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Y. Ünal, C. Kahya, D. Demirhan Barı

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EVALUATIONS ON AIR POLLUTION FROM SHIPS FOR GLOBAL AND BOSPHORUS: EFFECTS ON CLIMATE CHANGE

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ABSTRACT

One of the important environmental problems is air pollution from sea transportations, because of the transportation of goods has recently been increasing by ships. Usually, ships' emission is harmful for human health and animals, plants and the others. The air pollution in the all over the world, emissions of nitrogen oxides (NO_x), sulphur oxides (SO_x), carbon dioxide (CO_2), volatile organic compound (VOC) from shipping due to combustion of marine fuels are effective for air pollution. The ships that burn tons of fuel per hour, generating large volumes of pollution, global warming gases and black carbon, contribute to climate change. According to the International Maritime Organization (IMO) radioactive forcing due to CO_2 emissions from ships indicates that ships may account for 1.8 per cent of the global. European flagged ships emitted almost 200 million tones of CO_2, 2.6 million tons of SO_2 and 3.6 million tons of NO_x in 2000.

In this study the role of Bosphorus is emphasized for sea pollution from ships, which are more than 50000 are passing from the Bosphorus and more than percentage %10 of them are tanks.

Keywords: Sea Transportation, Air Pollution, Climate Change.

INTRODUCTION

Since the beginning of the industrialization population and sea transportation have been increasing and they cause for air pollution, which is some frightened for ecological future because of climate change. Therefore climate change is one of the most difficult environmental problems faced by humankind. There are a lot of scenario types about air pollution in the world; they are quality, quantity, transportation, possible effects and the others. The issue of controlling air pollution form ships was discussed in the International Convention for the Prevention of Marine Pollution (MARPOL) in the 1973. However, it was decided not to include regulations concerning air pollution at the time. Long and short distance shipping plays important roles in facilitating international trade transportation over the world. Cargo transport by ships is about 70 percent of all trade between the European Union (EU) and the rest of the world. More than 30,000 ships with tonnage at or above 250 gross registered tons operate in European waters in a given year. Air pollution like ozone and fine aerosol particles, produced as secondary products of shipping emissions, can be transported long distances in the atmosphere, from sea to land, and even from one continent to another, (Harrison et al., 2004; Derwent et al., 2004; Jaffe et al., 2003; ENTEC 2002; Qinbin et al., 2002; Davies et al. 2000).

Environmental and Engineering Consultancy (ENTEC) has been studied about ship emissions of SO_2, NO_x, CO_2 and hydrocarbons in the North Sea, Irish Sea, English Channel, Baltic Sea, Black Sea and Mediterranean, as well as quantifying in port emissions of these pollutants plus particulate matter; to determine these emissions for all vessels as well as separately for each vessel type and flag state. This should separately consider, all vessel movements, where the starting port and destination port are both in the Community, where the starting port is inside the Community but the destination port is not, where the destination port is in the Community but the starting port is not and where no stops at any Community port are undertaken; Estimation of the effects of the International Convention for the Prevention of Marine Pollution (MARPOL) from ships agreement and additional future scenarios upon emissions, principally sulphur dioxide and particles, in the North Sea and Baltic Sea and other European seas, to present these emissions in tabular and map form; to undertake a market survey of low sulphur marine distillates, and to investigate the feasibility of ships storing and using multiple grades of marine distillates, (ENTEC, 2002; Acid News, 2006).

Emissions from international shipping in European waters show a steady increase. Since 1990, ship emissions of SO_2 have gone up from 1.8 to 2.6 million tonnes, and those of NO_x from 2.6 to 3.7 million tones – in both cases an increase of more than 40 per cent, (Acid News, 2006). Ships are fast becoming the biggest source of air pollution in the EU. According to the Commission of the European Communities (CEC) unless more action is taken they are set to emit more than all land sources combined by 2020, (CEC, 2005).

As the International Maritime Organization (IMO) notes in their study of greenhouse emissions from ships, there is an increasing awareness of the impacts of shipping emissions on onshore air quality. An estimated 85 percent of international shipping traffic occurs in the northern hemisphere, and 70 percent of that is within 400 km of land. Much of the shipping activity and associated emissions occur near major urban areas, many of which are already struggling with air quality problems (IMO, 2000). In 2000 EU flagged ships also emitted almost 200 million tonnes of carbon dioxide. This is significantly more than emissions from EU aviation. Ships all over the world burns million tons of fuel per year, generating large volumes of global warming gases likes CO_2 that contribute to climate change, (ENTEC, 2005).

The ships passing from the Bosphorus (İstanbul and Çanakkale) contribute sea, air, noise pollution and other environmental risks like maritime accidents. Recently the number of ships passing from İstanbul and Çanakkale increases and these shipping activities contribute significantly to the air pollution in the Bosphorus. Emissions of nitrogen oxides (NO_x), sulphur oxides (SO_x) from shipping due to combustion of marine fuels contribute to air pollution in the form of SO_x and NO_x and particulate matter, harming the environment through acidification as well as human health, animal and plant life particularly around coastal areas. More than 50000 ships are passing from the Bosphorus and more than percentage %10 of them are tanks. In this study numbers of ships by ships are given and the results may help environmental scientists and policy makers, (Toros, 2000; Toros et al., 2006; Güven and Özturk, 2005).

STUDY AREA AND DATA

Scientist engaged in finding the affects of air pollution in sea transportation, estimate and design a model and to estimate its environmental effects. Engineers, on the other hand, are interested in finding cheaper but least harmful systems. Emission of air pollution from shipping due to combustion of marine fuels contribute to air pollution in the form of NO_x, SO_x, PM, CO_2, and VOC cause negative effect on climate change. SO_x and NO_x and particulate matter.

The Turkish Straits are one of the most crowded sea lanes in the world used for international navigation. The Bosphorus Strait is a geological strait separating the European and the Asian parts of Istanbul and it lies between the Black Sea and the Sea of Marmara, (Fig. 1). Ships which pass through the Bosphorus and ships going to European sea and all parts of the world pollute atmosphere in ways which should not be underestimated.

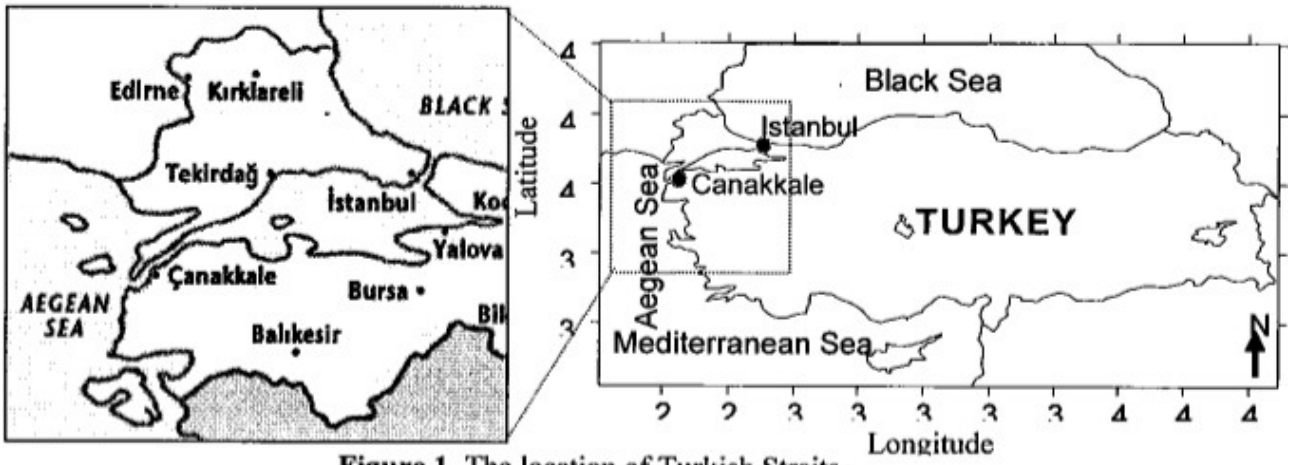

Figure 1. The location of Turkish Straits.

The Turkish Straits, comprising the Strait of Çanakkale and the Strait of Istanbul through the Black, Marmara, Aegean and Mediterranean Sea, are unique in many respects in the world. The Turkish Straits are one of the most crowded, hazardous, potentially dangerous and difficult waterways in the world for marines. All the dangers and obstacles characteristic of narrow waterways are present and acute in this critical sea lane. The Strait of Istanbul is approximately 31 kilometers long average depth 35 meters average width 1.5 km at the narrowest point is about 700 meters. The length of the strait of the Çanakkale is about 70 kilometers with a general width ranging 1-2 kilometers, (DM, 2004; TMPA, 2006; Akten, 2003; Özçayır, 2001; Yönsel, 2001).

With in ten years on the average annually 50000 ships (10 per cent being tankers) passed through the Bosphorus. The total figures of ships passing through from the strait of Istanbul and Çanakkale was shown in Table 1 and 2.

Table 1. Total Figures for the Strait of Istanbul 1995-2003, (TMPA, 2006).

YEARS	TOTAL	Took Pilot	SP report	Over 200m.	Over 500 GT	Direct Passed	Tankers
1995	35459	8292	12382	8164	31662	23249	N/A
1996	36198	10307	13473	8304	34789	24061	5658
1997	36198	10307	13473	8304	34789	24061	5658
1998	38777	11448	17692	2394	37295	25136	6546*
1999	40582	10002	24533	2568	44354	26900	5445
2000	41561	11130	33861	2697	40163	27033	5543
2001	39249	10703		2960		26452	7079
2002	42669	12164	42477	3665	41980	29900	7637
2003	42648	13020	42648	38925	42530	29117	8114

*This value includes all vessels carrying dangerous cargo

Table 2. Total Figures of Passages for the Strait of Çanakkale 1995-2003, (TMPA, 2006).

YEAR	Total	Used Pilot	SP report	Longer than 200m.	Over 500 GT	Direct Passed	Tankers
1995	46954	17772	9571	6491	40724	24325	-
1996	49952	20317	12777	7236	44636	23755	4248
1997	50942	19752	15503	6487	45849	24568	4303
1998	49304	18881	24432	1943	44829	24561	5142*
1999	47906	18424	30619	2168	44354	26323	4452
2000	48079	19209	38574	2203	44734	26858	4937
2001	42637	17767		2453		26113	6516
2002	47283	19905	44728	3113	45350	29398	7427
2003	46939	21175	45340	2923	45157	28961	6578

*Includes vessels carrying dangerous cargo.

Air pollution from ships depends on the vessel, vessel type, engine type, vessel size, and the quality of fuel oil and sea species for example the Bosphorus like a river. For example the ship going from Mediterranean to Black sea must use more fuel oil to burn and that means more air pollution. Also the effects of air pollution from ships depend on meteorological parameters in the region. Truck versus ship emissions average vehicle and fuel, a ship will let out 30-50 times more sulphur per ton-kilometers than a truck. When diesel becomes even cleaner in 2005, the difference will increase to 150-300 times. Turning to nitrogen oxides, ships now release about twice as much per ton-kilometer as the latest truck models, and the difference is set to increase, (Table 3). In 2005, the emission standards for trucks in the EU will be cut from the present 5.0 g/kWh to 3.5, and in 2008 to 2.0 g/kWh, (NTM, 2006).

Table 3. Emissions from trucks on long hauls with different EU standards for emissions and from cargo vessels of various sizes. Figures in grams per ton-kilometer, (NTM, 2006).

	CO_2	PM	SO_2	NO_x	VOC
Heavy truck with trailer:					
Before 1990	50	0.058	0.0093	1.00	0.120
Euro 0 (1990)	50	0.019	0.0093	0.85	0.040
Euro 1 (1993)	50	0.010	0.0093	0.52	0.035
Euro 2 (1996)	50	0.007	0.0093	0.44	0.025
Euro 3 (2000)	50	0.005	0.0093	0.31	0.025
Cargo vessel:					
large (>8000 dwt)	15	0.02	0.26	0.43	0.017
medium (2000-8000 dwt)	21	0.02	0.36	0.54	0.015
small (<2000 dwt)	30	0.02	0.51	0.72	0.016
RoRo (2-30 dwt)	24	0.03	0.42	0.66	0.029

Emissions are average in each case. Trucks: maximum overall weight 40 tons, loading 70 per cent, operating on diesel with a sulphur content of 300 ppm. Cargo vessel: bunker oil with and average sulphur content of 2.6 per cent, no cleaning of NO_x, (NTM, 2006).

Table 4 shows the growth of emissions of air pollutants (NO_x, SO_2, CO_2, HC, PM) and low and high estimation values of next future. Annual growth in shipping movements for future years, which estimated between 1.5% and 3% growth per annum in vessel movements for the period 2000 – 2010. The estimations of NO_x, SO_2, CO_2, HC and PM are 4.649, 3.294, 200.105, 171 and 28 million tons respectively, (ENTEC, 2002).

Table 4. Past and future estimated shipping emissions scenario in 1990, 2000 and 2010, (ENTEC, 2002).

	NO_x	SO_2	CO_2	HC	PM (in port)
1990	2,808	2,001	122,115	104	16
2000	3,617	2,578	157,298	134	21
2010-Low	4,015	2,845	172,791	147	24
2010-High	4,649	3,294	200,105	171	28

EVALUATION OF RESULTS

When the air pollution emitted from ships began to threaten the ecosystem, so scientist started to study the dimension of its effects and low maker, on the other hand, tried to enact lows which would minimize its effects, because of the quantity of emission from ships depends on the type of the ship, the quality of fuel oil and the largeness of the load carried. Sea transportation is preferred for carrying oil, oil products and the largeness and heavy load. Due to SO_2 and NO_x emissions are responsible for acid deposition, which can be harmful to the environment, as well as particulate matter harmful to health. NOx and VOC emissions

contribute to the formation of ground-level ozone harmful to health and to the environment. NO_x emissions contribute to environmentally damaging eutrophication. CO_2 emissions contribute to global climate change. Halon emissions damage the ozone layer.
The air pollution emissions of ships passing through the Turkish Straits, strategically situated between Asia and Europe, not only have harmful effects on the people but cause a great deal of damage to historical objects.
The purpose of this studying the air pollution emission from ships is to enlighten the people of its harmful effects and to encourage them to use less harmful fuel especially in transportation liquid or gaseous matters through the pipe system.
People's health, ecology, destruction of historical objects, and other problems like climatic change created by air pollution is a threat of the world's future. Unless we take steps to obliterate it we will have to face the consequences. As a result for our future we must do sets out a number of actions to reduce the air pollution from shipping to acidification, ground-level ozone, eutrophication, health, ozone depletion and climate change.

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