Table C-1. Estimated Air Emissions from Fuel Combustion Sources During Resupply Traverses Conducted in Alternative A

	Tractors		Generators		Heaters		Snowmobiles		
	Fuel Usage: 58 L/hr; 700,000 L/yr		Fuel Usage: 12 L/hr; 25,000 L/yr		Fuel Usage: 1.5 L/hr; 6,600 L/yr		Fuel Usage: 1 L/hr; 1,200 L/yr		
Air Pollutant	**Emissions Factor (kg/L) [1][2]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [1][3]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [4][5]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [1][6]**	**Emissions (kg/yr)**	**Total Emissions (kg/yr)**
Sulfur Oxides	5.71E-06	4.00E+00	7.39E-06	1.85E-01	6.91E-03	4.56E+01	6.05E-06	7.26E-03	**4.98E+01**
Nitrogen Oxides	1.52E-05	1.06E+01	2.07E-05	5.17E-01	2.40E-03	1.58E+01	4.16E-06	4.99E-03	**2.70E+01**
Carbon Monoxide	4.70E-06	3.29E+00	2.01E-05	5.03E-01	6.00E-04	3.96E+00	1.75E-03	2.10E+00	**9.85E+00**
Exhaust Hydrocarbons	7.22E-07	5.05E-01	4.31E-06	1.08E-01	NCA		6.42E-04	7.71E-01	**1.38E+00**
Particulate Matter	6.91E-07	4.83E-01	3.04E-06	7.59E-02	2.40E-04	1.58E+00	1.59E-05	1.91E-02	**2.16E+00**
Carbon Dioxide	1.49E-03	1.04E+03	2.24E-03	5.59E+01	2.66E+00	1.75E+04	1.17E-02	1.40E+01	**1.87E+04**
Total Organic Carbon (TOC)	NCA		NCA		6.67E-05	4.40E-01	NCA		**4.40E-01**
Non-methane TOC	NCA		NCA		4.08E-05	2.69E-01	NCA		**2.69E-01**
Methane	NCA		NCA		2.59E-05	1.71E-01	NCA		**1.71E-01**
Nitrous Oxide	NCA		NCA		1.32E-05	8.71E-02	NCA		**8.71E-02**
Polycyclic Organic Matter (POM)	NCA		NCA		3.96E-07	2.61E-03	NCA		**2.61E-03**

Notes:
NCA = No characterization data available.
[1] U.S. EPA Nonroad Emissions Model, U.S. EPA National Vehicle and Fuel Emissions Laboratory, draft version, June 1998.
[2] Emissions factor for tractors, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/57.8 L/hr fuel consumption
[3] Emissions factor for generators, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/12.1 L/hr fuel consumption
[4] U.S. EPA Office of Air and Radiation. *Compilation of Air Pollutant Emission Factors. AP-42*, Volume II, Mobile Sources, Fourth Edition. September 1985.
[5] Emissions factor for heaters, in kg/L = [emissions factor in lbs/gallon x 0.4536 kg/lb/3.78 liters/gal]/1.6 L/hr fuel consumption
[6] Emissions factor for snowmobiles, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/1.2 L/hr fuel consumption

Table C-2. Estimated Air Emissions from Fuel Combustion Sources During Resupply Traverses Conducted in Alternative B

Air Pollutant	Tractors		Generators		Heaters		Snowmobiles		Total Emissions (kg/yr)
	Fuel Usage: 58 L/hr; 350,000 L/yr		Fuel Usage: 12 L/hr; 13,000 L/yr		Fuel Usage: 1.5 L/hr; 3,400 L/yr		Fuel Usage: 1 L/hr; 600 L/yr		
	Emissions Factor (kg/L) [1][2]	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [1][3]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [4][5]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [1][6]**	**Emissions (kg/yr)**	
Sulfur Oxides	5.71E-06	2.00E+00	7.39E-06	9.60E-02	6.91E-03	2.35E+01	6.05E-06	3.63E-03	**2.56E+01**
Nitrogen Oxides	1.52E-05	5.30E+00	2.07E-05	2.69E-01	2.40E-03	8.16E+00	4.16E-06	2.49E-03	**1.37E+01**
Carbon Monoxide	4.70E-06	1.65E+00	2.01E-05	2.62E-01	6.00E-04	2.04E+00	1.75E-03	1.05E+00	**5.00E+00**
Exhaust Hydrocarbons	7.22E-07	2.53E-01	4.31E-06	5.60E-02	NCA		6.42E-04	3.85E-01	**6.94E-01**
Particulate Matter	6.91E-07	2.42E-01	3.04E-06	3.95E-02	2.40E-04	8.16E-01	1.59E-05	9.53E-03	**1.11E+00**
Carbon Dioxide	1.49E-03	5.22E+02	2.24E-03	2.91E+01	2.66E+00	9.03E+03	1.17E-02	7.01E+00	**9.59E+03**
Total Organic Carbon (TOC)	NCA		NCA		6.67E-05	2.27E-01	NCA		**2.27E-01**
Non-methane TOC	NCA		NCA		4.08E-05	1.39E-01	NCA		**1.39E-01**
Methane	NCA		NCA		2.59E-05	8.81E-02	NCA		**8.81E-02**
Nitrous Oxide	NCA		NCA		1.32E-05	4.49E-02	NCA		**4.49E-02**
Polycyclic Organic Matter (POM)	NCA		NCA		3.96E-07	1.35E-03	NCA		**1.35E-03**

Notes:
NCA = No characterization data available.
[1] U.S. EPA Nonroad Emissions Model, U.S. EPA National Vehicle and Fuel Emissions Laboratory, draft version, June 1998.
[2] Emissions factor for tractors, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/57.8 L/hr fuel consumption
[3] Emissions factor for generators, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/12.1 L/hr fuel consumption
[4] U.S. EPA Office of Air and Radiation. *Compilation of Air Pollutant Emission Factors. AP-42*, Volume II, Mobile Sources, Fourth Edition. September 1985.
[5] Emissions factor for heaters, in kg/L = [emissions factor in lbs/gallon x 0.4536 kg/lb/3.78 liters/gal]/1.6 L/hr fuel consumption
[6] Emissions factor for snowmobiles, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/1.2 L/hr fuel consumption

Table C-3. Estimated Air Emissions from Fuel Combustion Sources During Resupply Traverses Conducted in Alternative C

Air Pollutant	Tractors		Generators		Heaters		Snowmobiles		Total Emissions (kg/yr)
	Fuel Usage: 58 L/hr; 350,000 L/yr		Fuel Usage: 12.1 L/hr; 25,000 L/yr		Fuel Usage: 1.5 L/hr; 6,600 L/yr		Fuel Usage: 1 L/hr; 1,200 L/yr		
	Emissions Factor (kg/L) [1][2]	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [1][3]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [4][5]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [1][6]**	**Emissions (kg/yr)**	
Sulfur Oxides	5.71E-06	2.00E+00	7.39E-06	1.85E-01	6.91E-03	4.56E+01	6.05E-06	7.26E-03	**4.78E+01**
Nitrogen Oxides	1.52E-05	5.30E+00	2.07E-05	5.17E-01	2.40E-03	1.58E+01	4.16E-06	4.99E-03	**2.17E+01**
Carbon Monoxide	4.70E-06	1.65E+00	2.01E-05	5.03E-01	6.00E-04	3.96E+00	1.75E-03	2.10E+00	**8.21E+00**
Exhaust Hydrocarbons	7.22E-07	2.53E-01	4.31E-06	1.08E-01	NCA		6.42E-04	7.71E-01	**1.13E+00**
Particulate Matter	6.91E-07	2.42E-01	3.04E-06	7.59E-02	2.40E-04	1.58E+00	1.59E-05	1.91E-02	**1.92E+00**
Carbon Dioxide	1.49E-03	5.22E+02	2.24E-03	5.59E+01	2.66E+00	1.75E+04	1.17E-02	1.40E+01	**1.81E+04**
Total Organic Carbon (TOC)	NCA		NCA		6.67E-05	4.40E-01	NCA		**4.40E-01**
Non-methane TOC	NCA		NCA		4.08E-05	2.69E-01	NCA		**2.69E-01**
Methane	NCA		NCA		2.59E-05	1.71E-01	NCA		**1.71E-01**
Nitrous Oxide	NCA		NCA		1.32E-05	8.71E-02	NCA		**8.71E-02**
Polycyclic Organic Matter (POM)	NCA		NCA		3.96E-07	2.61E-03	NCA		**2.61E-03**

Notes:
NCA = No characterization data available.
[1] U.S. EPA Nonroad Emissions Model, U.S. EPA National Vehicle and Fuel Emissions Laboratory, draft version, June 1998.
[2] Emissions factor for tractors, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/57.8 L/hr fuel consumption
[3] Emissions factor for generators, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/12.1 L/hr fuel consumption
[4] U.S. EPA Office of Air and Radiation. *Compilation of Air Pollutant Emission Factors. AP-42*, Volume II, Mobile Sources, Fourth Edition. September 1985.
[5] Emissions factor for heaters, in kg/L = [emissions factor in lbs/gallon x 0.4536 kg/lb/3.78 liters/gal]/1.6 L/hr fuel consumption
[6] Emissions factor for snowmobiles, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/1.2 L/hr fuel consumption

Table C-4. Estimated Air Emissions from Fuel Combustion Sources During Resupply Traverses Conducted in Alternative D

Air Pollutant	Tractors		Generators		Heaters		Snowmobiles		Total Emissions (kg/yr)
	Fuel Usage: 58 L/hr; 700,000 L/yr		Fuel Usage: 12 L/hr; 25,000 L/yr		Fuel Usage: 1.5 L/hr; 6,600 L/yr		Fuel Usage: 1 L/hr; 1,200 L/yr		
	Emissions Factor (kg/L) [1][2]	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [1][3]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [4][5]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [1][6]**	**Emissions (kg/yr)**	
Sulfur Oxides	5.71E-06	4.00E+00	7.39E-06	1.85E-01	6.91E-03	4.56E+01	6.05E-06	7.26E-03	**4.98E+01**
Nitrogen Oxides	1.52E-05	1.06E+01	2.07E-05	5.17E-01	2.40E-03	1.58E+01	4.16E-06	4.99E-03	**2.70E+01**
Carbon Monoxide	4.70E-06	3.29E+00	2.01E-05	5.03E-01	6.00E-04	3.96E+00	1.75E-03	2.10E+00	**9.85E+00**
Exhaust Hydrocarbons	7.22E-07	5.05E-01	4.31E-06	1.08E-01	NCA		6.42E-04	7.71E-01	**1.38E+00**
Particulate Matter	6.91E-07	4.83E-01	3.04E-06	7.59E-02	2.40E-04	1.58E+00	1.59E-05	1.91E-02	**2.16E+00**
Carbon Dioxide	1.49E-03	1.04E+03	2.24E-03	5.59E+01	2.66E+00	1.75E+04	1.17E-02	1.40E+01	**1.87E+04**
Total Organic Carbon (TOC)	NCA		NCA		6.67E-05	4.40E-01	NCA		**4.40E-01**
Non-methane TOC	NCA		NCA		4.08E-05	2.69E-01	NCA		**2.69E-01**
Methane	NCA		NCA		2.59E-05	1.71E-01	NCA		**1.71E-01**
Nitrous Oxide	NCA		NCA		1.32E-05	8.71E-02	NCA		**8.71E-02**
Polycyclic Organic Matter (POM)	NCA		NCA		3.96E-07	2.61E-03	NCA		**2.61E-03**

Notes:
NCA = No characterization data available.
[1] U.S. EPA Nonroad Emissions Model, U.S. EPA National Vehicle and Fuel Emissions Laboratory, draft version, June 1998.
[2] Emissions factor for tractors, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/57.8 L/hr fuel consumption
[3] Emissions factor for generators, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/12.1 L/hr fuel consumption
[4] U.S. EPA Office of Air and Radiation. *Compilation of Air Pollutant Emission Factors. AP-42*, Volume II, Mobile Sources, Fourth Edition. September 1985.
[5] Emissions factor for heaters, in kg/L = [emissions factor in lbs/gallon x 0.4536 kg/lb/3.78 liters/gal]/1.6 L/hr fuel consumption
[6] Emissions factor for snowmobiles, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/1.2 L/hr fuel consumption

Table C-5. Estimated Air Emissions from Fuel Combustion Sources During Resupply Traverses Conducted in Alternative E

Air Pollutant	Tractors		Generators		Heaters		Snowmobiles		Total Emissions (kg/yr)
	Fuel Usage: 58 L/hr; 700,000 L/yr		Fuel Usage: 12 L/hr; 25,000 L/yr		Fuel Usage: 1.5 L/hr; 6,600 L/yr		Fuel Usage: 1 L/hr; 1,200 L/yr		
	Emissions Factor (kg/L) [1][2]	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [1][3]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [4][5]**	**Emissions (kg/yr)**	**Emissions Factor (kg/L) [1][6]**	**Emissions (kg/yr)**	
Sulfur Oxides	5.71E-06	4.00E+00	7.39E-06	1.85E-01	6.91E-03	4.56E+01	6.05E-06	7.26E-03	**4.98E+01**
Nitrogen Oxides	1.52E-05	1.06E+01	2.07E-05	5.17E-01	2.40E-03	1.58E+01	4.16E-06	4.99E-03	**2.70E+01**
Carbon Monoxide	4.70E-06	3.29E+00	2.01E-05	5.03E-01	6.00E-04	3.96E+00	1.75E-03	2.10E+00	**9.85E+00**
Exhaust Hydrocarbons	7.22E-07	5.05E-01	4.31E-06	1.08E-01	NCA		6.42E-04	7.71E-01	**1.38E+00**
Particulate Matter	6.91E-07	4.83E-01	3.04E-06	7.59E-02	2.40E-04	1.58E+00	1.59E-05	1.91E-02	**2.16E+00**
Carbon Dioxide	1.49E-03	1.04E+03	2.24E-03	5.59E+01	2.66E+00	1.75E+04	1.17E-02	1.40E+01	**1.87E+04**
Total Organic Carbon (TOC)	NCA		NCA		6.67E-05	4.40E-01	NCA		**4.40E-01**
Non-methane TOC	NCA		NCA		4.08E-05	2.69E-01	NCA		**2.69E-01**
Methane	NCA		NCA		2.59E-05	1.71E-01	NCA		**1.71E-01**
Nitrous Oxide	NCA		NCA		1.32E-05	8.71E-02	NCA		**8.71E-02**
Polycyclic Organic Matter (POM)	NCA		NCA		3.96E-07	2.61E-03	NCA		**2.61E-03**

Notes:
NCA = No characterization data available.
[1] U.S. EPA Nonroad Emissions Model, U.S. EPA National Vehicle and Fuel Emissions Laboratory, draft version, June 1998.
[2] Emissions factor for tractors, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/57.8 L/hr fuel consumption
[3] Emissions factor for generators, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/12.1 L/hr fuel consumption
[4] U.S. EPA Office of Air and Radiation. *Compilation of Air Pollutant Emission Factors. AP-42*, Volume II, Mobile Sources, Fourth Edition. September 1985.
[5] Emissions factor for heaters, in kg/L = [emissions factor in lbs/gallon x 0.4536 kg/lb/3.78 liters/gal]/1.6 L/hr fuel consumption
[6] Emissions factor for snowmobiles, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/1.2 L/hr fuel consumption

Table C-6. Estimated Air Emissions From Fuel Combustion Sources During Scientific Traverses

Air Pollutant	Tractors		Generators		Heaters		Snowmobiles		Total Emissions (kg)
	Fuel Usage: 30 L/hr; 30,000 L		Fuel Usage: 12 L/hr; 6,000 L		Fuel Usage: 1.5 L/hr; 3,000 L		Fuel Usage: 1 L/hr; 575 L		
	Emissions Factor (kg/L) [1][2]	**Emissions (kg)**	**Emissions Factor (kg/L) [1][3]**	**Emissions (kg)**	**Emissions Factor (kg/L) [4][5]**	**Emissions (kg)**	**Emissions Factor (kg/L) [1][6]**	**Emissions (kg)**	
Sulfur Oxides	6.19E-06	1.86E-01	7.39E-06	4.43E-02	6.91E-03	2.07E+01	6.05E-06	3.48E-03	**2.10E+01**
Nitrogen Oxides	1.60E-05	4.80E-01	2.07E-05	1.24E-01	2.40E-03	7.20E+00	4.16E-06	2.39E-03	**7.81E+00**
Carbon Monoxide	4.22E-06	1.27E-01	2.01E-05	1.21E-01	6.00E-04	1.80E+00	1.75E-03	1.01E+00	**3.05E+00**
Exhaust Hydrocarbons	9.66E-07	2.90E-02	4.31E-06	2.59E-02	NCA		6.42E-04	3.69E-01	**4.24E-01**
Particulate Matter	9.35E-07	2.81E-02	3.04E-06	1.82E-02	2.40E-04	7.20E-01	1.59E-05	9.13E-03	**7.75E-01**
Carbon Dioxide	1.62E-03	4.85E+01	2.24E-03	1.34E+01	2.66E+00	7.97E+03	1.17E-02	6.72E+00	**8.04E+03**
Total Organic Carbon (TOC)	NCA		NCA		6.67E-05	2.00E-01	NCA		**2.00E-01**
Non-methane TOC	NCA		NCA		4.08E-05	1.22E-01	NCA		**1.22E-01**
Methane	NCA		NCA		2.59E-05	7.78E-02	NCA		**7.78E-02**
Nitrous Oxide	NCA		NCA		1.32E-05	3.96E-02	NCA		**3.96E-02**
Polycyclic Organic Matter (POM)	NCA		NCA		3.96E-07	1.19E-03	NCA		**1.19E-03**

Notes:
NCA = No characterization data available.
[1] U.S. EPA Nonroad Emissions Model, U.S. EPA National Vehicle and Fuel Emissions Laboratory, draft version, June 1998.
[2] Emissions factor for tractors, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/29.1 L/hr fuel consumption
[3] Emissions factor for generators, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/12.1 L/hr fuel consumption
[4] U.S. EPA Office of Air and Radiation. *Compilation of Air Pollutant Emission Factors. AP-42*, Volume II, Mobile Sources, Fourth Edition. September 1985.
[5] Emissions factor for heaters, in kg/L = [emissions factor in lbs/gallon x 0.4536 kg/lb/3.78 liters/gal]/1.6 L/hr fuel consumption
[6] Emissions factor for snowmobiles, in kg/L = [emissions factor in lbs/hour x 0.4536 kg/lb]/1.2 L/hr fuel consumption

Table C-7. Detailed Air Emissions from Logistical Support Aircraft

Characteristic Pollutant	Missions per year [1]	Flight Hours below 60^0S	Additional Idling Time (hr) [3]	Emission Rates [4] LTO (kg/LTO)	Idling (kg/hr)	Flight (kg/hr)	Emissions (kg/year) LTO	Additional Idling	Cruise Flight	Total
Aircraft: LC-130 (4 Engine Turboprop, Engine Manufacturer: Detroit Diesel Allison Division of General Motors, Model T56)										
Alternative A										
Sulfur Oxides	69	397	69	0.73	0.8	3	101	55	1,190	**1,346**
Nitrogen Oxides	69	397	69	4.35	4	24.6	600	276	9,760	**10,636**
Carbon Monoxide	69	397	69	14.68	31.6	7.4	2,026	2,180	2,936	**7,142**
Exhaust Hydrocarbons	69	397	69	9.2	20.8	1.2	1,270	1,435	476	**3,181**
Particulates	69	397	69	1.98	2.8	6.2	273	193	2,460	**2,926**
Alternative B										
Sulfur Oxides	35	201	35	0.73	0.8	3	51	28	604	**683**
Nitrogen Oxides	35	201	35	4.35	4	24.6	305	140	4,951	**5,395**
Carbon Monoxide	35	201	35	14.68	31.6	7.4	1,028	1,106	1,489	**3,623**
Exhaust Hydrocarbons	35	201	35	9.2	20.8	1.2	644	728	242	**1,614**
Particulates	35	201	35	1.98	2.8	6.2	139	98	1,248	**1,484**
Alternative C										
Sulfur Oxides	35	201	35	0.73	0.8	3	51	28	604	**683**
Nitrogen Oxides	35	201	35	4.35	4	24.6	305	140	4,951	**5,395**
Carbon Monoxide	35	201	35	14.68	31.6	7.4	1,028	1,106	1,489	**3,623**
Exhaust Hydrocarbons	35	201	35	9.2	20.8	1.2	644	728	242	**1,614**
Particulates	35	201	35	1.98	2.8	6.2	139	98	1,248	**1,484**
Alternative D										
Sulfur Oxides	67	385	67	0.73	0.8	3	98	54	1,156	**1,307**
Nitrogen Oxides	67	385	67	4.35	4	24.6	583	268	9,477	**10,328**
Carbon Monoxide	67	385	67	14.68	31.6	7.4	1,967	2,117	2,851	**6,935**
Exhaust Hydrocarbons	67	385	67	9.2	20.8	1.2	1,233	1,394	462	**3,089**
Particulates	67	385	67	1.98	2.8	6.2	265	188	2,389	**2,841**
Alternative E										
Sulfur Oxides	69	397	69	0.73	0.8	3	101	55	1,190	**1,346**
Nitrogen Oxides	69	397	69	4.35	4	24.6	600	276	9,760	**10,636**
Carbon Monoxide	69	397	69	14.68	31.6	7.4	2,026	2,180	2,936	**7,142**
Exhaust Hydrocarbons	69	397	69	9.2	20.8	1.2	1,270	1,435	476	**3,181**
Particulates	69	397	69	1.98	2.8	6.2	273	193	2,460	**2,926**

Table C-7. Detailed Air Emissions from Logistical Support Aircraft

Characteristic Pollutant	Missions per year [1]	Flight Hours below 60^0S	Additional Idling Time (hr) [3]	Emission Rates [4]			Emissions (kg/year)			
				LTO (kg/LTO)	Idling (kg/hr)	Flight (kg/hr)	LTO	Additional Idling	Cruise Flight	Total

Notes:

N/A = Not Applicable. NA = Not Available.

[1] Intercontinental missions comprise one round trip to Antarctica and have one landing/takeoff (LTO) cycle below 60^oS; Intracontinental flights have two LTO cycles below 60^oS.

[2] Intercontinental flight hours represent number of flight hours below 60^oS; assumed to be 50 percent of the total flight hours.

[3] Represents extra aircraft idling at the South Pole, assumed to be 1.0 hours per mission. Routine aircraft idling is included in LTO emissions.

[4] Presented in Table 4-10 of the *2002 Permit Amendments* (RPSC, 2002).