Appendix B.9
Supporting Data for
Air Quality and Climate Change

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CONSTRUCTION EMISSIONS

This appendix presents support data on the methodologies used to quantify the estimated emissions from the identified construction and operations activities for IPC's proposed B2H Project.

Table B.9-1 presents the phase of the project, activities, and associated pollutants for the construction and operations phases of the B2H Project.

Table B.9-1. Emissions Categories

Phase	Activity	Pollutant of Concern
Construction	Access roads, tower pads, substations staging areas and fly yards, construction equipment exhaust emissions estimates, helicopter exhaust emissions estimates, portable, concrete batch plants, worker travel-related emissions, delivery and heavy duty diesel truck emissions, open burning	NO_x SO_x CO VOCs $PM_{2.5}$ and PM_{10} CO_2 and CO_2e
Operation	Access roads, operational emissions from maintenance and inspection activities, emergency generator emissions, greenhouse gas emissions estimates, greenhouse-gas emissions and statewide greenhouse-gas inventories, communication-sites, engine use	NO_x SO_x CO VOCs PM_{10} and $PM_{2.5}$ CO_2 and CO_2e

Table Abbreviations: NO_x = nitrogen oxides; SO_x = sulfur oxides; CO = carbon monoxide; VOC = volatile organic compound; $PM_{2.5}$ = particulate matter less than 2.5 microns (fine particles); PM_{10} = particulate matter less than 10 microns (coarse particles); CO_2 = carbon dioxide; CO_2e = carbon dioxide equivalent

ACCESS ROADS

For the purposes of calculating air emissions for the Proposed Action, it was assumed that approximately 450 miles of temporary access roads would be constructed or upgraded. Approximately 260 miles of new access roads were assumed, and approximately 190 miles of existing roads were assumed to be upgraded and widened. The access roads are assumed to be 14 feet wide on average, resulting in an assumed approximately 880 acres of access roads. During construction and upgrading of the access roads, watering and speed controls would be used to suppress and control fugitive dust. Speed controls, but no watering, would be used on the roads subsequent to construction for inspection and maintenance purposes. The use of water and speed controls in the road construction zone is expected to result in 80+ percent control of fugitive dust (particulate matter less than 10 microns [coarse particles], PM_{10}). The $PM_{2.5}$ (particulate matter less than 2.5 microns [fine particles]) portion of the fugitive PM_{10} is expected to be approximately 21 percent (California Air Resources Board 2002). Road-construction emission estimates are based on the Midwest Research Institute [MRI] methodology) using the Level 2 analysis procedure (1996; see also Western Regional Air Partnership 2006).

The average fugitive-dust emissions per the Level 2 analysis is 0.011 tons per acre per month based on a work schedule of 168 hours per month. IPC is estimating that the work schedule will be approximately 260 hours per month; therefore, the adjusted fugitive-dust emissions are assumed to be 0.017 ton per acre per month (prior to controls). The overall B2H Project construction schedule is

approximately 3 years. For purposes of access-road construction, it was assumed that these roads would be constructed as needed along the corridor with a maximum of 30 percent of the roads under construction at any one time. In addition, according to the precipitation map provided in, Section 13.2.2 of Environmental Protection Agency (EPA) Publication AP-42, Compilation of Air Pollution Emissions Factors from 1992, the general transmission line route experiences 90 to 120+ days per year with rainfall over 0.01 inch. The fugitive dust emissions calculation assumes no dust emissions on days with more than 0.01 inch of precipitation. Therefore, the construction period was reduced by 6 months and 9 months for purposes of calculating a range of estimated emissions for 90 days and 120 days of rainfall respectively. Estimated fugitive-dust emissions from the B2H Project construction phase for 90 days of rainfall are:

- 18.7 tons PM_{10} = (0.017 ton/acre/month)(21 months)(877.2 acres)(0.2 release factor)(0.3)
- 3.9 tons $PM_{2.5}$ = (16.1 tons PM_{10})(0.21 $PM_{2.5}$ fraction)

Estimated fugitive-dust emissions from the B2H Project construction phase for 120 days of rainfall are:

- 16.1 tons PM_{10} = (0.017 ton/acre/month)(18 months)(877.2 acres)(0.2 release factor)(0.3)
- 3.4 tons $PM_{2.5}$ = (16.1 tons PM_{10})(0.21 $PM_{2.5}$ fraction)

Fugitive dust emissions from the use of the access roads have been estimated using the EPA's AP-42, Section 13.2.2, Methodology. This method was used based on travel and road assumptions as follows:

- 450 miles of unpaved roads for 1,375 tower sites yields approximately 0.33 miles of road per tower site
- A round trip would be approximately 0.66 miles, with a maximum of 30 percent of roads used at any one time
- 51 vehicle trips per day (worker and delivery)
- 10 vehicle miles traveled (VMT)/day
- AP-42 equation 1(b) yields a PM_{10} factor of 0.54 pound/VMT assuming road surface silt content of 8.5 percent, average road surface moisture of 6.5 percent, and an average speed of 15 miles per hour
- 0.38 ton PM_{10} = (10 VMT/day)(26 days/month)(18 months[1])(0.3)(0.54)/2,000
- 0.08 ton $PM_{2.5}$ = (0.38 ton PM_{10})(0.21 $PM_{2.5}$ fraction)

[1] Incorporates the wet-season adjustment noted above (4 months for each year, or 9 months over the construction period). Speed controls on access-road use during the route construction phase are estimated to result in 44 percent control of fugitive dust (Western Regional Air Partnership 2006).

TOWER PADS

The tower structures planned for the Proposed Action would have a temporary disturbance area of approximately 1,887 acres (i.e., the area required to be cleared of vegetation for purposes of providing laydown areas, tower assembly areas, and tower foundation areas). Over the construction period, it was estimated that approximately 30 percent (566 acres) of the temporary disturbance area would yield emissions (i.e., only 30 percent of the tower sites would be under construction at any one time, therefore the entire potential tower-pad area would not be impacted every day). The MRI Level 2 analysis approach incorporating water and speed controls was used to estimate fugitive emissions from the construction of the tower-pad sites. Estimated emissions of PM_{10} and $PM_{2.5}$ for the Proposed Action for tower pad construction are as follows:

- 34.69 tons PM_{10} = (0.017 ton/acre/month)(18 months1)(566 acres)(0.2 release factor)
- 7.28 tons $PM_{2.5}$. = (34.69 tons PM_{10})(0.21 $PM_{2.5}$ fraction)

SUBSTATIONS, STAGING AREAS, AND FLY YARDS

Construction and/or expansion of the substations would consist of 4 primary types of activities: (1) site grading, (2) below-grade construction, (3) above-grade construction, and (4) electrical-equipment installation and testing. The staging areas and fly yards would be located in relatively flat areas with easy existing access to minimize site grading and new road construction. In addition, these areas are proposed to be located on previously disturbed sites or areas of minimal vegetative cover.

The maximum area affected during construction and/or expansion of the Proposed Action substations would be approximately 34 acres, with construction of the communication sites expected to cover approximately 2 acres, for a total of approximately 36 acres of disturbance. The total estimated cut and fill required to finish the grading, above and below grade construction phases for the substations, is approximately 20,600 cubic yards of soil material. Generally, the construction schedule shows approximately 3 years for construction of the substations, much of which is overlapped. The average construction period for the substations would be 19 months. This period has been reduced by 6 months per the wet-season adjustment discussed previously. The MRI Level 2 analysis procedure was used in this instance as well because it incorporates an emissions calculation procedure for cut and fill activities.

The total acres involved in the staging and fly yard areas would be approximately 750 acres, but it was assumed that less than or equal to 30 percent of this area would actually yield fugitive-dust emissions on a daily basis over the life of the construction project, due to the period of short use for each staging area and fly yard.

The use of water and speed controls on the sites was estimated to result in an 80+ percent reduction in fugitive emissions. Estimated emissions of PM_{10} and $PM_{2.5}$ are as follows:

- Fly yards and staging area use: 13.71 tons PM_{10} = (0.017 ton/acre/month)(18 months)(745.9 acres)(0.3)(0.2), 2.88 tons $PM_{2.5}$ = (13.71 tons PM_{10})(0.21 $PM_{2.5}$ fraction)

Substation/communication-site construction:

- 0.48 ton PM_{10} = (0.017 ton/acre/month)(13 months)(35.8 acres)(0.2 release factor)(0.3), 0.10 ton $PM_{2.5}$ = (0.48 ton PM_{10})(0.21 $PM_{2.5}$ fraction)
- Cut and fill emissions[2]: 0.49 ton PM_{10} = (20,620 cubic yards)(0.059 ton PM_{10}/1,000 cubic yards)(0.4 release factor), 0.10 tons $PM_{2.5}$ = (0.49 ton PM_{10})(0.21 $PM_{2.5}$ fraction)

CONSTRUCTION EQUIPMENT EXHAUST EMISSIONS ESTIMATES

This section presents the screening-level emissions estimates for construction equipment exhaust for all areas of the construction phase (i.e., access road construction, tower-pad construction, substation construction, and exhaust emissions from construction related equipment and support vehicles on the unpaved access roads). This section also contains a brief analysis of flight-generated emissions from the proposed use of helicopters during the tower construction phase.

Exhaust emissions for diesel construction equipment were estimated using the following methodology: (1) total equipment use rates per hour, and (2) a set of composite emissions exhaust factors derived from the California Air Resources Board's 2007 Off-Road Emissions Inventory database. The database incorporates state and federal emissions values and assumptions. These composite factors covered a total of approximately 35 equipment types and 202 engine-horsepower categories. These composite factors were derived for calendar years 2013–2016 (2013 is the earliest anticipated year that construction may begin). These factors are expected to be reasonable because the construction equipment delineated in the California Air Resources Board's 2007 off-road database is essentially similar to the equipment proposed for construction of the B2H Project (e.g., scrapers, graders, forklifts, backhoes, trenchers, dump trucks, aerial lifts, generators, compressors, bore/drill rigs, cranes, dozers, and loaders).

The total estimated hours diesel equipment would be in use are 760,670 hours over the entire B2H Project construction period. Table B.9-2 presents the composite hourly construction emissions estimates anticipated for the B2H Project.

Table B.9-2. Composite Construction Equipment Emissions Estimates (2013)

VOCs (ROGs) (lbs/hr)	CO (lbs/hr)	NO_x (lbs/hr)	SO_x (lbs/hr)	PM_{10} (lbs/hr)	CO_2 (lbs/hr)
0.1035	0.419	0.7732	0.001	0.0402	94

Table Abbreviations: VOC = volatile organic compound; ROG = reactive organic gas; CO = carbon monoxide; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than 10 microns (coarse particles); CO_2 =carbon dioxide

Table B.9-3 presents the estimated exhaust emissions from construction equipment from all related activities over the course of the B2H Project.

[2] Emissions reductions via watering for cut and fill operations are expected to achieve an overall control efficiency of 60 percent.

Table B.9-3. Diesel Construction Equipment Emissions

VOCs (ROGs) (tons/period)	CO (tons/period)	NO_x (tons/period)	SO_x (tons/period)	PM_{10} (tons/period) [1]	CO_2 (tons/period)
39.4	159.4	294.1	0.4	15.3	35,938

Table Abbreviations: VOC = volatile organic compound; ROG = reactive organic gas; CO = carbon monoxide; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than 10 microns (coarse particles); CO_2 =carbon dioxide

Table Note: [1] Over 99 percent of diesel PM_{10} is $PM_{2.5}$ (particulate matter less than 2.5 microns [fine particles]); therefore, $PM_{2.5}$ emissions would be approximately 15.1 tons.

Helicopter Exhaust Emissions Estimates

The current construction equipment listing anticipates the use of several helicopters, both light-lift for general construction and heavy-lift units for the tower erection phase. For purposes of this screening-level emissions estimate, the following helicopters were used to represent the applicable lift categories:

- Light-lift category—Hughes 500, rated at 420 horsepower.
- Heavy-lift category—Skycrane, rated at 8760 horsepower (two 4380-horsepower turbines).

Helicopter support of construction activities may be used on all project segments. Emissions factors were derived from the Federal Aviation Administration's 2005 Aircraft Emission Database (EDMS [Emissions and Dispersion Modeling System], Version 4.4).These factors are delineated for idle and approach/climb-out. The in-flight working mode is assumed to have a similar emissions signature as approach/climb-out mode. The emissions factors for both helicopter types are presented in Table B.9-4.

Table B.9-4. Helicopter Emissions Factors

Unit Type	CO (lbs/hr)	NO_x (lbs/hr)	PM_{10} (lbs/hr)	SO_x (lbs/hr)	VOCs (lbs/hr)
Light Lift	2.07	1.75	0.096	0.14	0.08
Heavy Lift	2.98	15.5	2.09	0.96	0.20

Table Source: California Public Utilities Commission 2006.

Table Abbreviations: CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter less than 10 microns (coarse particles); SO_x = sulfur oxides; VOC = volatile organic compound.

For the purposes of estimating helicopter emissions, the total estimated operational hours for each type of unit are assumed as follows:

- Light-lift units = 11,121 hours
- Heavy-lift units = 7,760 hours

Table B.9-5 presents the estimated emissions from helicopter use to construct transmission line structures. It should be noted that the construction contractor will have the final decision on whether or not to use helicopter support. If the contractor decides against the use of helicopter construction support, these emissions would not occur.

Table B.9-5. Helicopter Emissions

Unit Type	CO (tons/period)	NO_x (tons/period)	PM_{10} (tons/period)	SO_x (tons/period)	VOCs (tons/period)
Light Lift	11.5	9.73	0.53	0.78	0.44
Heavy Lift	11.56	60.14	8.11	3.72	0.78
Totals	23.07	69.87	8.64	4.5	1.22

Table Note: CO_2 emissions from helicopters were calculated using the Conklin and de Decker Associates Aviation Emissions Calculator, Ver. 2009. CO_2 emissions for total helicopter use were estimated to be 14,599 tons/constant period.

Over 99 percent of exhaust PM_{10} would be $PM_{2.5}$; therefore, $PM_{2.5}$ emissions would be approximately 8.55 tons/period.

	PM_{10} (tons)	$PM_{2.5}$ (tons)
$PM_{10}/PM_{2.5}$ fugitive emissions from landing/takeoff cycles	38.8	6.6

Table Abbreviations: CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter; SO_x = sulfur oxides; VOC = volatile organic compound.

Table Note: Emission data in this table is from Gilles et.al. 2007. Emission Factors derived for a Hughes UH-1H helicopter and linearly scaled to the B2H Project units based upon rotor sweep diameter.

Portable Concrete Batch Plants

It is anticipated that several portable concrete batch plants will be used along the project route to provide concrete for structure and substation structure foundations. Typically, portable plants employ truck mixing and are not configured as central mix plant operations. For the purposes of estimating air emissions, approximately 247,500 cubic yards of concrete was assumed to be needed for tower-structure foundations, substation construction, and communication sites. Water would be used to a moderate extent to control fugitive-dust from the concrete batching process. Data presented in EPA AP-42, Section 11.12 (6/06), indicate the range of PM_{10} emissions for truck-mix portable plants ranges from 0.2897 (uncontrolled) to 0.0277 (controlled) pounds per cubic yard of concrete mixed. Using a midpoint value, which assumes a moderate level of control, the assumed fugitive-dust emissions would be 0.1587 pound/cubic yard. The estimated fugitive emissions from concrete batching for the Proposed Action would be as follows:

- 19.63 tons PM_{10} = (247,440 cubic yards)(0.1587 pound PM_{10}/cubic yard)/2,000
- 5.73 tons $PM_{2.5}$ = (19.63 tons PM_{10})(0.292 $PM_{2.5}$ fraction[3])

Worker Travel-Related Emissions

For the purposes of estimating associated air emissions, it was assumed that construction workers would make an estimated 28 roundtrips per day in van shuttles to line segments and affected substations. Based on a review of the Proposed Action in relationship to populated areas that could be used to temporarily house construction crews, an average roundtrip distance of 50 miles was assumed as a conservative value for purposes of evaluating worker travel emissions. Based on these

[3]Data from the California Air Resources Board's (2002) PM profiles for Mineral Products-Loading and Unloading Operations.

assumptions, the total daily, unadjusted mileage would be approximately 1,400 VMT. The adjusted monthly VMT would be 36,400 based on 26 work days per month, and the B2H Project VMT would be 982,800 based on 3 years of actual construction. It was assumed that all of the worker travel would occur via shuttle vans, that is, light-duty truck (LDT) vehicles. Composite emissions estimates passenger cars (LDA) and LDTs were derived as follows:

- Emissions Factor 2007 (EMFAC2007), Version 2.30 (California Air Resources Board 2006), was used to generate a set of composite factors for the statewide area of California. It was assumed that the overall vehicle mix in Oregon and Idaho would be similar to the vehicle mix in California.
- The EMFAC run was generated for a vehicle mix covering the years 1969 through 2013. The composite factors generated were then applied to assumed worker travel data for years 2013–2015.
- The weighted composite emissions factors for LDAs/LDTs are as follows: volatile organic compounds (reactive organic gases) at 0.0007 pounds/VMT, CO (carbon monoxide) at 0.00686 pounds/VMT, NO_2 (nitrogen dioxide) at 0.00063 pounds/VMT, PM_{10} at 0.00008 pounds/VMT, SO_2 (sulfur dioxide) at 0.00001 pounds/VMT, and CO_2 (carbon dioxide) at 1.0 pound/VMT.

Table B.9-6 presents the anticipated total construction period emissions from worker travel over the B2H Project construction period.

Table B.9-6. Total B2H Project Construction Worker Travel Emissions

VOCs (ROGs)	CO	NO_x	SO_x	PM_{10} [1]	CO_2
0.34 tons	3.37 tons	0.31 tons	0.0049 tons	0.039 tons	467 tons

Table Abbreviations: VOC = volatile organic compound; ROG = reactive organic gas; CO = carbon monoxide; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than 10 microns (coarse particles); CO_2 = carbon dioxide

Table Note: [1] Over 99 percent of PM_{10} would be $PM_{2.5}$ (particulate matter less than 2.5 microns [fine particles]); therefore, $PM_{2.5}$ emissions would be approximately 0.0.39 ton/period.

Exhaust emissions from construction equipment fired on gasoline fuels are presented in Table B.9-7. The total equipment hours for gasoline combustion for the Proposed Action were assumed to be approximately 139,000 hours over the construction period. A majority of these emissions would come from LDTs included in the construction equipment mix. It was assumed that these trucks would travel at an average speed of less than or equal to 25 miles per hour since most would be used on or adjacent to the construction-site areas. This results in an assumed total mileage from these vehicles of 5,560 VMT over the construction period. The emissions factors noted above for LDAs/LDTs were used to estimate the emissions from gasoline combustion in construction related equipment.

Table B.9-7. Gasoline-Fueled Construction Equipment Emissions

VOCs (ROGs)	CO	NO_x	SO_x	PM_{10} [1]	CO_2
0.0032 tons	0.0302 tons	0.0045 tons	0.0001 tons	0.0003 tons	4 tons

Table Abbreviations: VOC = volatile organic compound; ROG = reactive organic gas; CO = carbon monoxide; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than 10 microns (coarse particles); CO_2 = carbon dioxide

Table Note: [1] Over 99 percent of PM_{10} would be $PM_{2.5}$ (particulate matter less than 2.5 microns [fine particles]); therefore, $PM_{2.5}$ emissions would be approximately 0.0003 ton/period.

DELIVERY AND HEAVY DUTY DIESEL TRUCK EMISSIONS

For the purposes of estimating air emissions, it was assumed that construction deliveries and heavy trucks would make an estimated 30 roundtrips per day (Table B.9-8). Based on a review of the Proposed Action in relationship to populated areas that could be sources of materials to staging areas (positioned at approximately 30-mile intervals along the project route), an average roundtrip distance of 50 miles was assumed as a conservative value for purposes of estimating delivery and heavy truck travel emissions. Based on these assumptions, the total daily mileage would be approximately 1,500 VMT. The adjusted monthly VMT would be 39,000, based on 26 work days per month, and the B2H Project VMT would be 1,053,000, based on 3 years of actual construction time. It was assumed that all of the delivery and heavy-duty truck travel would be by heavy duty diesel truck type vehicles. Composite emissions factors were derived as follows:

- EMFAC2007, Version 2.30 (California Air Resources Board 2006), was used to generate a set of composite factors for the statewide area of California. It was assumed that the overall vehicle mix in Oregon and Idaho is similar to the vehicle mix in California.
- The EMFAC run was generated for a vehicle mix covering the years 1969 through 2013. The composite factors generated were then assumed for worker travel data for years 2013–2015.
- The weighted composite emissions factors for the heavy duty diesel trucks are as follows: volatile organic compounds (reactive organic gases) at 0.001624 pound/VMT, CO at 0.00731 pound/VMT, NO_2 at 0.0232 pound/VMT, PM_{10} at 0.001014 pounds/VMT, SO_2 at 0.000038 pound/VMT, and CO_2 at 4.0 pounds/VMT.

Table B.9-8. Heavy Duty Delivery Truck Emissions

VOCs (ROGs)	CO	NO_x	SO_x	PM_{10} [1]	CO_2
0.86 tons	3.85 tons	12.21 tons	0.02 tons	0.53 tons	2,078 tons

Table Abbreviations: VOC = volatile organic compound; ROG = reactive organic gas; CO = carbon monoxide; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than 10 microns (coarse particles); CO_2 = carbon dioxide.

Table Note: [1] Over 99 percent of PM_{10} would be $PM_{2.5}$ (particulate matter less than 2.5 microns [fine particles]); therefore, $PM_{2.5}$ emissions would be approximately 0.53 tons/period.

OPEN BURNING

Open burning of cleared vegetation in some portions of the route is expected to occur. Open burning of cleared vegetation is only expected to occur in the forest areas. For the purposes of estimating the air emissions effects of open burning, it was assumed that approximately 680 acres of unspecified forest residue would be cleared and burned in the right-of-way. Open burning would take place in compliance with all applicable burn regulations, (e.g., pile size, pile clearances, vegetation moisture content, burning hours, and weather conditions). Waste generation rates and emissions from the burned residues are based on the emissions factors and support data presented in EPA AP-42, Section 2.5. For 680 acres of unspecified forest residues, the waste generation rate would be approximately 70 tons per acre, for a total estimated waste generation of 47,600 tons. Emissions factors for this type of waste are as follows:

- PM (particulate matter, total): 17 pounds/ton of waste burned
- CO: 140 pounds/ton of waste burned
- VOCs (nonmethane hydrocarbons): 19 pounds/ton of waste burned
- $NO_{2:}$ 4 pounds/ton of waste burned
- SO_2: 0 pound/ton of waste burned

Estimated emissions from open burning over the construction period of approximately 3 years are presented in Table B.9-9.

Table B.9-9. Estimated Emissions from Open Burning

Pollutant	Tons/Construction Period	Tons/Year	Tons/Mile/Year
PM (total)	389.39	173.10	0.58
NO_2	95.34	42.38	0.139
CO	3,336.90	1,483.10	4.86
VOCs (NMHCs)	452.87	201.30	0.66
SO_2	—	—	—

Table Abbreviations: PM = particulate matter; NO_2 = nitrogen dioxide; CO = carbon monoxide; VOC = volatile organic compound; NMHC = nonmethane hydrocarbon; SO_2 = sulfur dioxide

Table Note: Assumes a 27-month (2.25-year) construction period and total route miles of 305.

OPERATION EMISSIONS

ACCESS ROADS

Inspection of the transmission line would occur semi-annually. Assuming that the 450 miles of unpaved roads would be used to access the various transmission line corridor points along the Proposed Action results in an annual VMT calculation on the unpaved roads of approximately 1,800 (4 one-way trips or 2 roundtrips). Road use would be confined to LDTs (4X4 configuration, approximately 3-ton weight class), and road speeds would be less than or equal to 25 miles per hour. Using the EPA AP-42 Unpaved Road emissions equation in Section 13.2.2 (Equation 1b) results in a PM_{10} fugitive dust emissions factor of 0.696 pound/VMT, assuming the following:

- Average road-surface silt content is 8.5 percent (average of the soil values in AP-42).
- Average public road-surface moisture content is 6.5 percent (average of the range of values from EPA/AP-42 data, Section 13.2.2, Table 13.2.2-3).

Emissions of PM_{10} are assumed as follows:

- 0.63 tons PM_{10}/year = (1,805 VMT)(0.696 pounds PM_{10}/VMT)/2,000

Assuming that $PM_{2.5}$ is 21 percent of PM_{10} (per the Air Resources Board-CEIDARs Fractionation Inventory-Unpaved Road Category):

- $PM_{2.5}$ emissions would be approximately 0.13 ton per year.

Operational Emissions from Maintenance and Inspection Activities

For the purposes of calculating air emissions, the annual inspection and maintenance mileage (on access roads) was assumed to be 2,900 miles. Inspection vehicles would be primarily LDTs (4X4 configuration, gasoline fueled). In addition, it was assumed that four LDTs would be used, each having and annual mileage use rate of approximately 20,000 miles. Composite emissions factors as described in the previous Worker Travel Related Emissions section were derived for LDTs as follows: volatile organic compounds at 0.000857 pound/VMT, CO at 0.00856 pound/VMT, NO_2 at 0.000872 pounds/VMT, SO_2 at 0.00001 pounds/VMT, PM_{10} at 0.000102 pound/VMT, and CO_2 at 1.077 pounds/VMT.

Table B.9-10 presents the estimated exhaust emissions from LDT use during inspection and maintenance activities (operations phase).

Table B.9-10. Operations Exhaust Emissions (Inspection/Maintenance)

VOCs (ROGs) (tons/year)	CO (tons/year)	NO_x (tons/year)	SO_x (tons/year)	PM_{10} (tons/year)	CO_2 (tons/year)
0.04	0.35	0.04	0.0004	0.0042	44

Table Abbreviations: VOC = volatile organic compound; ROG = reactive organic gas; CO = carbon monoxide; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than 10 microns (coarse particles); CO_2 = carbon dioxide.

Emergency Generator Emissions

The B2H Project is proposing to locate and operate emergency generators at each of the communication sites. These engines would be fired on propane. Each engine would be rated at approximately 49 horsepower and would be operated for a maximum of 98 hours per year. There would be a total number of 8 engines. Each engine would burn approximately 410 gallons of propane per year. Emissions estimates from these engines are based on data derived from AP-42, Section 3.2 (7/2000, natural gas factors applied to propane). Table B.9-11 summarizes the anticipated communication-site engine emissions.

Table B.9-11. Operational Emergency Generator Exhaust Emissions

VOCs (ROGs) (tons/year)	CO (tons/year)	NO_x (tons/year)	SO_x (tons/year)	PM_{10} (tons/year)	$PM_{2.5}$ (tons/year)	CO_2 (tons/year)
0.02	0.05	0.61	0.0001	0.0015	0.0015	16.5

Table Abbreviations: VOC = volatile organic compound; ROG = reactive organic gas; CO = carbon monoxide; NOx = nitrogen oxides; SOx = sulfur oxides; PM10 = particulate matter less than 10 microns (coarse particles); PM2.5 = particulate matter less than 2.5 microns [fine particles]; CO2 = carbon dioxide.

Table Note: Total emissions for all 8 engines.

TOTAL ESTIMATED B2H PROJECT AIR EMISSIONS

The total criteria air emissions estimates for the construction and operation phases of the Proposed Action are presented in Table B.9-12.

Table B.9-12. Total B2H Project Estimated Emissions

VOCs (ROGs)	CO	NO_x	SO_x	$PM_{10}/PM_{2.5}$	CO_2
Construction[1] (tons per period)					
494.7	3,526.6	471.8	4.9	538.2/396.6	53,086
Operations (tons per year)					
0.06	0.40	0.65	0.0005	0.64/0.14	60.5

Table Abbreviations: VOC = volatile organic compound; ROG = reactive organic gas; CO = carbon monoxide; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter less than 10 microns (coarse particles); $PM_{2.5}$ = particulate matter less than 2.5 microns (fine particles); CO_2 = carbon dioxide.

Table Note: [1] Includes helicopter emissions that may or may not occur.

Table B.9-13 presents the criteria emissions inventory values for the base year 2002 and the projection year of 2018 for both states for comparison with the anticipated B2H Project emissions of criteria pollutants. Table B.9-14 presents a comparison of annualized construction emissions to the statewide emissions inventory values presented in Table B.9-13. This comparison indicates that construction emissions of criteria pollutants represent small temporary additions to the statewide point and area source inventories.

Table B.9-13. Emissions Inventory Values

Pollutant	Year	Oregon (tons per year)	Idaho (tons per year)
NO_x	2002	39,784	41,805
	2018	48,788	56,014
SO_x	2002	27,519	20,513
	2018	30,109	13,534
VOCs	2002	279,648	126,057
	2018	376,216	197,269
PM_{10}	2002	187,902	52,079
	2018	239,440	64,617
CO	2002	388,449	58,252
	2018	434,180	78,990

Table Source: Western Regional Air Partnership Point and Area Source Emissions Projections for the 2018 Base Case Inventory, Version 1, 1/2006. Mobile source emissions not included.

Table Abbreviations: NO_x = nitrogen oxides; SO_x = sulfur oxides; VOC = volatile organic compound; PM_{10} = particulate matter less than 10 microns (coarse particles); CO = carbon monoxide.

Table B.9-14. Project Construction Emissions Comparison

Pollutant	State Totals[1] (tons/year) 2002	State Totals[1] (tons/year) 2018	Est. Project Construction (tons/year)	Project % of 2002 State Totals	Project % of 2018 State Totals
NO_2	81,679	104,802	209.7	0.26	0.20
CO	446,701	513,170	1,567.4	0.35	0.31
VOCs	405,705	573,485	219.9	0.054	0.038
SO_2	48,032	43,643	2.2	0.0046	0.0050
PM_{10}	239,981	304,057	239.2	0.10	0.079

Table Abbreviations: NO_2 = nitrogen dioxide; CO = carbon monoxide; VOC = volatile organic compound; SO_x = sulfur oxides; PM_{10} = particulate matter less than 10 microns (coarse particles).

Table Note: [1] Oregon plus Idaho from Table B.9-13. State totals do not include mobile source emissions.

GREENHOUSE-GAS EMISSIONS ESTIMATES

Greenhouse-gas emissions, such as CO_2, CH_4 (methane), and N_2O, from the construction and operations of the transmission line are derived primarily from the fuel combustion sources involved in construction and operations. Support data for the greenhouse-gas analysis herein were derived from the California Climate Action Registry General Reporting Protocol, Version 3.1, January 2009, and Appendix X (Power/Utility Reporting Protocol) October 2004.

The total estimated CO_2 greenhouse-gas emissions from diesel and gasoline fuels during the construction phase are 53,086 tons.

The total estimated CO_2 greenhouse-gas emissions from propane and gasoline fuels during the operations phase are 60.5 tons per year.

As stated previously, these emissions are fuel-combustion related. Data presented in, and calculations based on, the protocol documents noted above result in the following set of emissions ratios for greenhouse gases: for diesel fuel combustion, the average methane fraction is 0.000051 of CO_2 and the average N_2O fraction is 0.000032 of CO_2. For gasoline combustion, the average methane fraction is 0.000213 of CO_2 and the average N_2O fraction is 0.000113 of CO_2. Therefore, if the CO_2 emissions are known for each fuel, the methane and N_2O emissions can be directly estimated using the fractional values noted.

Table B.9-15 presents the estimated GHG greenhouse-gas emissions by constituent for each B2H Project phase.

Table B.9-15. Greenhouse-Gas Emissions Estimates

Phase and Fuel Category	**CO_2 (tons)**	**Methane (tons)**	**N_2O (tons)**
Construction—All Fuels	53,086	2.71	1.70
IPCC Multipliers[1]	1	21	310
Equivalent CO_2e	53,086	56.9	527
Total Construction CO_2e	**53,670 tons/period**		
Operations—All Fuels	60.5	0.0129	0.0068
IPCC Multipliers	1	21	310
Equivalent CO_2e	60.5	0.27	2.11
Total Operations CO_2e	**63 tons/year**		

Table Abbreviations: CO_2 = carbon dioxide; N_2O = nitrous oxide; IPCC = Intergovernmental Panel on Climate Change; CO_2e = carbon dioxide equivalent.

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