OGV PM Speciation Profile Development and Assignment

Wenli Yang

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1. Profile Development

Based on the OGV fuel type information obtained from SSD (Bonnie Soriano), the PM speciation profile for HFO (2.5%S), MGO (0.3%S) and MGO (0.1%S) are needed for the SIP modeling use. The profiles for HFO (2.5%S) and MGO (0.1%S) were developed based on source testing data, and profile for MGO (0.3%S) is newly created in this work. The profile number is PM 4252.

The protocol to develop this profile is similar to the one used for HFO (1.0%S) in the previous work.

a. Calculate emission factor of SO_4^{2-} based on 3% conversion rate of fuel sulfur to SO_4^{2-}:

Emission factor of SO_4^{2-} = (Fuel consumption)*(Fuel sulfur content)*(3%)*(MW of SO_4^{2-}/ MW of S)
Given the fuel consumption is **217 g/kW-hr** for auxiliary engine (from Paul's 'sulfur calcs.xls')
Emission factor of SO_4^{2-} = (217 g/kW-hr) * (0.3%) *3% * (96/32) = 0.05859 g/kW-hr
Emission factor of $H_2SO_4 \cdot 6.5H_2O$ = Emission factor of SO_4^{2-} * (MW of $H_2SO_4 \cdot 6.5H2O$/MW of SO_4^{2-}) = (0.05859 g/kW-hr) * (215/96) = 0.131217 g/kW-hr

b. assume the emission factor of EC and OC for MGO (0.3%S) are the same of those for MGO (0.1%S):

Emission factor of EC = 0.020 g/kW-hr
Emission factor of OC= 0.181 g/kW-hr

c. Calculate weight fraction of EC, OC and SO_4^{2-}

Emission factor of PM mass = **0.33 g/kW-hr** for auxiliary engine burning MDO (0.3%S) (from Paul's 'sulfur calcs.xls')

	Emission Factor (g/kW-hr)	*Weight Fraction*
PM	0.33	
EC	0.020	0.061
OC	0.181	0.548
SO_4^{2-}	0.059	0.179
Others		0.212

2. Profile Assignment

Year	*Engine Type*	*ARB Rule and Fuel Type assumptions*	*PM Profile*
2007	Aux engine	0.3% MGO for 9 months (all vessels)	PM4252 (MGO-0.3%S)
		2.5% HFO for other months (all vessels)	PM1191 (HGO-2.5%S)
	Main engine	2.5% HFO all vessels	
	Boilers	2.5% HFO all vessels	
2008	Aux engine	0.3% MGO for 116 days (all vessels)	PM4252 (MGO-0.3%S)
		2.5% HFO for other months (all vessels)	PM1191 (HGO-2.5%S)
	Main engine	2.5% HFO all vessels	
	Boilers	2.5% HFO all vessels	
2019	Aux engine	0.1% S MGO	PM4251 (MGO-0.1%S)
	Main engine	0.1% S MGO	
	Boilers	0.1% S MGO	

3. **The fuel information for other years (2010-2018 and 2020) is available on Feb 2012 and fraction table is updated on 03/06/12**.

Year	*Engine Type*	*ARB Rule and Fuel Type assumptions*	*PM Profile*
2009	Aux engine	0.3% MGO for 6 months (all vessels)	PM4252 (MGO-0.3%S)
		2.5% HFO for 6 months (all vessels)	PM1191 (HGO-2.5%S)
	Main engine	0.3% MGO for 6 months (all vessels)	PM4252 (MGO-0.3%S)
		2.5% HFO for 6 months (all vessels)	PM1191 (HGO-2.5%S)
	Boilers	0.3% MGO for 6 months (all vessels)	PM4252 (MGO-0.3%S)
		2.5% HFO for 6 months (all vessels)	PM1191 (HGO-2.5%S)
2010-2013	Aux engine	0.3% S MGO	PM4252 (MGO-0.3%S)
	Main engine	0.3% S MGO	
	Boilers	0.3% S MGO	
2014-2020	Aux engine	0.1% S MGO	PM4251 (MGO-0.1%S)
	Main engine	0.1% S MGO	
	Boilers	0.1% S MGO	