



UNIVERSITI PUTRA MALAYSIA

***PREDICTION OF HEALTH IMPACT OF NITROGEN DIOXIDE AIR
POLLUTANT FROM PETROCHEMICAL INDUSTRY ON COMMUNITIES
IN KEMAMAN AND DUNGUN, MALAYSIA***

MOHD HABIR BIN IBRAHIM

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KEMAMAN AND DUNGUN, MALAYSIA**

MOHD HABIR BIN IBRAHIM

**DOCTOR OF PHILOSOPHY
UNIVERSITI PUTRA MALAYSIA**

2012

DEDICATION

To my beloved;

Father; Ibrahim Mamat

Mother; Hanipah Sidik

Wife; Nor Madihah Mohamed

Daughters and sons;

Nor Iman,

Nor Wafa,

Mohamad Imran (Ali),

Mohamad Wafiq (Omar),

Nor Izzah;

“for boundless and kind patient waiting to the success of long journey”



Abstract of thesis requirement presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

PREDICTION OF HEALTH IMPACT OF NITROGEN DIOXIDE AIR POLLUTANT FROM PETROCHEMICAL INDUSTRY ON COMMUNITIES IN KEMAMAN AND DUNGUN, MALAYSIA

By

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May 2012

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Petrochemical industry is one of the major air pollutant generators around the world. The same scenario is observed occurring at North East of Peninsular Malaysia where this industry is estimated of producing more than half of the Malaysian petrochemicals products. This research will focus on the point source NO₂ emission emitted by the petrochemicals plants. The ISCT3 air dispersion of Gaussain Transport Model is used to simulate the average predicted on ground concentration of NO₂ emitted by point source from the petrochemicals plants. The simulation covers major input of geographical domain set up, NO₂ generators specification and meteorological parameters. The geographical domain set up is at 20 km \times 20 km covering area centre of the petrochemicals plants with 0.5 km receptors grid spacing. The NO₂ emission rate was estimated through the use of the actual sampling data and the ultimate fuel analysis

method. The NO₂ generated combined with five yearly (2004-2008) meteorological data was applied to perform the simulation at the optimum correlation of wind direction at the range of -29° to 45° angle which leads to the polynomial model of predicting the wind direction. The simulation performed discovered that the maximum predicted of monthly and yearly average on ground NO₂ concentration to receptors range from 8.42 to 17.51 $\mu\text{g}/\text{m}^3$ and from 4.96 to 6.90 $\mu\text{g}/\text{m}^3$ respectively. The yearly predicted average concentration shows that the value is below the WHO and Malaysian DOE guideline which is at 40 and 90 $\mu\text{g}/\text{m}^3$ respectively. This average maximum yearly predicted NO₂ indicate that the Hazard Index value is less than 1.00 which conclude that the is no appreciable harmful effects to receptors surrounding the petrochemicals industry. Benchmarking of Hazard Index could not be performed at the predicted monthly average since there is no available standard guideline.

Abstrak tesis yang dikemukakan kepada Senate Universiti Putra Malaysia sebagai memenuhi keperluan Ijazah Doktor Falsafah

**RAMALAN IMPAK KESIHATAN OLEH PENCEMARAN UDARA NITROGEN
DIOKSIDA DARI INDUSTRI PETROKIMIA TERHADAP MASYARAKAT DI
KEMAMAN DAN DUNGUN, MALAYSIA**

Oleh

MOHD HABIR BIN IBRAHIM

Mei 2012

Pengerusi: Profesor Madya Ahmad Makmom Hj. Abdullah, PhD

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Industri petrokimia adalah salah satu penjana utama kepada pencemaran udara di dunia. Senario yang sama didapati berlaku di Timur Laut Semenanjung Malaysia di mana pengeluaran produk oleh industri petrokimia di sini dianggarkan melebihi separuh daripada keseluruhan jumlah produk petrokimia di Malaysia. Penyelidikan ini memberi fokus kepada pelepasan NO₂ oleh industri petrokimia melalui punca titik. Model Pengangkutan Gaussain yang digunapakai oleh program simulasi penyebaran udara ISCT3 digunakan untuk simulasi meramal pelepasan purata NO₂ yang dilepaskan oleh punca titik industri petrokimia. Simulasi ini merangkumi input utama persempadan geografi, spesifikasi penyebar NO₂ dan perimeter meteorologi. Persempadan geografi merangkumi keluasan kawasan 20 km x 20 km berpusat di tengah kilang petrokimia dengan jarak 0.5 km jejaring penerimaan. Kadar pelepasan NO₂ dianggarkan dengan penggunaan data rawak sebenar dan kaedah analisis muktamad bahanapi. Pelepasan NO₂ digabungkan dengan data meterologi tahunan (2004-2008) untuk melakukan simulasi

pada korelasi optima bagi arah angin dari sudut -29° hingga 45° yang membawa kepada model polinomial ramalan arah angin. Simulasi yang dilakukan mendapati ramalan purata kepekatan maksima bulanan dan tahunan NO_2 di muka bumi kepada penerima adalah pada nilai dari 8.42 hingga 17.51 $\mu\text{g}/\text{m}^3$ dan 4.96 hingga 6.90 $\mu\text{g}/\text{m}^3$. Ramalan purata kepekatan tahunan adalah di bawah tahap yang ditetapkan oleh Organisasi Kesihatan Sedunia (WHO) and Jabatan Alam Sekitar Malaysia iaitu pada 40 dan 90 $\mu\text{g}/\text{m}^3$. Ramalan purata maksima tahunan NO_2 ini menunjukkan Petunjuk Bahaya adalah kurang dari 1.00 yang membawa rumusan bahawa tidak ada kesan bahaya terhadap penerima di persekitaran industri petrokimia. Tiada pengukuran Petunjuk Bahaya pada ramalan purata maksima bulanan NO_2 dapat dilakukan kerana tidak ada rujukan garis panduan rasmi.

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I certify that a Thesis Examination Committee has met on 7 May 2012 to conduct the final examination of Mohd Habir bin Ibrahim on his thesis entitled "Prediction of Health Impact of Nitrogen Dioxide Air Pollutant from Petrochemical Industry on Communities in Kemaman and Dungun, 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 degree of Doctor of Philosophy

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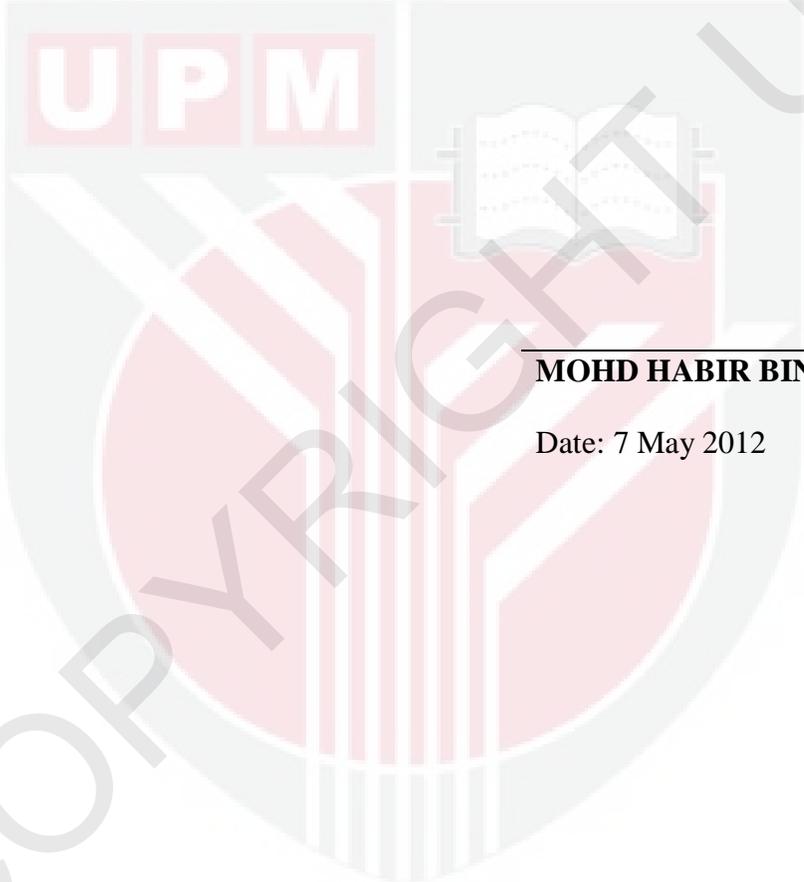
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DECLARATION

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

The logo of Universiti Putra Malaysia (UPM) is a shield-shaped emblem. It features a red and white design with a central book and a banner. The letters 'UPM' are prominently displayed in a red box at the top left of the shield.

MOHD HABIR BIN IBRAHIM

Date: 7 May 2012

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