

THE EFFECT OF AIR POLLUTION BY PETROCHEMICAL INDUSTRY AMONG COMMUNITY IN THE STATE OF TERENGGANU, PARTICULARLY AT DISTRICT OF DUNGUN AND KEMAMAN, TERENGGANU

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1. Introduction and overview of air pollution and petrochemicals industry

“The twentieth century, during which industrialization proceeded even faster than population growth, marked the beginning of an understanding, both popular and scientific, that human activity was having deleterious effects upon the natural world, including human health and welfare. These effects include increasing pollution of air, water and land the by products of industrial activity” (Fay and Golomb, 2002).

More industry means more wealth and jobs but there is a price in pollution and hence adverse effects on human health (Easton, 2005) where air quality is regarded as a major environmental pollution issue in many areas (EPA Queensland, 2005). Air pollution means the presence of one or more unwanted substances in air. Air pollutants have negative impacts on humans, animals and plants, and on [air quality](#). The most frequently present pollutants are sulphur oxides (SO_x), nitrogen oxides (NO_x), Volatile Organic Compounds (VOC) and small dust particles (aerosols) (Lenntech, 2005). According to the EDGAR of Netherlands Environmental Assessment Agency (EDGAR 2008), inventory emissions of these pollutants are significantly high at Southeast Asian Region particularly at east coast of Peninsular Malaysia

There are two types of sources of pollutants emissions; mobile sources and stationary sources (Master, 1998). Mobile sources are including highway vehicles and other mode of transportation while stationary sources are categorized as stationary fuel combustion and industrial process. There are 27,000 major and hundreds of thousands of minor sources of air pollution in the United States (Tietenberg, 2005). It was noted by the United States Environmental Agency (EPA) in 1994 that more than half of the six most important air pollutants (CO, Pb, NO_x, VOC_x, PM10 and SO_x; except CO) are contributed by stationary sources of which mostly from petrochemical plants (Masters, 1998).

One example of air pollutant contributed by stationary sources at Malaysia is due to the petrochemical industry. This sector has been considered as the second major industrial emission sources of SO₂, NO_x and CO₂ in Asia, after steel and iron industry (Akimoto, 1994). Historically, petrochemicals industry at east coast of Malaysia started in mid 90's (Petronas, 2006) and continue to expand since then. Petrochemical industry at

east coast Malaysia is capable of producing 6.9 million tons per year of various chemical products that is equivalent to 55 % of the total Malaysian chemicals product produced (MPA, 2003). (Please refer to Appendix I of list of petrochemical plants available versus plant capacity and products produced). This high productions figure may represent high contribution to air pollution.

Petrochemicals smog is another scenario caused by petrochemicals industry where it is a complex mixture of chemicals which is sometimes visible as white haze of which, the most significant components at ground-level are ozone and nitrogen dioxide (EPA New South Wales 2004, Fay and Golomb 2002). These pollutants are formed in the atmosphere when two classes of compounds-reactive organic compounds (ROCs) and oxides of nitrogen (NO_x) react under the influence of sunlight. The two pollutants are emitted by human activities as well as from natural sources, including vegetation, soil and the ocean. One of the direct sources where nitrogen dioxide (NO_2) are released is by the petrochemical industries, and nitrogen dioxide is one out of the five pollutants (CO , NO_2 , O_3 , PM_{10} , SO_3) controlled by the Malaysian government (DOE Malaysia, 2000) for calculation of air pollution index (API).

Many sources indicate that air pollution could cause harmful effect to human health. As an example, effect to human by air pollution may categorize into three impacts which are; chronic, acute and carcinogen (Nevers 1995, Wright and Nebel 2002, DOSH Malaysia 2000). Chronic disease is due to pollutant cause the gradual deterioration of a variety of physiological functions over a period of years. Acute is due to pollutants bring on life-threatening reactions within a period of hours or days and carcinogen is due to initiate changes within cells that lead to uncontrolled growth and division, which is frequently fatal. Data from World Health Organization shows that acute respiratory infection is the leading cause of yearly death from major infection diseases in 1999 which is estimated at 4,039,000 (WHO, 2000). One other harmful effect to human health under chronic category is asthma (an immune system disorder characterized by impaired breathing caused by the constriction of air passageways is brought on by contact with allergens and many of the compounds in polluted air). Epidemiological researchers have also shown associations between high levels of air pollution to an increased risk of cancer (Hrelia *et al.*, 2004). Therefore, air pollution required to be controlled (Nevers, 1995) and Malaysia realizes effect of air pollution through enforcement of Environmental Quality Act and Regulation 1974.

3 Research Objective

The main objective of this research is to perform risk assessment of community health in related to emission of air pollution by petrochemicals industry at district of Kemaman and Dungun in the state of Terengganu, Malaysia. The focus is to identify whether significant pollutant would enable the authority to necessarily react in tune with the need of the community health

The specific study objectives are;

- 1.2.1 To estimate the level of pollutants concentration at specified receptors surrounding an emission source of petrochemicals industry.
- 1.2.2. To determine hazard index among community surrounding petrochemicals industry

The study carried out is to simulate air pollution dispersion in order to estimate the level of pollutant concentration at specified receptors surrounding an emission source of petrochemicals industry. This would lead to the determination of Hazard Index (HI)

4 Instrumentation

In general, methodology used in this research is referred to the approach used by the U.S. Environmental Protection Agency's known as Human Health Risk Assessment Protocol, 2005 (HHRAP). The purpose of this approach is to develop and conduct multi-pathway, site-specific human health risk assessments so that area with the greatest contaminant deposition could be identified. The primary objectives are to develop protocol of performing risk assessment for specific combustion and burn hazardous waste. This protocol required a comprehensive collection of input parameter to accommodate regional and site specific information. The most important is that the HHRAP can be used as tool to provide critical information needed where the permitting authority determines such risk assessments that are necessary for future planning.

Since this research focus on the air pollution, the following processes and subsections are identified compulsory in achieving the objective. The applicable processes and subsections extracted would include the following;

- Characterizing facility emissions
- Air dispersion and deposition modeling
- Exposure scenario and identification
- Estimating media concentrations and Quantifying exposure
- Characterizing hazard

5 Result and Discussion

Simulation of daily and monthly data of year 2004 to 2008 for NO₂ has been performed. Result shows that pollution concentration profiles are not consistent compare to the actual data form DOE station. Further analysis is required.

6 Significance of Study

Several recent studies associated long-term exposure to air pollution with increased mortality (Beelen *et al.*, 2007). Epidemiological research into air pollution over the past 20 years has demonstrated cardio respiratory health effects ranging from minor respiratory symptoms to increased hospital admissions and mortality has included petrochemical industry as part of contributor to the pollutant source (Kjellstrom *et al.*, 2002) where the know effects were “Throat irritation; exacerbation of cardio respiratory diseases, including asthma”. The pollutant concerned such as particulate matter (PM), oxides of nitrogen (NO_x) and carbon monoxide (CO) that are commonly known to petrochemical industries where all these are among five controlled pollutants under the Malaysian environmental regulation (as being mentioned earlier). According to other research conducted, these commonly known substances are also among parameters that has been identified as adversely effecting young generation that lead to learning disabilities among children at United States of America (Margai and Henry, 2003) and also capable of contributing to frequent outbreaks of serious respiratory diseases (McMurray, 2005)

With the above concerned to community health among research previously conducted, this study hopes to alert parties involves in petrochemical industry either, government or private sector. One of this may reflect to the Terengganu State Government planning where the distribution of the residential area shall be well planned and managed due to the increasing number of houses in the near future by year 2020 as indicated by Structure Planning State of Terengganu it is important to understand the interrelationships between economic development, lifestyle changes, environmental factors and other risk factors linked to health and mortality (Choe and Chen, 2005).