Air Quality Calculations

Margaret Chase Smith Vessel Replacement

	Approximate Current Values	Approximate Values with New Vessels Only[6]	Savings w/ New Vessels Only[6]
Approximate Annual Diesel Consumption (gal)[1]	100,000	10,000	90,000
Approximate Annual Diesel Consumption of Tier 2 Engines (gal)[1]	100,000		100,000
Approximate Annual Diesel Consumption of Tier 4 Engines (gal)[1]	-	10,000	(10,000)
Annual Energy Consumption Equivalent (kWh)	4,028,488	402,849	3,625,639
Annual Energy Consumption Equivalent for Tier 2 Engines (kWh)	4,028,488	-	4,028,488
Annual Energy Consumption Equivalent for Tier 4 Engines (kWh)	-	402,849	(402,849)
Emissions Factors: Tier 2 Engines			
CO2 emission factor (pounds/gallon of diesel)[2]	22.4	22.4	22.4
PM emission factor (g/kWh)[3]	0.5	0.5	0.5
CO emission factor (g/kWh)[3]	5.0	5.0	5.0
NOX emission factor (g/kWh)[3]	9.8	9.8	9.8
Emissions Factors: Tier 4 Engines			
CO2 emission factor (pounds/gallon of diesel)[2]	22.4	22.4	22.4
PM emission factor (g/kWh)[3]	0.25	0.25	0.25
CO emission factor (g/kWh)[3]	5.0	5.0	5.0
NOX emission factor (g/kWh)[3]	1.8	1.8	1.8
Conversion Factors			
Btu content of 1 gallon of diesel[4]	137,452	137,452	137,452
Btu per kWh[4]	3,412	3,412	3,412
gram/pound	453.6	453.6	453.6
gram/metric tonne	1,000,000	1,000,000	1,000,000
MT/ tons	1.10	1.10	1.10
ANNUAL EMISSIONS			
CO2 (g/year)	1,016,064,000	101,606,400	914,457,600
PM (g/year)	2,014,244	100,712	1,913,532
CO (g/year)	20,142,438	2,014,244	18,128,195
NOX (g/year)	39,479,179	725,128	38,754,052
CO2 (pound/year)	2,240,000	224,000	2,016,000
PM (pound/year)	4,441	222	4,219
CO (pound/year)	44,406	4,441	39,965
NOX (pound/year)	87,035	1,599	85,437
CO2 (MT/year)	1,016	102	914
PM (MT/year)	2	0	2
CO (MT/year)	20	2	18
NOX (MT/year)	39	1	39
CO2 (tons/year)	1,120	112	1,008
PM (tons/year)	2	0	2
CO (tons/year)	22	2	20
NOX (tons/year)	44	1	43
Social Costs Savings of Emissions			
Social cost of carbon per metric tonne in 2025 [95th percentile estimate] ($2019)	$ 168	$ 168	$ 168
Annual Social Cost of Carbon ($2019)	$ 170,323	$ 17,032	$ 153,291

Notes:

[2]EIA Carbon Dioxide Emissions Coefficients by Fuel https://www.eia.gov/environment/emissions/co2_vol_mass.php

[3]Federal Marine Compression-Ignition (CI) Engines: Exhaust Emission Standards https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100OA0B.pdf

[4]https://www.eia.gov/energyexplained/print.cfm?page=about_energy_units

[5]https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/ERG_MCC_Vol2_CostOfDoingNothing_9-1-2020.pdf

[6]New vessels are assumed to have Tier 4 engines.