4.12 AIR QUALITY AND NOISE

4.12.1 Introduction

This section describes potential impacts to air quality and noise resources associated with the construction and operation of the proposed Project, to include connected actions, and discusses mitigation measures that would avoid or minimize the potential impacts. The information, data, methods, and/or analyses used in this discussion are based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS as well as the 2013 Draft Supplemental EIS and, in many instances, replicates that information with relatively minor changes and updates; other information is entirely new or substantially altered.

Specifically, the following information, data, methods, and/or analysis have been substantially updated from the 2011 document:

- A new section (see Section 4.12.2, Impact Assessment Methodology) was added to explain the assessment methodology used to evaluate potential air quality and noise impacts associated with the proposed Project.
- Revised air emission calculations (criteria pollutants and hazardous air pollutants [HAPs]) were performed for 10 construction spreads;[1] the revised emissions reflect changes in Nebraska due to changes in the proposed Project route and account for the increased number of construction camps[2] and emergency backup generators within the proposed pipeline corridor.
- An air conformity analysis was not done for this Final Supplemental EIS because the proposed Project would be located entirely within an attainment area and, as a result, this type of analysis is not applicable.
- Additional pump station noise data input such as number of pumps per station, pump size (horsepower [hp]), sound power levels of each pump, and closest receptor to each pump station were used to supplement previous information to allow for a more detailed and accurate assessment of noise impacts.

[1] A construction spread is a sequence of activities associated with the construction of a pipeline. For the proposed Project, the pipeline would be constructed in 10 spreads (or sequences) of approximately 45 to122 miles long (see Table 2.1-13 and Figure 2.1.7-2). Standard pipeline construction is composed of specific activities, including surveys and staking of the right-of-way (ROW), clearing and grading, pipe stringing, bending, trenching, welding, lowering in, backfilling, hydrostatic testing, and cleanup.
[2] A construction camp is a temporary work camp that would be constructed to meet the housing needs of the construction workforce in remote locations (see Figure 2.1.5-1). For the proposed Project, a total of eight temporary construction camps would be established (four camps in Montana, three camps in South Dakota, and one camp in Nebraska).

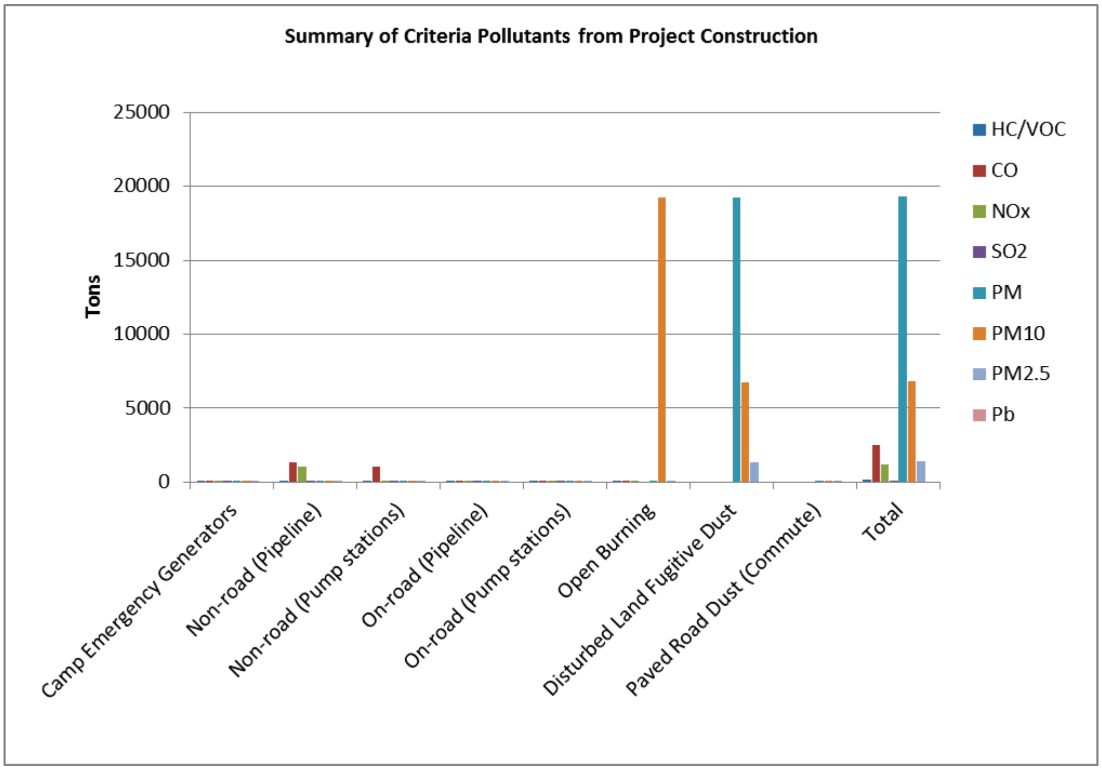
The following information, data, methods, and/or analysis have been substantially updated from the 2013 Draft Supplemental EIS:

- Pump station noise impact on nearest residences, National Historic Trails (NHTs) (actual routes), National Scenic Rivers, Wild and Scenic Rivers (WSRs), and National Recreational Rivers (NRR) has been re-evaluated using new octave band sound power level data as well as revised distances to these noise sensitive areas. Predicted noise levels are compared to applicable criteria, including noise limits established by individual states that are specific to the proposed Project.
- Blasting noise impacts at 100-foot intervals during proposed Project construction have been calculated.
- In response to National Park Service (NPS) comments, the percent highly annoyed (%HA) metric has been included as an additional noise criterion for evaluating noise induced human health effects associated with the proposed Project operational noise.
- In response to public and agency comments, text has been revised throughout the section where necessary.

Summary

Potential air quality impacts associated with construction of the proposed Project and connected actions could include emissions of criteria pollutants and HAPs. These emissions would result from the generation of fugitive dust; the use of fossil fuel construction equipment, such as construction camp generators, large earth-moving equipment, skip loaders, trucks, non-road engines, and other mobile sources; open burning of slash materials, including hay/grass and tree tops/stumps; and employing temporary fuel transfer systems and associated storage tanks. In total, construction of the proposed Project is estimated to result in emissions of 130 tons of hydrocarbons/volatile organic compounds (HC/VOCs), 2,531 tons of carbon monoxide (CO), 1,214 tons of nitrogen oxides (NO_x), 50.2 tons of sulfur dioxide (SO_2), 19,281 tons of particulate matter (PM) (including 6,781 tons of PM with a diameter of 10 microns or less [PM_{10}] and 1,398 tons of PM with a diameter of 2.5 microns or less [$PM_{2.5}$]), and 6.88 tons of total HAPs (Figure 4.12.1-1). The proposed Project construction emissions would occur over approximately 2 years.

Construction emissions typically would be localized, intermittent, and temporary since proposed pipeline construction would move through an area relatively quickly. These emissions would be unlikely to produce long-term effects on local or regional air quality, and mitigation measures would be employed and enforced by an environmental inspector assigned to each construction spread. These construction mitigation measures are described in the proposed Project Construction, Mitigation, and Reclamation Plan (CMRP) (see Appendix G).



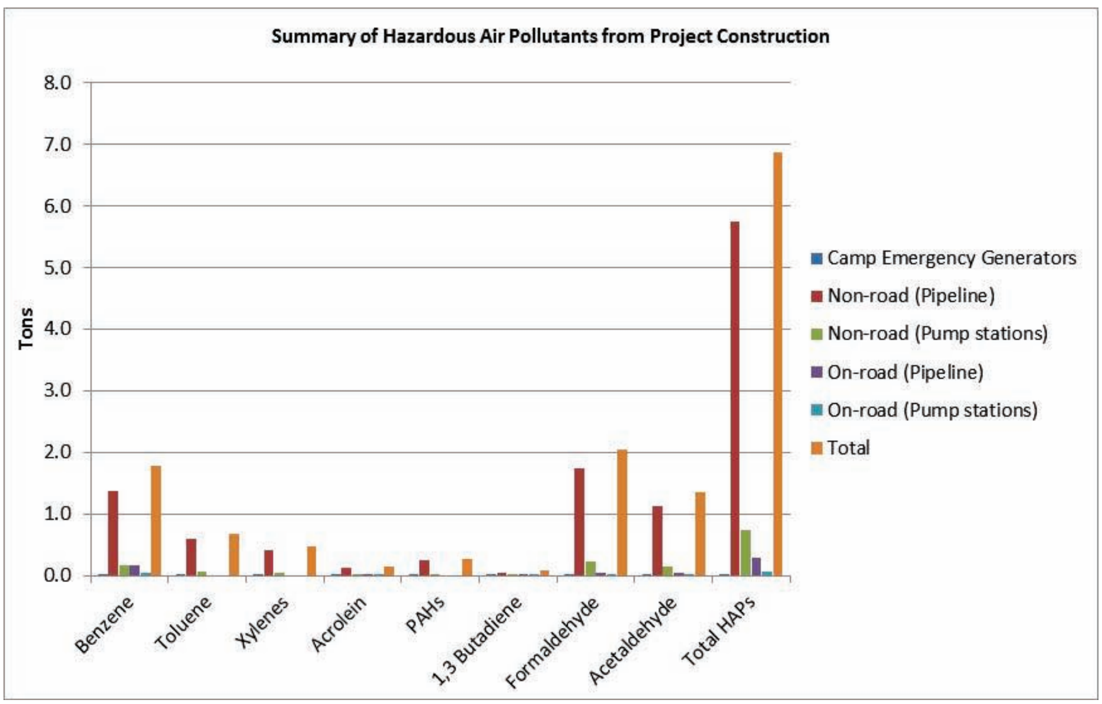


Figure 4.12.1-1 Summary of Criteria Pollutants and Hazardous Air Pollutants from Proposed Project Construction

During proposed Project operation, it is estimated that approximately 0.5, 0.61, 0.57, 0.001, and 0.05 tons per year (tpy) of VOCs, CO, NOx, SO2, and PM/PM10/PM2.5, respectively, would result from the backup emergency generators at the pump stations and mainline valves (MLVs) as well as intermittent releases (VOCs only) from MLVs along the proposed pipeline route, valves, pumps, flanges, and connectors at the pump stations. Lead (Pb) emissions from proposed Project operations would be negligible (0.0000055 tpy). Total HAP emissions from proposed Project operations are estimated to be 0.0024 tpy, with formaldehyde being the maximum individual HAP (0.00072 tpy). Emissions associated with an accidental release of crude from the proposed pipeline are qualitatively assessed in Section 3.13, Potential Releases. Proposed pipeline pumps would be electrically powered. MLVs would have backup emergency generators, which would only be used during times of power interruption; therefore, emissions from these sources would be negligible. The use of mobile sources during proposed Project operations, such as maintenance vehicles and aircraft for aerial inspections, would be infrequent and, therefore, negligible.

In addition to air quality impacts, noise impacts within the proposed Project area were also evaluated. Construction of the proposed Project would increase noise levels in the vicinity of proposed Project activities. Construction noise levels fluctuate depending on the number and type of equipment in use at any given time and vary by distance from the source. Construction-related noise impacts typically would be localized, intermittent, and short term since construction spreads move relatively quickly. There are 36 residences from 25 feet to 500 feet of the proposed construction right-of-way (ROW) and approximately 46 residences within 1 mile of the proposed Project pump stations, but the overall impact would be temporary and is not expected to be significant. The proposed Project would not affect any national parks or national forests. The proposed Project would cross five NHTs; however, NHTs are not part of the National Park System and are not under the management of the NPS. The trail crossings in the vicinity of the Project are not identifiable as crossings of a defined *trail* that could be walked. Most of the NHTs crossed by the proposed Project are either 1) actual trails on or near a river or in actively cultivated agricultural fields on private land; or 2) driving trails along two- to four-lane arterial or rural roads. The driving trails are not considered noise sensitive areas because these areas are currently (and would continue to be) exposed to vehicular traffic noise. Therefore, for the purpose of this noise analysis, only the actual trails were considered to be noise sensitive areas.

As indicated above, any construction noise impacts would be localized, short term, and intermittent. Conventional noise control measures described in Section 2.12 of the CMRP (see Appendix G) will be employed. Proposed pipeline construction would occur near portions of the Lewis and Clark National Historic Trail (LECL) in Montana, specifically along the Yellowstone River, Montana Route 200, the Missouri and Milk Rivers, and United States (U.S.) Route 2 near Fort Peck Lake. Trail users within the affected areas (i.e., areas where the proposed pipeline crosses the trail) would experience temporary inconvenience from noise associated with construction activities. The locations of ancillary facilities (e.g., access roads, pump stations, and construction camps) in Nebraska have not yet been determined. To the degree that such facilities are within sight of portions of the California, Oregon, Mormon Pioneer, and Pony Express NHTs, the proposed Project's construction noise impacts on these NHTs would be similar to those described for LECL.

Aside from the NHTs, pipeline construction would also occur approximately 9 miles east of the closest designated point on the Niobrara National Scenic River, 20 miles south of the closest designated point on the Niobrara WSR/NRR, and 19 miles south of the closest designated point on the Verdigre Creek WSR/NRR. Due to these long distances (i.e., 9 to 20 miles on a direct line), noise from pipeline construction would not change current baseline noise levels at the Niobrara National Scenic River and WSR/NRR as well as Verdigre Creek WSR/NRR.

Noise associated with construction blasting was also evaluated (if blasting would be necessary; the need for blasting and actual blast sites is currently unknown). Maximum sound pressure levels (Lmax)[3] from construction blasting were estimated to range from 88 decibels on the A-weighted scale (dBA) at 100 feet to 68 dBA at 1,000 feet. These Lmax values correspond to average equivalent continuous sound pressure levels (Leq)[4] of 68 and 48 dBA at 100 and 1,000 feet, respectively. Construction blast noise levels at 1,800 feet away are not expected to have significant effects on nearby receptors (e.g., residential and institutional land uses). To avoid noise impacts associated with construction blasting such as acoustic trauma[5] (if blasting becomes necessary), blast site locations should be at least 1,800 feet away from any sensitive receptor or structure. With modern blasting techniques, the blasting would be experienced by the nearest receptors as a faint warning whistle or siren, followed by a very brief, muted clap of thunder. Public acceptance is generally improved by scheduling blasting at the same time every day to further reduce the startle factor. Day-night sound levels (Ldn)[6] levels associated with horizontal directional drill (HDD) activities are expected to be below the USDOT's recommended 30-day average Ldn criterion of 75 dBA at nearest residential areas. Proposed pipeline construction noise levels would comply with any applicable municipal regulations. In areas near residences and businesses where construction activities or noise levels may be considered disruptive, pipeline work schedules would be coordinated to minimize disruption.

Noise impacts from operation of the proposed pipeline would be limited to the electrically driven pump stations, with pumps and motors being the most dominant noise sources. Without any noise control measures at the pump stations, the 11 residences located within 0.5 miles and the 46 residences within one mile of an uncontrolled[7] pump station could experience noise levels that would be above the proposed Project-specific noise limits or criteria for the affected states (i.e., Ldn of 60 dBA in Montana, L10[8] of 55 dBA in South Dakota, and Ldn of 55 dBA in Nebraska; Kansas and North Dakota have no noise criteria for the proposed Project) and/or the U.S. Environmental Protection Agency (USEPA) noise criterion of 55 dBA Ldn. These noise levels would also exceed a 10 dBA increase above baseline levels (i.e., doubling in loudness). In addition, noise from the uncontrolled pump stations could also result in the percent of people highly annoyed in a community to exceed the recommended 6.5 percent increase (Figure 4.12.1-2). The closest residence to a pump station is approximately 0.25 miles away (located in Nebraska), although there are non-residential structures (e.g., bridges, barns, silos, etc.) within 0.25 miles (see Section 3.12.3.1, Environmental Setting). Therefore, the addition of

[3] Lmax is the absolute maximum noise level in a noise sample.
[4] Leq represents the equivalent, or average noise energy, during a measurement period. For example, the Leq(24) noise descriptor refers to the Leq noise level calculated over a 24-hour period.
[5] Acoustic trauma is hearing damage caused by a short burst of an extremely loud noise.
[6] Ldn is the 24-hour equivalent noise levels (Leq[24]) with 10 dBA added to nighttime sound levels between the hours of 10 p.m. and 7 a.m. to account for people's greater sensitivity to sound during nighttime hours. Daytime hours are between 7 a.m. and 10 p.m. while nighttime hours are between 10 p.m. and 7 a.m.
[7] An uncontrolled pump station is a pump station without any engineering noise control such as acoustic blankets, motor enclosures, barriers, etc.
[8] L10 is the sound level exceeded for 10 percent of the measurement period. As an example, an L10 of 50 dBA means noise levels may not exceed 50 dBA more than 6 minutes in an hour (assuming the measurement period is 1 hour).

20 pump stations along the 875-mile proposed pipeline route could increase regional baseline noise conditions for receptors (e.g., residences, businesses, etc.) within a mile of the pump stations above recommended criteria if no noise controls were used.

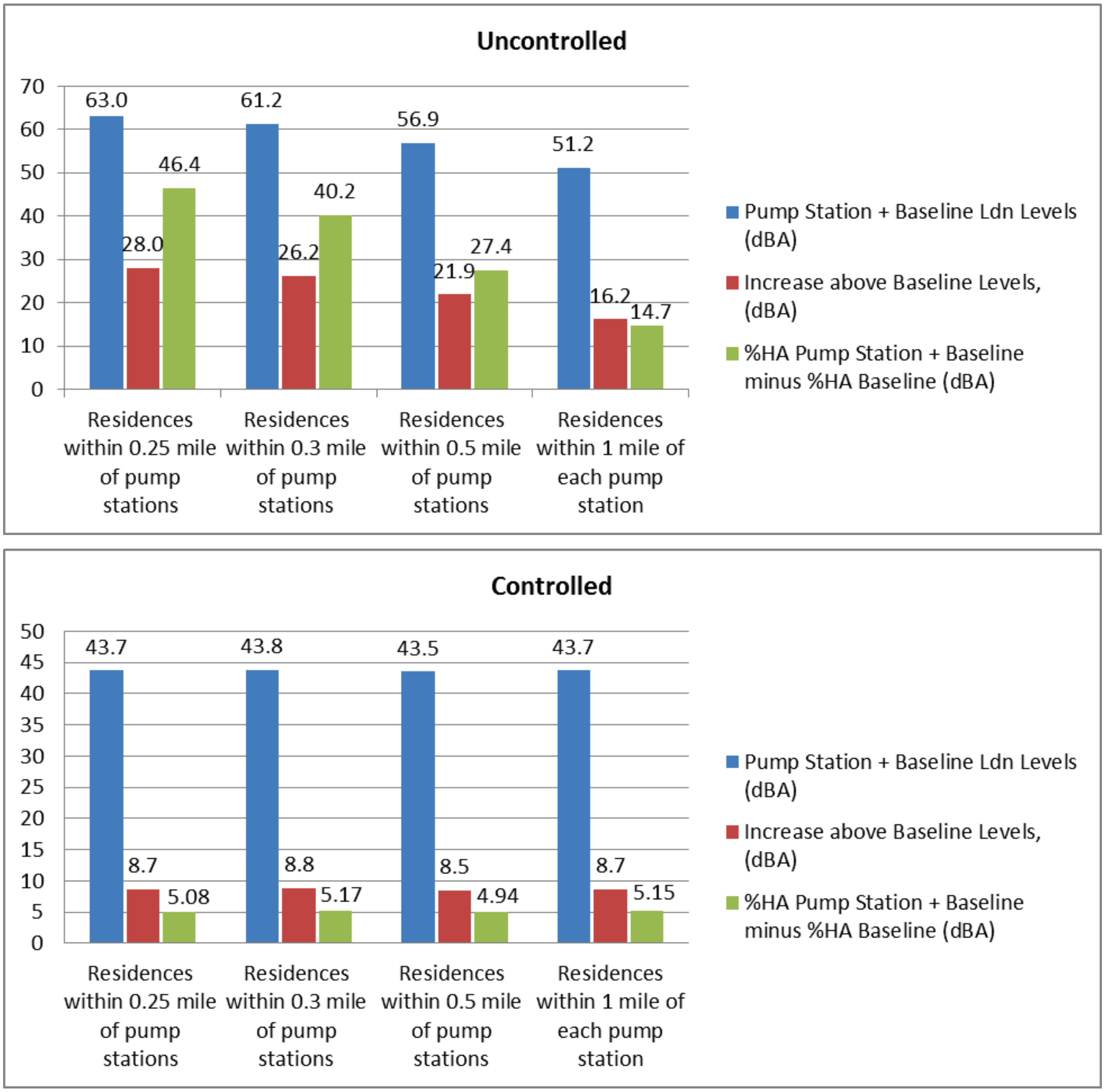


Figure 4.12.1-2 Predicted Noise Levels at Closest Noise Receptors from Uncontrolled and Controlled Pump Stations

To avoid community annoyance and activity interference that could occur due to noise from uncontrolled pump stations near residences and businesses, TransCanada Keystone, LP (Keystone) would implement a three-step noise control plan in a progressive order: 1) install pipe lagging[9] for all pipe suction pipes and discharge pipes; 2) install acoustic blankets for all pumps; and 3) upgrade enclosure for all motors, which would provide 3 decibels noise attenuation for each motor compared with a standard motor enclosure. Each step produces an incremental reduction in the overall noise emission level. If the three-step noise control plan would be insufficient to bring the stations into compliance, then Keystone would install sound barriers, which could take the form of free-standing walls or earth berms. The location and dimensions of the proposed sound barriers/earth berm would vary with site specification (i.e., relative elevation and distance between the proposed pump stations and nearest receptors). The barrier wall panel would have sufficient transmission loss such that sound passing through it does not contribute to the noise level at the receptor. Noise modeling results indicate that noise reductions of approximately 14 to 20 dBA could be required for Pump Station 13, 21, 25, and 27 to ensure they comply with the proposed Project's recommended noise criteria for nearest receptors. These noise criteria include the noise criteria for the affected states (Montana, South Dakota, and Nebraska) as described above, the USEPA Ldn criteria of 55 dBA and the 10 dBA increase above baseline limit, as well as, the 6.5 percent increase in %HA limit.[10] A noise reduction of 8 dBA could be required for any pump station located approximately 1 mile away from receptors (see Figure 4.12-2). These noise reductions can be achieved by applying Keystone's three-step noise control plan and installing sound barrier as necessary. Therefore, the controlled[11] pump stations would have a minimal impact on nearby residences and businesses.

Based on aerial photography, the closest pump stations to actual trail routes on LECL, Mormon Pioneer NHT (MOPI), California NHT (CALI), Pony Express NHT (POEX), and Oregon NHT (OREG) are Pump Station 11 (McCone County, Montana), Pump Station 13 (Prairie County, Montana), Pump Station 24 (Nance County, Nebraska), and Pump Station 26 (Jefferson County, Nebraska). Pump Station 11 is approximately 9 miles south of the LECL segment on the Missouri River; Pump Station 13 is approximately 5 miles southeast of the LECL segment on the Yellowstone River; Pump Station 24 is approximately 2 miles southeast of the CALI segment (following the Loup River), 3 miles south of the MOPI segment (following the Loup River), and 9 miles northwest of the CALI segment along the Platte River; and Pump Station 26 is approximately 2 miles southwest of the CALI, POEX, and OREG NHTs. Due to these long distances (i.e., 2 to 9 miles on a direct line), pump station sound contributions at the NHTs are expected to be below the recommended USEPA Ldn criterion of 55 dBA (i.e., 35.3 to 46.3 dBA), and below the recommended 6.5 percent increase in %HA limit (i.e., 0.1 to 7.7 percent increase in %HA). Except for the CALI NHT actual route along the Platte River located approximately 2 miles from Pump Station 24, sound contributions at all other identified NHTs are expected to be below the recommended 10 dBA increase above baseline limit (0.3 to 7.9 dBA increase above baseline levels). The CALI NHT actual route could experience an

[9] Pipe lagging is the acoustic treatment of walls of a pipe to reduce the noise it radiates due to excitation caused by disturbed flow through valves or dampers.

[10] The calculated noise reductions at the four affected pump stations were based on an estimated baseline Ldn of 35 dBA (baseline Ldn levels were estimated from population density; actual sound level measurements were not taken). If actual baseline Ldn levels were higher than 35 dBA, the noise reductions required at the four pump stations would be lower. For example, if actual baseline Ldn levels were 45 dBA, the noise reductions required at the four affected pump stations is expected to range from 2 to 10 dBA. Conversely, if actual baseline levels were lower than 35 dBA (though unlikely as such lower levels are typical of very quiet and pristine or wilderness areas), the noise reductions required at the four affected pump stations would be higher.

[11] A controlled pump station is a pump station with engineering noise controls such as acoustic blankets, motor enclosures, barriers, etc.

increase of approximately 11 dBA above baseline levels due to its proximity to Pump Station 24 (2 miles away) and because there are no other dominant noise sources in the area (e.g., existing pump stations). As discussed above, the implementation of Keystone's three-step noise control plan in a progressive order and installation of sound barriers as necessary at nearest pumps stations (including Pump Station 24) would reduce noise to acceptable levels (i.e., below the 10 dBA increase above baseline levels). Therefore, the pump station noise would have minimal impact on potential trail users in the vicinity.

In addition to the NHTs, the impact of pump station noise on the Niobrara National Scenic River, the Niobrara WSR/NRR, and Verdigre Creek WSR/NRR were also evaluated. Based on aerial photography, the closest pump stations to these National Scenic Rivers and WSRs/NRRs are Pump Station 21 (Tripp County, South Dakota), Pump Station 22 (Holt County, Nebraska), and Pump Station 23 (Antelope County, Nebraska). Pump Station 21 is approximately 19 miles north of the closest designated point on the Niobrara National Scenic River (upstream of pipeline crossing); Pump Station 22 is approximately 24 miles southwest of the closest designated point on the Niobrara WSR/NRR (downstream of the pipeline crossing); and Pump Station 23 is approximately 31 miles south of the closest designated point on Verdigre Creek WSR/NRR. Due to these long distances (i.e., approximately 19 to 31 miles on a direct line), pump station sound contribution at the National Scenic River and WSRs/NRRs would be expected to be below the recommended USEPA Ldn criterion of 55 dBA (i.e., 35.3 to 35.7 dBA), below the recommended 10 dBA increase above baseline limit (i.e., 0.3 to 0.7 dBA increase above baseline levels), and below the recommended 6.5 percent increase in %HA limit (i.e., 0.12 to 0.32 percent increase in %HA) and, as such, would have no impact on users of the Niobrara National Scenic River, the Niobrara WSR/NRR, and Verdigre Creek WSR/NRR. Keystone would conduct noise assessment surveys during proposed Project operations at locations where nearby receptors (e.g., residences, businesses, park visitors, etc.) express concerns about pump station noise, would implement the three-step noise control plan described above, and would install sound barriers as necessary to minimize the noise to acceptable levels.

Connected actions include the Bakken Marketlink Project, the Big Bend to Witten 230-kilovolt (kV) Transmission Line, and electrical distribution lines and substations. The extent of air and noise emissions is unknown at this time, but the impact of these connected actions to air quality and the noise environment is not expected to be significant. Air quality permitting and compliance efforts would be handled separately by appropriate regulatory agencies. Applicable federal, state, and local regulations would be followed to achieve compliance with air quality and noise requirements.

4.12.2 Impact Assessment Methodology

4.12.2.1 Air Quality

Air quality impacts associated with construction of the proposed Project would include fugitive dust and emissions from fossil-fuel-fired construction equipment, open burning of slash material as described below (if required and subject to local regulation), and temporary fuel transfer systems and associated storage tanks. During proposed Project operations, air quality impacts would mainly be minimal emission of criteria pollutants and HAPs from the backup emergency generators at the pump stations and MLV sites. Fugitive VOCs and methane emissions would also be generated from intermittent MLVs along the proposed pipeline route as well as from valves, pumps, flanges, and connectors at the pump stations.

The ambient air impact assessment presents emissions of criteria pollutants and HAPs from sources within the boundary of the proposed Project and as a result of the proposed Project's construction and operation activities. Proposed Project-related greenhouse gas emissions are discussed in Section 4.14, Greenhouse Gases and Climate Change. Air emissions generated onsite (direct emissions) were calculated from activity data as well as emission factors associated with proposed Project construction and operations. Some of the activity data used in the calculations include: area disturbed; tons of slash material burned (hay/grass, tree tops/ shrub); fuel use; equipment hp; hours of operation; vehicle miles traveled; and number of valves, pumps, flanges, and connectors. Some inputs were estimated based on best available information where necessary data were unavailable. The proposed Project activity data used in the calculations were taken from sources including the Final EIS, the Supplemental Environmental Report for the Nebraska Reroute (exp Energy Services Inc. [exp Energy] 2012a), and the Environmental Report (exp Energy 2012b). Commissioning of the proposed pipeline pumps and other infrastructures were accounted for in the operations phase.

Estimation of fugitive dust, VOCs, and methane emissions as well as open burning and combustion emissions (e.g., construction camp generators, heavy construction equipment and vehicles) during proposed Project construction and operations involved the use of best available emission estimation techniques and factors for each activity/source, including:

- Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (USEPA 2010a);
- Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling for Compression Ignition (USEPA 2010b) and Spark-Ignition Engines (USEPA 2010c);
- USEPA's AP-42 Compilation of Air Pollutant Emission Factors, Chapter 13.2.1, Paved Roads (USEPA 2011) and 13.2.3, Heavy Construction Operations (USEPA 1995a);
- USEPA's Preparation of Fine Particulate Emissions Inventories, Student Manual, Air Pollution Training Institute Course 419B (USEPA 2004);
- Air pollutant emissions associated with forest, grassland, and agricultural burning in Texas (Fraser et al. 2002); and
- USEPA's Protocol for Equipment Leak Emission Estimates (USEPA 1995b).

Estimated air emissions from proposed Project construction and operation (i.e., criteria pollutants and HAPs) were compared to federal and state regulatory requirements (see Section 3.12.2.2, Regulatory Requirements) to determine applicability and impacts.

This analysis does not include emissions associated with the extraction of heavy crude in the Western Canadian Sedimentary Basin, the transport of crude via pipeline in Canada (and associated pump stations and other aboveground facilities in Canada), or the processing and refining of crude transported by the proposed Project. Information and analysis related to these activities are discussed in Section 4.15.3.12, Air Quality and Noise

This analysis also does not include detailed data regarding emissions associated with onsite fueling of construction vehicles and use of maintenance vehicles and aircraft for land-based and aerial inspection of the proposed pipeline route, as these are expected to be minor. Backup emergency generators at the pump stations and MLV stations would only operate during upset conditions when commercial power is interrupted and during normal routine maintenance (approximately 500 hours per year for both upset conditions and normal routine maintenance). Annual emissions from the backup emergency generators are provided in Table 3.12-5. The use of maintenance vehicles and aircraft during proposed Project operations would be infrequent.[12]

4.12.2.2 Noise

Noise impacts associated with the proposed Project construction include noise from operation of heavy construction equipment, blasting if necessary, and HDD activities. During proposed Project operations, noise impacts would include noise from operation of the pump stations (pumps and motors). Routine maintenance and inspections as well as infrequent use of backup emergency generators at the MLV stations and pump stations would also contribute to noise during the proposed Project; however, such noise would be infrequent. Noise impact on wildlife is discussed in Section 4.6, Wildlife.

The noise impact assessment for the proposed Project evaluates impacts at the closest potential receptors to the proposed pipeline corridor and pump stations (e.g., homes, mobile homes, cabins). Noise impact on other receptors such as five NHTs, Niobrara National Scenic River, Niobrara WSR/NRR, and Verdigre Creek WSR/NRR were also assessed.

Proposed Project construction noise levels were calculated from typical sound pressure level data at a reference distance (50 feet) from construction equipment, including equipment used during HDD activities. Construction equipment sound pressure levels that would be experienced at the nearest receptors were estimated using hemispherical attenuation calculations, which assume a typical 6-decibel reduction per doubling of distance from noise sources. This is a conservative approach because the noise prediction does not account for other attenuation terms such as atmospheric absorption, ground effects, barrier/screening effects, or vegetation/foliage.

Proposed Project pump station noise levels during operation were calculated using the International Organization for Standardization (ISO) 9613 part 1 (ISO 1993) and part 2 (ISO 1996) noise prediction method (hereafter called the ISO 9613-1/2 acoustic model). The ISO 9613-1/2 acoustic model was used to determine the extent of noise effects from the proposed Project pump stations. This sound-propagation model consists of octave-band algorithms with nominal mid-band frequencies for computing the attenuation of sound originating from a point sound source or an assembly of point sources. The source(s) may be mobile or stationary. The model predicts equivalent continuous A-weighted sound pressure levels from sources of known sound emissions and accounts for attenuation due to distance (geometric divergence/ hemispherical spreading loss) and atmospheric absorption. Temperature and relative humidity of 50˚F (10 degrees Celsius [˚C]) and 70 percent, respectively, were used in estimating the attenuation due to atmospheric absorption. The model assumes meteorological conditions favorable to sound propagation (i.e., downwind propagation with wind speeds between 1 and 5 meters per second when measured 3 to 11 meters above the ground). This is a conservative approach because not all receptors may be located downwind of the sources (i.e., receptors located upwind would experience less noise since noise propagates farther

[12] Aerial inspection of the pipeline would be done at least 26 times per year, and MLVs would be inspected at least twice per year (see Section 2.1.11.1, Normal Operations and Routine Maintenance).

downwind than upwind). A further conservative assumption is that the modeling analysis did not include ground absorption for porous type ground (e.g., grassland, farmland, etc.) or any potential shielding effects from barriers, berms, or vegetation.

Estimated noise levels from proposed Project construction and operation plus baseline noise levels were compared to applicable regulatory guidelines (see Section 3.12.3.2, Regulatory Requirements) to determine impacts.

4.12.3 Potential Impacts

4.12.3.1 Air Quality

Criteria pollutant and HAP emissions that would arise from the construction and operation of the proposed Project are quantified and summarized below.

Construction Impacts

Air quality impacts (criteria pollutants and HAPs) associated with construction of the proposed Project would include fugitive dust and emissions from fossil-fuel-fired construction equipment, open burning, and temporary fuel transfer systems and associated storage tanks.

<u>*Fugitive Dust*</u>

Fugitive dust is a source of breathable airborne PM, including PM_{10} and $PM_{2.5}$. Fugitive dust results from land clearing, grading, excavation, concrete work, blasting and dynamiting as necessary, and vehicle traffic (including construction camp traffic) on paved and unpaved roads. The amount of dust generated is related to the type and duration of construction activities, silt, and moisture content of the soil, wind speed, frequency of precipitation, vehicle traffic, vehicle types, and roadway characteristics. Fugitive dust generation would be greater in fine-textured soils during drier summer and autumn months.

State and local agencies also regulate emissions of particulate matter arising from fugitive dust. Typically, the regulations require measures to prevent particulates from becoming airborne, such as application of dust suppressants. Specific requirements could also include development and approval of a fugitive dust control plan. The proposed Project would disturb over 15,000 acres of land during the construction phase. The majority of potential fugitive dust generation in a given construction spread would occur within a 30-day construction period prior to final grading, seeding, and mulching of the ROW. Fugitive dust impacts during construction would therefore be temporary and localized.

Keystone would ensure that contractors employ water trucks, sprinklers, or calcium chloride solution as necessary in order to reduce dust to acceptable levels, particularly in areas where work approaches dwellings, farm buildings, other areas occupied by people, as well as when the proposed pipeline parallels an existing road or highway. The speed of all contractor vehicles would be controlled in these areas. Use of calcium chloride solution would be limited to roads and as permitted by local regulations. Contractors would place curtains of suitable material, as necessary, to prevent wind-blown particles as a result of sand blasting operations from reaching any residence or public building. Additional dust control measures may be required by state or local ordinances.

Fossil-Fueled Construction Equipment

Construction camp generators, large earth-moving equipment, skip loaders, trucks, non-road engines, and other mobile sources would be fueled by diesel or gasoline and are sources of combustion emissions, including NO_x, CO, VOCs, SO_2, PM_{10}, $PM_{2.5}$, and small amounts of HAPs. Gasoline and diesel engines must comply with the USEPA mobile source regulations in Title 40 of the Code of Federal Regulations (CFR) Part 86 for on-road engines and 40 CFR 89 and 90 for non-road engines. USEPA has established rules in 40 CFR 80 that require significant reductions in the sulfur content of diesel fuel used in on-road and off-road (non-road) engines. As of December 1, 2010, USEPA requires that all on- and off-road diesel fuel not exceed 15 parts per million sulfur (i.e., ultra-low-sulfur fuel).

The construction equipment listed in Table 4.12-1 would be used in a typical construction spread. The proposed pipeline would be constructed in 10 construction spreads. Each spread would require approximately 6 to 8 months to complete. As stated in the Final EIS, the Supplemental Environmental Report for Nebraska Reroute (exp Energy 2012a), and the Environmental Report (2012b), Keystone would install one 400-kilowatt (kW) backup emergency generator engine at each of the eight proposed construction camps for use if commercial electrical power is interrupted. Emissions from construction equipment combustion would be controlled to the extent required by state and local agencies through the permitting process.

Table 4.12-1 Construction Equipment per Spread for the Proposed Project

Equipment Description[a,b]	Units per Spread	Equipment Rating (hp)	Hours of Operation (hours/day)	Fuel Type
Automobile	50	500	2	Gasoline/ Diesel
Bus	7	190	3	Diesel
Pickup 4x4	100	500	5	Gasoline/Diesel
Welding Rig	30	400	10	Gasoline/Diesel
Winch Truck	3	650	8	Diesel
Dump Truck	1	650	8	Diesel
Flatbed Truck	8	650	9	Diesel
Fuel Truck	2	650	9	Diesel
Grease Truck	1	325	9	Diesel
Mechanic Rig	1	500	10	Diesel
Skid Truck	1	650	10	Diesel
Stringing Tr. and Tr.	15	650	10	Diesel
Truck and Float	9	650	10	Diesel
Truck and Lowboy	5	650	10	Diesel
D-7 Dozer	12	240	8	Diesel
D-8 Dozer	22	310	8	Diesel
D-8 Ripper	0	310	0	Diesel
D-5 Tow	2	90/120	8	Diesel
D-7 Tow	1	200/240	8	Diesel
D-6 Tack	3	200	8	Diesel
CAT 225	7	150	8	Diesel
CAT 235	26	250	8	Diesel
CAT 235 w/Hammer	0-1	260	8	Diesel
Bending Machine 22-36	1	159	8	Diesel
Crane LS-98A (35 ton)	0-2	230	8	Diesel
Farm Tractor	2	60	8	Diesel

Equipment Description[a,b]	Units per Spread	Equipment Rating (hp)	Hours of Operation (hours/day)	Fuel Type
Frontend Loader 977	2	190	8	Diesel
Motor Grader 14G	2	200	8	Diesel
Sideboom 571	1	200	8	Diesel
Sideboom 572	1	200/230	8	Diesel
Sideboom 583	22	300/310	8	Diesel
Sideboom 594	4	410	8	Diesel
Air Compressor 1750 cfm[c]	3-9	50	8	Gasoline
Generators	9	10	8	Gasoline
Pump—3"	1	20	8	Gasoline
Pump—6"	9	40	8	Gasoline

Source: Keystone 2009

[a] Construction equipment does not include equipment needed for HDD, which would be used for portions of the proposed pipeline corridor that requires waterbody crossings.
[b] Construction equipment does not include backup emergency generators proposed for construction camps (emissions from generators at construction camps are included in Tables 3.12-4 and 3.12-7).
[c] cfm = cubic feet per minute

Open Burning

The burning of slash materials (e.g., hay/grass, tree tops/stump) could occur along the proposed route. However, the quantities and locations cannot be determined prior to construction because actual slash materials may be burned, chipped, or hauled for disposal in a suitable landfill depending on construction conditions, landowner requirements, or local regulations. Keystone would acquire necessary permits for slash burning prior to construction and would follow open-burning regulations, including restrictions on burn location, material, and time, as well as consideration of local air quality. Required burning would be done within the ROW in small piles to avoid damage to trees or structures. Emissions from open burning would be controlled to the extent required by state and local agencies through the permitting process.

Temporary Fuel Transfer Systems and Associated Storage Tanks

Temporary fuel storage systems would be located at contractor yards and pipe yards. Although temporary fuel transfer systems and tanks have the potential to release VOC emissions, VOC releases would be minimal because low vapor pressure diesel fuels and gasoline would be the primary fuels stored. Additionally, emissions from temporary fuel transfer systems would be controlled to the extent required by state and local agencies through the permitting process.

Summary

Construction emissions estimates of criteria pollutants and HAPs from the proposed Project are provided in Tables 4.12-2 and 4.12-3, respectively. Each table contains notes that provide information on the methodology, emission factors, activity data, and assumptions used for the air emission calculations during proposed Project construction. Construction emissions typically would be localized, intermittent, and temporary and as such would be unlikely to produce long-term effects on local or regional air quality. In addition, the emissions listed in Tables 4.12-2 and 4.12-3 would be the total from all 10 construction spreads along the proposed route. The localized emissions at each spread would be much less—roughly 10 percent (1/10) of the values listed in Tables 4.12-2 and 4.12-3. None of the temporary construction camps in Montana, South Dakota, and Nebraska would trigger requirements for preconstruction air permits.

Table 4.12-2 Total Emissions of Criteria Pollutants from Proposed Project Construction

	Criteria Pollutants (tons)							
Emission Source/Activity[a]	**HC[h]/VOC**	**CO**	**NO_x**	**SO_2**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**Pb**
Construction Camp Generators[b]	0.56	6.2	6.5	0.012	0.35	0.35	0.35	0.000068
Construction Non-road (Pipeline)[c]	88.7	1,353	1,065	44.4	44.7	44.7	44.7	ND[j]
Construction Non-road (Pump Stations)[c]	32.3	1,019	129	5.65	5.80	5.80	5.80	ND
Construction On-road (Pipeline)[d]	5.95	115	10.3	0.079	0.41	0.41	0.41	ND
Construction On-road (Pump Stations)[d]	1.51	28.2	3.35	0.022	0.13	0.13	0.13	ND
Open Burning[e]	1.45	10.3	0.24	NA	1.06	0.93	0.91	ND
Disturbed Land Fugitive Dust[f]	NA[i]	NA	NA	NA	19,220	6,727	1,345	NA
Paved Road Dust (Personnel Commute)[g]	NA	NA	NA	NA	8.82	1.76	0.43	NA
TOTAL	**130**	**2,727**	**1,214**	**50.2**	**19,281**	**6,781**	**1,398**	**0.000068**

[a] Construction of the proposed pipeline across Montana, South Dakota, and Nebraska would consist of 10 spreads being constructed simultaneously. Each spread would require an average of 6 to 8 months to complete. Pump station emissions include combined emissions from 18 pump stations along the proposed pipeline corridor in the three states plus two pump stations in Kansas (i.e., 20 pump stations total).
[b] Construction camp emission estimates include eight camps (four in Montana, three in South Dakota, and one in Nebraska) with one 400-kW backup emergency generator engine per camp operating for a total of 500 hours (when commercial power is interrupted).
[c] Non-road adjusted emission factors for diesel and gasoline fuelled equipment were derived using methodology described in Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling for Compression Ignition (USEPA 2010b) and Spark-Ignition Engines (USEPA 2010c), respectively. The adjusted factors accounted for Transient Adjustment Factor values and Deterioration Factors. The Deterioration Factor was estimated by conservatively assuming the age factor for each equipment is greater than one (i.e., the equipment is approximately at the end of its useful life). Load factor for each piece of equipment is taken from Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (USEPA 2010a).
[d] On-road emission factors for on-road vehicles were obtained from USEPA's MOBILE6.2 model. Total miles traveled estimated based on number of equipment, daily hours of operation per equipment, each operating 6 days per week, 24 to 34 weeks (an average of 30 weeks was assumed for the calculations) per spread, and an assumed 5 vehicle miles traveled per hour.
[e] Criteria pollutant emissions from open burning were calculated using an equation from Air Pollutant Emissions associated with Forest, Grassland, and Agricultural Burning in Texas (Fraser et al 2002): Emissions (pounds [lb]) = Emission Factor (lb/ton)* Fuel Consumption (tons/acre)* area burned (acres). Approximately 15,296 acres of land is expected to be disturbed in total, (Montana: 5,462 acres, South Dakota: 5,778 acres, Nebraska: 3,985 acres, Kansas: 15 acres, North Dakota: 56 acres), but area burned was assumed to be only 0.5 percent the total acres. Fuel load or consumption factors (ton/acre) for hay/grass were taken from Fraser et al 2002. Fuel load or combustion factor for tree tops and stumps were taken from USEPA AP-42 Table 13.1-1 (USEPA 1996b). Values applicable to Rocky Mountain Region (Montana = Region 1; South Dakota and Nebraska = Region 2) were used.
[f] Disturbed land fugitive dust emission factor for PM was taken from USEPA AP-42, Section 13.2.3, January 1995, for heavy construction operation (USEPA 1995a); fugitive dust emission factors for PM_{10} and $PM_{2.5}$ were taken from USEPA's Preparation of Fine Particulate Emissions Inventories, Student Manual, Air Pollution Training Institute Course 419B, September 2004, for road construction (USEPA 2004). Land (acres) disturbance would occur over a 1-month period; the remaining 5 to 7 months of construction activity per spread would not result in land disturbance or fugitive dust generation (welding, tie-ins, seeding, mulching, construction camp erection, etc.).
[g] Paved road emissions were calculated using formulas and assumptions from USEPA AP-42, Section 13.2 (USEPA 2011).The total vehicle miles traveled during project construction in Montana, South Dakota, and Nebraska was estimated based on a maximum of 600 workers per construction spread (i.e.,6,000 workers for all 10 spreads), each traveling a roundtrip of 40 miles to work per day via a 12-seater company-owned bus (assumed bus is always full), 6 days per week for 24 to 34 weeks (an average of 30 weeks was assumed for the calculations).
[h] HC = hydrocarbons
[i] NA = not applicable
[j] ND = no data

Table 4.12-3 Total Emissions of Hazardous Air Pollutants from Proposed Project Construction

	Hazardous Air Pollutants (tons)								
Emission Source/Activity[a]	**Benzene**	**Toluene**	**Xylenes**	**Acrolein**	**PAHs**[f]	**1,3-Butadiene**	**Formaldehyde**	**Acetaldehyde**	**Total HAPs**
Construction Camp Generators[b]	0.007	0.003	0.002	0.0007	0.0013	0.0003	0.009	0.006	0.03
Construction Non-road (Main Pipeline)[c]	1.39	0.61	0.42	0.14	0.25	0.058	1.75	1.14	5.75
Construction Non-road (Pump Stations)[c]	0.18	0.078	0.054	0.018	0.032	0.0074	0.22	0.15	0.73
Construction On-road (Main Pipeline)[d]	0.17	ND[e]	ND	0.0028	ND	0.020	0.054	0.044	0.29
Construction On-road (Pump Stations)[d]	0.044	ND	ND	0.00081	ND	0.0053	0.015	0.012	0.078
TOTAL	**1.78**	**0.69**	**0.48**	**0.16**	**0.28**	**0.091**	**2.05**	**1.35**	**6.88**

[a] Construction of the pipeline across Montana, South Dakota, and Nebraska would consist of 10 spreads being constructed simultaneously. Each spread would require an average of 6 to 8 months to complete. Pump station emissions include combined emissions from 18 pump stations along the pipeline corridor in the three states plus two pump stations in Kansas (i.e., 20 pump stations total).
[b] Construction camp emission estimates include eight camps (four in Montana, three in South Dakota, and one in Nebraska) with one 400-kW backup emergency generator engine per camp, operating for a total of 500 hours (when commercial power is interrupted).
[c] Non-road HAP emission factors (pounds per million British thermal units [lb/MMBtu]) were taken from USEPA AP-42, Section 3.3, Table 3.3-2 (USEPA 1996a); HAP emission factors for gasoline fired engines were not available. Annual HAP emissions (tpy) were calculated based on diesel density of 7.05 lb/gal; diesel heat input of 5.825 MMBtu/barrel from Table 13.1 of The Climate Registry (TCR) General Reporting Protocol, version 1.1 (TCR 2008); and a brake specific fuel consumption obtained from USEPA's Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling (USEPA 2010a).
[d] On-road emission factors for the on-road vehicles were obtained from USEPA's MOBILE6.2 model. Total miles traveled were estimated based on number of equipment, daily hours of operation per equipment, each operating 6 days per week, 24 to 34 weeks (an average of 30 weeks was assumed for the calculations) per spread, and an assumed 5 vehicle miles traveled per hour.
[e] ND = no data; emission factors not available
[f] PAHs = polycyclic aromatic hydrocarbons

Operations Impacts

A summary of estimated combustion criteria pollutant emissions from the backup emergency diesel generators at the pump stations and MLV sites as well as fugitive VOC emissions associated with the operation of the proposed Project is provided in Table 4.12-4. A summary of combustion HAP emissions from the backup emergency generators at the pump stations and MLV sites is provided in Table 3.12-6. Both tables contain notes that provide information on the methodology, emission factors, activity data, and assumptions used for the criteria pollutant and HAP emission calculations during proposed Project operations. Operational impacts would include minimal combustion emissions (i.e., criteria pollutants and HAPs) from the backup emergency generators (total of 30 hours per year for normal routine maintenance operations and upset conditions/unplanned events) and minimal fugitive emissions (i.e., VOCs) as a result intermittent releases from MLVs along the proposed pipeline route and from valves, pumps, flanges, and connectors at the pump stations. Proposed pipeline pumps would be electrically powered.[13] As shown in Table 4.12-4 and 3.12-6, emissions from these sources are expected to be below threshold levels. The use of mobile sources such as maintenance vehicles (at least twice per year) and aircraft for aerial inspections (at least once every 2 weeks) during proposed Project operations would be infrequent; therefore, emissions from mobile sources would be negligible.

Table 4.12-4 Annual Emissions of Criteria Pollutants from Proposed Project Operation

Emission Source	Criteria Pollutants (tons/year)							
	VOC[d]	CO	NO_x	SO_2	PM	PM_{10}	$PM_{2.5}$	Pb
Fugitive Emissions (Pipeline)[a]	0.0038	NA[e]	NA	NA	NA	NA	NA	NA
Fugitive Emissions (Pump Stations)[b]	0.45	NA	NA	NA	NA	NA	NA	NA
Emergency Generators (Pump Stations and MLV Sites)[c]	0.050	0.61	0.57	0.0010	0.050	0.050	0.050	0.0000055
TOTAL	**0.50**	**0.61**	**0.57**	**0.0010**	**0.050**	**0.050**	**0.050**	**0.0000055**

[a] Pipeline VOC emissions include combined fugitive emissions from approximately 55 intermittent MLVs along the pipeline route in Montana (25), South Dakota (15), and Nebraska (15).
[b] Pump station VOC emissions include combined fugitive emissions from 18 pump stations along the pipeline corridor in the three states plus two pump stations in Kansas (i.e., 20 pump stations total). Each pump station was assumed to have the following components: 13 valves, five electric pumps, and 109 flanges and connectors.
[c] Criteria pollutant emissions include backup emergency generator emissions from the 20 pump stations and 55 MLV sites along the proposed pipeline route.
[d] VOC emissions were estimated from the total organic carbon emission rates based on VOC's typical weight fraction of 0.85 (USEPA AP-42, Section 5.2, [USEPA 2006]). Total organic carbon emission factors taken from USEPA's Protocol for Equipment Leak Emission Estimates, (USEPA 1995b). Emission factors pertaining to Oil and Gas Production Operations for Heavy Oil were used.
[e] NA = not applicable

[13] Emissions associated with electrical distribution lines and substation are discussed in Section 4.12.5, Connected Actions.

The estimated operational emissions in Table 4.12-4 indicate that the proposed Project would not cause or contribute to a violation of any federal, state, or local air quality standards, and that the proposed Project operations would not be expected to trigger the requirement for a Title V operating permit, minor operating permit, or a preconstruction air permit in any of the affected states. As discussed in Section 3.12.2.2, Regulatory Requirements, the Federal Minor New Source Review Program in Indian Country does not apply to this proposed Project. Air emissions (toxics) associated with an accidental release is discussed in Section 4.13, Potential Releases. No specific air quality mitigation measures are recommended for proposed Project operations.

4.12.3.2 Noise

Construction Impacts

Construction of the proposed Project would increase noise levels in the vicinity of Project activities. Construction noise levels are rarely steady in nature, but instead fluctuate depending on the number and type of equipment in use at any given time. There would be times when no large equipment is operating and noise would be at or near ambient levels. In addition, construction-related sound levels would vary by distance.

Pipeline construction generally proceeds at a rate of approximately 20 completed miles per calendar month per spread. However, due to the assembly-line method of construction, pipeline construction activities in any one area within a construction spread or sequence could last from 30 days to 7 weeks. Construction of all pump stations would take approximately 18 to 24 months to complete. The total duration of construction at each pump station would vary somewhat depending on site conditions and environmental restrictions specific to each site. Conditions that could impact the construction duration include: scope of work (e.g., four or five pumps); weather (e.g., rain, snow, etc.); general site accessibility and access to public roads; road improvements required to access the site; amount of general site cut and fill required to achieve rough grade; amount of rock actually encountered; and other potential minor conditions. Outside of the above considerations, Keystone generally anticipates a total duration of 11 months for major construction activities. This duration is not necessarily continuous as there may be breaks required for such factors as harsh winter conditions, environmental restrictions, or optimization of construction efforts. Construction-related noise impacts typically would be localized, intermittent, and short term since construction spreads move relatively quickly (several hundred feet to roughly a mile and a half per day).

There are no residences (i.e., homes, mobile homes, cabins) within 25 feet and 36 residences within 25 to 500 feet of the proposed ROW (Table 3.12-9). The 36 residences within 500 feet of the ROW would experience temporary inconvenience from the construction equipment noise (Table 4.12-5).

Table 4.12-5 Typical Noise Levels for Construction[a]

Equipment	Typical Noise Levels (dBA at 50 feet)
Front loaders	85
Backhoes, excavators	80
Tractors, dozers	85
Graders, scrapers	85–89
Trucks	88
Concrete pumps, mixers	82–85
Cranes (movable)	83
Cranes (derrick)	88
Pumps	76
Generators	81
Compressors	81
Pneumatic tools	85
Jack hammers, rock drills	88–98
Pavers	89
Compactors	82

Source: U.S. Department of Transportation (USDOT) 2006

[a] This table does not include short-term maximum sound pressure levels (Lmax) from construction blasting. According to the U.S. Federal Highway Administration's (FHWA) Roadway Construction Noise Model (RCNM) User's Guide (USDOT 2006b), the Lmax for blasting is 94 dBA at 50 feet (equivalent to a Leq of 74 dBA at 50 feet).

In general, average equivalent noise levels from typical construction sites range from 79 to 89 dBA at 50 feet (USEPA 1971). The closest receptors are located approximately 150 feet from the pipeline ROW. Using a typical 6 decibel reduction in noise level per doubling of distance, a worst-case pipeline construction noise level of 89 dBA at 50 feet from the construction site would be reduced to approximately 80 dBA at 150 feet. These noise levels are the same as the USDOT's recommended daytime criterion for construction activities near residential areas (i.e., 8-hour Leq of 80 dBA; see Section 3.12.3-2, Regulatory Requirements) and, as such, could be perceived as moderately loud, with a significant effect over existing levels. However, any peak noise levels would be temporary and intermittent, generally limited to daylight hours, and would decrease with distance. Although individuals and livestock in the immediate vicinity of the construction activities may be temporarily disturbed, the impact on the noise environment at any specific location along the proposed pipeline route would be short term. Noise abatement measures planned for the affected receptors (residents and livestock) are discussed later in this subsection.

There are approximately 11 residences (i.e., homes, mobile homes, cabins) within 0.5 mile (2,640 feet) and 46 residences within 1 mile (5,280 feet) of the proposed Project pump stations (Table 3.12-9). The closest receptors are located approximately 0.25 mile (1,320 feet) north-northwest of Pump Station 25 in Nebraska, 0.3 mile (1,584 feet) southwest of Pump Station 21 in South Dakota, 0.3 mile southwest of Pump Station 27 in Kansas, and 0.5 mile (2,640 feet) south-southeast of Pump Station 13 in Montana. The remaining 16 pump stations in the affected states are farther away from residences. Using a typical 6-decibel reduction in noise level per doubling of distance, a worst-case pump station construction noise level of 89 dBA at 50 feet from the construction site would be reduced to approximately 60.6 dBA at 0.25 mile, 59 dBA at 0.3 mile, 54.5 dBA at 0.5 mile, and 48.5 dBA at 1 mile. Like pipeline construction noise, noise associated with construction of the proposed aboveground facilities (pump stations) would be intermittent during the construction period, but the overall impact would be temporary and is not expected to be significant. Daytime Leq associated with the construction of the pump stations are expected to be below the USDOT's recommended daytime 8-hour Leq criterion of 80 dBA at residential areas. Further, nighttime noise levels would normally be unaffected because most construction activities would be limited to daylight hours. Potential exceptions include completion of critical tie-ins on the ROW; HDD operations if determined by the contractor to be necessary; and other work if determined necessary based on weather conditions, safety, or other proposed Project requirements.

Keystone is proposing to use HDD techniques at approximately 14 waterbody crossings (Table 4.12-6). The proposed pipeline would not cross Kansas or North Dakota; therefore, HDD activities would not occur in those states. Aerial photography was used to estimate the closest noise receptor distances and direction to the HDD activity sites. The closest residences are located 0.15 mile (790 feet) from the Milk River HDD exit location and 0.19 mile (1,000 feet), from the Platte River HDD entrance location (see Table 4.12-6). Noise impacts from HDD operations were estimated at the closest noise receptors using sound pressure level data of typical HDD operations (entrance and exit) at 300 feet (AES Sparrows Point LNG, LLC [AES] 2008). Table 4.12-6 shows the predicted noise levels from uncontrolled[14] HDD activities at these distances. Without installing any noise barriers or controls, Ldn from HDD activities plus existing levels could be as high as 59.6 dBA at 790 feet or 0.15 mile (closest receptor located northwest of Milk River HDD exit location) and as high as 66.5 dBA at 1,000 feet or 0.19 mile (closest receptor located southwest of Platte River HDD entrance location). Therefore, Ldn levels associated with the 24-hour continuous HDD activities are expected to be below the USDOT's recommended 30-day average Ldn criterion of 75 dBA at nearest residential areas (see Section 3.12.3.2, Regulatory Requirements). HDD activities would be conducted consistent with any applicable local noise ordinances.

As indicated above, during occasional, short-term intervals, construction-related noise levels along the proposed pipeline ROW could be as high as 80 dBA at 150 feet (closest receptors). Noise abatement measures planned for the affected receptors are discussed later in this subsection. Similarly, HDD-related noise levels associated with waterbody crossings could be as high as 66.5 dBA at 1,000 feet. However, such construction and HDD-related noise levels would be temporary and localized and would not result in long-term noise impacts.

Blasting may be required in areas where conventional excavation methods cannot remove consolidated shallow bedrock or boulders. Blasting would also likely be required in areas where the bedrock type within 84 inches (7 feet) of the surface is lithic or very strongly cemented rock (Keystone 2009). If blasting is required to clear the ROW and fracture rock within the pipeline trench, Keystone would follow strict safety precautions and exercise extreme care to avoid damage to underground structures, cables, conduits, pipelines, and underground watercourses or springs. To protect property and livestock, Keystone would notify adjacent landowners or tenants in advance of blasting. Blasting activity would be performed during daylight hours and in compliance with federal, state, and local codes and ordinances as well as manufacturer-prescribed safety procedures and industry practices (Keystone 2009).

[14] Uncontrolled HDD activities means HDD equipment without any noise controls, barrier, berms, enclosures, etc.

Table 4.12-6 Predicted Noise Levels at Closest Receptors from Uncontrolled HDD Activities

HDD Location[a]	Approximate Mile Post[a]	Closest Noise Receptor (mile)[b]	Direction[b]	Baseline Ldn Levels (dBA)[c]	Reference Ldn Levels at 300 feet from HDD Activity (dBA)[d]	Reference HDD Activity Ldn at 300 feet plus Baseline Ldn Levels (dBA)[e]	Ldn Levels at Closest Receptor from HDD Activity (dBA)[d]	HDD Activity Ldn at Closest Receptor plus Baseline Ldn Levels (dBA)[e]
Montana								
Frenchman River entrance	25.20	1.48	S	35.0	77.0	77.0	48.7	48.9
Frenchman River exit	25.23	1.20	S	35.0	68.0	68.0	41.5	42.4
Milk River entrance	82.70	0.40	SW	35.0	77.0	77.0	60.0	60.1
Milk River exit	83.42	0.15	NW	35.0	68.0	68.0	59.6	59.6
Missouri River entrance	89.48	0.91	NW	35.0	77.0	77.0	52.9	53.0
Missouri River exit	89.97	1.26	NW	35.0	68.0	68.0	41.1	42.0
Yellowstone River entrance	197.70	0.48	NE	35.0	77.0	77.0	58.5	58.5
Yellowstone River exit	198.32	0.87	N	35.0	68.0	68.0	44.3	44.8
South Dakota								
Little Missouri River entrance	294.89	2.62	NW	35.0	77.0	77.0	43.7	44.3
Little Missouri River exit	295.19	2.64	SW	35.0	68.0	68.0	34.7	37.8
Cheyenne River entrance	429.57	2.02	SW	35.0	77.0	77.0	46.0	46.3
Cheyenne River exit	430.46	1.55	SW	35.0	68.0	68.0	39.3	40.7
Bridger Creek entrance	432.94	2.46	E	35.0	77.0	77.0	44.3	44.8
Bridger Creek exit	434.50	1.01	E	35.0	68.0	68.0	43.0	43.6
Bad River entrance	485.65	0.46	E	35.0	77.0	77.0	58.8	58.9
Bad River exit	486.04	0.41	NE	35.0	68.0	68.0	50.8	50.9
White River entrance	541.07	0.27	W	35.0	77.0	77.0	63.5	63.5
White River exit	541.40	0.44	NW	35.0	68.0	68.0	50.2	50.3
Nebraska								
Keya Paha River entrance	617.93	0.74	NW	35.0	77.0	77.0	54.7	54.8

HDD Location[a]	Approximate Mile Post[a]	Closest Noise Receptor (mile)[b]	Direction[b]	Baseline Ldn Levels (dBA)[c]	Reference Ldn Levels at 300 feet from HDD Activity (dBA)[d]	Reference HDD Activity Ldn at 300 feet plus Baseline Ldn Levels (dBA)[e]	Ldn Levels at Closest Receptor from HDD Activity (dBA)[d]	HDD Activity Ldn at Closest Receptor plus Baseline Ldn Levels (dBA)[e]
Keya Paha River exit	618.19	0.96	NW	35.0	68.0	68.0	43.4	44.0
Niobrara River entrance	625.88	0.95	SSE	35.0	77.0	77.0	52.5	52.6
Niobrara River exit	626.24	0.55	SSE	35.0	68.0	68.0	48.3	48.5
Elk Horn River entrance	713.14	0.56	SE	35.0	77.0	77.0	57.1	57.2
Elk Horn River exit	713.55	0.31	E	35.0	68.0	68.0	53.3	53.3
Loup River entrance	761.21	0.35	N	35.0	77.0	77.0	61.2	61.2
Loup River exit	761.91	0.54	SE	35.0	68.0	68.0	48.4	48.6
Platte River entrance	774.52	0.19	SW	35.0	77.0	77.0	66.5	66.5
Platte River exit	775.63	0.69	SE	35.0	68.0	68.0	46.3	46.6

[a] Aerial photography was used to determine all HDD entrance mile posts. The HDD exit mile posts were determined based on the width of each river or creek crossed.
[b] Aerial photography was used to estimate the closest noise receptor distances and direction to the HDD activity sites.
[c] Baseline noise levels were estimated based on population density of each county crossed by the proposed pipeline using methodology described in USDOT's Transit Noise and Vibration Impact Assessment, dated May 2006 (USDOT 2006a). See Table 3.12-8 of this Final Supplemental EIS.
[d] Ldn at 300 feet from typical HDD activities (entrance and exit points) were taken from the Sparrows Point Liquefied Natural Gas and Power Plant Project Final EIS (AES 2008). HDD activity Ldn levels at other distances (0.5 mile and 1 mile) were estimated using the hemispherical spreading loss calculation methodology as described in Section 3.12.2.2, Regulatory Requirements.
[e] HDD activity Ldn at closest receptors plus baseline noise levels were calculated using the typical logarithmic equation for combining noise levels: 10Log(10^(Baseline Noise/10) + 10^(HDD Noise/10)).

Actual blast sites are currently unknown. The reference Lmax value from construction blasting is 94 dBA at 50 feet per Federal Highway Administration's (FHWA) Roadway Construction Noise Model (RCNM) User's Guide (USDOT 2006b). At other distances, the Lmax values were estimated to range from 88 dBA at 100 feet to 68 dBA at 1,000 feet using equations and methodology described in FHWA RCNM User's Guide (USDOT 2006b) (see Table 4.12-7). These Lmax values correspond to an average Leq of 68 and 48 dBA at 100 and 1,000 feet, respectively. Construction blast noise levels at 1,800 feet away are not expected to have any significant effects on nearby receptors at residential and institutional areas. With modern blasting techniques, the blasting would be experienced by the nearest receptors as a faint warning whistle or siren, followed by a very brief, muted clap of thunder. Public acceptance is generally improved by scheduling blasting at the same time every day to further reduce the startle factor.

Noise from blasting (if necessary) would be periodic or impulsive (not continuous or steady) and would only occur during daylight hours when increases in noise levels are more tolerable. To minimize noise impacts associated with construction blasting such as acoustic trauma (if blasting becomes necessary), blast site locations should be at least 1,800 feet away from sensitive receptors such as residential and institutional areas (see Table 4.12-7).

The proposed Project would not affect any national parks or national forests; however, the Project would cross five NHTs (one in Montana and four in Nebraska) (see Table 3.9-5). NHTs are not part of the National Park System and are not under the direct management of the NPS. The trail crossings in the vicinity of the proposed Project are not identifiable as crossings of a defined *trail* that could be walked. Most of the NHTs that would cross the proposed Project are either 1) actual trails on/along a river or 2) driving trails along two- to four-lane arterial or rural roads. The driving trails are not considered noise sensitive areas because these areas are currently (and would continue to be) exposed to vehicular traffic noise. Therefore, for the purpose of this noise analysis, only the actual trails were considered to be noise sensitive areas. Any construction noise impacts would be localized, short term, and intermittent. Conventional noise control measures described in Section 2.12 of the CMRP (see Appendix G) would be employed. Pipeline construction would occur near portions of the LECL in Montana, specifically along the Yellowstone River, Montana Route 200, and the Missouri and Milk Rivers and US Route 2 near Fort Peck Lake. Trail users within or nearby the affected areas (i.e., areas where the pipeline crosses the trail) might experience temporary inconvenience from noise associated with the intermittent construction activities. The locations of ancillary facilities (e.g., access roads, pump stations, and construction camps) in Nebraska have not yet been determined. To the degree that such facilities are within sight of portions of the California, Oregon, Mormon Pioneer, and Pony Express NHTs, the proposed Project's construction noise impacts on these NHTs would be similar to those described for LECL. Pipeline construction noise levels would comply with any applicable municipal regulation. In areas near residences and businesses where construction activities or noise levels may be considered disruptive, pipeline work schedules would be coordinated with those parties to minimize disruption. Additionally, as mentioned above, those parties would be informed of any necessary blasting activities prior to that activity taking place.

Table 4.12-7 Construction Blasting Noise from Blast Site and Ground-Borne Noise Impact Criteria

Distance from blast site (feet)	Maximum Sound Pressure Levels, Lmax (dBA)[a]	Usage Factor (%)[b]	Average Equivalent Sound Pressure Levels, Leq (dBA)[c]	Ground-Borne Noise Impact Criteria for Infrequent Events, Leq (dBA)[d]
50	94.0	1	74.0	NA[e]
100	88.0	1	68.0	NA
200	82.0	1	62.0	NA
300	78.4	1	58.4	NA
400	75.9	1	55.9	NA
500	74.0	1	54.0	NA
600	72.4	1	52.4	NA
700	71.1	1	51.1	NA
800	69.9	1	49.9	NA
900	68.9	1	48.9	NA
1000	68.0	1	48.0	Institutional Land Use[f]
1780	63.0	1	43.0	Residential Land Use[g]

[a] Lmax calculations for construction blast at 100 feet intervals were based on a reference construction blast Lmax of 94 dBA at 50 feet per the FHWA's RCNM User's Guide, January 2006 (USDOT 2006b). The Lmax values at 100 feet intervals were calculated in accordance with the equations and methodology (accounting for distance between blast site and receiver) described in the FHWA's RCNM User Guide (USDOT 2006b).
[b] Usage factor is the percentage of time during a construction noise operation that a piece of construction equipment is operating at full power. In the case of construction blasting, the equipment gives a very short duration blast, and can be quantified by using a 1 percent usage factor in the RCNM to allow for some prediction. The usage factor term only affects the computation of Leq (not Lmax) (USDOT 2006b).
[c] Leq values at 100 feet intervals were calculated in accordance with the equations and methodology (accounting for usage factors and distance between blast site and receiver) described in the FHWA's RCNM User Guide (USDOT 2006b).
[d] Ground-borne noise impact criteria for infrequent events were taken from the Federal Transportation Administration's Transit Noise and Vibration Impact Assessment, May 2006 (USDOT 2006a). *Infrequent Event* is defined as fewer than 30 vibration events of the same kind per day. The Leq for impulsive sound sources such as blasting and pile driving are also called ground-borne noise, which is the rumbling sound caused by vibration of room surfaces. The annoyance potential of ground-borne noise is usually characterized with the A-weighted sound level (USDOT 2006a).
[e] NA = not applicable
[f] Includes institutional land uses with primarily daytime use such as schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment.
[g] Includes all residential land uses and buildings where people normally sleep such as hotels and hospitals.

Noise from construction activities and blasting (if necessary) would be expected to have no impact on the Niobrara National Scenic River, the Niobrara WSR/NRR, and the Verdigre Creek WSR/NRR in Nebraska because the designated portions of the Niobrara are located approximately 9 to 20 miles away (on a direct line) from the proposed pipeline route, and noise from the proposed Project would not be detected at that distance. For example, at 9 miles to the closest designated point on the Niobrara National Scenic River (on a direct line), Lmax and Leq from construction blasting would be 34.4 and 14.4 dBA, respectively (per construction blasting calculation methodology described in FHWA RCNM User's Guide dated January 2006) (USDOT 2006b). These sound levels are below the recommended ground-borne noise impact criteria of 43 and 48 dBA for residential and institutional areas, respectively, and, as such, would be imperceptible.

There are no regulations in rural areas along the proposed pipeline route applicable to construction noise, including noise from construction camps. In municipal areas, pipeline construction noise levels would comply with any applicable municipal regulations (there are no numerical state noise limits for construction activities in any of the five affected states). In areas near residences and businesses where construction activities or noise levels may be considered disruptive, pipeline work schedules would be coordinated to minimize disruption. The contractor would minimize noise during non-daylight hours and within 1 mile of residences or other noise-sensitive areas such as hospitals, motels, campgrounds, or NHTs. Keystone would give advance notice to landowners within 500 feet of the ROW prior to construction, limit the hours during which construction activities with high decibel noise levels are conducted, coordinate work schedules, and ensure that construction proceeds quickly through such areas. Using the noise control measures identified above, the contractor would minimize noise in the immediate vicinity of herds of livestock or poultry operations, which are particularly sensitive to noise. Keystone would set up a toll-free telephone line for landowners to report any construction noise-related issues and follow-up on appropriate mitigation measures, as necessary.

Additional analysis on potential impacts from construction noise indicated that although the construction noise would be temporary (lasting no more than 10 to 14 days in any one area), there is a possibility that due to the unusual nature of the noise in otherwise relatively quiet farmland, the public might experience a lingering annoyance effect for up to a few days after the construction work had moved to a new area. Keystone's proposed mitigation measures during Project construction are provided in Section 2.12 of the CMRP (see Appendix G).

Operations Impacts

Noise impacts from operation of the proposed pipeline would be limited to the pump stations in four states: Montana, South Dakota, Nebraska, and Kansas. No pump station or other noise-generating sources would be located in North Dakota. The pipe yards at North Dakota would no longer be needed after construction is over. Crude oil traveling through the buried pipeline would not emit audible noise above the surface, nor would there be perceptible levels of vibration associated with crude oil movement through the pipeline. MLVs would have backup emergency generators, which would only be used during times of power interruption and routine maintenance operation; however, noise impacts would be infrequent and negligible. Aerial inspection of the pipeline would be done at least 26 times per year (at least once every 2 weeks), and MLVs would be inspected at least twice per year (see Section 2.1.11.1, Normal Operations and Routine Maintenance). Noise from infrequent use of aircraft for maintenance purposes would be localized, intermittent, and short term. The few residences within the proposed pipeline ROW would experience temporary inconvenience from noise associated with low-level aircraft overflights.

During operation of the proposed pipeline, the noise associated with the electrically-driven pump stations would be limited to the vicinity of the facilities. The major source of noise at the pump stations are the pumps (each rated at 6,500 hp), followed by motor noise. Other sources such as piping noise are expected to be less dominant and were excluded from the analysis. Backup emergency generators at the pump stations and MLV station were also excluded from the noise analysis because they are also less dominant and would operate infrequently during power interruptions and normal routine maintenance operations. Except for Pump Station 13 in Prairie County, Montana, each pump station in the four states has a total of five pumps and motors. Pump Station 13 has a total of four pumps and motors. Octave band sound power levels (Lw) per pump and associated motor are provided in Table 4.12-8. As shown on the table, the overall Lw for one pump plus its associated motor is approximately 112 dBA. Using logarithmic addition, pump stations with five pumps and motors operating concurrently would generate an overall Lw of approximately 119 dBA. Similarly, pump stations with four pumps and motors would generate an overall Lw of approximately 118 dBA.

Table 4.12-8 Octave Band Sound Power Levels per Pump and Associated Motor

	unweighted decibels (dB)									Overall Lw
Noise Source	**31.5 Hertz**	**63 Hertz**	**125 Hertz**	**250 Hertz**	**500 Hertz**	**1000 Hertz**	**2000 Hertz**	**4000 Hertz**	**8000 Hertz**	**(A-weighted decibels, [dBA])[c]**
Pump[a]	96	92	100	97	104	106	104	102	95	110
Motor[a]	99	96	99	102	101	99	101	91	87	105
Total[b]	101	97	103	103	106	107	106	102	96	112

[a] Octave band Lw (manufacturer's specification) for each pump and its associated motor were provided by Keystone.
[b] Total octave band Lw for the pump and motor were calculated by logarithmically adding the individual octave b and sound power levels.
[c] The unweighted octave band Lw were converted to an overall dBA using A-weighted correction factors.

There are approximately 11 residences (i.e., homes, mobile homes, cabins) within 0.5 mile (2,640 feet) and 46 residences within 1 mile (5,280 feet) of a proposed pump station (Table 3.12-9). As indicated earlier, the closest receptors are located approximately 0.25 mile north-northwest of Pump Station 25 in Nebraska, 0.3 mile south-southwest of Pump Station 21 in South Dakota, 0.3 mile southwest of Pump Station 27 in Kansas, and 0.5 mile south-southeast of Pump Station 13 in Montana. There are non-residential structures (e.g., bridges, barns, silos) located less than 0.25 miles from some pump stations (see Section 3.12.3.1, Environmental Setting). The remaining 16 pump stations in the affected states are farther away from residences. Predicted noise levels at closest noise receptors from uncontrolled pump stations are presented in Table 4.12-9.

As shown on Table 4.12-9, uncontrolled pump station noise at the closest receptors located between 0.25 and 0.5 miles away would be reduced by attenuation (hemispherical spreading loss and atmospheric absorption) to 63.0 and 56.9 dBA, respectively. The logarithmic addition of the uncontrolled pump station Ldn levels at the closest receptors (56.9 to 63.0 dBA) with the baseline Ldn levels (35 dBA) would not change the result in total Ldn levels (i.e., total Ldn levels would remain 56.9 to 63.0 dBA at these receptors) (Table 4.12-9). The uncontrolled pump station noise contribution at receptors located approximately 1 mile away is expected to be 51.2 dBA (including the baseline Ldn of 35 dBA).

For long-term operational noise such as the pump station noise, the American National Standards Institute (ANSI) S12.9-2005/Part 4 specifies methods to assess environmental sounds and to predict the potential annoyance response of a community to outdoor long-term noise from any and all types of environmental sounds from one or more discrete or distributed sound sources (ANSI 2005, Michaud et al. 2008). Application of the prediction method is limited to areas where people reside and to related long-term land uses, which is typically 1 year or more (ANSI 2005). According to Annex F of ANSI S12.9-2005/Part 4, the percentage of a population that is highly annoyed (Shultz curve) is calculated using the adjusted Ldn average sound level (or Rating Level) pre-and post-Project. The noise from some pump stations, while below each applicable state criterion (first noise criterion) for the proposed Project (i.e., Ldn of 60 dBA in Montana, L10 of 55 dBA in South Dakota, and Ldn of 55 dBA in Nebraka; no state noise limits in Kansas and North Dakota) and the USEPA established Ldn threshold of 55 dBA (second noise criterion) for significant impacts at some receptors, might also be more annoying than the levels would suggest as the noise is unusual for the area and therefore may be more noticeable. Since the pump station noise would be generated over a long-term period, the %HA metric has been used to evaluate the percent of people highly annoyed due to pump station noise. The U.S. Federal Transit Administration criterion for defining severe impacts for land uses where people normally sleep and/or reside is based on an increase of 6.5 percent in %HA (US DOT 2006) (third noise criterion). Most of the surrounding communities are located in rural areas where baseline noise levels are typically low (approximately 35 dBA Ldn). Generally, a 10 dBA change in noise level is subjectively heard as approximately a doubling in loudness and can cause an adverse response from a community (fourth noise criterion). More details on the four noise criteria for the proposed Project are described in Section 3.12.3.2, Regulatory Requirements.

The few residences located within 0.5 mile of an uncontrolled pump station could experience noise levels above the recommended criterion for each affected state as described above and/or the USEPA noise criterion of 55 dBA (Ldn), and they could also exceed the recommended 10 dBA increase above baseline limit. In addition, these receptors located within 0.5 miles of the uncontrolled pump stations could also exceed the recommended 6.5 percent increase in %HA limit (see Table 4.12-10). At a distance of 1 mile away from any pump station with five pumps and motors operating concurrently, 1) total pump station plus baseline Ldn levels are expected to be 51.2 dBA (assume baseline Ldn of 35 dBA); 2) the increase above baseline levels is expected to be 16.2 dBA and could be perceived by receptors as doubling in loudness; and 3) 14.7 percent of the people in nearby communities could be highly annoyed. At a distance of 1.5 miles from any pump station with five pumps and motors operating concurrently, 1) total pump station plus baseline Ldn levels are expected to be 47.4 dBA (assume baseline Ldn of 35 dBA); 2) the increase above baseline levels is expected to be 12.4 dBA; and 3) 9.0 percent of the people in nearby communities are expected to be highly annoyed.

To avoid community annoyance and activity interference, Keystone would implement a three-step noise control plan in a progressive order: 1) install pipe lagging for all pipe suction pipes and discharge pipes; 2) install acoustic blankets for all pumps; and 3) upgrade enclosure for all motors, which would provide 3 decibels noise attenuation for each motor compared with a standard motor enclosure. Each step produces an incremental reduction in the overall noise emission level. If the three-step noise control plan is insufficient to bring the stations into compliance, then Keystone would install sound barriers, which could take the form of free-standing walls or earth berms. The location and dimensions of the proposed sound barriers/earth berm would vary with site specification (i.e., relative elevation and distance between the proposed pump stations and nearest receptors). The barrier wall panel would have sufficient transmission loss such that sound passing through it would not contribute to the noise level at the receptor.

Table 4.12-9 Predicted Noise Levels at Closest Noise Receptors from each Uncontrolled Pump Station

Pump Stations						Octave Band Center Frequency, Hertz																	
No.	Location (County, State)	Location/ Direction of Closest Residences	Distance to Closest Pump Station (miles)	Number of Pumps and associated Motors per Pump Station[a]	Uncontrolled Pump Station Sound Power Levels (Lw) and Attenuation Terms	31.5	63	125	250	500	1000	2000	4000	8000	Overall Pump Station Contribution @ Receptor, Leq(24) (dBA)[b]	Pump Station Ldn Levels at Receptor (dBA)[c]	Baseline Ldn Levels at Receptor (dBA)[d]	Pump Station + Baseline Ldn Levels (dBA)[e]	Overall Pump Station Contribution @ Receptor, L10 (dBA)[f]	Increase above Baseline Levels, (dBA)	Exceed State Noise Criteria? (Yes/No)[g]	Exceed the USEPA 55 dBA, Ldn Noise Criteria? (Yes/No)	Exceed the 10 dBA increase above Baseline Limit? (Yes/No)
13	Prairie Co.; Montana	Southeast of the pump station	0.5	4.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96									
					Uncontrolled Lw per Pump Station (dB)[h]	107	103	109	109	112	113	112	108	102									
					Atm. Absorp. @ 50˚F and 60% RH (dB)[i,j]	0.0	0.1	0.4	0.8	1.5	3.1	0.0	0.0	0.0									
					Hemispherical Spreading Loss (dB)[i]	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1									
					Source Contribution @ Receptor, Leq(24) (dB)	40.7	37.3	42.1	42.3	44.1	43.6	45.7	42.2	35.5	51.9								
					Source Contribution @ Receptor, Leq(24) (dBA)	1.3	11.1	26.0	33.7	40.9	43.6	46.9	43.2	34.4	50.4	56.8	35.0	56.9	53.6	21.9	No	Yes	Yes
21	Tripp Co.; South Dakota	Southwest of the pump station	0.3	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96									
					Uncontrolled Lw per Pump Station (dB)[h]	108	104	110	110	113	114	113	109	103									
					Atm. Absorp. @ 50˚F and 60% RH (dB)[i,j]	0.0	0.1	0.2	0.5	0.9	1.9	5.3	0.0	0.0									
					Hemispherical Spreading Loss (dB)[i]	61.7	61.7	61.7	61.7	61.7	61.7	61.7	61.7	61.7									
					Source Contribution @ Receptor, Leq(24) (dB)	46.1	42.7	47.6	48.0	50.2	50.2	45.8	47.6	41.0	57.0								
					Source Contribution @ Receptor, Leq(24) (dBA)	6.7	16.5	31.5	39.4	47.0	50.2	47.0	48.6	39.0	54.7	61.1	35.0	61.2	57.9	26.2	Yes	Yes	Yes

Pump Stations No.	Pump Stations Location (County, State)	Location/ Direction of Closest Residences	Distance to Closest Pump Station (miles)	Number of Pumps and associated Motors per Pump Station[a]	Uncontrolled Pump Station Sound Power Levels (Lw) and Attenuation Terms	Octave Band Center Frequency, Hertz 31.5	63	125	250	500	1000	2000	4000	8000	Overall Pump Station Contribution @ Receptor, Leq(24) (dBA)[b]	Pump Station Ldn Levels at Receptor (dBA)[c]	Baseline Ldn Levels at Receptor (dBA)[d]	Pump Station + Baseline Ldn Levels (dBA)[e]	Overall Pump Station Contribution @ Receptor, L10 (dBA)[f]	Increase above Baseline Levels, (dBA)	Exceed State Noise Criteria? (Yes/No)[g]	Exceed the USEPA 55 dBA, Ldn Noise Criteria? (Yes/No)	Exceed the 10 dBA increase above Baseline Limit? (Yes/No)
25	Fillmore Co.; Nebraska	North-northwest of the pump station	0.25	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96									
					Uncontrolled Lw per Pump Station (dB)[h]	108	104	110	110	113	114	113	109	103									
					Atm. Absorp. @ 50˚F and 60% RH (dB)[i,j]	0.0	0.1	0.2	0.4	0.8	1.6	4.4	0.0	0.0									
					Hemispherical Spreading Loss (dB)[i]	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1	60.1									
					Source Contribution @ Receptor, Leq(24) (dB)	47.7	44.3	49.3	49.7	51.9	52.1	48.2	49.2	42.5	58.7								
					Source Contribution @ Receptor, Leq(24) (dBA)	8.3	18.1	33.2	41.1	48.7	52.1	49.4	50.2	41.4	56.6	63.0	35.0	63.0	59.7	28.0	Yes	Yes	Yes
27	Riley Co.; Kansas	Southwest of the pump station	0.3	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96									
					Uncontrolled Lw per Pump Station (dB)[h]	108	104	110	110	113	114	113	109	103									
					Atm. Absorp. @ 50˚F and 60% RH (dB)[i,j]	0.0	0.1	0.2	0.5	0.9	1.9	5.3	0.0	0.0									
					Hemispherical Spreading Loss (dB)[i]	61.7	61.7	61.7	61.7	61.7	61.7	61.7	61.7	61.7									
					Source Contribution @ Receptor, Leq(24) (dB)	46.1	42.7	47.6	48.0	50.2	50.2	45.8	47.6	41.0	57.0								
					Source Contribution @ Receptor, Leq(24) (dBA)	6.7	16.5	31.5	39.4	47.0	50.2	47.0	48.6	39.9	54.7	61.1	35.0	61.2	57.9	26.2	NA	Yes	Yes

Pump Stations						Octave Band Center Frequency, Hertz																	
No.	Location (County, State)	Location/ Direction of Closest Residences	Distance to Closest Pump Station (miles)	Number of Pumps and associated Motors per Pump Station[a]	Uncontrolled Pump Station Sound Power Levels (Lw) and Attenuation Terms	31.5	63	125	250	500	1000	2000	4000	8000	Overall Pump Station Contribution @ Receptor, Leq(24) (dBA)[b]	Pump Station Ldn Levels at Receptor (dBA)[c]	Baseline Ldn Levels at Receptor (dBA)[d]	Pump Station + Baseline Ldn Levels (dBA)[e]	Overall Pump Station Contribution @ Receptor, L10 (dBA)[f]	Increase above Baseline Levels, (dBA)	Exceed State Noise Criteria? (Yes/No)[g]	Exceed the USEPA 55 dBA, Ldn Noise Criteria? (Yes/No)	Exceed the 10 dBA increase above Baseline Limit? (Yes/No)
NA[k]	NA	Distance from any pump station	1.0	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96									
					Uncontrolled Lw per Pump Station (dB)[h]	108	104	110	110	113	114	113	109	103									
					Atm. Absorp. @ 50˚F and 60% RH (dB)[i,j]	0.0	0.2	0.7	1.7	3.1	6.2	0.0	0.0	0.0									
					Hemispherical Spreading Loss (dB)[i]	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1									
					Source Contribution @ Receptor, Leq(24) (dB)	35.6	32.1	36.7	36.4	37.6	35.4	40.6	37.2	30.5	46.2								
					Source Contribution @ Receptor, Leq(24) (dBA)	-3.8	5.9	20.6	27.8	34.4	35.4	41.8	38.2	29.4	44.7	51.1	35.0	51.2	47.8	16.2	NA	No	Yes

[a] Keystone 2012
[b] Overall pump station Leq(24) levels at receiver location were calculated by logarithmically adding the individual octave band sound levels, after accounting for attenuation due to hemispherical spreading loss and atmospheric absorption. The unweighted sound pressure levels (dB) were converted to A-weighted decibels (dBA) using A-weighted correction factors.
[c] Ldn is approximately equal to Leq(24) (dBA) + 6.4 dBA for a steady state or continuous noise source.
[d] Baseline noise levels of 35 dBA were estimated based on population density of each county crossed by the proposed pipeline using methodology described in US DOT's Transit Noise and Vibration Impact Assessment, dated May 2006 (USDOT 2006a).
[e] Pump station plus baseline noise levels were calculated using the typical logarithmic equation for combining noise levels: 10Log(10^(Baseline Ldn/10) + 10^(Pump Station Ldn/10)).
[f] The L10 values were estimated from the Leq values using a standard deviation of 3.6 for a normal statistical distribution per the USEPA methodology (USEPA 1974).
[g] The State noise criteria or limits for the proposed Project are as follows: Ldn of 60 dBA in Montana (Montana DEQ 2012), L10 of 55 dBA in South Dakota (SDPUC 2010), and Ldn of 55 Ldn in Nebraska (Nebraska DEQ 2013). The State of Kansas has no noise limits for the proposed Project and there are no noise sources in North Dakota during the proposed Project's operational phase.
[h] Total octave band sound power level per pump station (i.e., sum of all pumps and motors) was calculated using the typical logarithmic equation for combining noise levels.
[i] Pump station Leq(24) levels at closest residences were calculated in accordance with ISO 9613-1/2 methodology accounting for geometric divergence (hemispherical spreading loss) and atmospheric absorption (ISO 1993, ISO 1996); assumed an average temperature of 50˚F (10˚C) and relative humidity of 60 percent.
[j] For octave band filters, the error in band-level attenuation is estimated not to exceed + or - 0.5 dB provided that the product of the source-receiver path length, in kilometers (or miles) and the square of the midband frequency, in kilohertz, does not exceed 3 km.kHz^2 (or 1.86 mi.kHz^2), nor does the path length exceed 3 km (or 1.86 mi) at any midband frequency (ISO 1993). The attenuation due to atmospheric absorption for any midband frequency not meeting the two conditions described above were assumed to be zero decibels.
[k] NA = Not applicable

Notes:
Leq(24) is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period.
Ldn is the Leq(24) with10 decibels on the A-weighted decibel scale (dBA) added to nighttime sound levels between the hours of 10 p.m. and 7 a.m. to account for people's greater sensitivity to sound during nighttime hours. Daytime hours are between 7 a.m. and 10 p.m. while nighttime hours are between 10 p.m. and 7 a.m.
L10 is the sound level exceeded for 10 percent of the measurement period. As an example, an L10 of 50 dBA means noise levels may not exceed 50 dBA more than 6 minutes in an hour (assuming the measurement period is one hour).
RH = relative humidity
dB = Unweighted decibel scale
dBA = A-weighted decibel scale
USEPA = United States Environmental Protection Agency

Table 4.12-10 Summary of Uncontrolled Pump Station Noise on Magnitude of Community Reaction or Percentage Change in High Annoyance at Closest Communities.

Pump Stations													
No.	Location (County, State)	Closest Residences	Quiet Rural Area? (Yes/No)[a]	Uncontrolled Pump Station Noise @ Receptor, Leq(24) (dBA)[b]	Uncontrolled Pump Station Ldn Levels at Receptor (dBA)[c]	Baseline Ldn Levels at Receptor (dBA)[d]	Adjusted Pump Station Ldn (New Unfamiliar Sound Source + Rural Area Adjustment), (dBA)[e]	Adjusted Baseline Ldn (Rural Area Adjustment), (dBA)[e]	Adjusted Pump Station Ldn + Adjusted Baseline Ldn, (dBA)[f]	%HA Baseline[g]	%HA Pump Station + Baseline[g]	%HA Pump Station + Baseline minus %HA Baseline	Exceed the 6.5% Increase in %HA Limit? (Yes/No)
13	Prairie Co.; Montana	0.5 miles southeast of the pump station	Yes	50.4	56.8	35.0	71.8	45.0	71.8	1.14	28.6	27.4	Yes
21	Tripp Co.; South Dakota	0.3 miles southwest of the pump station	Yes	54.7	61.1	35.0	76.1	45.0	76.2	1.14	41.4	40.2	Yes
25	Fillmore Co.; Nebraska	0.25 miles north-northwest of the pump station	Yes	56.6	63.0	35.0	78.0	45.0	78.0	1.14	47.5	46.4	Yes
27	Riley Co.; Kansas	0.3 miles southwest of the pump station	Yes	54.7	61.1	35.0	76.1	45.0	76.2	1.14	41.4	40.2	Yes
NA[h]	NA	1 mile from any pump station	Yes	44.7	51.1	35.0	66.1	45.0	66.2	1.14	15.9	14.7	Yes

[a] A quiet rural area is considered an area where a noise receptor (or group of receptors) has a greater expectation for any value placed on *peace and quiet*. According to ANSI S12.9-2005/Part 4, baseline Ldn should be increased by 10 dBA for each applicable receptor when exposure duration is greater than one year. Typically, receptors with a daytime Leq of 45 dBA or less and a nighttime Leq of 35 dBA or less are considered rural areas (equivalent to Ldn of 45 dBA or less).
[b] Overall source contribution at receiver was calculated in accordance with ISO 9613-1/2 methodology accounting for geometric divergence (hemispherical spreading loss) and atmospheric absorption (ISO 1993, ISO 1996); assumed an average temperature of 50˚F (10˚C) and relative humidity of 60 percent.
[c] Ldn is approximately equal to Leq(24) (dBA) + 6.4 dBA for a steady state or continuous noise source.
[d] Baseline noise levels of 35 dBA were estimated based on population density of each county crossed by the proposed pipeline using methodology described in US DOT's Transit Noise and Vibration Impact Assessment, dated May 2006 (USDOT 2006a).
[e] The adjustments applicable in determining the adjusted operation Ldn are i) the new, unfamiliar sound source adjustment and ii) the quiet rural area adjustment per ANSI S12.9-2005/Part 4 (ANSI 2005). In newly created situations, especially when the community is not familiar with the sound source in question (i.e., pump stations), higher community annoyance can be expected and the difference may be equivalent to up to 5 dB (ANSI 2005). When receptor locations are identified as *quiet and rural*, 10 dBA is added to both the operation Ldn and baseline Ldn to obtain the adjusted operation Ldn and adjusted baseline Ldn (ANSI 2005). It should be noted that the decibel addition in this case is a linear sum. For example, a baseline Ldn of 40 dBA becomes 50 dBA in a quiet rural area, and a predicted operational Ldn of 45 dBA becomes 60 dBA i) if the community is not familiar with the new sound source and ii) if the new source is sited in a quiet rural area.
[f] Adjusted pump station Ldn plus adjusted baseline Ldn were calculated using the typical logarithmic equation for combining noise levels: 10Log(10^(Adjusted pump station Ldn/10) + 10^(Adjusted baseline Ldn/10)).
[g] The %HA values for both baseline and pump station plus baseline were calculated in accordance with the methodology described in ANSI S12.9-2005/Part 4 (ANSI 2005).
[h] NA = Not applicable
Notes:
Ldn is the Leq(24) with 10 decibels on the A-weighted decibel scale (dBA) added to nighttime sound levels between the hours of 10 p.m. and 7 a.m. to account for people's greater sensitivity to sound during nighttime hours. Daytime hours are between 7 a.m. and 10 p.m. while nighttime hours are between 10 p.m. and 7 a.m.
%HA = percent highly annoyed

Noise modeling results indicate that noise reductions of approximately 14 to 20 dBA could be required for Pump Stations 13, 21, 25, and 27 (located 0.25 to 0.5 miles away from receptors) to ensure they do not exceed the recommended criterion for each affected state, the USEPA Ldn criterion of 55 dBA, the recommended 10 dBA increase above baseline limit, and the recommended 6.5 percent increase in %HA limit (Table 4.12-11). For receptors located 1 mile away from any pump station, a noise reduction of approximately 8 dBA could be required to ensure that the recommended 10 dBA increase above baseline limit is not exceeded. These noise reductions are expected to be achieved by applying the Keystone's three-step noise control plan described above and installing the sound barriers as necessary. After implementation of Keystone's planned noise control measures, the controlled pump stations would be expected to have a minimal impact on nearby residences and businesses (i.e., pump station noise at nearest receptors would be reduced to an acceptable level).

It should be noted that the calculated noise reductions at the four affected pump stations were based on an estimated baseline Ldn of 35 dBA (the baseline Ldn levels were estimated from population density; actual sound level measurements were not taken). If actual baseline Ldn levels were higher than 35 dBA, the noise reductions required at the four affected pump stations would be expected to be lower. For example, if actual baseline Ldn levels were 45 dBA, the noise reductions required at the four affected pump stations would be expected to range from 11 to 17 dBA. Conversely, if actual baseline levels were lower than 35 dBA (though unlikely as such lower levels are typical of very quiet and pristine or wilderness areas), the noise reductions required at the four affected pump stations would be higher.

As indicated in Section 4.12.2, Impact Assessment Methodology, the ISO 9613-1/2 acoustic model used for predicting pump station noise assumes meteorological conditions favorable to sound propagation (i.e., downwind propagation with wind speeds between 1 and 5 meters per second when measured 3 to 11 meters above the ground). This is a conservative approach because not all receptors may be located downwind of the sources (i.e., receptors located upwind would experience less noise because noise propagates farther downwind than upwind). A further conservative assumption is that the modeling analysis did not include ground absorption for porous type ground (e.g., grassland, farmland, etc.) in the proposed Project area or any potential shielding effects from barriers, berms, or vegetation. Based on the conservative approach used for the modeling analysis, it is expected that higher noise attenuations could be achieved due to the likelihood of some receptors being located upwind or crosswind, porous ground types, and potential shielding effects. The inclusion of such attenuation terms to the acoustic model is expected to reduce overall pump station noise contribution at nearby receptors, which would ultimately reduce the calculated noise reductions (14 to 20 dBA) at the four affected pump stations.

Based on aerial photography, the closest pump stations to actual trail routes on LECL, MOPI, CALI, POEX, and OREG NHTs are Pump Station 11 (McCone County, Montana), Pump Station 13 (Prairie County, Montana), Pump Station 24 (Nance County, Nebraska), and Pump Station 26 (Jefferson County, Nebraska). Pump Station 11 is approximately 9 miles south of the LECL segment on the Missouri River; Pump Station 13 is approximately 5 miles southeast of the LECL segment on the Yellowstone River; Pump Station 24 is approximately 2 miles southeast of the CALI segment (following the Loup River), 3 miles south of the MOPI segment (following the Loup River), and 9 miles northwest of the CALI segment along the Platte River; and Pump Station 26 is approximately 2 miles southwest of the CALI, POEX, and OREG NHTs. Due to these long distances (i.e., 2 to 9 miles on a direct line), pump station sound contributions at the NHTs (i.e., 35.3 to 49.4 dBA) are expected to be below the recommended noise criterion for each affected state and the USEPA Ldn criterion of 55 dBA, and below the recommended 6.5 percent increase in %HA limit (i.e., 0.1 to 7.7 percent increase in %HA). Except for the CALI NHT actual route along the Platte River located approximately 2 miles from Pump Station 24, sound contributions at all other identified NHTs are expected to be below the recommended 10 dBA increase above baseline limit (0.3 to 7.9 dBA increase above baseline levels). The CALI NHT actual route could experience an increase of approximately 11 dBA above baseline levels due to its proximity to Pump Station 24 (approximately 2 miles away) and because there are no other dominant noise sources in the area. It should be noted that Pump Station 26 is also located in close proximity to some NHTs (also approximately 2 miles away); however, a pump station already exists in this area (Steele City Terminus) so the baseline levels are expected to be higher than 35 dBA (46.4 dBA). Due to the higher baseline levels at Pump Station 26, the increase above baseline levels at approximately 2 miles away is expected to be approximately 3 dBA (see Table 4.12-12 and 4.12-13). As discussed above, the implementation of Keystone's three step noise control plan in a progressive order and installation of sound barriers as necessary at nearest pumps stations (including Pump Station 24) would reduce noise levels to acceptable levels (i.e., below 10 dBA increase above baseline levels). Therefore, the pump station noise would have minimal impact on potential trail users in the vicinity.

In addition to the NHTs, the impact of pump station noise on the Niobrara National Scenic River, the Niobrara WSR)/NRR, and Verdigre Creek WSR/NRR were also evaluated. Based on aerial photography, the closest pump stations to these National Scenic Rivers and WSRs/NRRs are Pump Station 21 (Tripp County, South Dakota), Pump Station 22 (Holt County, Nebraska), and Pump Station 23 (Antelope County, Nebraska). Pump Station 21 is approximately 19 miles north of the closest designated point on the Niobrara National Scenic River (upstream of pipeline crossing); Pump Station 22 is approximately 24 miles southwest of the closest designated point on the Niobrara WSR/NRR (downstream of the pipeline crossing); and Pump Station 23 is approximately 31 miles south of the closest designated point on Verdigre Creek WSR/NRR. Due to these long distances (i.e., 19 to 31 miles on a direct line), pump station sound contributions at the National Scenic River and WSRs/NRRs (i.e., 35.3 to 35.7 dBA) are expected to be below the recommended noise criterion for each affected state and the USEPA Ldn criterion of 55 dBA, below the recommended 10 dBA increase above baseline limit (i.e., 0.3 to 0.7 dBA increase above baseline levels), and below the recommended 6.5 percent increase in %HA limit (i.e., 0.12 to 0.32 percent increase in %HA) and as such, would have no impact on users of the Niobrara National Scenic River, the Niobrara WSR/NRR, and Verdigre Creek WSR/NRR (see Tables 4.12-12 and 4.12-13).

Table 4.12-11 Summary of Noise Reductions Required for Pump Station Compliance with all Applicable Noise Criteria for the Proposed Project

Pump Stations																					
No.	Location (County, State)	Closest Residences	Quiet Rural Area? (Yes/No)[a]	Uncontrolled Pump Station Contribution @ Receptor, L10 (dBA)[b,c]	Uncontrolled Pump Station Ldn Levels at Receptor (dBA)[b,d]	Noise Reductions Required to Ensure Compliance (dBA)	Controlled Pump Station Contribution @ Receptor, L10 (dBA)[e]	Controlled Pump Station Ldn Levels at Receptor (dBA)[e]	Base-line Ldn Levels at Recep-tor (dBA)[f]	Controlled Pump Station + Baseline Ldn Levels (dBA)[g]	Adjusted Pump Station Ldn (New Unfamiliar Sound Source + Rural Area Adjustment), (dBA)[h]	Adjusted Baseline Ldn (Rural Area Adjust-ment), (dBA)[h]	Adjusted Pump Station Ldn + Adjusted Baseline Ldn, (dBA)[g]	%HA Base-line[i]	%HA Pump Station + Base-line[i]	%HA Pump Station + Base-line minus %HA Base-line	Increase of Controlled Pump Station Ldn above Baseline Levels, (dBA)	Exceed State Noise Criteria? (Yes/No)[j]	Exceed the USEPA 55 dBA, Ldn Noise Criteria? (Yes/No)	Exceed the 10 dBA Increase Above Baseline Limit? (Yes/No)	Exceed the 6.5% Increase in %HA Limit? (Yes/No)
13	Prairie Co.; Montana	0.5 miles southeast of the pump station	Yes	53.6	56.8	14.0	39.6	42.8	35.0	43.5	57.8	45.0	58.1	1.14	6.09	4.94	8.5	No	No	No	No
21	Tripp Co.; South Dakota	0.3 miles southwest of the pump station	Yes	57.9	61.1	18.0	39.9	43.1	35.0	43.8	58.1	45.0	58.4	1.14	6.31	5.17	8.8	No	No	No	No
25	Fillmore Co.; Nebraska	0.25 miles north-northwest of the pump station	Yes	59.7	63.0	20.0	39.7	43.0	35.0	43.7	58.0	45.0	58.2	1.14	6.22	5.08	8.7	No	No	No	No
27	Riley Co.; Kansas	0.3 miles southwest of the pump station	Yes	57.9	61.1	18.0	39.9	43.1	35.0	43.8	58.1	45.0	58.4	1.14	6.31	5.17	8.8	NA	No	No	No
NA[k]	NA	1 mile from any pump station	Yes	47.8	51.1	8.0	39.8	43.1	35.0	43.7	58.1	45.0	58.3	1.14	6.29	5.15	8.7	NA	No	No	No

[a] A quiet rural area is considered an area where a noise receptor (or group of receptors) has a greater expectation for an value placed on *peace and quiet*. According to ANSI S12.9-2005/Part 4 (ANSI 2005), baseline Ldn should be increased by 10 dBA for each applicable receptor when exposure duration is greater than 1 year. Typically, receptors with a daytime Leq of 45 dBA or less and a nighttime Leq of 35 dBA or less are considered rural areas (equivalent to Ldn of 45 dBA or less).
[b] Overall source contribution at receiver was calculated in accordance with ISO 9613-1/2 methodology accounting for geometric divergence (hemispherical spreading loss) and atmospheric absorption (ISO 1993, ISO 1996); assumed an average temperature of 50˚F (10˚C) and relative humidity of 60 percent.
[c] The L10 values were estimated from the Leq values using a standard deviation of 3.6 for a normal statistical distribution per the USEPA methodology (USEPA 1974).
[d] Ldn is approximately equal to Leq(24) (dBA) + 6.4 dBA for a steady state or continuous noise source.
[e] Controlled Pump Station Noise = Uncontrolled Pump Station Noise (dBA) minus Noise Reductions (dBA)
[f] Baseline noise levels of 35 dBA were estimated based on population density of each county crossed by the proposed pipeline using methodology described in US DOT's Transit Noise and Vibration Impact Assessment, dated May 2006 (USDOT 2006a).
[g] Controlled pump station plus baseline noise levels were calculated using the typical logarithmic equation for combining noise levels: 10Log(10^(Baseline Ldn/10) + 10^(Controlled Pump Station Ldn/10)). Similarly, adjusted pump station plus adjusted baseline noise levels were calculated using the same logarithmic equation: 10Log(10^(Adjusted Baseline Ldn/10) + 10^(Adjusted Pump Station Ldn/10))
[h] The adjustments applicable in determining the adjusted operation Ldn are i) the new, unfamiliar sound source adjustment; and ii) the quiet rural area adjustment per ANSI S12.9-2005/Part 4 (ANSI 2005). In newly created situations, especially when the community is not familiar with the sound source in question (i.e., pump stations), higher community annoyance can be expected and the difference may be equivalent to up to 5 dB (ANSI 2005). When receptor locations are identified as *quiet and rural*, 10 dBA is added to both the operation Ldn and baseline Ldn to obtain the adjusted operation Ldn and adjusted baseline Ldn (ANSI 2005). The decibel addition in this case is a linear sum. For example, a baseline Ldn of 40 dBA becomes 50 dBA in a quiet rural area and a predicted operational Ldn of 45 dBA becomes 60 dBA i) if the community is not familiar with the new sound source and ii) if the new source is sited in a quiet rural area.
[i] The %HA values for both baseline and pump station plus baseline were calculated in accordance with the methodology described in ANSI S12.9-2005/Part 4 (ANSI 2005).
[j] The State noise criteria or limits for the proposed Project are as follows: Ldn of 60 dBA in Montana (Montana DEQ 2012), L10 of 55 dBA in South Dakota (SDPUC 2010), and Ldn of 55 dBA in Nebraska (Nebraska DEQ 2013). The State of Kansas has no noise limits for the proposed Project and there are no noise sources in North Dakota during the proposed Project's operational phase.
[k] NA = Not applicable
Notes:
Ldn is the Leq(24) with10 decibels on the A-weighted decibel scale (dBA) added to nighttime sound levels between the hours of 10 p.m. and 7 a.m. to account for people's greater sensitivity to sound during nighttime hours. Daytime hours are between 7 a.m. and 10 p.m. while nighttime hours are between 10 p.m. and 7 a.m.
L10 is the sound level exceeded for 10 percent of the measurement period. As an example, an L10 of 50 dBA means noise levels may not exceed 50 dBA more than 6 minutes in an hour (assuming the measurement period is 1 hour).
%HA = percent highly annoyed
USEPA = United States Environmental Protection Agency

Table 4.12-12 Uncontrolled Pump Station Noise Levels at Closest Designated Points on National Historic Trails, National Scenic Rivers, Wild and Scenic Rivers, and National Recreational Rivers.

Pump Stations		Closest Designated Points on NHTs, National Scenic Rivers, or WSRs/NRRs	Under the National Park System Unit? (Yes/No)	Distance to Closest Pump Station (miles)	Number of Pumps and associated Motors per Pump Station[a]	Uncontrolled Pump Station Sound Power Levels (Lw) and Attenuation Terms	Octave Band Center Frequency, Hertz									Overall Pump Station Contribution @ Receptor, Leq(24) (dBA)[e]	Overall Pump Station Contribution @ Receptor, L10 (dBA)[f]	Pump Station Ldn Levels at Reciptor (dBA)[g]	Baseline Ldn Levels at Receptor (dBA)[h]	Pump Station + Baseline Ldn Levels (dBA)[i]	Increase above Baseline Levels, (dBA)	Exceed the State Noise Criteria? (Yes/No)[j]	Exceed the USEPA 55 dBA, Ldn Noise Criteria? (Yes/No)	Exceed the NPS 60 dBA at 50 feet, Leq(24) Noise Criteria? (Yes/No)	Exceed the 10 dBA Increase Above Baseline Limit? (Yes/No)
No.	Location (County, State)						31.5	63	125	250	500	1000	2000	4000	8000										
11	McCone Co.; Montana	South of Lewis and Clark NHT (LECL) actual route on the Missouri River	No	9.0	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96										
						Uncontrolled Lw per Pump Station (dB)[b]	108	104	110	110	113	114	113	109	103										
						Atm. Absorp. @ 50˚F and 60% RH (dB)[c,d]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
						Hemispherical Spreading Loss (dB)[c]	91.2	91.2	91.2	91.2	91.2	91.2	91.2	91.2	91.2										
						Source Contribution @ Receptor, Leq(24) (dB)	16.5	13.2	18.3	19.0	21.5	22.6	21.5	18.1	11.4	28.8									
						Source Contribution @ Receptor, Leq(24) (dBA)	-22.9	-13.0	2.2	10.4	18.3	22.6	22.7	19.1	10.3	27.3	30..5	33.7	35.0	37.4	2.4	No	No	NA	No
13	Prairie Co.; Montana	Southeast of the Lewis and Clark NHT (LECL) actual route on the Yellowstone River	No	4.6	4.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96										
						Uncontrolled Lw per Pump Station (dB)[b]	107	103	109	109	112	113	112	108	102										
						Atm. Absorp. @ 50˚F and 60% RH (dB)[c,d]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
						Hemispherical Spreading Loss (dB)[c]	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4										
						Source Contribution @ Receptor, Leq(24) (dB)	21.4	18.1	23.2	23.8	26.4	27.4	26.4	23.0	16.3	33.6									
						Source Contribution @ Receptor, Leq(24) (dBA)	-18.0	-8.1	7.1	15.2	23.2	27.4	27.6	24.0	15.2	32.2	35.3	38.6	35.0	40.2	5.2	No	No	NA	No

Pump Stations							Octave Band Center Frequency, Hertz																		
No.	Location (County, State)	Closest Designated Points on NHTs, National Scenic Rivers, or WSRs/NRRs	Under the National Park System Unit? (Yes/No)	Distance to Closest Pump Station (miles)	Number of Pumps and associated Motors per Pump Station[a]	Uncontrolled Pump Station Sound Power Levels (Lw) and Attenuation Terms	31.5	63	125	250	500	1000	2000	4000	8000	Overall Pump Station Contribution @ Receptor, Leq(24) (dBA)[e]	Overall Pump Station Contribution @ Receptor, L10 (dBA)[f]	Pump Station Ldn Levels at Reptor (dBA)[g]	Baseline Ldn Levels at Receptor (dBA)[h]	Pump Station + Baseline Ldn Levels (dBA)[i]	Increase above Baseline Levels, (dBA)	Exceed the State Noise Criteria? (Yes/No)[j]	Exceed the USEPA 55 dBA, Ldn Noise Criteria? (Yes/No)	Exceed the NPS 60 dBA at 50 feet, Leq(24) Noise Criteria? (Yes/No)	Exceed the 10 dBA Increase Above Baseline Limit? (Yes/No)
21	Tripp Co.; South Dakota	North of the closest designated point on Niobrara National Scenic River (upstream of pipeline crossing)	Yes	18.8	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96										
						Uncontrolled Lw per Pump Station (dB)[b]	108	104	110	110	113	114	113	109	103										
						Atm. Absorp. @ 50˚F and 60% RH (dB)[c,d]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
						Hemispherical Spreading Loss (dB)[c]	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6										
						Source Contribution @ Receptor, Leq(24) (dB)	10.1	6.8	11.9	12.6	15.1	16.2	15.1	11.7	5.0	22.4									
						Source Contribution @ Receptor, Leq(24) (dBA)	-29.3	-19.4	-4.2	4.0	11.9	16.2	16.3	12.7	3.9	20.9	24.1	27.3	35.0	35.7	0.7	No	No	No	No
22	Holt Co.; Nebraska	Southwest of the closest designated point on Niobrara WSR/NRR (downstream of the pipeline crossing)	Yes	23.8	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96										
						Uncontrolled Lw per Pump Station (dB)[b]	108	104	110	110	113	114	113	109	103										
						Atm. Absorp. @ 50˚F and 60% RH (dB)[c,d]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
						Hemispherical Spreading Loss (dB)[c]	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7										
						Source Contribution @ Receptor, Leq(24) (dB)	8.1	4.8	9.9	10.5	13.1	14.1	13.1	9.7	3.0	20.3									
						Source Contribution @ Receptor, Leq(24) (dBA)	-31.3	-21.4	-6.2	1.9	9.9	14.1	14.3	10.7	1.9	18.9	22.0	25.3	35.0	35.4	0.4	No	No	No	No

Pump Stations		Closest					Octave Band Center Frequency, Hertz																		
No.	Location (County, State)	Designated Points on NHTs, National Scenic Rivers, or WSRs/NRRs	Under the National Park System Unit? (Yes/No)	Distance to Closest Pump Station (miles)	Number of Pumps and associated Motors per Pump Station[a]	Uncontrolled Pump Station Sound Power Levels (Lw) and Attenuation Terms	31.5	63	125	250	500	1000	2000	4000	8000	Overall Pump Station Contribution @ Receptor, Leq(24) (dBA)[e]	Overall Pump Station Contribution @ Receptor, L10 (dBA)[f]	Pump Station Ldn Levels at Reptor (dBA)[g]	Baseline Ldn Levels at Receptor (dBA)[h]	Pump Station + Baseline Ldn Levels (dBA)[i]	Increase above Baseline Levels, (dBA)	Exceed the State Noise Criteria? (Yes/No)[j]	Exceed the USEPA 55 dBA, Ldn Noise Criteria? (Yes/No)	Exceed the NPS 60 dBA at 50 feet, Leq(24) Noise Criteria? (Yes/No)	Exceed the 10 dBA Increase Above Baseline Limit? (Yes/No)
23	Antelope Co.; Nebraska	South of the closest designated point on Verdigre Creek WSR/NRR	Yes	31.1	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96										
						Uncontrolled Lw per Pump Station (dB)[b]	108	104	110	110	113	114	113	109	103										
						Atm. Absorp. @ 50˚F and 60% RH (dB)[c,d]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
						Hemispherical Spreading Loss (dB)[c]	102	102	102	102	102	102	102	102	102										
						Source Contribution @ Receptor, Leq(24) (dB)	5.8	2.5	7.5	8.2	10.8	11.8	10.8	7.3	0.6	18.0									
						Source Contribution @ Receptor, Leq(24) (dBA)	-33.6	-23.7	-8.6	-0.4	7.6	11.8	12.0	8.3	-0.5	16.6	19.7	23.0	35.0	35.3	0.3	No	No	No	No
24	Nance Co.; Nebraska	South of the Mormon Pioneer NHT (MOPI) actual route, following the Loup River	No	3.4	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96										
						Uncontrolled Lw per Pump Station (dB)[b]	108	104	110	110	113	114	113	109	103										
						Atm. Absorp. @ 50˚F and 60% RH (dB)[c,d]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
						Hemispherical Spreading Loss (dB)[c]	82.8	82.8	82.8	82.8	82.8	82.8	82.8	82.8	82.8										
						Source Contribution @ Receptor, Leq(24) (dB)	25.0	21.7	26.8	27.4	30.0	31.0	30.0	26.6	19.9	37.2									
						Source Contribution @ Receptor, Leq(24) (dBA)	-14.4	-4.5	10.7	18.8	26.8	31.0	31.2	27.6	18.8	35.8	38.9	42.2	35.0	42.9	7.9	No	No	NA[k]	No

Pump Stations		Closest Designated Points on NHTs, National Scenic Rivers, or WSRs/NRRs	Under the National Park System Unit? (Yes/No)	Distance to Closest Pump Station (miles)	Number of Pumps and associated Motors per Pump Station[a]	Uncontrolled Pump Station Sound Power Levels (Lw) and Attenuation Terms	Octave Band Center Frequency, Hertz									Overall Pump Station Contribution @ Receptor, Leq(24) (dBA)[e]	Overall Pump Station Contribution @ Receptor, L10 (dBA)[f]	Pump Station Ldn Levels at Reptor (dBA)[g]	Baseline Ldn Levels at Receptor (dBA)[h]	Pump Station + Baseline Ldn Levels (dBA)[i]	Increase above Baseline Levels, (dBA)	Exceed the State Noise Criteria? (Yes/No)[j]	Exceed the USEPA 55 dBA, Ldn Noise Criteria? (Yes/No)	Exceed the NPS 60 dBA at 50 feet, Leq(24) Noise Criteria? (Yes/No)	Exceed the 10 dBA Increase Above Baseline Limit? (Yes/No)
No.	Location (County, State)						31.5	63	125	250	500	1000	2000	4000	8000										
24	Nance Co.; Nebraska	Southeast of the California NHT (CALI) actual route, following the Loup River	No	2.2	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96										
						Uncontrolled Lw per Pump Station (dB)[b]	108	104	110	110	113	114	113	109	103										
						Atm. Absorp. @ 50˚F and 60% RH (dB)[c,d]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
						Hemispherical Spreading Loss (dB)[c]	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0										
						Source Contribution @ Receptor, Leq(24) (dB)	28.8	25.5	30.5	31.2	33.8	34.8	33.8	30.3	23.6	41.0									
						Source Contribution @ Receptor, Leq(24) (dBA)	-10.6	-0.7	14.4	22.6	30.6	34.8	35.0	31.3	22.5	39.6	42.7	46.0	35.0	46.3	11.3	No	No	NA	Yes
24	Nance Co.; Nebraska	Northwest of the California NHT (CALI) actual route along the Platte River	No	9.2	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96										
						Uncontrolled Lw per Pump Station (dB)[b]	108	104	110	110	113	114	113	109	103										
						Atm. Absorp. @ 50˚F and 60% RH (dB)[c,d]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
						Hemispherical Spreading Loss (dB)[c]	91.4	91.4	91.4	91.4	91.4	91.4	91.4	91.4	91.4										
						Source Contribution @ Receptor, Leq(24) (dB)	16.3	13.0	18.1	18.8	21.3	22.4	21.3	17.9	11.2	28.6									
						Source Contribution @ Receptor, Leq(24) (dBA)	-23.1	-13.2	2.0	10.2	18.1	22.4	22.5	18.9	10.1	27.1	30.3	33.5	35.0	37.3	2.3	No	No	NA	No

Pump Stations		Closest	Under	Distance	Number of	Uncontrolled	Octave Band Center Frequency, Hertz																		
No.	Location (County, State)	Designated Points on NHTs, National Scenic Rivers, or WSRs/NRRs	the National Park System Unit? (Yes/No)	to Closest Pump Station (miles)	Pumps and associated Motors per Pump Station[a]	Pump Station Sound Power Levels (Lw) and Attenuation Terms	31.5	63	125	250	500	1000	2000	4000	8000	Overall Pump Station Contribution @ Receptor, Leq(24) (dBA)[e]	Overall Pump Station Contribution @ Receptor, L10 (dBA)[f]	Pump Station Ldn Levels at Reptor (dBA)[g]	Baseline Ldn Levels at Receptor (dBA)[h]	Pump Station + Baseline Ldn Levels (dBA)[i]	Increase above Baseline Levels, (dBA)	Exceed the State Noise Criteria? (Yes/No)[j]	Exceed the USEPA 55 dBA, Ldn Noise Criteria? (Yes/No)	Exceed the NPS 60 dBA at 50 feet, Leq(24) Noise Criteria? (Yes/No)	Exceed the 10 dBA Increase Above Baseline Limit? (Yes/No)
26	Jefferson Co.; Nebraska	Southwest of the CALI, POEX, and OREG actual routes (segment shared in common)	No	2.1	5.0	Uncontrolled Lw per Pump and Motor (dB)[a]	101	97	103	103	106	107	106	102	96										
						Uncontrolled Lw per Pump Station (dB)[b]	108	104	110	110	113	114	113	109	103										
						Atm. Absorp. @ 50˚F and 60% RH (dB)[c,d]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0										
						Hemispherical Spreading Loss (dB)[c]	78.6	78.6	78.6	78.6	78.6	78.6	78.6	78.6	78.6										
						Source Contribution @ Receptor, Leq(24) (dB)	29.2	25.9	31.0	31.6	34.2	35.2	34.2	30.7	24.1	41.4									
						Source Contribution @ Receptor, Leq(24) (dBA)	-10.2	-0.3	14.9	23.0	31.0	35.2	35.4	31.7	23.0	40.0	43.1	46.4	46.4	49.4	3.0	No	No	NA	No

[a] Keystone 2013[b] Overall Lw per pump station (i.e., sum of all pumps and motors) was calculated using the typical logarithmic equation for combining noise levels.
[c] Pump station Leq(24) levels at closest NHTs, National Scenic Rivers, or WSRs/NRRs were calculated in accordance with ISO 9613-1/2 methodology accounting for geometric divergence (hemispherical spreading loss) and atmospheric absorption (ISO 1993, ISO 1993); assumed an average temperature of 50˚F (10˚C) and relative humidity of 60 percent.
[d] For octave band filters, the error in band-level attenuation is estimated not to exceed + or - 0.5 dB provided that the product of the source-receiver path length, in kilometers (or miles) and the square of the midband frequency, in kilohertz, does not exceed 3 km.kHz2 (or 1.86 mi.kHz2), nor does the path length exceed 3 km (or 1.86 mi) at any midband frequency (ISO 1993). The attenuation due to atmospheric absorption for any midband frequency not meeting the two conditions described above were assumed to be zero decibels.
[e] Overall sound pressure levels at receiver location were calculated by logarithmically adding the individual octave band sound levels after accounting for attenuation due to hemispherical spreading loss and atmospheric absorption. The unweighted sound pressure levels (dB) were converted to A-weighted decibels (dBA) using A-weighted correction factors.
[f] The L10 values were estimated from the Leq values using a standard deviation of 3.6 for a normal statistical distribution per the USEPA methodology (USEPA 1974).
[g] Ldn is approximately equal to Leq(24) (dBA) + 6.4 dBA for a steady state or continuous noise source.
[h] Baseline noise levels of 35 dBA were estimated based on population density of each county crossed by the proposed pipeline using methodology described in U.S. DOT's Transit Noise and Vibration Impact Assessment, dated May 2006 (USDOT 2006a). Existing noise levels for NHTs near Pump Station 26 are higher than 35 dBA because of the existing pump station at the Steele City Terminus.
[i] Pump station plus baseline noise levels were calculated using the typical logarithmic equation for combining noise levels: 10Log(10^(Baseline Ldn/10) + 10^(Pump Station Ldn/10)).
[j] The State noise criteria or limits for the proposed Project are as follows: Ldn of 60 dBA in Montana (Montana DEQ 2012), L10 of 55 dBA in South Dakota (SDPUC 2010), and Ldn of 55 dBA in Nebraska (Nebraska DEQ 2013). The State of Kansas has no noise limits for the proposed Project and there are no noise sources in North Dakota during the proposed Project's operational phase.
[k] NA = not applicable; the NPS noise standards were not applicable because the NHTs are not under the National Park System unit

Notes:
Leq(24) is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period.
Ldn is the Leq(24) with10 decibels on the A-weighted decibel scale (dBA) added to nighttime sound levels between the hours of 10 p.m. and 7 a.m. to account for people's greater sensitivity to sound during nighttime hours. Daytime hours are between 7 a.m. and 10 p.m. while nighttime hours are between 10 p.m. and 7 a.m.
L10 is the sound level exceeded for 10 percent of the measurement period. As an example, an L10 of 50 dBA means noise levels may not exceed 50 dBA more than 6 minutes in an hour (assuming the measurement period is one hour).

Table 4.12-13 Summary of Uncontrolled Pump Station Noise on Magnitude of Community Reaction or Percentage Change in High Annoyance at National Historic Trails, National Scenic Rivers, and National Recreational Rivers

Pump Stations														
No.	Location (County, State)	Closest Designated Points on NHTs, National Scenic Rivers, or WSRs/NRRs	Quiet Rural Area? (Yes/No)[a]	Overall Pump Station Contribution @ Recaptor, Leq(24) (dBA)[b]	Pump Station Ldn Levels at Receptor (dBA)[c]	Baseline Ldn Levels at Receptor (dBA)[d]	Adjusted Pump Station Ldn (New Unfamiliar Sound Source + Rural Area Adjustment), (dBA)[e]	Adjusted Baseline Ldn (Rural Area Adjustment), (dBA)[e]	Adjusted Pump Station Ldn + Adjusted Baseline Ldn, (dBA)[f]	%HA Baseline[g]	%HA Pump Station + Baseline[g]	%HA Pump Station + Baseline minus %HA Baseline	Exceed the 6.5% increase in %HA Limit? (Yes/No)
11	McCone Co.; Montana	9 miles south of LECL actual route on the Missouri River	Yes	27.3	33.7	35.0	48.7	45.0	50.3	1.14	2.26	1.12	No
13	Prairie Co.; Montana	4.6 miles southeast of the LECL actual route on the Yellowstone River	Yes	32.2	38.6	35.0	53.6	45.0	54.2	1.14	3.73	2.58	No
21	Tripp Co.; South Dakota	18.8 miles north of the closest designated point on Niobrara National Scenic River (upstream of pipeline crossing)	Yes	20.9	27.3	35.0	42.3	45.0	46.9	1.14	1.46	0.32	No
22	Holt Co.; Nebraska	23.8 miles southwest of the closest designated point on Niobrara WSR/NRR (downstream of the pipeline crossing)	Yes	18.9	25.3	35.0	40.3	45.0	46.3	1.14	1.35	0.20	No
23	Antelope Co.; Nebraska	31.1 miles south of the closest designated point on Verdigre Creek WSR/NRR	Yes	16.6	23.0	35.0	38.0	45.0	45.8	1.14	1.27	0.12	No
24	Nance Co.; Nebraska	3.4 miles south of the MOPI actual route, following the Loup River	Yes	35.8	42.2	35.0	57.2	45.0	57.4	1.14	5.64	4.50	No
24	Nance Co.; Nebraska	2.2 miles southeast of CALI actual route, following the Loup River	Yes	39.6	46.0	35.0	61.0	45.0	61.1	1.14	8.81	7.66	Yes
24	Nance Co.; Nebraska	9.2 miles northwest of the California NHT (CALI) actual route along the Platte River	Yes	27.1	33.5	35.0	48.5	45.0	50.1	1.14	2.23	1.08	No

Pump Stations													
No.	Location (County, State)	Closest Designated Points on NHTs, National Scenic Rivers, or WSRs/NRRs	Quiet Rural Area? (Yes/No)[a]	Overall Pump Station Contribution @ Recaptor, Leq(24) (dBA)[b]	Pump Station Ldn Levels at Receptor (dBA)[c]	Baseline Ldn Levels at Receptor (dBA)[d]	Adjusted Pump Station Ldn (New Unfamiliar Sound Source + Rural Area Adjustment), (dBA)[e]	Adjusted Baseline Ldn (Rural Area Adjustment), (dBA)[e]	Adjusted Pump Station Ldn + Adjusted Baseline Ldn, (dBA)[f]	%HA Baseline[g]	%HA Pump Station + Baseline[g]	%HA Pump Station + Baseline minus %HA Baseline	Exceed the 6.5% increase in %HA Limit? (Yes/No)
26	Jefferson Co.; Nebraska	2.1 miles southwest of the CALI, POEX, and OREG actual routes (segment shared in common)	Yes	40.0	46.4	46.4	56.4	56.4	59.4	4.93	7.17	2.23	No

[a] A quiet rural area is considered an area where a noise receptor (or group of receptors) has a greater expectation for an value placed on *peace and quiet*. According to ANSI S12.9-2005/Part 4, baseline Ldn should be increased by 10 dBA for each applicable receptor when exposure duration is greater than 1 year. Typically, receptors with a daytime Leq of 45 dBA or less and a nighttime Leq of 35 dBA or less are considered rural areas (equivalent to Ldn of 45 dBA or less).
[b] Overall source contribution at receiver was calculated in accordance with ISO 9613-1/2 methodology accounting for geometric divergence (hemispherical spreading loss) and atmospheric absorption (ISO 1993, ISO 1996); assumed an average temperature of 50˚F (10˚C) and relative humidity of 60 percent.
[c] Ldn is approximately equal to Leq(24) (dBA) + 6.4 dBA for a steady state or continuous noise source.
[d] Baseline noise levels of 35 dBA were estimated based on population density of each county crossed by the proposed pipeline using methodology described in USDOT's Transit Noise and Vibration Impact Assessment, dated May 2006 (USDOT 2006a). Existing noise levels for NHTs near Pump Station 26 are higher than 35 dBA because of the existing pump station at the Steele City Terminus.
[e] The adjustments applicable in determining the adjusted operation Ldn are i) the new, unfamiliar sound source adjustment and ii) the quiet rural area adjustment per ANSI S12.9-2005/Part 4 (ANSI 2005). In newly created situations, especially when the community is not familiar with the sound source in question (i.e., pump stations), higher community annoyance can be expected and the difference may be equivalent to up to 5 dB (ANSI 2005). When receptor locations are identified as *quiet and rural*, 10 dBA is added to both the operation Ldn and baseline Ldn to obtain the adjusted operation Ldn and adjusted baseline Ldn (ANSI 2005). It should be noted that the decibel addition in this case is a linear sum. For example, a baseline Ldn of 40 dBA becomes 50 dBA in a quiet rural area and a predicted operational Ldn of 45 dBA becomes 60 dBA i) if the community is not familiar with the new sound source and ii) if the new source is sited in a quiet rural area. Receptors around Pump Station 26 were assumed to be familiar with the noise from the existing pump station at the Steele City Terminus; therefore, the new unfamiliar sound source adjustment does not apply to receptors near this location.
[f] Adjusted pump station Ldn plus adjusted baseline Ldn were calculated using the typical logarithmic equation for combining noise levels: 10Log(10^(Adjusted pump station Ldn/10) + 10^(Adjusted baseline Ldn/10)).
[g] The %HA values for both baseline and pump station plus baseline were calculated in accordance with the methodology described in ANSI S12.9-2005/Part 4 (ANSI 2005).
Note: %HA = percent highly annoyed

Keystone has indicated that it would comply with all state and local regulations concerning noise control. Keystone is also identifying noise-sensitive receptors that are in close proximity to HDD locations to develop site-specific measures in order to abate noise impacts to landowners. Keystone would confer with landowners along the construction ROW prior to construction to 1) identify any noise-related concerns they may have and 2) develop mutually agreeable solutions. For all pump station operations, Keystone would identify all noise sensitive receptors within 1.5 miles of each pump station. Ambient noise measurements would be taken at these receptors prior to operations to determine the incremental noise impact that pump station operations may have. As indicted earlier, Keystone would implement a three-step noise control plan in a progressive order and install sound barriers as necessary to avoid community annoyance and activity interference.

4.12.4 Additional Mitigation

No additional potential mitigation measures for air quality or noise impacts have been required by regulatory agencies to date. However, additional mitigation measures may be identified and required by regulatory agencies during the permitting process.

4.12.5 Connected Actions[15]

4.12.5.1 Bakken Marketlink Project

The Bakken Marketlink Project would result in air and noise emissions from construction and operation. At Baker, Montana, the potential-to-emit fugitive VOC emissions from the Bakken Marketlink Project tanks[16] were estimated to be 21.9 tpy (Keystone 2012). All booster pumps would be electric-driven. Based upon preliminary design engineering, there would be no combustion equipment such as backup emergency generator engines or other add-on control devices such as emergency flares or vapor recovery units constructed at the facility. The Bakken Marketlink Project pipeline is approximately 5 miles in length; therefore, the impact of this connected action to air quality and noise is not expected to be significant. Air quality permitting and compliance efforts would be handled separately by appropriate regulatory agencies. Applicable federal, state, and local regulations would be followed to achieve compliance with air quality and noise requirements.

4.12.5.2 Big Bend to Witten 230-kV Transmission Line

The Big Bend to Witten 230-kV Transmission Line would result in air and noise emissions, particularly during construction. Construction impacts of this connected action to air quality and noise would be short term. The extent of air and noise emissions is unknown at this time, but the impact of this connected action to air quality and the noise environment is not expected to be significant. Air quality permitting and compliance efforts would be handled separately by appropriate regulatory agencies. Applicable federal, state, and local regulations would be followed to achieve compliance with air quality and noise requirements.

[15] Connected actions are those that 1) automatically trigger other actions which may require environmental impact statements, 2) cannot or will not proceed unless other actions are taken previously or simultaneously, 3) are interdependent parts of a larger action and depend on the larger action for their justification.
[16] Two 250,000-barrel tanks would be used to store crude from connecting third-party pipelines and terminals. Total throughput would be 65,000 barrels per day, or approximately 1 billion gallons per year.

The electric cooperatives servicing the transmission line or their contractors would use available methods and devices to control, prevent, and otherwise minimize atmospheric emissions or discharges of air contaminants. Dust control of access roads and work areas would occur when air quality is compromised by construction activities. Equipment and vehicles would be maintained in a proper operating condition to minimize air and noise emissions.

4.12.5.3 Electrical Distribution Lines and Substations

The proposed Project would require electrical service from local power providers for pump stations and other aboveground facilities. Construction and operation of these electrical lines and substations would result in air emissions and noise. Construction impacts of this connected action to air quality and noise would be short term. The extent of air and noise emissions is unknown at this time, but the impact of this connected action to air quality and the noise environment is not expected to be significant. Air quality permitting and compliance efforts would be handled separately by appropriate regulatory agencies. The applicable federal, state, and local regulations would be followed to achieve compliance with air quality and noise requirements.

The electric cooperatives servicing the electrical lines or their contractors would use available methods and devices to control, prevent, and otherwise minimize atmospheric emissions or discharges of air contaminants, including greenhouse gases. Dust control of access roads and work areas would occur when air quality is compromised by construction activities. Equipment and vehicles would be expected to be maintained in a proper operating condition to minimize air emissions and noise.

4.12.6 References

AES. See AES Sparrows Point LNG, LLC.

AES Sparrows Point LNG, LLC (AES). 2008. Sparrows Point Liquefied Natural Gas Terminal and Power Plant Project. Final Environmental Impact Statement. Docket Nos. CP07-62 to 65. Prepared by the Federal Energy Regulatory Commission, Office of Energy Projects. Washington DC 20426. December 2008.

American National Standards Institute (ANSI). 2005. Quantities and Procedures for Description and Measurement of Environmental Sound Part 4: Noise Assessment and Prediction of Long-Term Community Response. Reference No. ANSI S12.9-2005/Part 4.Standards Secretariat Acoustical Society of America.

ANSI. See American National Standards Institute.

exp Energy. See exp Energy Services Inc.

exp Energy Services Inc (exp). 2012a. TransCanada XL Pipeline Project: Supplemental Environmental Report for the Nebraska Reroute. September 5, 2012.

____________. 2012b. Environmental Report for the Keystone XL Pipeline. September 7, 2012. Prepared for TransCanada Keystone Pipeline, LP.

Fraser, D., M. Anderson, and D. Allen. 2002. Air pollutant emissions associated with forest, grassland, and agricultural burning in Texas. Atmospheric Environment, 36, pp. 3779-3792.

International Organization for Standardization (ISO). 1993. Acoustics – Attenuation of Sound During Propagation Outdoors – Part 1: Calculation of the Absorption of Sound by the Atmosphere. Reference No. ISO 9613-1:1993(E). Geneva, International Organization for Standardization. June 01, 1993.

____________. 1996. Acoustics—Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation. Reference No. ISO 9613-2:196(E). Geneva, International Organization for Standardization. December 15, 1996.

ISO. See International Organization for Standardization.

Keystone. See TransCanada Keystone Pipeline, LP.

Michaud, D.S., Bly, S.H.P.& Keith, S.E. 2008. Using a Change in Percent Highly Annoyed with Noise as a Potential Health Effect Measure for Projects under the Canadian Environmental Assessment Act. Canadian Acoustics, 36, pp. 13-30.

Montana Department of Environmental Quality (DEQ). 2012. Environmental Specifications for the Keystone XL Project in Montana, April 2012.

National Park Service (NPS). 2012. Frequently Asked Questions: Maximum Trailer Lengths. Available at: http://www.nps.gov/pub_aff/e-mail/trailers.htm.

Nebraska Department of Environmental Quality (DEQ). 2013. Nebraska's Keystone XL Pipeline Evaluation, Final Evaluation Report, January 2013.

NPS. See National Park Service.

South Dakota Public Utilities Commission (SDPUC). 2010. Final Decision on the Application by TransCanada Keystone Pipeline, Lp for a Permit under the South Dakota Energy Conversion and Transmission Facilities Act to Construct the Keystone XL Project, HP09-001, June 29, 2010.

SDPUC. See South Dakota Public Utilities Commission.

TCR. See The Climate Registry.

The Climate Registry (TCR). 2008. The Climate Registry General Reporting Protocol, Table 13.1, version 1.1, May 2008.

TransCanada Keystone Pipeline, LP (Keystone). 2009. Supplemental Filing to Environmental Report. July 6, 2009. Document No. 10623-006. Submitted to the U.S. Department of State and the Bureau of Land Management by TransCanada Keystone Pipeline, L.P.

____________. 2012. Response to Data Request 2.0 for Keystone XL Pipeline Project. October 1, 2012.

U.S. Department of Transportation (USDOT). 2006a. Transit Noise and Vibration Impact Assessment. Office of Planning and Environment, Federal Transit Administration. FTA-VA-90-1003-06. May 2006.

____________.2006b. Roadway Construction Noise Model User's Guide. Research and Innovative Technology Administration, Reference No. FHWA-HEP-05-054 and DOT-VNTSC-FHWA-05-01. January 2006.

U.S. Environmental Protection Agency (USEPA). 1971. Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, office of Noise Abatement and Control. December 31, 1971.

____________.1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. USEPA 550/9-74-004. March 1974.

____________.1995a. AP-42 Compilation of Air Pollutant Emission Factors, Chapter 13.2.3, Heavy Construction Operations. January 1995. Office of Air and Radiation.

____________.1995b. Protocol for Equipment Leak Emission Estimates, Office of Air Quality Planning and Standards, EPA-453/R-95-017, November 1995.

____________. 1996a. AP-42 Compilation of Air Pollutant Emission Factors, Chapter 3.3, Gasoline and Diesel Industrial Engines. October 1996. Office of Air and Radiation.

____________. 1996b. AP-42 Compilation of Air Pollutant Emission Factors, Chapter 13.1, Wildfires and Prescribed Burning. October 1996. Office of Air and Radiation.

____________. 2004. Preparation of Fine Particulate Emissions Inventories, Student Manual, Air Pollution Training Institute (APTI) Course 419B, September 2004.

____________. 2010a. Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, EPA-420-R-10-016, NR-005d, July 2010.

____________. 2010b. Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling-Compression-Ignition, EPA-420-R-10-018, NR-009d, July 2010.

____________. 2010c. Exhaust Emission Factors for Nonroad Engine Modeling: Spark - Ignition, EPA-420-R-10-019, NR-010f, July 2010.

____________. 2011. AP-42 Compilation of Air Pollutant Emission Factors, Chapter 13.2.1, Paved Roads. January 2011.Office of Air and Radiation.

USDOT. See U.S. Department of Transportation.

USEPA. See U.S. Environmental Protection Agency.