

# **Appendix 7.1: Atmospheric Emissions from South Stream Offshore Pipeline – Turkish Sector – Construction and Pre-Commissioning Phase**



## Introduction

This Appendix presents anticipated quantities of atmospheric emissions emitted during the Construction and Pre-commissioning Phase of the Project.

The calculated emissions have been used to present total mass of emissions per pollutant and greenhouse gas. This appendix supports subsequent tables provided in **Chapter 5 Project Description** and **Chapter 7 Physical Environment**.

The methodology for calculating emissions quantities has been based on assumptions of fuel consumption for vessels used in the Construction and Pre-Commissioning Phase. Further breakdown of these activities calculations and associated methodology of emissions is presented in the following section of this appendix.

Greenhouse gas emissions are presented as carbon dioxide equivalent (CO<sub>2</sub>e) which assumes a greenhouse gas potential of 21 for CH<sub>4</sub>, 310 for N<sub>2</sub>O and 1 for CO<sub>2</sub>.

### Atmospheric Emissions from Construction and Pre-Commissioning Vessels

The following data was used to calculate fuel consumption per unit time and factored for tonnes of fuel consumed per year:

- Type of vessel;
- No of vessels required;
- Days of service for project; and
- Main engine power rating, efficiency of engine and unitisation of main engine per day.

European Monitoring and Evaluation Programme (EMEP) / European Environment Agency (EEA) Emissions factors (Ref. 1) were applied to peak and factored annual fuel consumption to quantify emissions of pollutant averaged out over a year for long term. Carbon Dioxide equivalent (eCO<sub>2</sub>) assumes a greenhouse gas potential of 21 for CH<sub>4</sub>, 310 for N<sub>2</sub>O and 1 for CO<sub>2</sub> (Table 1).

**Table 1 Emissions Data Summary (tonnes)**

NO <sub>x</sub>	CO	PM	NM VOC	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>	SO <sub>2</sub>	eCO <sub>2</sub>
2,283.3	215.2	43.6	81.4	7.9	6.4	91,912	872.6	94,061

The following tables (Table 2 to Table 5) provide values used for nearshore vessel pollutant modelling and calculating overall vessel pollutant and greenhouse gas emissions.

**Table 2 Emission Factors**

Pollutant	NO <sub>x</sub>	CO	NM VOC	SO <sub>2</sub>	PM <sub>10</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
kg/tonne fuel	78.50	7.40	2.80	30.00	1.50	3,160	0.27	0.22
g/kWh	6.57	0.62	0.23	2.51	0.13	264.56	0.02	0.02

Ref. Table 3-2, Chapter 1.A.3.d of the 2009 EMEP / EEA Emission Factors, Tier 1 Efs for ships using marine diesel oil / marine gas oil

**Table 3 Diesel Parameters**

Parameter	Value	Unit
Diesel Heating value	43	MJ/kg
Diesel Heating value	12	kWh/kg
Density of Diesel	850	kg/m <sup>3</sup>
CO <sub>2</sub> Emission Factor	3,160	kg/tonne fuel
Percentage Sulphur Fuel Content	1.5	%

Ref. EU Directive 2009/30/EC Article 4. 1.5% S content according to Reg SG 66/25.07.2003 (ships diesel fuel)

**Table 4 Long Term Emissions Data Summary (grams per second)**

Long Term NO <sub>x</sub>	Long Term CO	Long Term PM	Long Term NM VOC	Long Term CH <sub>4</sub>	Long Term N <sub>2</sub> O	Long Term CO <sub>2</sub>	Long Term SO <sub>2</sub>
72.4	20.6	4.2	7.8	0.8	0.6	8,798.8	83.5

**Table 5 Vessels Usage During Offshore Pipe-laying**

Type of Vessel	Vessels	Days	Power rating (kW)	Utilisation (%)	Efficiency (%)
Deep water Lay Vessel	1	170	7,000	40	35
Tugs	1	170	13,800	40	35
PSV (Pipe-lay Supply Vessel)	*	1217*	7,160	60	35
Survey Vessel	2	170	7,604	60	35

*Continued...*

Type of Vessel	Vessels	Days	Power rating (kW)	Utilisation (%)	Efficiency (%)
MSV (Multi Service Vessel)	2	170	10,000	60	35
Crew boats, fast cats	1	5	2,250	60	35
Helicopter	1	9	1,200	60	35
Maintenance vessel	1	9	7,160	60	35
Fuel/waste water collector vessel	1	9	610	60	35
Rescue vessel	1	1	9,548	60	35

\* This indicative number only accounts for the maximum number of PSVs that would be present inside the Turkish EEZ at any one time to supply the spread whilst pipe-laying is undertaken in Turkey. PSVs will also pass through the Turkish EEZ to reach the construction spread when pipe-laying is occurring in Russia.

*Complete.*

## References

Number	Reference
Ref. 1	EMEP/ European Environment Agency (EEA) Air Pollutant Emission Inventory Guidebook — 209. Technical Report No 9/2009.

