Pacific Connector Gas Pipeline, LP

Resource Report No. 9

Air Quality and Noise

Pacific Connector Gas Pipeline Project

May 2017

Air Quality and Noise Location of Information to Satisfy Minimum Filing Requirements	
	Section
Describe existing air quality in the vicinity of the project.	9.3
Quantify the existing noise levels (day-night sound levels (Leq and Ldn) and other applicable noise parameters) at noise-sensitive areas and at other areas covered by relevant state and local noise ordinances.	Appendix C.9
Quantify existing and proposed emissions of compressor equipment, plus construction emissions, including nitrogen oxides (NOx) and carbon monoxide (CO), and the basis for these calculations. Summarize anticipated air quality impacts for the project.	Tables 9.5-1, 9.5-2, and 9.5-3; 9.6 Tables 9.6-1 and 9.6-2; 9.7 Appendix A.9
Describe the existing compressor units at each station where new, additional, or modified compressor units are proposed, including the manufacturer, model number, and horsepower of the compressor units. For proposed new, additional, or modified compressor units include the horsepower, type, and energy source.	9.2 Appendix B.9
Identify any nearby noise-sensitive area by distance and direction from the proposed compressor unit building/enclosure.	Table 9.8-1 Appendix C.9
Identify any applicable state or local noise regulations.	9.8.1 Appendix C.9
Calculate the noise impact at noise-sensitive areas of the proposed compressor unit modifications or additions, specifying how the impact was calculated, including manufacturer's data and proposed noise control equipment.	9.8.5 Table 9.8-3 and 9.8-4 Appendix C.9

Information Recommended or Often Missing	
Air Quality	**Section**
Include climate information as part of the air quality information provided for the project area.	9.4
Identify potentially applicable federal and state air quality regulations.	9.6
Provide construction emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for pipelines and above-ground facilities.	9.7.1, Appendices E.9, F.9, G.9, H.9
Provide copies of state and federal applications for air permits.	Appendix J.9
Provide operation emissions (criteria pollutants, hazardous air pollutants, greenhouse gases) for pipelines and above-ground facilities.	9.7.2, Appendix A.9
Provide air quality modeling for entire compressor station.	9.7.2
Identify temporary and permanent emissions sources that may have cumulative air quality effects in addition to those resulting from the project.	9.7.3
Noise	Section
Describe the existing noise environment and ambient noise surveys for compressor stations, liquefied natural gas facilities, meter and regulations facilities, and drilling locations.	9.8.1, 9.8.2, Appendix K.9
Identify any state or local noise regulations applicable to construction and operation of the project.	9.8.1.2
Indicate whether construction activities would occur over 24-hour periods.	9.8.1.3
Discuss construction noise impacts and quantify construction noise impacts from drilling, pile driving, dredging, etc.	9.8.2.1, Appendix K.9
Quantify operation noise from above-ground facilities, including blowdowns.	9.8.1.4, 9.8.2.3
Describe the potential for the operation of the proposed facilities to result in an increase in perceptible vibration and how this would be prevented.	9.8.1.6
Identify temporary and permanent noise sources that may have cumulative noise effects in addition to those resulting from the project.	9.8.3

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List of Abbreviations and Acronyms

ABC	Augmented Backside Cooled
ACDP	Air Contaminant Discharge Permit
AQCR	Air Quality Control Region
AERMAP	Terrain Data Processor for AERMOD
AERMET	Meteorological Data Processor for AERMOD
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AERSCREEN	American Meteorological Society/Environmental Protection Agency Regulatory Model - Screening Version
AERSURFACE	Surface Land Use Characteristics Processor for AERMET
AGF	Above-Ground Facility
AP-42	USEPA Compilation of Air Pollutant Emission Factors
AQCR	Air Quality Control Region
ASOS	Automated Surface Observing System
BACT	Best Available Control Technology
BMP	EPA's Best Management Practices
CAA	Clean Air Act
CFR	Code of Federal Regulations
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
dB	Decibel
DP	Direct Pipe
dBA	A-weighted sound level
Dth/d	Dekatherms per Day
EPA	U.S. Environmental Protection Agency
EPCM	Engineering, Procurement, and Construction Management
FERC	Federal Energy Regulatory Commission
°F	Fahrenheit
FHWA	Federal Highway Administration
GHG	Greenhouse Gas
HAP	Hazardous Air Pollutant
HDD	Horizontal Directional Drilling
HP	Horsepower
HR	Hour
ISO	International Standards Organization
ISR	EPA In-Stack Ratio
JCEP	Jordan Cove Energy Project, L.P.
KLMT	Klamath Falls Airport Weather Station
LB	Pounds
LdN	Day-Night Average Sound Level
Leq	Night time Energy Equivalent Sound Level
LLC	Limited Liability Corporation
LNG	Liquefied Natural Gas
LP	Limited Partnership
MAKEMET	Meteorological Processor for AERSCREEN
MMBTU	Million British Thermal Units
MP	Milepost
MPH	Miles per Hour
MTPA	Million Tonnes per Annum
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NESHAP	National Emission Standards for Hazardous Air Pollutants

NGA	Natural Gas Act
N_2O	Nitrous Oxide
NOx	Nitrogen Oxides
NO2	Nitrogen Dioxide
NSA	Noise Sensitive Area
NSR	US EPA New Source Review Permitting
NSPS	New Source Performance Standards
O&M	Operations and Maintenance
OAR	Oregon Administrative Rules
ODEQ	Oregon Department of Environmental Quality
PCGP	Pacific Connector Gas Pipeline
POD	Plan of Development
$PM_{2.5}$	Particulate Matter less than 2.5 micrometers diameter
PM_{10}	Particulate Matter less than 10 micrometers diameter
PPM	Parts Per Million
PSD	Prevention of Significant Deterioration
PSEL	Plant Specific Emission Limit
PTE	Potential to Emit
RICE	Reciprocating Internal Combustion Engine
SER	Significant Emission Rate
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SoLoNOx	Solar Low Nitrogen Oxides
SPL	Sound Pressure Level
SSW	South-Southwest
STC	Sound Transmission Class
TACT	Typically Achievable Control Technology
TPY	Tons per Year
UGB	Urban Growth Boundary
UHC	Unburned Hydrocarbon Emissions
VOC	Volatile Organic Compound
VOL	Volatile Organic Liquid
WRCC	Western Regional Climatic Center

9. AIR QUALITY AND NOISE

9.1 INTRODUCTION

Pacific Connector Gas Pipeline, LP ("PCGP") is seeking authorization from the Federal Energy Regulatory Commission ("FERC" or "Commission") under Section 7 of the Natural Gas Act ("NGA") to construct and operate a new approximately 235-mile-long, 36-inch-diameter natural gas transmission pipeline ("Pipeline"), capable of transporting approximately 1,200,000 dekatherms per day (Dth/d) of natural gas from interconnections with two existing interstate natural gas pipelines; (Ruby Pipeline LLC's Ruby Pipeline and Gas Transmission Northwest LLC's GTN Pipeline) near Malin, Oregon, to the proposed Jordan Cove Liquefied Natural Gas ("LNG") export facility ("LNG Terminal") being developed by Jordan Cove Energy Project, L.P. ("JCEP"). The Pipeline and the LNG Terminal are referred to, collectively, as the "Project."

This resource report addresses existing air quality and noise conditions along the Pipeline's Route in Coos, Douglas, Jackson, and Klamath counties ("Proposed Route") (see Figure 1.1-1 in Resource Report 1, Pipeline Proposed Route), and effects to air quality and noise due to construction and operation of the Pipeline.

The Pipeline will require the construction of a new compressor station, the Klamath Compressor Station, to move gas from proposed interconnects near Malin, Oregon to the LNG Terminal.

Activities that affect air quality in this area fall under the jurisdiction of the Oregon Department of Environmental Quality ("ODEQ") – Western Region. The following sections provide an analysis of the air quality and noise impacts from construction and operation of the Pipeline and Klamath Compressor Station.

9.2 PROJECT DESCRIPTION

The proposed site of the Klamath Compressor Station is located in and adjacent to a small agricultural area, approximately 1.75 miles northeast of Malin, Klamath County, Oregon. The nearest residential dwelling is approximately 1,378 feet from the center of the site. This dwelling is currently occupied. Other residences are 1,900 feet and more than 2,000 feet from the center of the site. The Klamath Compressor Station will be located at MP 228.81 in Section 11, T. 41 S., R 12 E. in Klamath County (see Map 35 in the Mapping Supplement, Appendix G.1). The compressor station will occupy a site of approximately 17 acres. The center of the station is at approximately 42° 02' 01.80"N latitude, 121° 22' 26.00" W longitude, which is at an elevation of approximately 4,168 feet.

The proposed compressor station will consist of four new Solar Titan 130-20502S turbine-driven centrifugal compressor units. Three units are proposed for operation with the fourth solely for reliability to maintain maximum throughput for the Pipeline at times when one of the three operating units are off-line for maintenance. For flexibility in case of operating four turbines simultaneously, permitting will include four units operating at any given time. Maximum site rating of the Titan 130 turbine is 18,035 hp at 4,080 foot elevation and 0ºF. Corrected to a standard sea level elevation, the ISO horsepower of each unit is 20,500 HP. The new compression units will be installed in a new Class 1, Division 2-rated compressor building. Each unit will include an inlet filter/separator, lube oil cooler, inlet air silencer/cleaner and exhaust system. The compressor building will include skid-mounted fuel gas conditioning, measuring, and regulation equipment. Related suction and discharge piping headers will be installed between the pipeline and the compressor units. The turbine-driven compressors will be installed contemporaneously with the pipeline construction.

Other buildings inside the station boundary include a new control room/ancillary equipment building and two unit valve skid buildings. The ancillary equipment building will include an air compressor system, hot water boiler, and back-up generator. Related suction and discharge piping headers will be installed between the pipeline and the compressor units. A high pressure vent system with a silencer will be installed in order to allow the station to be blown down. The site will include tanks for storage of any collected pipeline liquids and compressor oil/water. Near the northeast corner of the station, where the pipeline enters the station boundaries, an above-ground pig launcher and receivers will be installed.

The complete facility will include installation of all building foundations and other equipment foundations; the construction and installation of site and yard improvements; the fabrication and installation of high-pressure gas piping; the installation of electrical equipment and instrumentation; and the installation of all other equipment and other piping to make the new facility operational.

There will be no gas dehydrators or line heaters on the Pipeline or at the compressor station.

9.3 EXISTING AIR QUALITY

The Klamath Compressor Station will be located in Klamath County near the town of Malin in the Central Oregon Air Quality Control Region (AQCR 190). The station would be located in an area designated as attainment or unclassifiable with the National Ambient Air Quality Standards ("NAAQS") for all pollutants. The closest non-attainment or maintenance areas are the Klamath Falls Air Quality Maintenance Area for PM_{10} and the Klamath Falls 24-hour $PM_{2.5}$ (2006 NAAQS) nonattainment area. The Klamath Compressor Station will be located approximately 14 miles to the southeast of the southeast corner of the 24-hour $PM_{2.5}$ (2006 NAAQS) non-attainment area and the PM_{10} maintenance area.

The Pipeline would be located in Coos, Douglas, Jackson, and Klamath counties in Oregon. These counties are in the Central Oregon Air Quality Control Region (Klamath) and the Southwest Oregon Air Quality Control Region (Coos, Douglas and Jackson). The Pipeline would be located in an attainment area for all pollutants except for a very small segment (approximately 325 feet) that would lie in the Klamath Falls PM_{10} maintenance area and approximately 4.34 miles of Proposed Route that would lie in the Klamath Falls $PM_{2.5}$ nonattainment area (see Appendix I.9).

In general, background air quality along the Proposed Route is characterized by very low concentration values for all pollutants well below the NAAQS due to the remote/rural nature of the route. However, in or near urbanized locations (such as such at Klamath Falls) in counties along the Proposed Route, background air pollutant concentrations are higher than rural background. The main pollutant of concern is $PM_{2.5}$, primarily due to the use of wood for residential heating during the winter months (ODEQ 2012). During 2014 and 2015, Klamath Falls experienced elevated $PM_{2.5}$ ambient concentrations (higher than normal) due to wildfires in southern Oregon.

Ambient air monitoring stations are typically sited in urban areas or near other developed areas where the state air quality agency has determined that specific air pollutant emissions are of concern or monitoring is deemed necessary for public heath purposes. Monitoring stations in proximity to the Proposed Route focus primarily on monitoring of PM_{10} and $PM_{2.5}$ due to the specific issues related to particulate matter emissions from wood heating in the region. There are no stations monitoring for SO_2 and NO_2 in the multi-county area of southern/southwestern Oregon and northern California for the data period 2012 to 2016. Monitoring for CO was performed in Medford up through 2010, after which the monitor site was closed. The lack of monitoring stations in current operation for these pollutants indicates that the state monitoring agency expects background concentrations to be very low and not of concern. The nearest monitoring stations for SO_2 and NO_2 (and CO after 2010) are in urbanized areas near Eugene, Oregon, approximately 130 kilometers northeast of the Proposed Route and Portland, more than 200 kilometers to the north. These sites are not representative of the Proposed Route since they reflect values for developed/urbanized areas.

Data from air quality monitoring stations located in Klamath County was used to approximate the PM_{10} and $PM_{2.5}$ background air quality for the Klamath Compressor Station site and eastern section of the Pipeline. Data from Jackson County was used to approximate the PM_{10} and $PM_{2.5}$ background air quality for the middle section of the Pipeline; data from Lane County (Cottage Grove monitoring station) was used to approximate the PM_{10} and $PM_{2.5}$ background air quality for the western section of the Pipeline. Values were obtained from the EPA's AIRSdata website and represent the value corresponding to the statistical characteristic of the NAAQS during the five year period from 2012 through 2016. In 2014 and 2015, wildfire events affected the Klamath Falls area, causing exceedance of the $PM_{2.5}$ NAAQS. The ODEQ issued an exceptional events document in April 2017 requesting that the EPA exclude $PM_{2.5}$ data affected by the wildfire events. The public comment period for this document is open until May 15, 2017 (ODEQ 2017).

Concentration values, along with the relevant NAAQS, are listed in Table 9.3-1.

Table 9.3-1
Local Ambient Concentrations of Pollutants from Stations Closest to the Klamath Compressor Station Site and Pipeline Proposed Route

(Period of Record 2012 to 2016)

Station	Pollutant	Year	Averaging Period	Ambient Concentration	NAAQS	Project Location Closest to Monitoring Site
Jackson County (Medford) ID: 410292129 Owner: ODEQ	PM_{10}	2013	2nd Max. 24-hour	71 $\mu g/m^3$	150 $\mu g/m^3$	Pipeline Mid-section
	Ozone[2]	2013-2015	4th daily Max. 8-hour, 3 year average	0.065 ppm	0.070 ppm	
	$PM_{2.5}$	2013-2015	24-hour 98th percentile, 3 year average	40 $\mu g/m^3$ (see note 3)	35 $\mu g/m^3$	Pipeline Mid-section
		2013-2015	Annual mean, 3 year average	11 $\mu g/m^3$	12 $\mu g/m^3$	
Lane County (Cottage Grove)	$PM_{2.5}$	2013-2015	24-hour 98th percentile, 3 year average	22 $\mu g/m^3$	35$\mu g/m^3$	Pipeline Western Section

Table 9.3-1
Local Ambient Concentrations of Pollutants from Stations Closest to the Klamath Compressor Station Site and Pipeline Proposed Route

(Period of Record 2012 to 2016)

Station	Pollutant	Year	Averaging Period	Ambient Concentration	NAAQS	Project Location Closest to Monitoring Site
ID: 410399002 Owner: ODEQ		2013-2015	Annual mean, 3 year average	7.2 μg/m³	12 μg/m³	
Lane County (Oakridge) ID: 410392013 Owner: ODEQ	PM_{10}	2014	2nd Max. 24-hour	44 μg/m³	150 μg/m³	Pipeline Western Section
Jackson County (Medford) ID: 410292129 Owner: ODEQ	PM_{10}	2013	2nd Max. 24-hour	71 μg/m³	150 μg/m³	Compressor Station and Pipeline Eastern Section[1]
Klamath County (Altamont) ID: 410350004 Owner: ODEQ	$PM_{2.5}$	2012 - 2014	24-hour 98th percentile, 3 year average	33 μg/m³	35 μg/m³	
			Annual mean, 3 year average	10.2 μg/m³	12 μg/m³	

Data Source: USEPA AirsData, Monitor Values, accessed April 2017.
Note:
[1] Compressor Station site is located outside of Klamath $PM_{2.5}$ nonattainment area and PM_{10} maintenance area.
[2] Monitoring site described in AirsData as "not in a city", value likely representative of entire southwestern/southern portion of Oregon including PCGP project corridor.
[3] May include data deemed part of the 'exceptional event" due to wildfires in the region during 2014 and 2015.

Key:
μg/m³ = Micrograms per cubic meter.
PM_{10} = particulate matter less than 10 micrometers aerodynamic diameter.
$PM_{2.5}$ = particulate matter less than 2.5 micrometers aerodynamic diameter.

It is anticipated that pre-construction monitoring for the Klamath Compressor Station will not be required.

9.4 METEOROLOGICAL INFORMATION

The dispersion of emitted pollutants is affected by the local meteorological conditions.

The region surrounding the Klamath Compressor Station receives an annual average of 14.2 inches of precipitation per year, monitored at the Klamath Falls 2 SSW weather station for the period January 1981 through December 2010 and reported to the Western Regional Climatic Center ("WRCC"). Average daily temperature is 50.4°F from the same station and reporting period. The prevailing wind direction is from the west at an average daily speed of 6.3 mph, as recorded at the Klamath Falls Airport Weather Station (KLMT), from November 1997 to December 2008.

The air temperature extreme in Klamath Falls ranges from -10°F to 100°F. For the period 1997 to 2008, an air temperature below 0°F was recorded on average 1.3 days per year (*i.e.*, at least one hourly reading was below 0°F on average 1.3 days per year) (WRCC 2012). Hourly meteorological data for Klamath Falls was obtained from the National Climatic Data Center (NCDC) for the five-year period (2008 to 2012) (NCDC 2013). During the 2008 to 2012 period, ambient air temperature at or below 0°F occurred for 84 hours for an average of approximately 17 hours (0.7 days) per year.

9.5 COMPRESSOR STATION SPECIFICATIONS AND EMISSIONS

Air pollutant emissions from the completed Klamath Compressor Station will be produced from the combustion of natural gas. The majority of emissions will be from the natural gas-fired turbines. In addition to the turbines, a small amount of emissions will be emitted from the proposed emergency generator engine and boiler. All combustion sources will use pipeline quality natural gas exclusively as a fuel. This section discusses potential emissions from the proposed turbines.

9.5.1 Klamath Compressor Station Operating Emissions Estimates

General specifications for each of the turbines are provided by the turbine vendor for typical minimum (0ºF), maximum (100ºF), and normal (60ºF) temperatures and are listed in Table 9.5-1.

Table 9.5-1
Proposed Solar Titan 130-20502S Turbine Specifications

	Engine Inlet Temperature of 0ºF	Engine Inlet Temperature of 60ºF	Engine Inlet Temperature of 100ºF
Site Rating (hp)	18,035	16,624	13,575
Fuel Flow (MMBTU/hr)	134.96	122.18	107.88
Heat Rate (BTU/Hp-hr)	7,483	7,350	7,947
Thermal Efficiency (%)	34.002	34.619	32.018
Exhaust Flow (lbm/hr)	376,491	336,736	292,148
Exhaust Temperature (°F)	901	945	993
Note: the turbine specifications taken from New Equipment Predicted Emission Performance data sheets provided by Solar Turbines Incorporated dated July 12, 2012. All data is based on 100% engine load and a site elevation of 4,080 feet.			

Predicted NOx, CO, and VOC emission rates from one Titan 130 turbine are presented in Table 9.5-2. Each turbine will be equipped with dry Low NOx technology (SoLoNOx) and Augmented Backside Cooled (ABC) liner technology to control NOx and CO emissions. VOC emissions will be controlled through good combustion practices. These control technologies are considered Best Available Control Technology (BACT) for natural gas-fired turbines of this size.

Table 9.5-2
Solar Titan 130 Rate Summary (lb/hr)

Pollutant	Ambient Temperature 0°F	Ambient Temperature 60°F	Ambient Temperature 100°F
NO_x	8.11	7.29	6.30
CO	8.23	7.40	6.40
VOC	4.71	4.24	3.66
Note: Predicted emission performance from a Titan 130 turbine at site-specific conditions provided by Solar Turbines Incorporated. VOC emissions are conservatively assumed the same as unburned hydrocarbon (UHC) emissions.			

Estimated annual potential to emit (PTE) emissions for the turbines calculated using the annual average temperature condition is summarized in Appendix A.9.

As noted in section 9.4, ambient temperatures at or below 0°F occurred on average 17 hours (0.7 days) per year between 2008 and 2012. During the period 1997 to 2008, an air temperature below 0°F was recorded on average 1.3 days per year (*i.e.*, at least one hourly reading was below 0°F on average 1.3 days per year). Operation of the gas turbines at ambient temperatures below 0°F may cause the turbines to operate without benefit of SoLoNOx. PCGP will coordinate with ODEQ to incorporate any ODEQ requirements to address operation at less than 0°F. It is anticipated, however, due to the low number of potential hours of ambient temperatures below 0°F per year, operation of the gas turbines during below 0°F conditions will have minimal impact on annual emissions.

9.5.2 Start-up, Shutdown, and Commissioning Emissions Estimates for Turbines

Due to the mechanical processes involved in turbine start-up and shutdown, NO_x, CO, and VOC emissions concentrations may exceed the values listed in Table 9.5-2 during such times. Start-up and shutdown cycles on the Titan 130 may each last up to 10 minutes. While Solar does not guarantee emission levels during start-up and shutdown, estimated emission rates provided by Solar are summarized in Table 9.5-3.

Table 9.5-3
Solar Titan 130 Start-up and Shutdown Emissions Summary

MODE	NOx – lbs/event	CO – lbs/event	VOC – lbs/event
Startup	1.9	176.9	10.1
Shutdown	2.4	207.6	11.9

Note: Mass emissions estimates calculated by Solar using empirical exhaust characteristics assuming ISO conditions: 59ºF, 60% RH, sea level, no losses. Assumes unit is operating full load prior to shutdown. Assumes natural gas fuel ES 9-98 compliant. VOC emissions are conservatively assumed to be the same as unburned hydrocarbon (UHC) emissions.

Emissions during turbine commissioning may also exceed the values listed in Table 9.5-2. Commissioning generally takes place over a two week period prior to the in-service date and typically includes a week of static testing, where no combustion occurs, and a week of dynamic testing where combustion does occur. During dynamic testing, the turbine will be run at various loads (including loads within the low emissions mode), and undergo numerous start-up and shutdown cycles. As it is impossible to predict the operating conditions during commissioning, reasonable emission estimates cannot be made prior to commissioning.

9.5.3 Electric Motor Driven Compressor Units

A discussion of the feasibility of installing electric-driven compressor units instead of natural gas driven units at the proposed Klamath Compressor Station is provided in section 10.6 of Resource Report 10.

9.5.4 Waste Heat Recovery and Operational Efficiency

[Content to be provided with Certificate Application]

9.6 REGULATORY REVIEW FOR KLAMATH COMPRESSOR STATION

The Klamath Compressor Station will be located in Klamath County, in a location considered to be an attainment area or unclassifiable for all pollutants. This section summarizes the regulatory requirements for greenhouse gases (GHG), Prevention of Significant Deterioration (PSD), New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), Title V Operating Permit, Typically Achievable Control Technology (TACT), and construction notification/permitting requirements.

9.6.1 Greenhouse Gas Mandatory Reporting Rule and Tailoring Rule

The EPA has promulgated rules requiring monitoring, reporting and recordkeeping for greenhouses gases beginning with calendar year 2010. 40 CFR Part 98. A compressor station would have to report its GHG emissions if its aggregate maximum rated heat input from all combustion sources is greater than 30 MMBTU/hr and the station emits more than 25,000 metric tons per year of carbon dioxide equivalent (CO_2e).

The EPA promulgated the Prevention of Significant Deterioration (PSD) and Title V Greenhouse Gas Tailoring Rule (published in the Federal Register on June 3, 2010). However, the Supreme Court issued a decision on June 23, 2014 that GHG may not be treated as an air pollutant for purposes of determining if a source is a major source required to obtain a PSD or Title V Operating Permit. Traditional thresholds based on criteria pollutant emissions continue to apply. Therefore, the compressor station is not subject to PSD because emissions of criteria pollutants are less than major new source review thresholds even though emissions of GHG are above significant emission rates. However, the Klamath Compressor Station is subject to the Title V Operating Permit program since emissions of criteria pollutants are above Title V major source thresholds of 100 tons per year. As a result, since GHG emissions are above the significant emission rate for GHG, GHGs and any operating permit conditions associated with GHG would be included in the Title V Operating Permit.

9.6.2 Federal Prevention of Significant Deterioration (PSD) Applicability

The Klamath Compressor Station does not meet the definition of “Federal Major Source” as defined in OAR 340-200-0020(91), therefore it is a minor source for New Source Review purposes. Potential to emit (PTE) emissions of all criteria pollutants at the station will be less than 250 tons per year. Because all criteria pollutants will be less than 250 tons per year, emissions of GHG cannot be considered in determining applicability of PSD. The estimated PTE is summarized in Table 9.6-1. For additional details regarding emission calculations see Appendices A.9 and B.9.

Within the Federal PSD program, certain air quality areas known as Class I areas are afforded more stringent protection of air quality. Within 100 kilometers of the Proposed Route are six Federal Class 1 areas. Forest Service Class 1 areas include Gerhart Mountain, Mountain Lakes Wilderness Area, Kalmiopsis Wilderness, and Diamond Peak Wilderness. National Park Service Class 1 areas include Crater Lake National Park and the Lava Beds National Monument (California). There are no U.S. Fish and Wildlife Service or Native American Federal Class 1 areas within 100 kilometers of the Proposed Route. A map showing the 100 kilometer boundary of the Class I areas can be found in Appendix I.9.

Table 9.6-1
Klamath Potential Emissions Summary

Pollutant	Proposed New Turbines (tpy)[a]	Boiler (tpy)[b]	Proposed Generator (tpy)[c]	Venting, Blowdown and Condensate Tank	Facility-Wide PTE Emissions (tpy)	Significant Emission Rates (tpy)[d]	PSD Major Source Threshold (tpy)
NO_x	142	1.9	0.3	0	144	40	250
CO	144	3.3	0.6	0	148	100	250
VOC	16.4	0.34	0.2	6.8	23.9	40	250
SO_2	8.8	0.02	0. 0	0	8.9	40	250
$PM_{2.5}$	17.2	0.25	0.01	0	17.4	15	250
PM_{10}	17.2	0.25	0.01	0	17.4	15	250
CO_2	285,748	3,904	69	8.7	289,728	See note [e]	N/A
CH_4	68	0.1	1	402	470		N/A
N_2O	8.0	0.02		0	7.8		N/A
CO_2e	289,720	3,912	88	10,067	303,799	75,000	N/A

[a] Emissions for the proposed turbines are calculated using vendor specifications for NOx, CO and VOC. Emission rates for SO_2, PM_{10}, CO_2, CH_4, N_2O and CO_2e are based on the EPA's AP-42 emission factors. Supporting documentation can be found in Appendices 9A and 9B. Emissions are estimated assuming continuous operation at the annual average ambient temperature of 60^o F.
[b] Emissions for the proposed boiler are based on EPA AP-42 emission factors. Supporting documentation can be found in Appendix A.9. Emissions are estimated assuming continuous operation.
[c] Emissions for the proposed emergency generator engine are based on EPA AP-42 emission factors. Emissions are estimated assuming 100 hours per year operation.
[d] Significant emission rates as defined in OAR 340-200-0020 Table 2 (criteria pollutants) and 40 CFR Parts 51, 52, 70, et al. PSD and Title V Greenhouse Tailoring Rule, Final Rule (Federal Register Vol. 75, No. 106, June 3, 2010).
[e] Significant emission rate is 250 tpy compared to the combined mass emission rate of individual GHGs.

9.6.3 New Source Performance Standards (NSPS) Applicability

NSPS regulations are issued for categories of sources that cause or contribute significantly to air pollution which may reasonably be anticipated to endanger public health or welfare. The standards apply to new stationary sources of emissions, *i.e.*, sources whose construction, reconstruction, or modification began after a standard for those sources was proposed.

NSPS Subpart KKKK (Standards of Performance for Stationary Combustion Turbines) regulates emissions of NO_x and SO_2 from combustion turbines. NSPS Subpart KKKK will apply to the turbines at the Klamath Compressor Station. PCGP will comply with the requirements of Subpart KKKK for both turbines.

NSPS Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines) regulates emissions for various engine sizes. These standards implement Section 111(b) of the Clean Air Act ("CAA"). The proposed Klamath Compressor Station emergency generator engine is subject to this rule. PCGP will comply with the applicable requirements of Subpart JJJJ.

NSPS Subpart Kb applies to each storage vessel with a capacity greater than or equal to 75 cubic meters (19,812 gallons) used to store volatile organic liquids (VOL). The Klamath Compressor Station design has not been finalized; however, PCGP may install storage tanks for condensate and oil/water. If the storage tanks are subject to NSPS Subpart Kb, PCGP will comply with the requirements of NSPS Subpart Kb.

NSPS Subpart OOOO (Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution) regulates VOC and SO_2 emissions for several types of facilities and equipment used in those facilities. Many of the affected facilities and equipment types do not apply to a mainline natural gas transmission facility such as the Klamath Compressor Station. However, since the Klamath Compressor Station would include centrifugal compressors, component fugitives and may include storage vessels, applicability of NSPS Subpart OOOO to these components was analyzed.

Centrifugal Compressors:

40 CFR §60.5365(b) states that an affected centrifugal compressor facility is a single centrifugal compressor using wet seals that is located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment. The Klamath Compressor Station is not a facility located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment, and therefore the centrifugal compressors are not subject to the regulations.

Storage Vessels:

The storage vessel standards are applicable to tanks located in the oil and natural gas production segment, natural gas processing segment or natural gas transmission and storage segment with the potential for VOC emissions equal to or greater than six (6) tpy. The Klamath Compressor Station would be in the natural gas transmission and storage segment. The storage vessels at the Klamath Compressor Station have a potential to emit less than six (6) tpy and therefore are not subject to the regulations.

Leak Standards:

The leak standards under NSPS Subpart OOOO only apply to onshore natural gas processing plants. The Klamath Compressor Station does not meet the definition of an onshore natural gas processing plant provided in 40 CFR §60.5430 and therefore the leak standards do not apply.

9.6.4 National Emission Standards for Hazardous Air Pollutants Applicability

NESHAP Subpart YYYY (National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines) is not applicable to the proposed turbines at the Klamath Compressor Station as estimated PTE emissions of hazardous air pollutants (HAPs) are less than the major source thresholds (*i.e.*, 25 tons per year aggregate HAPs or 10 tons per year individual HAP) (see Table 9.6-2 and Appendix A.9).

NESHAP for Reciprocating Internal Combustion Engines (RICE) amendments were promulgated under 40 CFR Part 63, Subpart ZZZZ by the EPA. The original major source NESHAP for RICE was amended to include those with a site rating of 500 hp or less located at major sources, and new and reconstructed stationary RICE located at area sources. An area source is defined as a minor source.

The new spark ignition internal combustion engine proposed for the Klamath Compressor Station (~450 hp emergency generator engine) is subject to Subpart ZZZZ. The air quality permit issued by ODEQ will incorporate any applicable requirements from Subpart ZZZZ into permit conditions. PCGP will comply with all permit conditions including those for Subpart ZZZZ.

Table 9.6-2
Summary of HAP Potential Emissions

Emission Source	Potential Emissions (tpy)	
	Individual HAP	Total HAPs
Solar Titan 130 (4)	1.8 (formaldehyde)	2.5
Natural gas fired stand-by generator	0.03 (formaldehyde)	0.04
Hot water heater/boiler	0.059 (hexane)	0.061

Key:
HAP = hazardous air pollutant
tpy = tons per year
PTE = potential to emit

9.6.5 Title V Operating Permit Applicability

The Oregon Air Operating Permit program is codified in OAR 340 Division 218. Estimated PTE emissions at the Klamath Compressor Station are above major stationary source thresholds for NOx and CO (100 tons per year each). In addition, since Title V is triggered by criteria pollutants, emissions of CO_2e must then be considered for Title V applicability. Emissions of CO_2e would be above 100,000 tons per year. Estimated PTE for other criteria pollutants and HAPs are less than major source thresholds. Therefore, the facility is subject to the Title V Operating Permit program.

9.6.6 State Required Typically Achievable Control Technology (TACT)

New stationary sources are required to meet TACT as per OAR 340-226-0130. Emissions from the proposed Titan 130 turbines will be controlled through the use of dry low-NO_x (SoLoNOx) technology, ABC liner technology, and good combustion practices. These control technologies meet and/or exceed TACT for natural gas-fired turbines of this size.

9.6.7 Stationary Source Notification Requirements

Stationary Source Notification Requirements are codified in OAR 340 Division 210. The proposed construction of the Klamath Compressor Station will be considered Type 4 Construction as defined under OAR 340-210-0225(4). Under OAR 340-210-0240(1)(d), PCGP must obtain a new Standard Air Contaminant Discharge Permit (ACDP) before proceeding with construction. See section 9.6.8 below for details.

9.6.8 Air Contaminant Discharge Permit Requirements

Requirements and procedures for obtaining a Standard ACDP for the Klamath Compressor Station are codified in OAR 340 Division 216. PCGP submitted an application to ODEQ in May 2015; a draft ACDP permit was subject to and completed the public hearing process in April 2016. The draft permit was based on operation of three Solar T130 gas turbines. PCGP is in process of submitting a modification to the Standard ACDP for operation of the fourth Solar T130 gas turbine. Construction will not commence until the modified Standard ACDP is issued for the facility. PCGP will submit the modification of the Standard ACDP to the ODEQ in August 2017.

9.6.9 General Conformity

Section 176 of the 1990 CAA Amendments required the EPA to promulgate rules to ensure federal actions conform to the appropriate State Implementation Plan (SIP).

These rules, known together as the General Conformity Rule (40 CFR Part 93 Subpart B), require any federal agency responsible for an action in a non-attainment or maintenance area for any criteria pollutant to determine if the action conforms to the applicable SIP or is exempt from the General Conformity Rule requirements. Under the regulations, an agency must determine that federally supported or funded activities will not:

(1) Cause or contribute to any new violation of any standard in any area;

(2) Interfere with provisions in the applicable SIP for maintenance of any standard;

(3) Increase the frequency or severity of any existing violation of any standard in any area; or

(4) Delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

Emissions regulated by any permit issued under minor and major New Source Review (NSR) air permit programs are excluded from a General Conformity applicability analysis.

A conformity determination is required for each pollutant where the total of direct and indirect emissions caused by a federal action (such as a FERC action) would equal or exceed *de-minimis* levels as specified in 40 CFR Part 93.153 with the exceptions specified in 40 CFR Part 93.153(c), (d), or (e) (USEPA 2008a). Conformity evaluations are not required for areas that are in attainment for NAAQS.

Klamath County is designated attainment for ozone, NO_2, CO and SO_2. A portion of Klamath County, generally the area within the urban growth boundary (UGB), is subject to a maintenance plan for PM_{10} and is designated nonattainment for the 24-hour 2006 $PM_{2.5}$ NAAQS. The Klamath Compressor Station site is not located within the nonattainment area or area subject to the PM_{10} maintenance plan. A very small portion of the Pipleine Proposed Route (approximately 325 feet) is within the Klamath Falls PM_{10} maintenance plan area. Emissions from construction in this small segment of the Pipeline Proposed Route will be below the General Conformity *de minimis* threshold value for PM_{10} of 100 tons per year, given that emissions from one construction spread from a much larger pipeline distance is below the *de minimis* threshold of 100 tons per year. Approximately 4.3 miles of the Pipeline Proposed Route is within the Klamath Falls $PM_{2.5}$ non-attainment area as shown in Appendix I.9. Emissions from construction in this segment are estimated to be less than the General Conformity *de minimis* threshold value for $PM_{2.5}$ of 100 tons per year. This estimate is based on a ratio of emissions produced by one construction spread over a much larger pipeline distance. Emissions from the construction spread over the larger distance is below 100 tons per year, therefore emissions from the shorter distance in the Klamath Falls $PM_{2.5}$ nonattainment area would be less than 100 tons per year. Therefore, a General Conformity determination is not required.

9.7 AIR EMISSION AMBIENT IMPACTS

9.7.1 Ambient Air Quality Impacts During Construction

9.7.1.1 Klamath Compressor Station

The construction schedule for the Klamath Compressor Station is in development. Currently, construction at the Klamath Compressor Station is expected to occur during a 12 to 18 month period. During this period, construction activities will create intermittent and short-term emissions generally limited to daytime hours between 7 a.m. and 7 p.m. six days per week. These emissions will include fugitive dust from soil disruption and emissions from combustion-type construction equipment.

Construction equipment will typically include cranes, bulldozers, graders, backhoes, front-end loaders, welding machines, trucks, pickups, and other miscellaneous equipment, each of which will have silencers and emissions control equipment (catalytic converters) commonly used for these types of equipment.

The construction will occur in the following four main phases:

- Site preparation;
- Foundation work;
- Construction/installation of major structures and equipment/pipeline; and
- Right-of-way restoration.

Site preparation includes clearing, grading, excavation of footings and foundations, and backfilling operations. After site preparation is finished, the construction of the foundations and structures will begin. Once the foundations and structures are finished, installation and assembly of the mechanical and electrical equipment will commence.

Fugitive dust emissions from the construction of the compressor station will result from:

- Dust entrained during site preparation and grading/excavation at the construction site;
- Dust entrained during onsite travel on paved and unpaved surfaces;
- Dust entrained during aggregate and soil loading and unloading operations; and
- Wind erosion of areas disturbed during construction activities.

Worst-case daily dust emissions are expected to occur during the first one to two months of construction when site preparation occurs. The following mitigation measures are proposed to control fugitive dust emissions during construction of the Klamath Compressor Station:

- Use either water application or chemical dust suppressant application to control dust emissions from unpaved road travel and unpaved parking areas as required; and
- Mitigate fugitive dust emissions from wind erosion of areas disturbed from construction activities (including storage piles) by application of either water or chemical dust suppressant as required.

In addition, Appendix B to the Plan of Development (POD), included as Appendix F.1 to Resource Report 1 provides PCGP's Air/Noise and Fugitive Dust Control Plan, which describes the EPA's Best Management Practices (BMPs) that will be utilized to control fugitive dust in more detail.

Estimated fugitive dust emissions from construction activities at the Klamath Compressor Station are summarized in Table 9.7-1. For additional details regarding emission calculations see Appendices E.9 and F.9.

Table 9.7-1
Fugitive Dust Emissions from Construction Activities at Klamath Compressor Station

Source	Emissions	
	PM10 (tons)	PM2.5 (tons)
Unpaved Roadway Travel	4.67	0.47
Earthwork (material handling)	2.04	2.04
Total	**6.71**	**2.51**

Combustion emissions during construction will result from:

- Exhaust from the diesel construction equipment used for site preparation, grading, excavation, and construction of onsite structures;
- Exhaust from water trucks used to control construction dust emissions;
- Exhaust from diesel-powered welding machines, electric generators, air compressors, and water pumps;
- Exhaust from pickup trucks and diesel trucks used to transport workers and materials around the construction site;
- Exhaust from diesel trucks used to deliver concrete, fuel, and construction supplies to the construction site; and
- Exhaust from automobiles used by workers to commute to the construction site.

The worst-case daily exhaust emissions are expected to occur during the middle of the construction schedule and during the installation of the major mechanical equipment. Exhaust emissions will be minimized as vehicle/equipment engines are built to meet the standards for mobile sources established by EPA mobile source regulations (40 CFR Part 85. Equipment will be operated on an as-needed basis. Additionally, the construction equipment will be equipped with the normal types of silencers and emissions control equipment (catalytic converters) commonly used for these types of equipment.

Overall, through the use of the control measures listed above, the intermittent air quality impacts during construction are expected to be substantially below Oregon and National ambient limits at the compressor station property boundaries.

Estimated exhaust emissions from construction equipment/activities at the Klamath Compressor Station are summarized in Table 9.7-2. Exhaust emission factors for construction equipment were derived from the EPA Non-road emission factor model. For additional details regarding emission calculations see Appendix G.9.

Table 9.7-2
Exhaust Emissions from Construction Activities at Klamath Compressor Station

Pollutant	Emissions (tons)
NO_x	1.52
CO	1.48
VOC	0.29
SO_2	0.07
PM_{10}	0.21
$PM_{2.5}$	0.20
Aldehydes	0.15

9.7.1.2 Pipeline

Pipeline construction will generate air emissions through short-term construction activities (see Appendix H.9) from the anticipated seven pipeline construction spreads. The spreads will be located roughly equidistant along the Proposed Route and work concurrently. Therefore, emissions from construction will be widely dispersed within the approximate 235-mile Proposed Route.

Construction activities and emission estimates include installing the Pipeline and any above ground facilities such as meter/regulator stations, valve sites or pig launcher/receivers. Construction activities will generally be limited to the hours between dawn and dusk with pollutant emission levels that are variable and intermittent throughout the day. Emissions will result from earthmoving (dust generation) and heavy equipment use. These emissions will be generated from land clearing, ground excavation, cut-and- fill operations and minor modifications to access roads. Dust emissions will vary substantially from day to day depending on the level of activity, the specific operations, and the prevailing weather. Predominantly these emissions will likely result from equipment traffic over existing access roads.

Fugitive dust emissions from construction could result from:

- Dust entrained during site preparation and grading/excavation on the construction right-of-way;
- Dust entrained during onsite travel on paved and unpaved surfaces;
- Dust entrained during aggregate and soil loading and unloading operations; and
- Wind erosion of areas disturbed during construction activities.

Estimated fugitive dust emissions from construction activities along the entire Proposed Route are summarized in Table 9.7-3. Additional details regarding Pipeline construction emission calculations are in Appendices H.9. The construction duration is not finalized, therefore construction emissions shown in the table assume all construction occurs in a single calendar year.

Table 9.7-3
Fugitive Dust Emissions from Pipeline Construction

Source	Emissions[1]	
	PM10 (tons)	**PM2.5 (tons)**
Material Handling	146.3	146.3
Pipeline Road Travel	123.5	12.6
Timber Road Travel	30.9	3.2
Total	**300.7**	**162.1**

[1] Total emissions along entire pipeline construction corridor (approximately 235 miles).

In addition to particulate matter emissions from earth moving, exhaust combustion emissions from construction equipment will occur. Such equipment is either diesel or gasoline fueled, each of which will have normal types of silencers and emissions control equipment (*e.g.,* catalytic converters for gasoline fueled vehicles). Diesel-fueled vehicles and equipment will use diesel fuel compliant with current diesel fuel specifications.

Construction equipment will typically include bulldozers, graders, backhoes, front-end loaders, welding machines, trucks, pickups, and other miscellaneous equipment. Combustion emissions during construction could result from:

- Exhaust from chainsaws used to remove timber and vegetation from the construction right-of-way;
- Exhaust from the diesel construction equipment used for construction activities;
- Exhaust from water trucks used to control construction dust emissions;
- Exhaust from diesel-powered welding machines, electric generators, air compressors, and water pumps;
- Exhaust from pickup trucks and diesel trucks used to transport workers and materials around the construction site;

- Exhaust from diesel trucks used to deliver fuel and construction supplies to the construction site; and
- Exhaust from automobiles used by workers to commute to the construction site.

A summary of exhaust emissions from construction activities along the entire Pipeline corridor is shown in Table 9.7-4. The construction duration is not finalized, therefore construction emissions shown in the table assume all construction occurs in a single calendar year.

Table 9.7-4
Summary of Exhaust Emissions from Pipeline Construction Activities

Pollutant	Emissions (tons)[1]
NO_x	137.6
CO	77.4
VOC	16.9
SO_2	91.7
PM_{10}	16.7
$PM_{2.5}$	16.2

[1] Total emissions along entire pipeline construction corridor.

As detailed in the Air, Noise and Fugitive Dust Control Plan (see Appendix B to the Plan of Development (POD), Appendix F.1), to minimize wind erosion and fugitive dust emissions during construction, PCGP will implement the following BMPs along the construction right-of-way, soil stockpiles and access roads:

- Disturb no more earth than required for construction to occur;
- Water the right-of-way, laydown areas, and temporary roads at least daily in areas of active construction, if necessary, as determined by the Environmental Inspector;
- Control Project-related traffic speeds on dirt access roads and on linear facility rights-of-way;
- Adhere to speeds as determined by the property owner on private lands and by the county or federal land managing agency on public roads;
- Water gravel or dirt access roads in areas of heavy traffic, as determined necessary by the Environmental Inspector to control fugitive dust;
- Ensure that speeds on the construction right-of-way will not exceed fifteen miles per hour (mph) where fugitive dust can be generated;
- Decrease speed limits when excessive winds prevail and where sensitive areas such as public roads may be adjacent to access roads or the right-of-way;
- Maintain speed limit signs for the duration of the construction activities, and they will be placed where access roads intersect the construction right-of-way. Signs will be designed to endure weather conditions and will be posted in a non-obscured, visible manner;
- Water temporarily stockpiled soils to create a semi-hard protective layer to minimize wind erosion, if necessary, as determined by the Environmental Inspector. This treatment would occur once after the trench has been excavated; and
- Ensure that wind erosion BMPs will be in place during forecasted high wind (greater than 25 mph) weather advisories.

Construction will result in intermittent and short-term fugitive emissions. Emissions from construction are not expected to cause or significantly contribute to a violation of any applicable ambient air quality standard because the construction equipment will be operated on an as-needed basis during daylight hours only. Air pollutants from construction equipment internal combustion engines will be limited to the immediate vicinity of the Project and will be short-term. In addition, emissions from each construction spread will only affect the vicinity of active construction at each spread location for a short time period. As each construction spread moves along the Proposed Route, emission sources will move along with the construction spread and will cease at locations where construction is completed.

9.7.2 Operational Ambient Air Quality Impacts

Operational emissions from the Klamath Compressor Station are shown in Table 9.6-1. In addition to emissions from compressor station operation, fugitive emissions from Pipeline operation may occur.

9.7.2.1 Fugitive VOC Emissions from Pipeline Operation

VOC emissions may occur from various locations along the Proposed Route during operation. The VOC emission factors in Table 9.7.5 are based on the methane emission factors for meter & regulator stations at transmission interconnects and for gas transmission via protected steel pipe shown in Table 4-4 (Tier 3) in INGAA 2005. The VOC factors were derived based on a volume ratio (1% VOC to 93.4% methane in natural gas) applied to the methane emission factor shown in Table 4-4 (Tier 3) in INGAA 2005.

The Tier 3 estimation methodology is based on facility count and pipeline mileage. Three meter & regulator stations were used in the estimate (based on meter & regulator stations identified in Resource Report 1) and pipeline length used was 235 miles.

Table 9.7-5
Fugitive VOC Emission Factors and Component Data for Pipeline Operations

Emission Source	Emission Factor (lb/stn-yr)	Emission Factor (lb/mile-yr)	Pipeline Length (miles)	Number of Meter Stations
Pipeline	-	0.16	235	-
Meter and Regulator Station	657	-	-	3

Table 9.7-6
Fugitive VOC Leak and Venting Emissions from Pipeline Operations

Fugitive/Venting Source	VOC (lbs/year)	VOC (tons/year)
Pipeline Leaks	37	0.02
Pipeline Meter/Regulator Stations	1,971	0.99
Total	**2,008**	**1.01**

9.7.2.2 Fugitive Methane and Greenhouse Gas Emissions from Pipeline Operation

The fugitive emission estimate for pipeline operations shown in Table 9.7-7 is based on methodology found in *Greenhouse Gas Emission Estimation Guidelines for Natural Gas Transmission and Storage – Volume I GHG Emission Estimation Methodologies and*

Procedures (Interstate Natural Gas Association (INGAA), Revision 2, September 28, 2005).

Along the Proposed Route, leaks and/or venting could occur at meter & regulator stations and potentially from small leaks at flanges, valves, etc. The Tier 2 INGAA emission estimate methodology was used. This method is based on facility count and pipeline mileage. Three (3) meter & regulator stations were used in the estimate; pipeline length used was 235 miles.

Table 9.7-7
Estimated GHG Fugitive Emissions for Pipeline Operations

Pipeline Transmission Emission Factors (Tier 2 INGAA)				
	lb/stn-yr	lb/stn-yr	lb/mile-yr	lb/mile-yr
Emission Source	M&R CO2	M&R CH4	Pipeline CO2	Pipeline CH4
Emission Factor/unit	146.3	2533	9.11	23.08
Number of Units	3	3	235	235
Emissions per Year				
	M&R CO2	M&R CH4	Pipeline CO2	Pipeline CH4
Emissions (lb/yr)	439	7599	2086	5285
Emissions CO2e (lb/yr)	439	189,975	2086	132,133
Emissions CO2e (tons/yr)	0.22	95	1.04	66.1
Summary Tons per Year				
Fugitive/Venting Source	CO2	CH4	CO2e	Data Source
Pipeline and M&R	1.26	6.44	162	Tier 2 INGAA

Key:

M&R = meter and regulator station
lb/stn-yr = pounds per station year
lb/mile-yr = pounds per mile year
Pipeline CO2 emission factor is sum of CO2 from methane oxidation and CO2 from leaks

A summary of annual operational emissions from Pipeline and compressor station operation combined is shown in Table 9.7-8.

Table 9.7-8
Summary of Annual Operational Emissions

Klamath Compressor Station							
Pollutant	**Gas Turbines (tpy)[a]**	**Boiler (tpy)[b]**	**Proposed Generator (tpy)[c]**	**Venting, Blowdown and Condensate Tank**	**Total Emissions (tpy)**	**Pipeline[d]**	**Meter Stations[d]**
NO_x	142	1.9	0.3	0	144	-	-
CO	144	3.3	0.6	0	148	-	-
VOC	16.4	0.34	0.2	6.8	23.9	0.02	0.99
SO_2	8.8	0.02	0. 0	0	8.9	-	-
$PM_{2.5}$	17.2	0.25	0.01	0	17.4	-	-
PM_{10}	17.2	0.25	0.01	0	17.4	-	-
CO_2	285,748	3,904	69	8.7	289,728	1.04	0.22
CH_4	68	0.1	1	402	470	2.6	3.8
N_2O	8.0	0.02		0	7.8	-	-
CO_2e	289,720	3,912	88	10,067	303,799	67.1	95.2

[a] Emissions for the proposed turbines are calculated using vendor specifications for NOx, CO and VOC. Emission rates for SO_2, PM_{10}, CO_2, CH_4, N_2O and CO_2e are based on the EPA's AP-42 emission factors. Supporting documentation can be found in Appendices A.9 and B.9. Emissions are estimated assuming continuous operation at 60° F.
[b] Emissions for the proposed boiler are based on EPA AP-42 emission factors. Supporting documentation can be found in Appendix A.9. Emissions are estimated assuming continuous operation.
[c] Emissions for the proposed emergency generator engine are based on EPA AP-42 emission factors. Emissions are estimated assuming 100 hours per year operation.
[d] Fugitive emissions estimated using INGAA factors.

9.7.2.3 Ambient Impact Analysis

Emissions of NOx, CO, PM_{10} and $PM_{2.5}$ from the proposed stationary sources at the Klamath Compressor Station are above the Significant Emission Rate (SER) as defined in Table 2 of OAR 340-200-0020 (see table 9.6-1 for SER comparison) and therefore are subject to an ambient impact (modeling) analysis. Emissions of GHG (CO_2e) are not subject to an ambient air quality impact analysis since no ambient air quality standards exist for GHGs.

A preliminary assessment of potential ambient air quality impacts was performed using dispersion modeling for the Klamath Compressor Station to provide the information required by 18 §380.12(k)(3) in the environmental reports to be submitted to FERC.

Two dispersion models were used in the analysis. The AERSCREEN model was first used to evaluate effects on ambient air quality for CO, annual and 1-hour NO_2, 24-hour PM_{10} and annual and 24-hour $PM_{2.5}$. AERSCREEN was used for these pollutants and averaging periods because the output of the model is suitable for these pollutants and averaging period combinations and if maximum modeled concentration (plus background) is less than the NAAQS, compliance with the standard is demonstrated. Due to the statistical basis of the NAAQS for 1-hour NO_2, the output of AERSCREEN is not directly suitable for an evaluation of ambient air quality impacts for this pollutant and averaging period combination. Therefore, the AERMOD model was used in a refined analysis for 1-hour NO_2.

PCGP submitted an ACDP application in May 2015. ODEQ required dispersion modeling for the ACDP application as part of a state-only requirement. Modeling was performed following the previously ODEQ approved modeling protocol. PCGP is discussing with ODEQ modeling updates that may be required as part of the ACDP modification process.

AERSCREEN Model

The AERSCREEN model is a simplified version of the EPA AERMOD model. AERSCREEN produces a "worse case" 1-hour ambient impact concentration based on a set of input data describing the facility. The model does not use actual meteorological data but instead uses a set of meteorological conditions covering a range of dispersion conditions that determine how pollutants disperse from the facility under evaluation. A simple receptor grid is used in the model for calculation of ambient concentrations. Terrain elevation surrounding the facility is also used in the model.

The following common input data for AERSCREEN was used:

- Source type: Point;
- Terrain: Complex (that is, terrain elevation was input for each receptor location);
- Rural/Urban: Rural land use selected since the surrounding area is primarily undeveloped and/or cultivated/vegetated;
- Meteorology: the MAKEMET preprocessor in AERSCREEN was used based on a minimum temperature of 0°F, maximum temperature of 100°F, minimum wind speed of 0.5 m/s, anemometer height of 10 meters, land use type 5 (cultivated land) and climatology type 3 (dry conditions);
- Fumigation: None;
- Receptors: Automatic – minimum 30 meters, maximum 10,000 meters; and
- Flagpole: Zero meters elevation.

The compressor building is the dominant structure on site for stack emission downwash/cavity circulation evaluation. The compressor turbine stacks will be located 27.5 feet (8.4 meters) from the building along the east face (based on preliminary facility layout drawings). Preliminary building dimensions input to AERSCREEN were as follows:

- Height: 43.5 feet (13.3 meters);
- Minimum Dimension: 75 feet (22.9 meters);
- Maximum Dimension: 250 feet (76.2 meters);
- Angle of maximum building dimension from north: 180 degrees; and
- Angle of stack from north: 90 degrees (on east side of building).

For evaluation of NO_2 concentration, the ozone limiting method was used in AERSCREEN using an in-stack NO_2 to NO_X ratio of 0.19 (based on gas industry data for a Titan 130) and background 1-hour ozone concentration of 0.051 ppm (2009-2011 PVMRM 1-hour ozone concentration as derived for the Pipeline from Northwest AirQuest). The EPA In-Stack Ratio (ISR) database was reviewed to determine an appropriate in-stack NO_2/NOx ratio for equipment similar to the gas turbines proposed for the Klamath Compressor Station, however no data was available. Gas industry data for natural gas turbines manufactured by Solar and used in compressor station service was selected instead as they are comparable. A summary of the database entries is provided in Appendix D.9.

Emission rates, exhaust stack parameters (temperature and flow rate) and operating hours were obtained from vendor emission data and representative Solar Titan 130 facilities. PCGP anticipates operating the facility at 8,760 hours per year for up to four turbines. A summary of emission rates and stack parameter data input to AERSCREEN is shown in Table 9.7-9. Since AERSCREEN is limited to modeling a single stack, and since exhaust parameters of all stacks are the same, stack emissions from four turbine stacks were merged into a single stack for modeling purposes. A copy of the AERSCREEN output file, which includes input data to the model as well as its output, is shown in Appendix D.9.

AERSCREEN output is only provided as a 1-hour concentration. Conversion from the 1-hour model result to averaging times consistent with the appropriate NAAQS used the following screening model conversion factors:

- Conversion to the 8-hour value for CO used the conversion factor of 0.9;
- Conversion from the 1-hour value to the annual value for $PM_{2.5}$ and NO_2 used the conversion factor of 0.1; and/or
- Conversion from the 1-hour value to the 24-hour value for PM_{10} used the conversion factor of 0.6.

Modeling results are shown in Table 9.7-10. Background air quality concentration data has been estimated using the Northwest AirQuest design value lookup tool and added to AERSCREEN modeling results (WSU 2017). Screening level maximum impacts are below the applicable NAAQS except for 1-hour NO_2.

Table 9.7-9
Stack Parameters Input for AERSCREEN – Klamath Compressor Station

Compressor Station	Stack Parameters				Emission Rate (g/s)		
	Stack Height (m)	Stack Inside Diameter (m)	Stack Gas Exit Temperature (ºF)	Stack Gas Exit Velocity (m/s)	NO_2	CO	$PM_{10}/PM_{2.5}$
Unit 1 to 4 (each)	21.3	2.7	967	17.6	1.02	1.04	0.12
Merged Stack (for AERSCREEN)	21.3	2.7	967	17.6	4.08	4.12	0.49

Key:
CO = carbon monoxide
g/s = grams per second
°F = degrees Fahrenheit
m = meters
m/s = meters per second
NO_2 = nitrogen dioxide

The form of the 1-hour NO_2, 24-hour PM_{10} and 24-hour $PM_{2.5}$ NAAQS are statistical values not based on maximum modeled values. AERSCREEN does not provide a similar statistical value for pollutant and averaging time concentrations matching the NAAQS, thus the comparison of AERSCREEN maximum results to the NAAQS is overly conservative. As shown in Table 9.7-10, the modeled result for 1-hour NO_2 is greater than the value of the NAAQS, however the AERSCREEN result is not in the same statistical form as the NAAQS. Therefore, the 1-hour NO_2 analysis was repeated using the AERMOD model.

Table 9.7-10
Class II Area AERSCREEN Model Results: Klamath Compressor Station

Pollutant	Averaging Period	Maximum [1] ($\mu g/m^3$)	Background ($\mu g/m^3$)	Maximum plus Background ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	Annual	20	2.1	22.1	100
	1 Hour	204	10.0	214	188
CO	1 Hour	230	993	1,223	40,000
	8 Hour	207	748	955	10,000
PM_{10}	24 Hour	16.5	32	48.5	150
$PM_{2.5}$	Annual	2.8	5.3	8.1	12
	24 Hour	16.5	17	33.5	35

Note:
[1] Values shown are maximum values. NO_2 1-hour NAAQS standard is a statistical 3-year average of the 98th percentile of the daily 1-hour maximum value. CO and PM10 NAAQS are based on second highest value. $PM_{2.5}$ 24-hour NAAQS is based on the 3-year average of the 98th percentile.

Key:
CO = Carbon monoxide.
$\mu g/m^3$ = Micrograms per cubic meter.
NAAQS = National Ambient Air Quality Standards
NO_2 = Nitrogen dioxide.
PM_{10} = particulate matter less than 10 micrometers aerodynamic diameter.
$PM_{2.5}$ = particulate matter less than 2.5 micrometers aerodynamic diameter.

AERMOD Model

AERMOD allows use of more detailed input data compared to AERSCREEN and therefore produces results less conservative than AERSCREEN. AERMOD uses hourly meteorological data from a nearby weather station (Klamath Kingsley Field) over a five year period. It is therefore able to produce a model result for 1-hour NO_2 that is statistically comparable to the NAAQS for 1-hour NO_2. The model results are shown in Table 9.7-11; the maximum modeled result (including background) complies with the 1-hour NO_2 NAAQS.

Much of the input data used in AERSCREEN is also used in AERMOD. The major differences are the use of a five-year meteorological data set of hourly observations of surface weather and “upper air” weather conditions, ability to input data for each emission source rather than merging all sources into a single source, and ability to implement a more refined receptor grid including ability to place receptors along the facility fence line.

AERMOD was run with five years of surface weather data (2008-2012) obtained from Klamath Kingsley Field. Kingsley Filed is approximately 20.5 miles (33 km) northwest of the Klamath Compressor Station. Meteorological data from Kingsley Field included wind speed, wind direction, temperature, and atmospheric stability. One-minute Automated Surface Observing System (ASOS) data from Kingsley Field was supplemented into the dataset. The 1-minute ASOS data was preprocessed using the most current version of the AERMINUTE preprocessor (currently version 15272).

The Upper air data set was obtained from the Medford, OR National Weather Service Station. Medford is approximately 130 km northwest of the Klamath Compressor Station.

The most current version of the AERMET meteorological data pre-processor (currently version 16216) was used to prepare meteorological data for use in AERMOD. Guidance provided in the most recent AERMOD Implementation Guide (EPA, 2009) was followed.

The most current version of the AERSURFACE program (currently version 13016) was used to determine the surface characteristics surrounding the proposed facility. AERSURFACE is a tool developed by the EPA that processes land cover data to determine the surface characteristics for use in AERMET. AERSURFACE uses a 1-km radius surrounding the site to determine surface roughness values for each sector, and a 10x10-km area to determine the mid-day albedo and daytime Bowen Ratio. AERSURFACE was run for month-specific surface characterization.

One-hour NO_2 concentrations were predicted at receptor locations placed along and beyond the fence line of the facility. Receptors were placed at the following intervals:

- Along fence line: 25-m spacing;
- Fence line to 1.5 kilometers beyond fence line: 50-m spacing;
- 1.5 kilometers to 3 kilometers beyond fence line: 250-m spacing;
- 3 kilometers to 10 kilometers beyond fence line: 500-m spacing;
- 10 kilometers to 20 kilometers beyond fence line: 1 kilometer spacing; and
- 20 kilometers to 50 kilometers beyond fence line: 2.5 kilometer spacing.

Receptor elevations and hill heights were determined using AERMAP (the AERMOD's terrain processing program). The terrain surrounding the Klamath compressor station is categorized as complex. Terrain features to the west include Turkey Hill, rising 352 feet (107 m) to an elevation of 4,520 feet (1,378 m) within 1.9 miles (3 km) of the center of the site. Terrain features to the east include Bryant Mountain rising 1,552 feet (473 m) to an elevation of 5,720 feet (1,743 m) within 1.9 miles (3 km) of the center of the site. Bryant Mountain continues rising to an elevation of 6,440 feet (1,963 m) within 4 miles (6.5 km) of the site. The terrain to the north rises 952 feet (290 m) to an elevation of 5,120 feet (1,560 m) within 2.5 miles (4 km) of the site. The terrain to the south is generally flat past a distance of 3.2 miles (5.2 km) from the site.

The current version of AERMAP (version 11103) was used to assign terrain elevations of source, building, and receptor locations (and hill heights for receptor locations) for the analysis. U.S. Geological Survey (USGS) NED GEOTIFF 10 meter resolution data was used for processing in AERMAP. The project datum is North American Datum of 1983 (NAD83) - Universal Transverse Mercator coordinates.

Table 9.7-11
Class II Area AERMOD 1-Hour NO_2 Results: Klamath Compressor Station

Pollutant	Averaging Period	Maximum[1] (μg/m³)	Background (μg/m³)	Maximum plus Background (μg/m³)	NAAQS (μg/m³)
NO_2	1 Hour	101	10.0	111	188

Note:
[1] Value shown is the maximum 3-year average of the 98th percentile of the daily NO_2 1-hour impact, directly comparable to the statistical form of the 1-hour NO_2 NAAQS standard.

Key:
μg/m³ = Micrograms per cubic meter.
NAAQS = National Ambient Air Quality Standards
NO_2 = Nitrogen dioxide.

9.7.3 Cumulative

A review of proposed and reasonably foreseeable stationary air emission sources near the Klamath Compressor Station was conducted. A search for FERC jurisdictional projects in Klamath County was performed using the FERC "Projects Near You" search function available on the FERC website (www.ferc.gov). In addition, natural gas pipeline pre-filing announcements, approved and pending major pipeline project listings for 2017, 2016 and 2015 were reviewed. No projects in Klamath County were found under FERC jurisdiction.

A review of filings with the Oregon Energy Facility Siting Council (OEFSC) was also performed (OEFSC 2017). Although there are two existing facilities in operation in Klamath County (Klamath Cogeneration and Klamath Generation Peakers), there are no new or modified facilities under review by the OEFSC in Klamath County.

The ODEQ air quality program/public notice listing of Title V Operating Permits, Title V Operating Permit renewals, modifications and construction permits was also reviewed (ODEQ 2017a). Although there are existing emission sources with operating permits in Klamath County, no permits for new or modified construction were found in its database. The Klamath Energy Facility in the southwest section of Klamath Falls has applied for renewal of its Title V Operating Permit. No new sources are being added as part of the renewal application; emissions of particulate matter and volatile organic compounds will be lower during the proposed permit term (2017 to 2021) compared to the previous five year period.

9.8 NOISE

Noise is generally defined as sound with intensity greater than the ambient or background sound pressure level (SPL). The SPL is determined by measuring noise emissions in terms of sound pressure in a relationship defined as a decibel (dB). All sound levels are referenced to the A-weighted scale (dBA) to adjust for the sensitivity of different sound frequencies to the human ear. The Day-night Average Sound Level (Ldn) is a statistical measure for relating the time-varying quality of environmental noise to its effect on people. The Ldn is a weighted 24-hour sound level calculated by adding 10 dBA to the nighttime energy-equivalent (Leq) sound levels, which accounts for peoples' greater sensitivity to sound during nighttime hours.

In areas subject to steady noise levels throughout a 24-hour period, the Ldn noise level is about 6.4 dBA higher than the 24-hour Leq because of the nighttime weighting factor. This is applicable to noise emitted by the compressor station because of its continuous operation.

The Leq is the level of steady sound with the same total energy as the time-varying sound energy averaged over a given period. Noise levels are often assessed at noise-sensitive areas (NSAs), which are defined as homes, schools, churches, or any location where people reside or gather. All sound levels are referenced to the A-weighted scale (dBA) to adjust for the sensitivity of different sound frequencies to the human ear.

9.8.1 Compressor Station

This section describes the existing noise levels at the Klamath Compressor Station site, noise regulatory requirements and noise impacts from construction and operation of the compressor station.

9.8.1.1 Existing Noise Levels at the Compressor Station Site

Ecology and Environment, Inc. conducted a noise survey on November 5 and 6, 2012. The purpose of the survey was to characterize the existing noise environment around the proposed Klamath Compressor Station site. The area of interest included the compressor station boundaries and nearest noise sensitive areas (NSAs). Background sound levels obtained in the 2012 survey are appropriate for continued use in this analysis since there have been no changes to surrounding land use and no development that would increase background noise levels since the last survey.

The Klamath Compressor Station site is located in a quiet rural area with approximately 16 residences within a one-mile radius of the site. Noise sources in the area contributing to the background sound levels and captured in the background noise monitoring study are the Gas Transmission Northwest and Ruby Pipeline meter facilities, farm animals and equipment, traffic on local roads, and an occasional aircraft overhead. The nearest NSA is a farm residence located about 1,500 feet southeast of the proposed compressor building location.

Sound levels were measured at the nearest NSAs to the site existing in 2012, identified as follows:

- NSA #1 34545 Malin Loop Road (Subsequent to the 2012 noise survey, PCGP purchased this property);
- NSA #2 33909 Malin Loop Road (Subsequent to the 2012 noise survey, PCGP purchased this property);
- NSA #3 20933 Morelock Road;
- NSA #4 33535 Malin Loop Road;
- NSA #5 33770 Malin Loop Road; and
- NSA #6 34631 Malin Loop Road.

For a detailed description of conditions during the background sound level measurement survey, see Section 4 of Appendix C.9. Figure 9.8-1 (end of report) shows the compressor station and NSA locations.

Figure 9.8-1
Station Location and Nearest NSAs

{Figure to be included in Certificate Application}

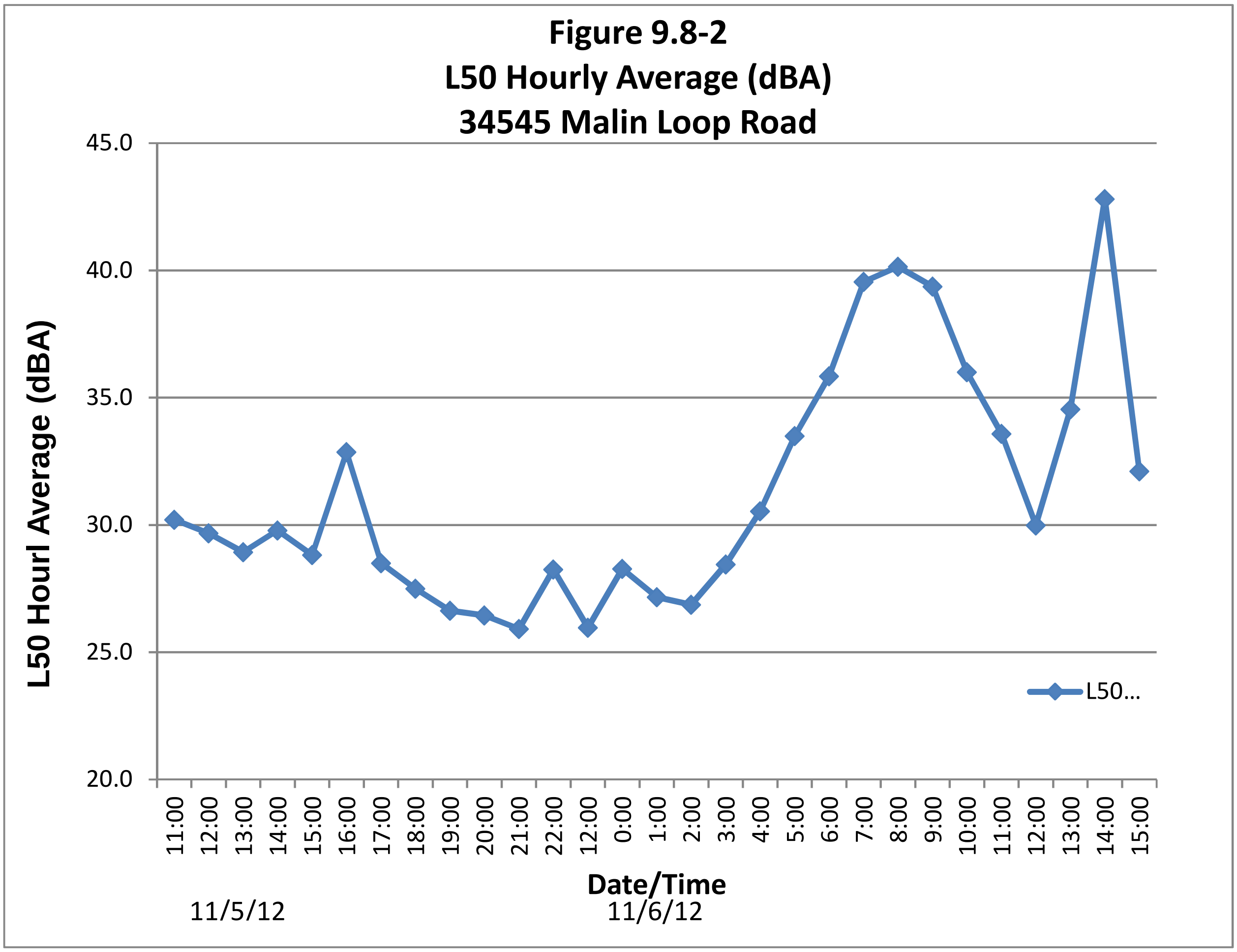
A summary of the existing noise levels is presented in Table 9.8-1.

Table 9.8-1
Existing Noise Level Summary for the Klamath Compressor Station Site

NSA	Distance from NSA (feet)	Direction from NSA	Ld Leq (dBA)	Ln Leq (dBA)	Calculated Ldn (dBA)
#1	Property Purchased				
#2	Property Purchased				
#3	1839	Northwest	35.3	31.5	38.7
#4	2,820	Southwest	31.7	30.2	36.9
#5	2,275	Southwest	53.6	36.0	52.0
#6	1,500	Southeast	40.9	38.8	45.6
#7[a]	1,230	North	38.7	36.5	43.3

[a] Residence to be built existing noise level based on level measured at NSA #1

In addition, continuous sound levels were measured statistically in consecutive 10-minute intervals at the nearest NSA to the proposed compressor station (NSA 1 at 34545 Malin Loop Road - subsequently the nearest NSA property was purchased by PCGP). The hourly average L50 sound levels for this location are presented graphically in Figure 9.8-2. Measurements were collected from 10:20 a.m. on November 15, 2012, and continued 24 hours a day until 4:45 p.m. on November 6, 2013. The lowest hourly average L50 sound level measured at NSA 1 during that period was 26 dBA.



9.8.1.2 Noise Regulations

The operation of a compressor station must comply with Federal noise regulations pertaining to noise impacts for interstate pipeline blanket certifications. Under these regulations, the noise attributable to any new natural gas compressor station, added compression to an existing station, or any modification, upgrade or update of an existing station, must not exceed a Ldn of 55 dBA at any pre-existing NSA (18 CFR 157.206 [b][5]). In areas subject to steady noise levels throughout a 24-hour period, the Ldn noise level is about 6.4 dBA higher than the 24-hour Leq because of the nighttime weighting factor. For a compressor station that is operating continuously, an Leq noise level of 48.6 dBA is equal to the FERC Ldn noise limit of 55 dBA. FERC requirements stipulate that in addition to the Ldn 55 dBA limit, any applicable state or local noise regulations must be identified (FERC 2017).

Portions of the Oregon State noise regulations are contained in OAR 340-035-0035 Noise Control Regulations for Industry and Commerce. A summary of the regulations can be found in the noise study in Appendix C.9. OAR 340-035-0035(1)(b)(B)(i) restricts some new noise sources, relative to the existing ambient noise levels, in certain previously undeveloped areas. The regulation prohibits any increase in ambient statistical noise levels, L10 or L50, by more than 10 dBA in any one hour. OAR 340-035-0035(5) and (6) provide exemptions and exceptions, respectively, to the Noise Control Regulations for Industry and Commerce. Specifically, OAR 340-035-0035(5)(g) exempts construction noise from compliance with noise standards.

At the outset it is important to note that OAR 340-035-0035 only applies to a limited subset of noise sources which are "new industrial or commercial noise source[s]." These are defined as sources that generate "industrial or commercial noise levels." OAR 345-035-0015(23). Those in turn are defined as: *those noises generated by a combination of equipment, facilities, operations, or activities employed in the production, storage, handling, sale, purchase, exchange, or maintenance of a product, commodity, or service and those noise levels generated in the storage or disposal of waste products.* OAR 340-035-0015(24). Even then, as noted above, the rules allow for exceptions to the defined list. In sum, the Oregon state noise regulation does not apply to all sources, rather the regulation only applies to a narrowly defined subset of noise sources.

Notably, the defined list of noise sources does not include distribution or transmission. For the following reasons the Pipeline, compressor station and metering stations are sources which involve distribution and/or transmission and therefore do not fall within the category of defined sources regulated by OAR 340-035-0035 Noise Control Regulations for Industry and Commerce.

First, the Pipeline is a lateral gas transportation facility. As a transportation facility the Pipeline does not fall within the definition of "industrial or commercial noise source." Second, the metering stations are involved in the distribution of natural gas as the gas moves through underground piping and is transferred to the surface through valves and interconnecting piping. Moreover, typically metering stations do not generate appreciable noise during normal operation. As a distribution facility the metering stations are not within the definition of "industrial or commercial noise source." Third, the compressor station will convey or transport a commodity. Since conveyance and transportation do not fall within the definition of an industrial or commercial noise source, the compressor station is not a regulated "industrial or commercial noise source." Because none of the components are within the narrow definition of "industrial or commercial noise source" OAR 345-035-0035 is not applicable.

Additionally, the compressor station would not be engaged in the "production, storage . . . sale, purchase, exchange or maintenance" of natural gas. Of the regulated activities, "handling" could be seen as potentially applicable to pipeline transport of natural gas. "Handling" is not defined by the regulation, but the term implies performing some function involving contact with the commodity. The proposed compressor station would move natural gas within a pressurized, wholly confined lateral structure, with the gas being entirely enclosed as it passes through. The gas would not be "handled" within the common understanding of the term.

Any ambiguity might perhaps be resolved through consultation with the jurisdictional regulatory agency, ODEQ. In fact, the regulation authorizes ODEQ (or the Environmental Quality Commission within ODEQ) to issue exemptions and variances to address particular cases. OAR 340-035-0010 and OAR 340-035-0100. In practice, though, those procedures are no longer available, because the Oregon legislature terminated funding for ODEQ's administration of the state noise regulations in 1991. ODEQ no longer administers or interprets the regulations. *See Oregon DEQ Internal Management Direct re Staff Guidance on Noise Control Issues (July 2003) (available at http://www.deq.state.or.us/aq/noise/).* OAR 340-035-0110 states as follows: *In 1991, the Legislative Assembly withdrew all funding for implementing and administering ORS Chapter 467 and the Department's noise program. Accordingly, the Commission and the Department have suspended administration of the noise program, including but not limited to processing requests for exceptions and variances, reviewing plans, issuing certifications, forming advisory committees, and responding to complaints. Similarly, the public's obligations to submit plans or certifications to the Department are suspended*.

Compliance with the Oregon standard for Noise Control Regulations for Industry and Commerce is not required because the Pipeline, the compressor station, and the metering stations do not constitute a "commercial or industrial noise source" under Oregon regulations.

9.8.1.3 Compressor Station Construction

Construction activities at the compressor station will involve clearing and grading, placement of fill, excavation for foundations for the compressor unit packages, other equipment settings, ancillary equipment, associated unit housing, piping, and structures. The compressor station will be constructed contemporaneously during the latter portion of Pipeline construction and will, based on preliminary construction schedule estimates, require between 12 and 18 months to complete. Table 9.8-2 presents typical noise emission levels at various distances for the noise producing equipment that will be operating during the construction of the station. Construction of the Klamath Compressor Station would cause temporary increases in ambient noise levels in the immediate vicinity of the construction site. PCGP's standard construction operating hours are 7:00 a.m. to 7:00 p.m., Monday through Saturday, but may vary to be in compliance with local ordinances. Even though the Oregon state noise rules are not applicable, OAR 340-035-0035(5)(g) provides an exemption for construction noise from compliance with noise standards.

Table 9.8-2
Typical Construction Equipment Noise Levels at Various Distances

Construction Equipment	Quantity	Usage Factor %	Lmax SPL @ 50 Feet (dBA)	Distance in Feet/SPL[1] (dBA) (L_{eq})				
				50 (adjusted)	250	500	1000	1500
Tractor W/Trailer	2	40	84	83	69	63	57	53
Air Compressor	2	40	78	77	63	57	51	47
Generator	3	50	81	83	69	63	57	53
Ext-Boom RT Hoe	1	40	78	74	60	54	48	44
RT Forklift	1	40	75	71	57	51	45	41

Construction Equipment	Quantity	Usage Factor %	Lmax SPL @ 50 Feet (dBA)	Distance in Feet/SPL[1] (dBA) (L_{eq})				
				50 (adjusted)	250	500	1000	1500
Welding Rigs	10	40	74	80	66	60	54	50
60 ft Manlift	2	20	75	71	57	51	45	41
Ramax Compactor	1	20	83	76	62	56	50	46
Excavator	2	40	81	80	66	60	54	50
Side boom	3	16	85	82	68	62	56	52
Crane	2	16	81	76	62	56	50	47
Haul Truck	5	40	76	79	65	59	53	49
Combined Noise Level				**90**	**76**	**70**	**64**	**60**

Source: FHWA 2006.
[1]SPL = Sound Pressure Level

9.8.1.4 Compressor Station Operation

Long-term impacts on the existing noise environment would occur due to the operation of the Klamath Compressor Station. The Klamath Compressor Station detailed design has not been completed, therefore estimates of compressor station operational noise levels are based on best available information. In addition to the compressors, other equipment may include a backup generator (1,050 kilowatt unit), a small boiler, gas coolers, and cooling fans. During development of the detailed design, best practices applicable to noise reduction will be incorporated. Best design practices routinely incorporated in gas turbine stations are: low noise air intakes; exhaust silencers; blow down silencers; gas cooler fans; and sound insulated buildings, housings, and piping. In rare cases, if necessary for compliance with noise limits, noise barriers may be installed. PCGP will mitigate noise in the final design with insulated buildings and pipe insulation, and select low noise versions of equipment for components such as gas coolers and exhaust systems where necessary.

To evaluate the compressor station potential operational noise impact, noise levels were estimated based on the manufacturers' noise emission data for the anticipated compressors, associated noise producing equipment, and typical noise control applications, and compared to the applicable regulatory limits. Noise regulations, existing and future noise levels, and noise control measures for the Klamath Compressor Station are discussed below. The evaluation discusses predicted noise levels and how they relate to federal (*i.e.* FERC) requirements and Oregon State requirements. The study is documented in the noise study report included in Appendix C.9 of this report.

Table 9.8-3 presents the specifications for proposed compressors for the Klamath Compressor Station:

Table 9.8-3
Project Compressor Specifications

Unit	Proposed ISO Rating (HP)	Manufacturer	Model Number
1	20,500	Solar	Titan 130
2	20,500	Solar	Titan 130
3	20,500	Solar	Titan 130
4	20,500	Solar	Titan 130

Operation of the Klamath Compressor Station may result in long-term increases in noise levels in the vicinity of the compressor station. Noise would generally be produced on a continuous basis primarily by the station's gas turbines, compressors, pumps, and cooling fans.

To identify potential noise impacts resulting from the operation of the Klamath Compressor Station, acoustic modeling was conducted. Modeling results were compared with the FERC limit of Ldn 55 dBA. Acoustic noise modeling of the major Klamath Compressor Station sources was conducted using the CadnaA acoustic model version 3.7.124 developed by Datakustik GmbH.

Primary noise-producing equipment to be included on the equipment at the compressor station, along with corresponding estimated noise emission data and noise control equipment reduction values, were derived from equipment manufacturer's data sheets and measurements of similar equipment at other similar facilities. The model simulates the outdoor three-dimensional propagation of sound from each noise source and accounts for sound wave divergence, atmospheric and ground sound absorption, and sound attenuation due to interceding barriers and topography based on the International Standard ISO9613-2 (ISO 1996). Noise modeling standard conditions of 50 degrees Fahrenheit and 50 percent relative humidity were assumed. Ground absorption was set to 0.5. A database was developed that specified the location and sound power levels of each noise source. A receptor grid was specified that covered the entire area of interest. The model calculated the overall A-weighted sound pressure levels (SPLs) within the receptor grid based on the sound level contribution of each noise source. The model receptors included the five identified NSAs. The modeling included a revised station location to the west of the original proposed location and with the hillside excavated to form a partial noise barrier to the west. The modeling conservatively predicted the noise contribution during the operation of all four compressor units operating under full load conditions.

The insertion loss values used in calculating the estimated future sound levels are presented in Table 9.8-4.

Table 9.8-4
Insertion Loss Values and Building Attenuation

Description	Octave Band Center Frequencies (Hz)/Loss (dB)								
	31.5	63	125	250	500	1000	2000	4000	8000
Inlet Silencer Standard Titan	-3	-7	-13	-23	-40	-54	-57	-59	-48
Inlet Filter Insertion Loss	-2	-4	-8	-9	-13	-26	-27	-27	-33

Exhaust Silencer	-1	-6	-10	-20	-35	-38	-36	-24	-16
Building Attenuation	-17.0	-19.0	-24.0	-34.0	-43.0	-50.0	-55.0	-55.0	-55.0

The modeled Leq noise levels are summarized in Table 9.8-5. The table shows that the estimated Ldn station noise contributions range between 42.5 dBA and 54.7 dBA. All of the noise levels are below the FERC limit of Ldn 55 dBA.

Table 9.8-5
Estimated Klamath Compressor Station Operation Noise Levels at NSAs

NSA	Location (feet, direction)	Existing Ambient Ldn (dBA)	Station Contribution Ldn (dBA)	Combined Ldn (dBA)	Expected Increase
NSA #1	Purchased Property				
NSA #2	Purchased Property				
NSA #3	1,839/Northwest	38.7	51.4	51.6	12.9
NSA #4	2,820/Southwest	36.9	42.5	43.6	6.7
NSA #5	2,275/Southwest	52	44.8	52.8	0.8
NSA #6	1,500/Southeast	48.6	46.1	50.5	1.9
NSA #7	1,230/North	43.3	54.7	55.0	11.7

9.8.1.5 Noise Control Measures

The acoustic design recommendations that will be adopted for the Klamath Compressor Station as identified in the noise study report (Appendix C.9) are summarized below:

- The turbine exhaust duct located between the compressor building wall and the silencer will be acoustically insulated;
- The gas after-coolers will be designed so that the noise levels at a horizontal distance of 50 feet from the center of each cooler will be about 60 dab;
- Outdoor above-ground gas piping will be inserted underground soon after exiting the compressor building;
- The compressor building will be acoustically insulated with a minimum of 6-inches of 8-lbs/cubic feet density mineral wool insulation. The building shell will have 22 gauge, minimum, metal outer sheeting in the walls and roof and a 26 gauge minimum perforated metal liner;
- The compressor building roll-up door will have a minimum noise reduction rating of STC-28 through the door (this may require a double door);
- Personnel doors will be standard insulated doors with an STC-26 noise reduction rating;
- The compressor building ventilation system has not yet been designed. The building ventilation openings will be acoustically designed so that they are compatible with the silencing in the rest of the station; and
- The compressor impeller wheels have not yet been selected and the unit piping noise levels could not be evaluated. It is expected that the unit piping will require acoustic insulation.

9.8.1.6 Vibration

PCGP has not conducted a detailed final design of the compressor station or associated piping. Typically turbines do not create vibration problems but they can create noise that is transferred down the piping. PCGP will mitigate this in the final design using insulated buildings and piping, and select low noise versions of equipment for components such as gas coolers and exhaust systems where necessary. The Klamath Compressor Station will be designed to meet the 55 dBA requirement at all NSAs.

9.8.2 Pipeline

Pipeline construction will be accomplished using multiple construction spreads along the Proposed Route. These spreads will move along the Pipeline right-of-way and not remain in any particular location for a significant length of time. However, drilling or direct pipe installation will be used at several locations and will require operating equipment in the same location for multiple days. Therefore, the Pipeline construction noise analysis focuses on these latter activities.

9.8.2.1 Horizontal Directional Drilling and Direct Pipe Crossings

Horizontal Directional Drilling (HDD) or Direct Pipe (DP) will be used to cross under six waterbodies and a powerline/steep slope location (BPA Powerline Corridor). Table 9.8-6 presents the location and extent of the crossings.

A measurement survey of existing background noise levels was conducted in the vicinity of each crossing site. Leq sound level measurements were collected during daytime and nighttime periods and are presented in Table 9.8-7. The Ldn sound levels were calculated based on the daytime and nighttime measurements.

Table 9.8-6
HDD Locations

Crossing Description	Operation	Milepost	HDD/DP Distance (feet)
North Slough	HDD	2	6400
Haynes Inlet	HDD	1.47 H	2,600
BPA Powerline Corridor	HDD	25	3,530
Coos River	HDD	11	1600
South Umpqua River	DP	71	1700
Rogue River	HDD	122	3000
Klamath River	HDD	199	2500

Table 9.8-7
Measured Noise Levels (dBA)

Crossing	Location	Daytime	Nighttime	24-hour Ldn
North Slough	NSA #1	62.6	45.7	61.1
	NSA #2	64.9	45.7	63.2
Haynes Inlet	TBD	TBD	TBD	TBD
BPA Powerline Corridor	NSA #1	54.1	48.7	56.4
	NSA #2	42.9	44.9	51.1
Coos River	NSA #1	65.3	35.2	63.3
	NSA #2	65.3	37.8	63.3

Table 9.8-7
Measured Noise Levels (dBA)

Crossing	Location	Daytime	Nighttime	24-hour Ldn
	NSA #3	59.8	40.5	58.1
	NSA #4	59.9	36.6	58.0
South Umpqua	NSA #1	53.4	49.8	56.9
	NSA #2	62.9	58.5	65.9
	NSA #3	57.1	51.1	59.1
	NSA #4	62.4	53	62.6
Rogue River	NSA #1	45.7	35	45.5
	NSA #2	45.7	35	45.5
	NSA #3	45.7	35	45.5
	NSA #4	45.7	35	45.5
	NSA #5	54.1	35	52.4
	NSA #6	35.7	35	41.5
	NSA #7	44.8	35	44.9
Klamath River	NSA #1	62.1	45.6	60.6
	NSA #2	56.6	46.6	56.6
	NSA #3	52.7	43.3	52.9

HDD and DP operations could generate relatively high noise levels for long periods compared to conventional pipeline construction, in that these operations may occur 24 hours per day and on a seven-day-per-week basis. A noise analysis report for each crossing is included in Appendix J.9.

Table 9.8-8 lists the drill unit noise levels predicted using acoustic noise modeling with no noise mitigation, with a barrier wall, and with two types of acoustic tents. The tents include a vinyl acoustic tent installed over the entire drilling site. The tent would be approximately 190 feet long by 90 feet wide by 35 feet high and would contain all equipment on the site and an additional special fabric acoustic tent installed over the entire drilling site. The vinyl acoustic tent would have a noise reduction rating of STC-21. The special acoustic tent includes the same type of temporary acoustic tent-like structure as the vinyl acoustic tent except that the noise reduction of the fabric was increased to an STC-30 noise reduction rating. The Federal Ldn limit is based on a 24 hour weighted average noise where 10 dBA is added to the nighttime noise levels. If no work is done at night, then the Ldn noise level is less. The Federal Ldn limit is 55 dBA.

Table 9.8-8
HDD Crossing Day-Night Ldn Drilling Noise Level Summary

Crossing	Mitigation Measure	Estimated Ldn (dBA)			
		NSA #1	NSA #2	NSA #3	NSA #4
North Slough	No Mitigation	61.9	63.8	n/a	n/a
Haynes Inlet	TBD	TBD	TBD	n/a	n/a
BPA Powerline Corridor	No Mitigation	36.5	48.4	n/a	n/a
Coos River	No Mitigation	61.1	59.6	71.5	72.7
	20' High Barrier Wall	38.5	36.8	50.9	53.1
	Vinyl Acoustic Tent	50.3	51.5	60.0	62.2
	Special Acoustic Tent	45.1	46.4	54.2	56.4

Table 9.8-8
HDD Crossing Day-Night Ldn Drilling Noise Level Summary

Crossing	Mitigation Measure	Estimated Ldn (dBA)			
		NSA #1	NSA #2	NSA #3	NSA #4
South Umpqua River	No Mitigation	35.3	64.2	59.5	49.5
	20' High Barrier Wall	32.2	56.8	51.4	42.5
	Vinyl Acoustic Tent	38.2	53.8	49.6	42.3
	Special Acoustic Tent	32.5	51.0	47.3	38.3
Rogue River East Entry	No Mitigation	77.2	67.6	72	78.5
	20' High Barrier Wall	60.4	53.2	53.3	60
	Vinyl Acoustic Tent	60.6	52.1	56.0	61.8
	Special Acoustic Tent	51.2	42.6	46.5	52.4
		NSA #5	**NSA #6**	**NSA #7**	
Rogue River West Entry	No Mitigation	62.6	70.8	63.5	
	20' High Barrier Wall	48.3	54.9	45.1	
	Vinyl Acoustic Tent	47.9	54.9	48.7	
		NSA #1	**NSA #2**	**NSA #3**	
Klamath River East Entry	No Mitigation	79.0	68.3	69.5	
	20' High Barrier Wall	62.7	52.5	50.7	
	Vinyl Acoustic Tent	62.4	52.8	53.8	
	Special Acoustic Tent	53.0	43.2	44.2	
Klamath River West Entry	No Mitigation	57.0	57.0	58.4	
	20' High Barrier Wall	51.2	51.2	52.6	
	Vinyl Acoustic Tent	43.4	43.3	44.5	

Key:
n/a = NSA not applicable to this location.

Table 9.8-9 presents a comparison of the measured existing noise, the predicted drill unit noise, and the total noise at each of the nearest NSAs for each river crossing during daytime and nighttime. The total noise is the drilling noise combined with the measured background noise level.

As indicated in the table, the noise levels from the drilling unit will comply with the Federal regulation Ldn noise limit of 55 dBA in most cases, when appropriate mitigation measures are installed. In some cases, the total level exceeds Ldn 55 dBA, however in these situations the background level also exceeds Ldn 55 dBA. PCGP will select the appropriate noise mitigation during set up of the HDD.

Table 9.8-9
Drilling Noise Impact Comparison (Ldn)

Crossing	NSA	Existing Noise	Drilling Noise	Total Noise	Noise Increase
North Slough	NSA #1	61.1	54.3	61.9	0.8
	NSA #2	63.2	55.0	63.8	0.6
Haynes Inlet	TBD	TBD	TBD	TBD	TBD
BPA Powerline Corridor	NSA #1	56.4	36.5	56.4	0.0
	NSA #2	51.1	48.4	52.9	1.8
Coos River Daytime Comparison 20' Barrier Wall	NSA #1	65.3	38.5	65.3	0.0
	NSA #2	65.3	36.8	65.3	0.0

Table 9.8-9
Drilling Noise Impact Comparison (Ldn)

Crossing	NSA	Existing Noise	Drilling Noise	Total Noise	Noise Increase
	NSA #3	59.8	50.9	60.3	0.5
	NSA #4	59.9	53.1	60.7	0.8
Coos River Nighttime Comparison 20' Barrier Wall	NSA #1	35.2	38.5	40.2	5.0
	NSA #2	37.8	36.8	40.3	2.5
	NSA #3	40.5	50.9	51.3	10.8
	NSA #4	36.6	53.1	53.2	16.6
S. Umpqua Daytime comparison Special Acoustic Tent	NSA #1	53.4	32.5	53.4	0.0
	NSA #2	62.9	51	63.2	0.3
	NSA #3	57.1	47.3	57.5	0.4
	NSA #4	62.4	38.3	62.4	0.0
S. Umpqua Nighttime comparison Special Acoustic Tent	NSA #1	49.8	32.5	49.9	0.1
	NSA #2	58.5	51	59.2	0.7
	NSA #3	51.1	47.3	52.6	1.5
	NSA #4	53	38.3	53.1	0.1
Rogue River Daytime Comparison East Entry Special Acoustic Tent	NSA #1	45.7	51.2	52.3	6.6
	NSA #2	45.7	42.6	47.4	1.7
	NSA #3	45.7	46.5	49.1	3.4
	NSA #4	45.7	52.4	53.2	7.5
Rogue River Nighttime Comparison East Entry Special Acoustic Tent	NSA #1	35	51.2	51.3	16.3
	NSA #2	35	42.6	43.3	8.3
	NSA #3	35	46.5	46.8	11.8
	NSA #4	35	52.4	52.5	17.5
Rogue River Daytime Comparison West Entry 20' Barrier Wall	NSA #5	54.1	48.3	55.1	1.0
	NSA #6	35.7	54.9	55.0	19.3
	NSA #7	44.8	45.1	48.0	3.2
Rogue River Nighttime Comparison West Entry 20' Barrier Wall	NSA #5	35	48.3	48.5	13.5
	NSA #6	35	54.9	54.9	19.9
	NSA #7	35	45.1	45.5	10.5
Klamath River Daytime Comparison East Entry Special Acoustic Tent	NSA #1	62.1	53	62.6	0.5
	NSA #2	56.6	43.2	56.8	0.2
	NSA #3	52.7	44.2	53.3	0.6
Klamath River Nighttime Comparison East Entry Special Acoustic Tent	NSA #1	45.6	53	53.7	8.1
	NSA #2	46.6	43.2	48.2	1.6
	NSA #3	43.3	44.2	46.8	3.5
Klamath River Daytime Comparison West Entry Vinyl Acoustic Tent	NSA #1	62.1	43.4	62.2	0.1
	NSA #2	56.6	43.3	56.8	0.2
	NSA #3	52.7	44.5	53.3	0.6
Klamath River Nighttime Comparison West Entry Vinyl Acoustic Tent	NSA #1	45.6	43.4	47.6	2.0
	NSA #2	46.6	43.3	48.3	1.7
	NSA #3	43.3	44.5	47.0	3.7

9.8.2.2 Blasting

A discussion regarding blasting for the Pipeline is contained in Resource Report 6 and the Blasting Plan is attached to the POD, Appendix C, which is included as Appendix F.1.

9.8.2.3 Blowdown Event

A blowdown event at individual block valves is a rare and infrequent event. Block valve blowdowns, if scheduled for maintenance activities during the life of the Pipeline will be communicated to the surrounding landowners in writing (*e.g*, letters and "door-hangers") in advance of the event. These events are conducted during daylight hours only. Such transient events are very short duration and do not represent continuous or routine noise or disturbance to any NSA's. Table 9.8-10 presents the residences located within ¼ mile of a block valve location and the corresponding distance from the block valve to the residence.

Table 9.8-10
Blowdown Valve Locations

Location	County	Distance (feet)
02 - AGF 15.69 (BVA #2)	Coos	727
05 - AGF 59.58 (BVA #5)	Douglas	1114
06 - AGF 71.46 (BVA #6)	Douglas	1096
08 - AGF 94.66 (BVA #8)	Douglas	205
10 - AGF 122.18 (BVA #10)	Jackson	896
15 - AGF 197.77 (BVA #15)	Klamath	1092
16 - AGF 214.28 (BVA #16)	Klamath	604
17 - AGF 228.13 (Klamath Compressor Station, BVA #17)	Klamath	743

9.8.2.4 Noise Control Measures

The following mitigation measures will be implemented during construction of the Pipeline including the Klamath Compressor Station:

- Perform construction during daytime hours when there is less sensitivity to sound;
- Ensure that all equipment has sound control devices no less effective than those provided by the manufacturer. No equipment will have unmuffled exhausts; and
- To the extent feasible, the construction site will be configured in a manner that keeps noisier equipment and activities as far as possible from noise sensitive locations.

If necessary, for greater noise reduction, moveable paneled noise shields, barriers, or enclosures adjacent to or around noisy equipment will be installed where required to meet applicable Project noise limits. Temporary barriers can result in a noise reduction of up to 10 dBA at the receptor.

9.8.3 Cumulative Effects

The Ruby pipeline and Gas Transmission Northwest pipeline meter and regulator station is located adjacent to the Klamath Compressor station. The meter and regulator station does not contain continuous significant noise-producing equipment such as gas turbines and gas compressors. Background sound level measurements performed at the site of the Klamath Compressor Station captured the contribution of existing noise from the meter and regulator noise stations. Noise levels predicted using noise modeling for the Klamath Compressor Station equipment, when added to the background sound levels, demonstrated compliance with FERC noise standards. Therefore, a cumulative effect is not expected.

9.8.4 Conclusions

The final silencing and acoustic design of the compressor station equipment will provide a well-balanced design without individual noise sources being excessively loud or over the FERC noise limit. The compressor building ventilation system, the compressor impellers, and the unit piping will be selected and the noise levels evaluated during the detailed design phase prior to construction of the compressor station. The noise sources will be acoustically designed so as not to significantly increase the station noise levels.

As explained in Section 9.8.1.2 the Pipeline, compressor station, and metering stations do not fall within the Oregon regulated noise sources. As such, the Oregon noise regulations do not apply to any of the aforementioned components. However, the PCGP will comply with the rule in all locations except one, that being the Klamath Compressor Station. The compressor station is proposed in a rural area with 14 residences scattered within one mile of the station site. Due to the area’s low ambient sound levels, the lowest one hour of a 24 hour measurement period was 25.9 dBA for the nearest NSA. The compressor station would likely not achieve the Oregon regulations’ limit of a Ldn of 36 dBA even with acoustic mitigation measures installed. Note that the Leq level was used to determine the L50 plus 10. The L50 is in most cases very close to the Leq noise level. However, as previously described, OAR 340-035-0035 is not applicable to the compressor station because it is not a regulated noise source and ODEQ has suspended administration of the noise program since 1991.

9.9 REFERENCES

Ecology and Environment, Inc., Klamath Compressor Station Noise Study – Pacific Connector Gas Pipeline, prepared for Pacific Connector Gas Pipeline, LP, December 2012.

Federal Energy Regulatory Commission (FERC). 2017. Resource Report 9 – Air and Noise Quality, section 4.9.2.2, Commission Staff Guidance, February 2017.

Federal Highway Administration (FHWA). 2006. FHWA Highway Construction Noise Handbook. U.S. Department of Transportation. August 2006.

INGAA (2005), Greenhouse Gas Emission Estimation Guidelines for Natural Gas Transmission and Storage – Volume I GHG Emission Estimation Methodologies and Procedures (Interstate Natural Gas Association (INGAA), Revision 2, September 28, 2005).

Maki Corporation, Compressor Station Noise Study Pacific Connector Gas Pipeline, LP, Butte Falls, September 2006.

Maki Corporation, Klamath River Pipeline Crossing Drilling Unit Noise Study, Revision 1, June 2007.

National Climatic Data Center (NCDC). 2013. http://www.ncdc.noaa.gov/data-access/land-based-station-data. Accessed May 2013.

Oregon Department of Environmental Quality (ODEQ). 2017. Public notice: DEQ Requests comments on Klamath Falls Exceptional Event EPA Concurrence Request for 2014 and 2015. Available at: http://www.oregon.gov/deq/get-involved/documents/051517ExcepEventKFalls.pdf. Accessed May 2017.

Oregon Department of Environmental Quality (ODEQ). 2017a. "Public Notices". Available at: http://www.oregon.gov/deq/Get-Involved/Pages/Public-Notices.aspx. Accessed May 2017.

Oregon Department of Environmental Quality (ODEQ). 2012. Klamath Falls Fine Particulate Matter ($PM_{2.5}$) Attainment Plan. ODEQ Air Quality Division, Portland OR. December 2012.

Oregon Energy Facilities Siting Council (OEFSC). 2017. "Facilities under EFSC". Available at: http://www.oregon.gov/energy/facilities-safety/facilities/Pages/Facilities-Under-EFSC.aspx. Accessed May 2017.

Solar Turbines Incorporated, Noise Prediction Guidelines for Industrial Gas Turbines, 2005.

US EPA, July 1998, AP 42, Fifth Edition, Volume I Chapter 1: External Combustion Sources, Section 1.4 Natural Gas Combustion. Available online at http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf.

US EPA, April 2000, AP 42, Fifth Edition, Volume I Chapter 3: Stationary Internal Combustion Sources, Section 3.1 Stationary Gas Turbines. Available online at http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s01.pdf.

US EPA, July 2000, AP 42, Fifth Edition, Volume I Chapter 3: Stationary Internal Combustion Sources, Section 3.2 Natural Gas-fired Reciprocating Engines. Available online at http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s02.pdf.

Washington State University (WSU). 2017. Criteria Pollutant Design Values. Lookup 2009-2011 design values of criteria pollutants. Northwest International Air Quality Environmental Science and Technology Consortium. Available at: http://lar.wsu.edu/nw-airquest/lookup.html. Accessed May 2017.

Western Region Climate Center (WRCC). 2012. http://www.wrcc.dri.edu/summary/climsmor.html. Accessed May 2013.

Witherspoon, Leslie, Solar Turbines Product Information Letter (PIL) 167 Rev. 4, SoLoNOx Products Emissions in non-SoLoNOx Modes, June 6, 2012.

Witherspoon, Leslie, Solar Turbines Product Information Letter (PIL) 168 Rev. 3, Volatile Organic Compound, Sulfur Dioxide, and Formaldehyde Emission Estimates, February 15, 2008.

Witherspoon, Leslie, Solar Turbines Product Information Letter (PIL) 171 Rev. 3, Particulate Matter Emissions Estimates, June 1, 2012.