UNIVERSITI PUTRA MALAYSIA

INFLUENCE OF SHIPPING ACTIVITIES ON AIR POLLUTANT CONCENTRATIONS IN KALNG AND PENANG, MALAYSIA

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INFLUENCE OF SHIPPING ACTIVITIES ON AIR POLLUTANT CONCENTRATIONS IN KALNG AND PENENG, MALAYSIA

By

OMAR ALI JASSIM

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in fulfillment of the Requirements for the Degree of Master of Science

May 2013

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DEDICATIONS

TO MY MOTHER, FATHER AND WIFE WITH LOVE AND RESPECT

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

INFLUENCE OF SHIPPING ACTIVITIES ON AIR POLLUTANT CONCENTRATIONS IN KALNG AND PENENG, MALAYSIA

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May 2013

Chairman : Professor Mohamad Pauzi Zakaria, PhD

Faculty : Environmental Studies

Air pollution is the presence of substances in air, so as to be, or bluster to be a threat to humanity, plant or animal life, or to property. Air pollutants emerge from both manmade and natural processes. Pollutants are also defined as primary pollutants resulting from combustion of fuels and industrial operations and secondary pollutants, those which are produced because the reaction of primary pollutants in the atmosphere. Ship emissions are remarkable growing globally and have significantly influenced on air quality on sea and land. These emissions engage dangerous adverse health and environmental effects. Territorial waters, inland seas and ports are the regions most affected by vessel emissions. The aim of this work is to investigate air pollution levels due to shipping activities along the Strait of Malacca. This study was conducted to assess the level of air pollution and to investigate the level of air pollution from emission gases due to shipping activities in the Strait of Malacca. Six air quality stations which were close to the coast area were selected from Department of Environment (DOE) database for collecting data during 2000 to 2010. Furthermore the

related data to ship traffic (type and numbers) were collected in the same period from the Malaysian Marine Department. Meteorological parameters and wind direction were also obtained from the Meteorological Department of Malaysia. Descriptive statistics, spatial distribution, Principle Component Analysis and regression analysis are employed to achieve the objectives. Data of vessels passing this strait indicates that the strait indeed has a high volume of patronage and this is likely to increase as the years roll. The analysis of the concentration of five air pollutants (NO_2, CO, SO_2, O_3 and PM_{10}) shows that their concentrations have an increasing trend from 2000 to 2010. The results of the spatial distribution also revealed that these air pollutants are concentrated towards the middle region of the Strait of Malacca. Principle Component Analysis categorized all air pollutants in two groups. CO, NO_2 and SO_2 were the most important pollutants across the Strait of Malacca. The result of regression analysis indicated a positive and significant positive relationship of number of vessels on the concentrations of CO, SO_2, and NO_2 while it was not significant for PM_{10} and O_3 concentrations.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

PENGARUH AKTIVITI PERKAPALAN KEPADA KEPEKATAN PENCEMAR DI KLANG DAN PULAU PINANG, MALAYSIA

Oleh

OMAR ALI JASSIM

Mei 2013

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Pencemaran udara adalah kehadiran bahan-bahan di udara, supaya, atau marah-marah menjadi ancaman kepada manusia, tumbuhan atau haiwan hidup, atau harta. Pencemar udara keluar dari kedua-dua buatan manusia dan proses semula jadi. Pencemar juga ditakrifkan sebagai pencemar utama yang terhasil daripada pembakaran bahan api dan operasi industri dan pencemaran menengah, orang-orang yang dihasilkan kerana tindak balas bahan pencemar utama di dalam atmosfera. Pelepasan kapal yang luar biasa yang semakin meningkat di seluruh dunia dan telah dipengaruhi dengan ketara kepada kualiti udara di laut dan tanah. Pengeluaran ini melibatkan kesan kesihatan dan alam sekitar berbahaya yang buruk. Perairan, laut pedalaman dan pelabuhan adalah kawasan yang paling terjejas oleh pelepasan kapal. Tujuan kerja ini adalah untuk menyiasat tahap pencemaran udara akibat aktiviti perkapalan di sepanjang Selat Melaka. Kajian ini dijalankan untuk menilai tahap pencemaran udara dan untuk menyiasat tahap pencemaran udara daripada pelepasan gas kerana aktiviti perkapalan

di Selat Melaka. Enam stesen kualiti udara yang berada berhampiran dengan kawasan pantai telah dipilih daripada Jabatan Alam Sekitar pangkalan data (JAS) untuk mengumpul data pada tahun 2000 hingga 2010. Tambahan pula, data yang berkaitan untuk menghantar lalu lintas (jenis dan nombor) telah dikumpulkan dalam tempoh yang sama dari Jabatan Laut Malaysia. Parameter meteorologi dan arah angin juga diperolehi dari Jabatan Meteorologi Malaysia. Statistik deskriptif, pengedaran ruang, Prinsip Analisis Komponen dan analisis regresi digunakan untuk mencapai objektif. Data kapal lulus selat ini menunjukkan bahawa Selat Melaka sememangnya mempunyai jumlah yang tinggi naungan dan ini dijangka meningkat kerana roll tahun. Analisis kepekatan lima bahan pencemar udara (NO_2, CO, SO_2, O_3 dan PM_{10}) menunjukkan bahawa kepekatan mereka mempunyai trend yang semakin meningkat dari 2000 hingga 2010. Keputusan taburan juga mendedahkan bahawa pencemaran udara tertumpu ke arah kawasan tengah-tengah Selat Melaka. Prinsip Analisis Komponen dikategorikan semua pencemar udara dalam dua kumpulan. CO, NO_2 dan SO_2 adalah pencemaran yang paling penting di seluruh Selat Melaka. Hasil analisis regresi menunjukkan hubungan yang positif dan signifikan positif bilangan kapal di kepekatan CO, SO_2, NO_2 dan semasa ia tidak penting bagi PM_{10} dan O_3 kepekatan.

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I certify that a Thesis Examination Committee has met on 20 May 2013 to conduct the final examination of Omar Ali Jassim on his thesis entitled " Influence of Shipping Activities on Air Pollutant Concentrations in Klang and Penang, Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Masters of Science. The members of the Supervisory Committee were as follows:

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DECLARATION

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously and it is not any other institution concurrently, submitted for any other degree at Universiti Putra Malaysia or other institutions.

OMAR ALI JASSIM

Date: 20 May 2013

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