Mobile Harbor Cranes

The Port of Everett owns and operates two diesel-electric mobile harbor cranes at Pier 1 to load and unload cargo vessels that call the terminal. Currently, the mobile harbor cranes utilize their diesel engines when working at Pier 1. The mobile harbor cranes are equipped with a conversion system for connecting to electrical power. Once the electrical infrastructure is in place at Pier 1, the two mobile harbor cranes will plug in when loading and unloading cargo. It is estimated that approximately 900 annual engine hours will be reduced per crane. The characteristics of the two mobile harbor cranes are listed below:

Table 1: Crane Characteristics and Activity

Unit Count	Type	Make	Model	Year	Engine Make	hp	Annual Hours (hours per year)	Fuel Consumption (gallons per year)
1	Crane	Gottwald	HMK280E	2000	Cummins	805	900	4,500
1	Crane	Gottwald	HMK7608	2015	Cummins	1490	900	4,500

Per the EPA Diesel Emissions Quantifier, the following table summarizes the annual emissions from these cranes that are expected to be reduced each year once the South Terminal Modernization project is complete. It is expected that the emission reductions may be realized starting in 2019.

Table 2: Estimated Annual Emission Reductions for Cranes, tons per year

Crane	NOx (tpy)	$PM_{2.5}$ (tpy)	CO_2 (tpy)
HMK280E	2.16	0.065	50
HMK7608	1.52	0.018	50
Total	**3.68**	**0.08**	**100**

Per the EPA Quantifier, the remaining useful life of the 2000 model year crane is 14 years and the remaining useful life of the 2015 crane is 39 years. So these existing diesel-electric cranes have a long expected lifetime and the potential emission reductions if this project were to be funded are provided below as lifetime emissions once the electrical infrastructure is in place in 2019 (3 years from now). To estimate the lifetime emissions, the 3-year timeframe was subtracted from the 14 and 39 years of remaining useful life and the results (11 and 36 years) were multiplied by the respective annual emission reductions.

Table 3: Lifetime Emission Reductions for Cranes, tons

Crane	NOx (tons)	$PM_{2.5}$ (tons)	CO_2 (tons)
HMK280E	24	0.7	550
HMK7608	54	0.6	1,800
Total	**78**	**1**	**2,350**

Ocean-going Vessels

The South Terminal Modernization project includes providing shore-side power and equipment to allow shore power capable vessels to use shore power ("cold iron") while at berth, significantly reducing hotelling emissions. The emission reductions will be realized when vessels receive power needed for house load while at berth from the shore-side power system, shutting down their auxiliary engine(s).

Table 4 summarizes the assumptions used for the activity and emission factors. The dwell/hotelling time is based on projected assumptions for all vessels calling the terminal from 2019-on. The average auxiliary engine load at berth is based on typical vessels that presently call the terminal. The control factor for cold ironing is used to account for time needed to connect and disconnect the power supply, during which the auxiliary engine(s) continue to operate.

Table 4: Projected Vessel Activity and Emission Factors

Load at Berth (kW)	Annual Hotelling Time (hours)	Sulfur Content of Fuel Used	Control Factor for cold ironing	NO_x (g/kW-hr)	$PM_{2.5}$ (g/kW-hr)	CO_2 (g/kW-hr)
900	1,000	0.1% S	0.95	12.2	0.24	686

At this time, it is unknown whether all the vessels calling the South Terminal will be shore power ready by 2019. To account for this uncertainty, the estimated emissions reductions were calculated using two assumptions, half of the calls at the South Terminal will use shore power and also 100% of the calls. The estimated emission reductions are presented to serve as an example of the potential emission reductions that may be achieved per year if this project were to be completed successfully and the vessels calling agreed to retrofit their vessels and use shore power.

Table 5: Potential Annual Hotelling Emission Reductions, tons per year

Percent of Calls	NOx (tpy)	$PM_{2.5}$ (tpy)	CO_2 (tpy)
50%	5.7	0.1	323
100%	11.5	0.2	646

It should be noted that if larger container vessels were to call the terminal, as is expected, there may be higher potential emission reductions since the larger vessels have higher engine loads. To be conservative in the estimate, the higher engine loads were not used for this calculation. For lifetime emission reductions, it was assumed the new shore power infrastructure will have a useful life of 30 years. The annual emission reductions were multiplied by 30 to estimate the lifetime emissions.

Table 6: Potential Lifetime Hotelling Emission Reductions, tons per year

Percent of Calls	NOx (tpy)	$PM_{2.5}$ (tpy)	CO_2 (tpy)
50%	172	3	9,698
100%	345	7	19,396