APPENDIX F
ENERGY RESOURCES/AIR QUALITY CALCULATIONS

The following tables contain background data used in the calculation of energy and air quality emissions contained in Section 4.3 and 4.4 of the EIS. The energy analysis primarily focused on fuel consumption, while the air quality assessment analyzed the resulting emissions as a result of the fuel consumption. The following tables outline the potential fuel usage based on project specific data and the rated fuel economy, as well as air emission calculations as summarized in Section 4.4.

Fuel Economy Calculations

Annual Fuel Consumption Calculation – Proposed Action (via the Wallaceton to Munson Route)

	A	B	C	
Operation	SD40 Locomotive Fuel Economy (g/h)*	Round Trip Train Travel Time	Gallons/year (2 locomotives, 6 days/week)	Comments
Transport	59.2	2.3	84,964	C = A x B x 2 locomotives x 6 days/week x 52 weeks/year
Idle	4.1	8.0	20,467	C = A x B x 2 locomotives x 6 days/week x 52 weeks/year
		Total (gallons/year)	**105,431**	

Annual Fuel Consumption Calculation – Modified Proposed Action (via Alt. Rte from Philipsburg to Munson)

	A	B	C	
Operation	SD40 Locomotive Fuel Economy (g/h)*	Round Trip Train Travel Time	Gallons/year (2 locomotives, 6 days/week)	Comments
Transport	59.2	2.0	73,882	C = A x B x 2 locomotives x 6 days/week x 52 weeks/year
Idle	4.1	8.0	20,467	C = A x B x 2 locomotives x 6 days/week x 52 weeks/year
		Total (gallons/year)	**94,349**	

* Note: SD40 fuel consumption for transport and idle derived from manufacturer. See attached spec sheet.

Annual Fuel Consumption Calculation – No Build Alternative (Local Road System Upgrade)

	A	B	C	D	
Roadway Segment	Roundtrip # Trucks/day	Miles	Fuel Economy (mpg) *	Annual Fuel Consumption (gal/yr)	Comments
SR 0053 - Kylertown to Moshannon	275	10.7	6.0	153010	D = (A x B/C) x 6 days/week x 52 weeks/year
SR 144 - Snow Shoe to Moshannon	715	3.9	6.0	145002	D = (A x B/C) x 6 days/week x 52 weeks/year
Gorton Road - Moshannon to Gorton	1100	3.4	6.0	194480	D = (A x B/C) x 6 days/week x 52 weeks/year
			Total (gallons/year)	**492,492**	

* Note: Common fuel efficiency for diesel semi tractor trailer rigs

ELECTRO-MOTIVE

LaGrange, Illinois 60525 (708) 387-6000

Accessory Horsepower	
Auxiliary Gen:	4.0
TMB:	127.2
Rad Fan :Hi-Spd:	38.9
Rad Fan :Lo-Spd:	0.0
DBB:	13.1
Air Compressor:	15.1

Model: SD40-2 LOCOMOTIVE
16-645E3B ENGINE
NOM. 3000 TRAC. HORSEPOWER
315/ IDLE; 2 SPEED DYN. BRAKE
FANS: 3-8 BLADE, SINGLE SPEED-Q;
HUB LINER, 14.5 FRP
BLOWER: 2600 CFM
COOL: 3. CORES.
STRAIGHT THRU SILENCER

Conditions		
Standards :	AAR	
Eng Speed:	904	rpm
Barometer:	28.86	inch Hg
Ambient :	60.00	F
Fuel Temp:	80.00	F
Fuel SpGr :	0.845	
Fuel Wt :	7.043	lbs/gal
Fuel HHV :	19350	BTU/lb
Train Spd :	40	mph

						Medium Duty Cycle (DC)				
Throttle Position	Eng rpm	Traction hp	Net thp	Fuel lbs/hr	Fuel gals/hr	DC %	DC thp	DC Net thp	DC lbs/hr	DC gals/hr
8	904	3012	2828	1121.6	159.3	17.00%	512.0	480.8	190.7	27.1
7	820	2418	2270	910.7	129.3	4.00%	96.7	90.8	36.4	5.2
6	729	1805	1694	686.9	97.5	4.00%	72.2	67.8	27.5	3.9
5	651	1428	1341	547.7	77.8	4.00%	57.1	53.6	21.9	3.1
4	568	1074	1008	416.8	59.2	4.00%	43.0	40.3	16.7	2.4
3	490	772	724	304.2	43.2	4.00%	30.9	29.0	12.2	1.7
2	343	420	395	175.8	25.0	4.00%	16.8	15.8	7.0	1.0
1	315	95	89	64.1	9.1	4.00%	3.8	3.6	2.6	0.4
Idle	315	0	0	36.1	5.1	15.30%	0.0	0.0	5.5	0.8
Low Idle	255	0	0	28.8	4.1	30.70%	0.0	0.0	8.8	1.3
DB-4	568	0	0	105.1	14.9	2.30%	0.0	0.0	2.4	0.3
DB-1	315	0	0	36.6	5.2	6.70%	0.0	0.0	2.5	0.3
						100%	832.5	781.6	334.2	47.4

Annual Fuel Consumption Based on Duty Cycle Utilization

75%	(6570 hrs)	311710 gals/yr	90%	(7884 hrs)	374052 gals/yr
80%	(7008 hrs)	332491 gals/yr	95%	(8322 hrs)	394833 gals/yr
85%	(7446 hrs)	353272 gals/yr	100%	(8760 hrs)	415614 gals/yr

DCTSFC:	0.4014	#/THP-HR	13.09	kW-hrs / gal
DCNTSFC:	0.4275	#/NTHP-HR	12.29	kW-hrs / gal

Notes:

1) Horsepower and fuel consumption numbers will vary with deviation from stated conditions.
2) All stated numbers are valid for locomotives that has seen 6 to 9 months of normal service with genuine EMD components and maintained to EMD Maintenance Instructions
3) All numbers stated are nominal fleet average with +/-3% tolerance.

File: SD40-2 Fuel & HP 03.xls
Ref. File: SD40-2 Eng Perf 01.xls
Ref. Date 10/10/05

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Air Quality Calculation – Modified Proposed Action (via the Alternate Route from Philipsburg to Munson)						
		Pollutant				Comments
		PM_{10}	HC	NO_x	CO	
A	Emission Factor (g/bhp-hr)	0.32	0.48	8.60	1.28	Emission factors from US EPA "Emission Factors for Locomotives" EPA-420-F-09-025 April 2009
B	Large Line- Haul EPA Conv Factor	20.80	20.80	20.80	20.80	
C	grams of pollutant/gallon	6.66	9.98	178.88	26.62	= Emission Factor (A) x EPA Conversion Factor (B)
D	gallons/year consumption	94,349	94,349	94,349	94,349	See fuel usage estimates provided for energy analysis
E	grams/year	627986.94	941980.42	16877149.12	2511947.78	= grams of pollutant (C) x yearly fuel consumption (D)
	Tons/year	**0.69**	**1.04**	**18.60**	**2.77**	= grams/year (E) x .00000110231

Air Quality Calculation – Proposed Action (via the Wallaceton to Munson Route)						
		Pollutant				Comments
		PM_{10}	HC	NO_x	CO	
A	Emission Factor (bhp-hr)	0.32	0.48	8.60	1.28	Emission factors from US EPA "Emission Factors for Locomotives" EPA-420-F-09-025 April 2009
B	Large Line- Haul EPA Conv Factor	20.80	20.80	20.80	20.80	
C	grams of pollutant/gallon	6.66	9.98	178.88	26.62	= Emission Factor (A) x EPA Conversion Factor (B)
D	gallons/year consumption	105,431	105,431	105,431	105,431	See fuel usage estimates provided for energy analysis
E	grams/year	701748.74	1052623.10	18859497.28	2806994.94	= grams of pollutant (C) x yearly fuel consumption (D)
	Tons/year	**0.77**	**1.16**	**20.79**	**3.09**	= grams/year (E) x .00000110231

Air Quality Calculation – No-Build Alternative (Local Road System Upgrade) - Truck Transport Emission Factors (g/mile)						
		Pollutant				Comments
		PM_{10}	HC	NO_x	CO	
A	Emission Factor (grams/mile)	0.41	1.22	16.07	7.64	Emission factors from US EPA MOBILE6.2.
B	Length of Roadway Segment (miles)					Length of each roadway segment in miles
B.1	SR 0053	10.7	10.7	10.7	10.7	
B.2	SR 144	3.9	3.9	3.9	3.9	
B.3	Gorton Road	3.4	3.4	3.4	3.4	
C	Trucks on Roadway Segment (trucks/day)					Truck traffic increase on each roadway segment resulting from Local Road Upgrade Alternative
C.1	SR 0053	275	275	275.0	275.0	
C.2	SR 144	715	715	715.0	715.0	
C.3	Gorton Road	1100	1100	1100.0	1100.0	
D	SR 0053	377710.5	1123918.9	14804407.2	7038311.8	= Emission Factor (A) x Length of Roadway (B) x Truck Traffic (C) x 312 days
E	SR 144	354383.7	1054507.6	13890112.5	6603637.8	
F	Gorton Road	472584.5	4507.1	18523005.2	8806207.8	
G	**Total**	1204678.6	2182933.6	47217524.8	22448157.4	= D+E+F (Total pollutant emissions/year in grams/year)
H	lbs/year	2653.5	4808.2	104003.4	49445.3	=G/454 (Total pollutant emissions/year in lbs/year)
	Tons/year	**1.3**	**2.4**	**52.0**	**24.7**	= H x .0005 (Total pollutant emissions/year in tons/year)
NOTE: Emission factors from US EPA "Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level" April 2005, Appendix B: Estimation of Future Truck Emissions, Table B-2: Local Road Truck Emissions Factors						