,c,d] . Current knowledge of subsurface geologic features, the types of layers and potential existence of fractures is implemented in the determination of ground water protection, and 100% entrapment of acid gases is the intended goal. Examples specifically for New Mexico gas plants exist (Zia II, Linum Ranch, Monument, and Jal#3)[d] and there is a body of knowledge that existing UIC programs are existing and available[a,b,c,d,e,f] . **Hence, BACT could be a Class II acid gas injection well (AGI). A flare could serve as secondary BACT for SSM if AGI needed maintenance.**
Evaluate Energy, Environment, Indirect economic	**AQB:** Agrees that thermal oxidizers (TO) will be good feasible controls for VOC emissions. At 99% control efficiency, VOC emissions from each TO unit will be reduced from 274 tpy (pre-control) to 2.74 tpy (post-control). Combusting VOC does create a lot of CO2, a greenhouse gas (GHG). Each TO will be emitting 101,000 tpy of CO2e for a combined total of 303,000 tpy for all 3 TO units. Carbon capture and storage has also been evaluated for GHG conrol. **Eventual CAM Plan will also be part of BACT (TO control amine units which will be subject to CAM).**	N/A is BACT
Economic analysis	N/A	N/A is BACT
BACT Selection	**Yes**	**Remains open for consideration**

a. Title 19, Chapter 5, Part 26, Oil and Gas Injection (19.15.26 NMAC).

b. Class II Well Facts: New Mexico's Underground Injection Control (UIC) Program, NMEMNRD, Oil Conservation Division (OCD).

c. "A Blueprint for the Regulation of Geologic Sequestration of Carbon Dioxide in New Mexico," NMEMNRD, Pursuant to Executive Order 2006-69. Fesmire, Rankin, Brooks, and Jones. Dec. 1, 2007

d. Chapter 1: Acid Gas Injection in the Permian and San Juan Basins: Recent Case Studies from New Mexico. Lescinsky, A. Gutierrez, Hunter, J. Gutierrez, and Bentley (of Geolux, Inc, and Carbon Free Corp), 2nd International Acid Gas Injection Symposium, Calgary, Sept. 27-30, 2010. 29 pgs.

e. Intergovernmental Panel on Climate Change (IPCC), 2005. Carbon Dioxide Capture and Storage. Cambridge University Press.

f. The North American Carbon Storage Atlas (NACSA) 2012. www.nacsap.org

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 23. Amine Sweetening Still Vent: GHG BACT (Units AU1-AU3)

	Control Technologies →→→			
	Combustion (Flares or Thermal Oxidizers)	**Proper Design and Operation**	**Flash Tank Off-Gas Recovery System**	**Carbon Capture and Sequestration (CCS) and/or Acid Gas Injection (AGI)**
Identified Air Pollution Control Technologies	**Applicant:** Flares and combustors are examples of control devices in which the control of certain pollutants causes the formation of collateral GHG emissions.	**Applicant:** The amine units will be brand new, energy efficient equipment. The units will operate at minimum circulation rate with consistent amine concentrations.	**Applicant:** The amine units will be equipped with flash tanks. The flash tank emissions will be recycled into the plant for reprocessing, instead of venting to the atmosphere or combustion device.	**Applicant:** CCS could be approached in 3 ways: 1) Class VI well can be permitted and drilled for CO_2 storage; 2) CO_2 captured and used in enhanced oil recovery (EOR); and 3) Class II well drilled for acid gas injection (AGI) of amine still vent stream. **Class VI wells** are used for long-term storage of CO_2 in underground rock formations. **EOR utilizes** the CO_2 for recovery of oil in other wells. **Class II AGI wells** store the acid gases (more than just CO_2, includes VOC and any H_2S) in an isolated subsurface reservoir.
Feasibility Evaluations	**Applicant:** The control of CH_4 in the process gas at the flare or combustor results in the creation of additional CO_2 emissions via the combustion reaction mechanism.	**Applicant:** By minimizing the circulation rate, the amine unit avoids pulling out additional GHGs in the amine streams, which would increase GHG emissions into the atmosphere. **AQB:** Too slow circulation could absorb some CH_4 in amine stream, but CH_4 will be flashed back to the process (see next column on tank off-gas).	**Applicant:** Feasible. **AQB:** This is considered an initial recovery of potential emissions. Absorbed CH_4 is expected to flash-off back to the process.	**Applicant: Class VI wells:** This was evaluated since most of the CO_2 emissions are from the amine units. CO_2 portions would have to be separated from VOC components prior to routing to a pipeline. **EOR** would also require separation of the CO_2 from VOC. CO_2 is good for EOR because it is partially miscible in oil and lowers viscosity and surface tension. **Class II wells** are regulated by New Mexico's Oil Conservation Division (NMOCD). There are a number of Class II injection wells in New Mexico. AGI wells are designed to accept CO_2 as well as other acid gases from sour gas processing streams, such as amine still vent streams of the Husky plant. **AQB:** Agrees with the known occurences of AGI in NM which is a good indication of availability and possible implementation of AGI.
Technically feasible?	**Yes**	**Yes**	**Yes**	**Yes**
Other	**AQB:** Control of any CH_4, via conversion to CO_2, although creating additional GHG, CO_2 is of lesser concern than CH_4 since the global warming potential for CH_4 is 25. Thermal oxidizers (TO) will be used for VOC control, but are not of much additional use for GHG.	**Applicant (XTO): Proposed to use the thermal oxidizers (combustion), proper design and operation, and flash tank off-gas recovery. XTO did not propose CCS or AGI.**	**Applicant:** The use of flash tanks increases the effectiveness of other downstream control devices.	**Applicant: Class VI wells:** Require monitoring and testing for proper operation (40 CFR 146 Subpart H). These wells are designed for CO_2 only, require 5 specific project plans, including corrective action, monitoring, well plugging, and closure. Option feasible if available. **EOR,** by its name, is not designed for permanent sequestration when compared to Class VI wells. **Class II wells:** Does not require separation of CO_2 from other gases and ideal reservoir for AGI is in area not compromised by future oil and gas exploration. **AQB:** Class II wells are designed to protect ground water resources. NMOCD regulations on Class II wells are thorough with the intent to geologically sequester CO_2 (more discussion below). AQB certainly considers Class II wells an existing and readily accessible type of CCS that could be used for this facility. Research and advancement of geologic sequestration methods have been on-going for years, and moving towards practical implementation (Class VI). Tracer studies would be definitive for determining control efficiency (i.e., that gases do not get pulled out via another well operation), but these have been primarily implemented in research studies.[e] AGI examples for New Mexico are: Zia II, Linum Ranch, Monument, and Jal#3.[d] There is a body of knowledge that existing UIC programs are existing and available[a, b, c, d, f] .
Evaluate Energy, Environment, Indirect economic	**AQB:** A flare could serve as a backup control device when CCS or AGI was down for maintenance. Would also provide 98-99% control of any potential H_2S emissions, a state regulated air pollutant.	N/A is BACT	N/A is BACT	**Applicant:** The additional processing required[h] for injection in a Class VI well with regards to separating out the CO_2 portion is not required for a Class II well which saves energy as well as reduces other pollutants such as H_2S and VOC associated with the emission source. XTO searched NMEMNRD maps for currently active CO_2 wells and found were operated by OXY USA and located 200 miles away. XTO also searched for existing pipelines, nearest was 29 miles south. XTO estimated pipeline installation costs and arrived at \$18.18 per ton CO_2 removed.[h] XTO did not consider this economically feasible. **AQB:** Applicant was not correct in stating most of CO_2 comes from the amine units. Under no co-gen 31% is from amine and under co-gen only 11%, while 81% is from the turbines. **Class VI:** At present NM does not have primacy for permitting, meaning would have to go through EPA, but EMNRD is exploring the possibilities. Class VI are designed for larger and purer CO_2 streams[g] but this technology is expanding rapidly. Both Class VI and Class II wells are designed to protect ground water resources. NMOCD regulations on Class II wells are thorough with the intent to geologically sequester acid gases[a,b,c,d] . Knowledge of subsurface geologic features, the types of layers and potential existence of fractures is implemented in the determination of ground water protection, and 100% entrapment of acid gases is the intended goal.
Economic analysis	N/A is BACT	N/A is BACT	N/A is BACT	The Carbon Capture Coalition (CCC) has worked towards implementing the 45Q federal tax credits, which can provide from \$35/MT for EOR to \$50/MT for saline storage.[i, j,l] CCC and sponser Great Plains Institute (GPI) have also evaluated that existing NM gas plants Zia II, Linam Ranch, and Jal#3 could all qualify for the 45Q tax credit and each of these facilities emits just a fraction (6-12%) of what Husky will potentially emit. Additional CCC and GPI economic cost perspectives: 3 gas-fired turbines could feed 2 million MT/yr of CO_2 capture (refer to the turbine BACT analysis as well), and carbon capture costs from natural gas processing can be as low as \$15-29/MT.[k] Hence, XTO's estimated \$18.18/ton CO_2e based on 29-mile pipeline appears feasible under 45Q. This method of GHG control has reasonable feasibility potential for the Husky Gas Plant facility. One missing piece in the cost assessment is equipment necessary to create a purer CO_2 stream from amine units and/or turbine stacks.
BACT Selection	**Yes - for VOC**	**Yes**	**Yes**	**BACT could potentially be either Class II AGI well or CO_2 pipeline installation**

a. Title 19, Chapter 5, Part 26, Oil and Gas Injection (19.15.26 NMAC).

b. Class II Well Facts: New Mexico's Underground Injection Control (UIC) Program, NMEMNRD, Oil Conservation Division (OCD).

c. "A Blueprint for the Regulation of Geologic Sequestration of Carbon Dioxide in New Mexico," NMEMNRD, Pursuant to Executive Order 2006-69. Fesmire, Rankin, Brooks, and Jones. Dec. 1, 2007

d. Chapter 1: Acid Gas Injection in the Permian and San Juan Basins: Recent Case Studies from New Mexico. Lescinsky, A. Gutierrez, Hunter, J. Gutierrez, and Bentley (of Geolux, Inc, and Carbon Free Corp), 2nd International Acid Gas Injection Symposium, Calgary, Sept. 27-30, 2010. 29 pgs.

e. Intergovernmental Panel on Climate Change (IPCC), 2005. Carbon Dioxide Capture and Storage. Cambridge University Press.

f. The North American Carbon Storage Atlas (NACSA) 2012. www.nacsap.org

g. Federal Requirements Under the Underground (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells; Final Rule. 40 CFR Parts 124, 144, 145, et al. FR Vol 75, No. 237, pgs 77230-77303, Dec. 10, 2010.

h. National Energy Technology Laboratory (NETL), Estimating Carbon Dioxide Transport and Storage Costs. DOE/NETL-2010/1447, March, 2010.

i. Carbon Capture Coalition: https://carboncapturecoalition.org/wp-content/uploads/2019/06/BluePrint-Compressed-Updated.pdf

j. Better Energy: https://www.betterenergy.org/wp-content/uploads/2019/06/45Q_Primer_May_2019.pdf

k. Regional Carbon Capture Deployment Initiative (RCCDI): Western Regional Meeting, Denver, CO, Nov 12-13, 2019.

l. IRS 45Q procedure document: Part III, Administrative, Procedural, and Miscellaneous, 26 CFR 601.105, Rev. Proc. 2020-12.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 23. Amine Sweetening Still Vent: GHG BACT (Units AU1-AU3)

	Control Technologies →→→			
	Combustion (Flares or Thermal Oxidizers)	**Proper Design and Operation**	**Flash Tank Off-Gas Recovery System**	**Carbon Capture and Sequestration (CCS) and/or Acid Gas Injection (AGI)**
Identified Air Pollution Control Technologies	**Applicant:** Flares and combustors are examples of control devices in which the control of certain pollutants causes the formation of collateral GHG emissions.	**Applicant:** The amine units will be brand new, energy efficient equipment. The units will operate at minimum circulation rate with consistent amine concentrations.	**Applicant:** The amine units will be equipped with flash tanks. The flash tank emissions will be recycled into the plant for reprocessing, instead of venting to the atmosphere or combustion device.	**Applicant:** CCS could be approached in 3 ways: 1) Class VI well can be permitted and drilled for CO2 storage; 2) CO2 captured and used in enhanced oil recovery (EOR); and 3) Class II well drilled for acid gas injection (AGI) of amine still vent stream. **Class VI wells** are used for long-term storage of CO2 in underground rock formations. **EOR utilizes** the CO2 for recovery of oil in other wells. **Class II AGI wells** store the acid gases (more than just CO2, includes VOC and any H2S) in an isolated subsurface reservoir.
Feasibility Evaluations	**Applicant:** The control of CH4 in the process gas at the flare or combustor results in the creation of additional CO2 emissions via the combustion reaction mechanism.	**Applicant:** By minimizing the circulation rate, the amine unit avoids pulling out additional GHGs in the amine streams, which would increase GHG emissions into the atmosphere. **AQB:** Too slow circulation could absorb some CH4 in amine stream, but CH4 will be flashed back to the process (see next column on tank off-gas).	**Applicant:** Feasible. **AQB:** This is considered an initial recovery of potential emissions. Absorbed CH4 is expected to flash-off back to the process.	**Applicant: Class VI wells:** This was evaluated since most of the CO2 emissions are from the amine units. CO2 portions would have to be separated from VOC components prior to routing to a pipeline. **EOR** would also require separation of the CO2 from VOC. CO2 is good for EOR because it is partially miscible in oil and lowers viscosity and surface tension. **Class II wells** are regulated by New Mexico's Oil Conservation Division (NMOCD). There are a number of Class II injection wells in New Mexico. AGI wells are designed to accept CO2 as well as other acid gases from sour gas processing streams, such as amine still vent streams of the Husky plant. **AQB:** Agrees with the known occurences of AGI in NM which is a good indication of availability and possible implementation of AGI.
Technically feasible?	**Yes**	**Yes**	**Yes**	**Yes**
Other	**AQB:** Control of any CH4, via conversion to CO2, although creating additional GHG, CO2 is of lesser concern than CH4 since the global warming potential for CH4 is 25. Thermal oxidizers (TO) will be used for VOC control, but are not of much additional use for GHG.	**Applicant (XTO): Proposed to use the thermal oxidizers (combustion), proper design and operation, and flash tank off-gas recovery. XTO did not propose CCS or AGI.**	**Applicant:** The use of flash tanks increases the effectiveness of other downstream control devices.	**Applicant: Class VI wells:** Require monitoring and testing for proper operation (40 CFR 146 Subpart H). These wells are designed for CO2 only, require 5 specific project plans, including corrective action, monitoring, well plugging, and closure. Option feasible if available. **EOR,** by its name, is not designed for permanent sequestration when compared to Class VI wells. **Class II wells:** Does not require separation of CO2 from other gases and ideal reservoir for AGI is in area not compromised by future oil and gas exploration. **AQB:** Class II wells are designed to protect ground water resources. NMOCD regulations on Class II wells are thorough with the intent to geologically sequester CO2 (more discussion below). AQB certainly considers Class II wells an existing and readily accessible type of CCS that could be used for this facility. Research and advancement of geologic sequestration methods have been on-going for years, and moving towards practical implementation (Class VI). Tracer studies would be definitive for determining control efficiency (i.e., that gases do not get pulled out via another well operation), but these have been primarily implemented in research studies.[e] AGI examples for New Mexico are: Zia II, Linum Ranch, Monument, and Jal#3.[d] There is a body of knowledge that existing UIC programs are existing and available[a, b, c, d, f].

Table 23. Amine Sweetening Still Vent: GHG BACT (Units AU1-AU3)

	Control Technologies →→→			
	Combustion (Flares or Thermal Oxidizers)	**Proper Design and Operation**	**Flash Tank Off-Gas Recovery System**	**Carbon Capture and Sequestration (CCS) and/or Acid Gas Injection (AGI)**
Evaluate Energy, Environment, Indirect economic	**AQB:** A flare could serve as a backup control device when CCS or AGI was down for maintenance. Would also provide 98-99% control of any potential H2S emissions, a state regulated air pollutant.	N/A is BACT	N/A is BACT	**Applicant:** The additional processing required[h] for injection in a Class VI well with regards to separating out the CO2 portion is not required for a Class II well which saves energy as well as reduces other pollutants such as H2S and VOC associated with the emission source. XTO searched NMEMNRD maps for currently active CO2 wells and found were operated by OXY USA and located 200 miles away. XTO also searched for existing pipelines, nearest was 29 miles south. XTO estimated pipeline installation costs and arrived at $18.18 per ton CO2 removed.[h] XTO did not consider this economically feasible. **AQB:** Applicant was not correct in stating most of CO2 comes from the amine units. Under no co-gen 31% is from amine and under co-gen only 11%, while 81% is from the turbines. **Class VI:** At present NM does not have primacy for permitting, meaning would have to go through EPA, but EMNRD is exploring the possibilities. Class VI are designed for larger and purer CO2 streams[g] but this technology is expanding rapidly. Both Class VI and Class II wells are designed to protect ground water resources. NMOCD regulations on Class II wells are thorough with the intent to geologically sequester acid gases[a,b,c,d] . Knowledge of subsurface geologic features, the types of layers and potential existence of fractures is implemented in the determination of ground water protection, and 100% entrapment of acid gases is the intended goal.
Economic analysis	N/A is BACT	N/A is BACT	N/A is BACT	The Carbon Capture Coalition (CCC) has worked towards implementing the 45Q federal tax credits, which can provide from $35/MT for EOR to $50/MT for saline storage.[i, j,l] CCC and sponser Great Plains Institute (GPI) have also evaluated that existing NM gas plants Zia II, Linam Ranch, and Jal#3 could all qualify for the 45Q tax credit and each of these facilities emits just a fraction (6-12%) of what Husky will potentially emit. Additional CCC and GPI economic cost perspectives: 3 gas-fired turbines could feed 2 million MT/yr of CO2 capture (refer to the turbine BACT analysis as well), and carbon capture costs from natural gas processing can be as low as $15-29/MT.[k] Hence, XTO's estimated $18.18/ton CO2e based on 29-mile pipeline appears feasible under 45Q. This method of GHG control has reasonable feasibility potential for the Husky Gas Plant facility. One missing piece in the cost assessment is equipment necessary to create a purer CO2 stream from amine units and/or turbine stacks.

BACT Selection	**Yes - for VOC**	**Yes**	**Yes**	**BACT could potentially be either Class II AGI well or CO2 pipeline installation**

a. Title 19, Chapter 5, Part 26, Oil and Gas Injection (19.15.26 NMAC).

b. Class II Well Facts: New Mexico's Underground Injection Control (UIC) Program, NMEMNRD, Oil Conservation Division (OCD).

c. "A Blueprint for the Regulation of Geologic Sequestration of Carbon Dioxide in New Mexico," NMEMNRD, Pursuant to Executive Order 2006-69. Fesmire, Rankin, Brooks, and Jones. Dec. 1, 2007

d. Chapter 1: Acid Gas Injection in the Permian and San Juan Basins: Recent Case Studies from New Mexico. Lescinsky, A. Gutierrez, Hunter, J. Gutierrez, and Bentley (of Geolux, Inc, and Carbon Free Corp), 2nd International Acid Gas Injection Symposium, Calgary, Sept. 27-30, 2010. 29 pgs.

e. Intergovernmental Panel on Climate Change (IPCC), 2005. Carbon Dioxide Capture and Storage. Cambridge University Press.

f. The North American Carbon Storage Atlas (NACSA) 2012. www.nacsap.org

Table 23. Amine Sweetening Still Vent: GHG BACT (Units AU1-AU3)

Control Technologies →→→			
Combustion (Flares or Thermal Oxidizers)	**Proper Design and Operation**	**Flash Tank Off-Gas Recovery System**	**Carbon Capture and Sequestration (CCS) and/or Acid Gas Injection (AGI)**

g. Federal Requirements Under the Underground (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells; Final Rule. 40 CFR Parts 124, 144, 145, et al. FR Vol 75, No. 237, pgs 77230-77303, Dec. 10, 2010.

h. National Energy Technology Laboratory (NETL), Estimating Carbon Dioxide Transport and Storage Costs. DOE/NETL-2010/1447, March, 2010.

i. Carbon Capture Coalition: https://carboncapturecoalition.org/wp-content/uploads/2019/06/BluePrint-Compressed-Updated.pdf

j. Better Energy: https://www.betterenergy.org/wp-content/uploads/2019/06/45Q_Primer_May_2019.pdf

k. Regional Carbon Capture Deployment Initiative (RCCDI): Western Regional Meeting, Denver, CO, Nov 12-13, 2019.

l. IRS 45Q procedure document: Part III, Administrative, Procedural, and Miscellaneous, 26 CFR 601.105, Rev. Proc. 2020-12.

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Table 24. Tanks - Fixed Roof (Oil Storage, Slop Oil, Gunbarrel, and Produced Water): VOC BACT (Units OTK1 to OTK6, OTK7, GBS1, PWTK1 to PWTK2)

Table 24. Tanks - Fixed Roof (Oil Storage, Slop Oil, Gunbarrel, and Produced Water): VOC BACT (Units OTK1 to OTK6, OTK7, GBS1, PWTK1 to PWTK2)

	Control Technologies →→→	
	Thermal Incineration[a]	**Fixed Roof and Submerged Fill**
Identified Air Pollution Control Technologies	**Applicant:** Vent tanks to a closed flame control device like the proposed ECD (Enclosed Combustion Device) used for disposing of waste gas streams. Temp 1,100 - 1,200 °F ; inlet flow 500 - 50,000 scfm; inlet VOC concentrations 1500-3000 ppmv.	**Applicant:** Filling tanks through submerged fill, and using white or aluminum paint.
Feasibility Evaluations	**Applicant:** Included in RBLC for the control of VOC emissions from storage tanks. Typically not utilized for low-concentration, high-flow organic streams. The slop oil tank goes through stabilization.	**Applicant:** Included in RBLC for the control of VOC emissions from storage tanks.
Technically feasible?	**Yes**	**Yes**
Other	**Applicant:** 99% destruction rate efficiency (DRE). **AQB:** XTO will implement an ECD unit as BACT. The tanks will have no emissions. Because the oil storage tanks (**OTK1 to OTK6**), the slop oil tank (**OTK7**), and the produced water tanks (**PWTK1 to PWTK2**) will be vented to and controlled via the ECD unit. This control mechanism will keep all of them below the PTE applicability threshold for tank standards in NSPS OOOOa. Nevertheless, the 500 ppm leak detection requirement for fugitives (60.5400a) would apply to the oil tanks (OTK1 to OTK7) as there is a feedback loop into the NGL stabilization towers.	**AQB:** These are fixed roof tanks that will be vented to an enclosed combustion device (ECD, refer to thermal incineration in the left column).
Evaluate Energy, Environment, Indirect economic	**AQB: The Gunbarrel separator vessel (or tank), Unit GBS1,** is another vessel that is handling oil that is directly controlled by the ECD (it vents straight to the ECD). This vessel contributes 56.7% of all un-controlled VOC emissions to the ECD. Its emissions are reduced from 1006 tpy to 10.06 tpy via the ECD (one has to assume the ECD controls all vessels at equal 99% rate). This leaves the GBS1 with a VOC PTE of 10.06 tpy (which is greater than the 6 tpy threshold in NSPS OOOOa for storage vessels (60.5365a(e)). It is the permit writer's interpretation that GBS1 is a storage vessel subject to NSPS OOOOa (see OOOOa rule analysis in the Statement of Basis) and that **BACT for GBS1 will also mean meeting OOOOa requirements. Eventual CAM Plan will also be part of BACT (ECD controls OTK1 to OTK7 and GBS1 which will all be subject to CAM).**	N/A is BACT
Economic analysis	N/A is BACT	N/A is BACT
BACT Selection	**Yes**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Thermal Incinerator)," EPA-452/F-03-022.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 25. Tanks - Internal Floating Roof (Oil Storage): VOC BACT (Units IFR1 to IFR4)

	Control Technologies →→→	
	Thermal Incineration[a]	**Submerged Fill and Mechanical/Liquid Mounted Seals**
Identified Air Pollution Control Technologies	**Applicant:** Vent tanks to an enclosed flame control device for disposing of waste gas streams. Temp 1,100 - 1,200 °F ; inlet flow 500 - 50,000 scfm; inlet VOC concentrations 1500-3000 ppmv.	**Applicant:** Filling tanks through submerged fill, using white or aluminum paint, and with drain dry floor design. These tanks go through stabilization prior to being filled. Vapor pressure will be less than 11 psia and tanks will have primary and secondary seals.
Feasibility Evaluations	**Applicant:** Included in RBLC for the control of VOC emissions from storage tanks. Typically not utilized for low-concentration, high-flow organic streams.	**Applicant:** Included in RBLC for the control of VOC emissions from storage tanks.
Technically feasible?	**Applicant says no**	**Yes**
Other	**Applicant:** Technically infeasible - portable thermal incineration is included in RBLC for the control of VOC emissions during tank landings and cleanings, but not for routine operations.	**AQB:** These tanks will have both primary and secondary seals.
Evaluate Energy, Environment, Indirect economic	**AQB:** Is wondering if some form of portable incineration could be implemented during tank landings and simultaneously reduce worker exposure to VOC fumes?	**AQB:** Tank roofs shall be routinely inspected during landings and cleanings and all seals inspected for potential leaks. Although PTE is calculated to be 5.15 tpy VOC (using ProMax modeling) and this is below the 6 tpy applicability threshold for tank standards in NSPS OOOOa, it is not very far below. Routine seal inspections and monitoring of tank throughputs will be key in verification of allowable emissions.
Economic analysis	N/A is BACT	N/A is BACT
BACT Selection	**Consider portable incineration during tank landings?**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Thermal Incinerator)," EPA-452/F-03-022.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 26. Truck Loading and Unloading for Tanks: VOC BACT (Units OTK1 to OTK7 and PWTK1 to PWTK2)

Table 26. Truck Loading and Unloading for Tanks: VOC BACT (Units OTK1 to OTK7 and PWTK1 to PWTK2)

	Control Technologies →→→	
	Thermal Incineration[a]	**Dry Break Hoses, Specialized Connection, and Submerged Fill**
Identified Air Pollution Control Technologies	**Applicant:** Vent fugitive emissions to an enclosed flame combustion control device (ECD) used for disposing of waste gas streams. Temp 1,100 - 1,200 °F ; inlet flow 500 - 50,000 scfm ; inlet VOC concentrations 1500-3000 ppmv.	**Applicant:** Specialized connection system of transfer valves to minimize vapors released. Dry break hoses. Filling trucks through submerged fill pipe will help reduce fugitive vapors.
Feasibility Evaluations	**Applicant:** Included in RBLC for the control of VOC emissions from truck unloading.	**Applicant:** Included in RBLC for the control of VOC emissions from truck unloading/loading.
Technically feasible?	**Yes**	**Yes**
Other	**Applicant:** 99% destruction rate efficiency (DRE). Typically not utilized for low-concentration, high-flow organic vapor streams. **AQB:** AQB is a bit confused about the non-typical comment on part of the applicant. XTO will implement an ECD unit as BACT. ECD implementation for truck loading will help minimize VOC emissions. Fugitives from the Truck loading/unloading would fall under facility-wide fugitives subject to NSPS OOOOa with 500 ppm leak detection requirement for fugitives (60.5400a). **This control technology will be part of the BACT.**	N/A
Evaluate Energy, Environment, Indirect economic	N/A is BACT	N/A is BACT
Economic analysis	N/A is BACT	N/A is BACT
BACT Selection	**Yes**	**Yes**

a. U.S. EPA, Office of Air Quality Planning and Standards, "Air Pollution Control Technology Fact Sheet (Thermal Incinerator)," EPA-452/F-03-022.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 27. Fugitives: VOC and GHG (CH4) BACT (Unit FUG)

	Control Technologies →→→				
	Implementation of LDAR[a]	**Installation of Leakless Equipment**	**Alternative Monitoring Program - Remote Sensors / Infrared Technologies**	**Audio/Visual/Olfactory (AVO) Monitoring Program[a]**	**Use High Quality Components and Materials of Construction Compatible with Process**
Identified Air Pollution Control Technologies	**Applicant:** The LDAR program has traditionally been developed for the control of VOC emissions. The facility is an onshore natural gas processing plant and is subject to NSPS OOOOa. The facility is required to comply the monitoring and repair requirements for a LDAR program per 40 CFR 60, Subpart VVa.	**Applicant:** Leakless technology valves are available and currently in use, primarily where highly toxic or otherwise hazardous materials are used.	**Applicant:** Alternate monitoring programs such as remote sensing technologies have been proven effective in leak detection and repair. The use of sensitive infrared camera technology has become widely accepted as a cost effective means for identifying leaks of hydrocarbons.	**Applicant:** Leaking fugitive components can be identified through audio, visual, or olfactory (AVO) methods.	**Applicant:** The use of high quality equipment that is designed for the specific service in which it is employed results in effective control of fugitive emissions.
Feasibility Evaluations	**Applicant:** Technically feasible. Included in RBLC for the control of VOC emissions from fugitive VOC emissions.	**Applicant:** Technically Infeasible. Not implemented or included in RBLC for VOC streams at gas plants.	**Applicant:** Technically feasible.	**Applicant:** Technically feasible for the identification of larger leaks.	**Applicant:** Technically feasible.
Technically feasible?	**Yes**	**No**	**Yes**	**Yes**	**Yes**
Other	**Applicant:** LDAR and Adhere to 40 CFR 60 Subpart OOOO Equipment Leak Requirements.	N/A	N/A	**AQB:** An LDAR program per NSPS OOOOa will be implemented (see LDAR column).	**AQB:** An LDAR program per NSPS OOOOa will be implemented (see LDAR column). Facility will be installing all new state of the art equipment.
Evaluate Energy, Environment, Indirect economic	**Applicant:** Varies with LDAR program and type of component. **AQB: Agrees that BACT will be LDAR via NSPS OOOOa** (and this rule cites NSPS VVa). The facility shall conduct monitoring, maintenance, recordkeeping, and reporting per OOOOa program which addresses both VOC and methane (CH4).	**AQB:** Implementation of LDAR under NSPS OOOOa is intended to closely monitor and minimize occurrances of leaking equipment (refer to LDAR column).	**AQB:** Implementation of LDAR under NSPS OOOOa is intended to closely monitor and minimize occurrances of leaking equipment (refer to LDAR column).	N/A using LDAR	N/A using LDAR
Economic analysis	N/A is BACT	N/A	**Applicant:** Cost effective method for identifying leaks of hydrocarbons.	N/A using LDAR	N/A using LDAR
BACT Selection	**Yes**	**See LDAR**	**See LDAR**	**See LDAR**	**See LDAR**

a. EPA document "Leak Detection and Repair - A Best Practices Guide" (http://www.epa.gov/Compliance/resources/publications/assistance/ldarguide.pdf)

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 28. Enclosed Combustion Device: NOx, CO, VOC, PM, and GHG BACT (Unit ECD1)

Table 28. Enclosed Combustion Device: NOx, CO, VOC, PM, and GHG BACT (Unit ECD1)

	Control Technologies →→→	
	Fuel Selection - Pipeline Quality Natural Gas[a]	**Good Combustion, Operating, and Maintenance Practices and Low NOx Burners (for all criteria pollutants)**
Identified Air Pollution Control Technologies	**Applicant:** Use of natural gas fuel low in sulfur.	**Applicant:** Good combustion and operating practices are a potential control option for improving the combustion efficiency of the vapor combustion device (VCD). Good combustion practices include proper operation and design, maintenance, and tune-up of the VCD at least annually per the manufacturer's specifications. The VCD is a unit that is used to control emissions of VOC from the storage tanks and truck loading operations. In addition to incomplete combustion emissions, additional emissions of VOC result from the un-destructed portion of the vent streams.
Feasibility Evaluations	**Applicant:** Included in RBLC.	**Applicant:** Included in RBLC. **AQB:** The applicant stated the text that the RBLC search is similar to that for flares, but flares are open, the VCD (i.e., ECD) is an enclosed flame. The RBLC search covers VCD and thermal oxidizers (TO) (see the TO summary for low NOx burners).
Technically feasible?	**Yes**	**Yes**
Other	**Applicant:** Base case.	**Applicant proposed the following BACT Limits** for several pollutants are as follows: **NOx: 0.138 lb/MMBtu; CO: 0.2755 lb/MMBtu; VOC: 0.3966 lb/MMBtu; CO2e: 0.25 lbs/scf (=96.2 lbs/MMBtu).**
Evaluate Energy, Environment, Indirect economic	**AQB:** The permittee shall also ensure that the combustion device is operating properly.	**AQB: Proposes BACT as follows as used for Zia II Gas Plant: NOx: 0.098 lb/MMBtu; CO: 0.082 lb/MMBtu; VOC: 0.21 lb/MMBtu (implemented through 98-99% DRE [destruction rate efficiency] of VOC); and CO2e: 96.2 lb/MMBtu. Eventual CAM Plan will also be part of BACT (ECD controls OTK1 to OTK7 and GBS1 which will all be subject to CAM).** For NOx, RBLC shows a range from 0.025 to 0.15 lb/MMBtu with a mean of 0.071 (8 data points). For CO the highest figure in RBLC is 0.11 lb/MMBtu. Hence, between RBLC and Zia II implemented here in NM, AQB recommends the above identified figures. CO2 and CO2e calculations performed monthly, using a 12-month rolling average per 40 CFR Part 98. The ECD shall be tuned and maintained per manufacturer specifications; a fuel flowmeter will record fuel combusted in the ECD; high heat values will be tracked, an extended gas analysis will be run, and each month demonstrate compliance with the emission limits (pph and lb/MMBtu). The ECD being a control device for oil tanks, produced water tanks, and truck loadout, hence it is subject to the BACT floor in NSPS OOOOa with a required control efficiency of 95% for each vessel (60.5395a(d)(1)), and under 60.5400a referencing NSPS VVa at 60.482.
Economic analysis	N/A is BACT	N/A is BACT
BACT Selection	**Yes**	**Yes**

a. Pipeline quality natural gas is defined as gas having sulfur content of 5 gr/100 scf or less.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 29. Flares: Natural Gas Pilot plus SSM: NOx, CO, VOC, PM-10, PM-2.5, and GHG BACT (Units FL1, FL2, and FL3)

Table 29. Flares: Natural Gas Pilot plus SSM: NOx, CO, VOC, PM-10, PM-2.5, and GHG BACT (Units FL1, FL2, and FL3)

	Control Technologies →→→			
	Pipeline Quality Natural Gas[a]	**Good Combustion, Operating, and Maintenance Practices (for all criteria pollutants)**	**Good Flare Design (for all criteria pollutants)**	**Carbon Capture and Sequestration (CCS)**
Identified Air Pollution Control Technologies	**Applicant:** Use of low sulfur, natural gas as fuel results in low CO, SO2, PM-10, and PM-2.5 emissions.	**Applicant:** Good combustion and operating practices are a potential control option for improving the combustion efficiency of the flares. Good combustion practices include proper operation, maintenance, and tune-up of the flares at least annually per the manufacturer's specifications.	**Applicant:** Good flare design can be employed to destroy large fractions of the flare gas. Good flare design includes pilot flame monitoring, flow measurement, and monitoring/control of waste gas heating value.	**Applicant:** CCS was also briefly discussed. With no ability to collect exhaust gas from a flare other than using an enclosure, post combustion capture is technically infeasible. The flares are for controls of emissions from emergency situations and SSM activities.
Feasibility Evaluations	**Applicant:** Included in RBLC.	**Applicant:** Included in RBLC. **AQB:** The permittee will also meet 40 CFR 60.18 to demonstrate compliance with this BACT.	**Applicant:** Included in RBLC.	N/A
Technically feasible?	**Yes**	**Yes**	**Yes**	**No**
Other	N/A	The flares (FL1 to FL3) will meet the minimum requirements set out in 40 CFR §60.18 which will provide a destruction efficiency of 98% for VOCs, CH4, and H2S. The applicant has provided SSM emission figures for: 1) flare stabilizer overhead and 2) cryo blowdowns which will become BACT (pph for criteria pollutants and tpy for CO2e).	**AQB:** Gas flows to the flares will be monitored.	N/A
Evaluate Energy, Environment, Indirect economic	N/A is BACT	N/A is BACT	N/A is BACT	**AQB:** As the facility is currently designed and planned to be permitted, the flares are not expected to be major CO2 emitters (relative to other equipment). Under the cogen scenario the turbines and thermal oxidizers account for 92% of all GHG emissions from the facility.
Economic analysis	N/A is BACT	N/A is BACT	N/A is BACT	N/A not technically feasible
BACT Selection	**Yes**	**Yes**	**Yes**	**No**

a. Pipeline quality natural gas is defined as gas having sulfur content of 5 gr/100 scf or less.

b. GWPs = global warming potentials. CO2 is the base with a factor of 1, while CH4 has a factor of 25 (meaning for each ton of CH4 emitted, multiply by 25).

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 30. Thermal Oxidizers: NOx, CO, VOC, PM, and GHG BACT (Units TO1 to TO3)

Table 30. Thermal Oxidizers: NOx, CO, VOC, PM, and GHG BACT (Units TO1 to TO3)

	Control Technologies →→→	
	Low NOx Burners[a]	**Good Combustion, Operating, and Maintenance Practices (for all criteria pollutants)**
Identified Air Pollution Control Technologies	**Applicant:** Reduce NOx by accomplishing the combustion process in stages. Staging delays the combustion process resulting in a cooler flame which suppresses NOx formation. Temp - 1400 F.	**Applicant:** Operate and maintain the equipment in accordance with good combustion practices. Incomplete combustion can be due to insufficient oxygen, poor fuel/air ratio mixing, reduced temperature, and reduced residense time. Oxidizers will be fueled with natural gas.
Feasibility Evaluations	**Applicant:** Included in RBLC.	**Applicant:** Included in RBLC.
Technically feasible?	**Yes**	**Yes**
Other	**Applicant:** 99.9% control and proposed 30 ppmvd at 3% O2.	**Applicant proposed the following limits**: **NOx: 30 ppmv at 3% O2; CO: 50 ppmv at 3% O2; VOC: proposed allowable rates; GHG: good combustion and proper design.**
Evaluate Energy, Environment, Indirect economic		**AQB: BACT as follows NOx: 30 ppmv at 3% O2; CO: 50 ppmv at 3% O2; AQB proposes as follows as used for Zia II Gas Plant: VOC: 0.21 lb/MMBtu (implemented through 98-99% DRE [destruction rate efficiency] of VOC); CO2e: 117 lb/MMBtu. Eventual CAM Plan will also be part of BACT (TO control amine units which will be subject to CAM).** Since thermal oxidizers and other vapor combustion devices are treated similarly in RBLC, AQB is anticipating similar rates be applied for TO relative to the ECD. For NOx, RBLC does show a range from 0.025 to 0.15 lb/MMBtu with a mean of 0.071 (8 data points). For CO the highest figure in RBLC is 0.11 lb/MMBtu. Hence, between RBLC and Zia II implemented here in NM, AQB recommends the above identified figures. CO2 and CO2e calculations performed monthly, using a 12-month rolling average per 40 CFR Part 98. The TO emit 11% of all GHG under the cogen scenario, and 31% of GHG under the no cogen scenario. So any possible kind of carbon capture and storage (CCS) process would carry more importance under the no cogen scenario (relative for TO operation, see discussion under Amine Unit GHG).
Economic analysis	N/A is BACT	N/A is BACT
BACT Selection	**Yes**	**Yes**

a. U.S. EPA Office of Air Quality Planning and Standards, "Technical Bulletin Nitrogen Oxides (NOx), Why and How They are Controlled" EPA 456/F-99-006R.

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.

Table 31. Haul Road: PM-10/PM-2.5 BACT (Unit ROAD)

	Control Technologies →→→		
	Speed Reduction and Base Course[a]	**Water Application/Sweeping**	**Paving**
Identified Air Pollution Control Technologies	**Applicant:** A limit on the speed of the vehicular traffic and use of aggregate base course prevents disturbance of particulate matter from the surface of the road.	**Applicant:** Spraying water on the roads has been found to reduce fugitive emissions from unpaved haul roads.	**Applicant:** A durable surface material like asphalt or concrete is laid out on the road, to sustain vehicular traffic.
Feasibility Evaluations	**Applicant:** Feasible. Included in RBLC. **AQB:** From the applicant's calculations it appears the round-trip distance per truck load is 3000 ft. With this distance, the use of base course is recommended.	**Applicant:** Included in RBLC.	**Applicant:** Included in RBLC. Paving is not feasible for industrial roads which are subject to very heavy vehicles and pavement breakage.
Technically feasible?	**Yes**	**Yes**	**No**
Other	**Applicant:** Since the emissions from this source are minor, limiting the speed at the facility to 15 mph provides 57% control, and base course provides a 60% control. These controls provide a cost effective method of controlling emissions[a].	**Applicant:** Infeasible based on very limited availability of water in the proposed location in addition to local meteorlogical conditions.	N/A
Evaluate Energy, Environment, Indirect economic	**Applicant:** 57% reduction - speed limit. 60% reduction - base course. **AQB:** Researched a few other sources of documented information on unpaved roads and dust[b,c].	**AQB:** The AQB concurs that water use would not be the wisest control method in our arid Southwest environment, and that water conservation is another environmental concern that also needs to be considered. Use of base course as proposed by the applicant is the desired method.	**AQB:** Will go with base course and speed reduction.
Economic analysis	N/A is BACT	N/A	N/A
BACT Selection	**Yes**	**No**	**No**

a. WRAP Fugitive Dust Handbook, Fugitive Dust Control Measures Applicable for the WRAP Region (September 7, 2006).

b. US Geological Survey. 1997. Desert Features. http://pubs.usgs.gov/gip/deserts/features/. Maintained by Publications Service Center Last modified 10/29/97.

c. Methodology to Estimate the Transportable Fraction (TF) of Fugitive Dust Emissions. http://www.epa.gov/ttn/chief/emch/dustfractions/transportable_fraction_080305_rev.pdf

All "applicant" statements and BACT analysis was reviewed and verified by AQB and is summarized here. For more details, see the applicant's BACT analysis.