

Urban Public Park from Ex-landfill: Impact to Community Health

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ABSTRACT: Issues on inadequate urban green areas provision to meet the needs of community social recreation become more crucial with the increase of urban population and lack of urban spaces. To deal with the issues, the Malaysian government has developed policies to reuse ex-landfill as public park. However, public health issues related to landfill gas emission have threatened public's confidence in the appropriateness of the public parks to be developed at the ex-landfills. Therefore, this paper serves as a background study to identify the impact of the redevelopment of urban ex-landfill into public park on the community health. A field study was conducted at four study areas, which covered two ex-landfills and two public parks that had been developed on ex-landfills. The study focused on two main aspects, community health perceptions and air quality. Community health perceptions data were collected through respondent's self-assessment questionnaire from 287 residents within the study areas. Meanwhile, air quality data were gathered from five air parameters of landfill gas emission, which were detected from 16 gas sampling stations within four boundary areas of 1.0 kilometer radius from the study areas. The findings from the survey revealed that the public park developed from ex-landfill gave positive impacts on the community health. The analyzed data are anticipated to be used as the basic indicators to justify the community acceptance towards the proposal of 296 public parks that could serve the social recreation needs of 462,500 Malaysian urban populations in 2020.

Keywords: ex-landfill, public parks, community health, development policy

Introduction

The adequacy of urban public parks in Malaysia refers to the ability of the city administrator, which is the Local Authority, to provide an urban green open space according to the standard of 2 hectares per 1,000 urban populations (Department of Town and Country Planning Peninsular Malaysia, 2010). Inadequate urban parks provision could become a bridle for urban areas to achieve the status of sustainable urban as stated in the National Urban Policy, as well as the aim to develop Malaysia as a Garden Nation (Department of Town and Country Planning Peninsular Malaysia, 2010; National Landscape Department, 2010). However, rapid urban growth that deteriorates urban green open space and increases urban population rapidly due to the impact of urban migration have been identified as the causes of the Local Authority's inability to provide adequate urban public parks (Abd. Mutalib, 1999; National Physical Planning Council, 2004). These issues become more complicated in 2012, where there were only 13,625 hectares of public parks throughout Malaysia that could only accommodate 24% of urban social recreation needs (National Landscape Department, 2012; Department of Statistics, 2012). Kuala Lumpur as the capital of Malaysia could only provide 0.4 hectares of public parks per 1,000 urban populations (Ismail, 1999), and 12 square meters of urban green space per individual, which is below the standard set by the World Health Organization (PEMANDU, 2010).

In order to address these issues, the development of public parks on urban ex-landfill has been proposed as an alternative strategy (National Landscape Department, 2010). The proposed development of public parks on ex-landfill refers to the decision of the National Physical Planning Council (2004), which stated that public park should be considered as the main priority development for ex-landfill redevelopment in Malaysia. In addition, the proposal is also based on the justification of the increasing numbers of ex-landfills within the urban areas due to the impact to urban sprawl and expansion of urban areas (Department of National Solid Waste Management, 2012; Mazifah *et al.*, 2013). With the acceptance of the proposal, future redevelopment of 296 urban ex-landfills as public parks will lead to an additional of 462,500 social recreation opportunities for the urban population in 2020.

Will the redevelopment of ex-landfill as an urban public park not give any harmful effect to the community health? This question arises due to the research outcome of George (1991), Vrijheid (2000), Lisa *et al.*, (2003), and the United States Environmental Protection Agency (2010), which stated that there are four major issues pertaining to the landfill that affect the community's quality of life, which are leachate, landfill gas, soil subsidence, and mass movement. Even though there are four major issues of landfill, this study will only focus on the issue of landfill gas. Landfill gas has been selected as the focus of the study due to the previous research outcomes (Heartzman *et al.*, 1987; Geshwind *et al.*, 1992; Miller, 1996; Vreijheid, 2000; ATDSR, 2012), which showed that there are positive correlations between landfill gases with the status of human health. The selection of landfill gas is also based on the results of a public perception study, which shows that the Malaysian community associates bad odor from ex-landfill with their current health status (Mazifah *et al.*, 2013). The community also ranked the odor issue as the main issue that needs to be addressed for the proposed redevelopment of ex-landfill so that it could be accepted by the community. Therefore, this study tried to evaluate health impact based on the perception of health status experienced by the communities and landfill gas. The results then become the basic indicator for the community's acceptance towards the appropriateness of the proposal to develop urban public parks on ex-landfills.

Study Area and Methodology

Residential areas located within 1.0 kilometer radius from four ex-landfills that have been closed for more than 5 years and located within the urban areas were selected as the study areas. The ex-landfills represents two different criteria: (1) urban ex-landfills that have not been redeveloped (Jinjang Utara ex-landfill and Banting ex-landfill), and (2) urban ex-landfills that have been redeveloped as public parks (Worldwide Landfill Park and Taman Pasif, Kuantan).

The differences in selection criteria were designed to assess whether there were differences between the community's health based on the effects of living nearby the urban ex-landfills that have not been developed or developed as public parks. Jinjang Utara and Banting are urban ex-landfills that have been closed for more than five years, which is the minimum period prescribed by the Ministry of Housing and Local Government (2004) suitable for

public park's redevelopment purposes. Meanwhile, Worldwide Landfill Park and Taman Pasif Kuantan are pilot projects for the development of public parks on ex-landfills. Both were redeveloped as public parks and began to serve as public parks in the year 2012. As there were only two public parks that have been developed in Malaysia, both Worldwide Landfill Park and Taman Pasif, Kuantan were chosen as the study areas. Meanwhile, the setting of the study area within the radius of 1.0 kilometer was based on the standard distance set by the United States Environmental Protection Agency (2010) for landfill gas monitoring. It also refers to the recommendation by Lisa *et al.* (2003). The authors emphasised that a study to identify the relationship between landfill impact and community health should focus on the community living within 1.0 kilometer from the landfills, which they assumed that there is a higher health risk for the community living close to the area (Lisa *et al.*, 2003).

The investigation on the relationship between landfill gas and public health was done using mixed-method approach. Quantitative data were collected through distribution of questionnaires, which consists of "self-assessment report" on health. By using a 5-point Likert scale responses, respondents were asked to (i) assess the current status of their own health and family's health, and also (ii) the frequency of health services due to the disease that may be triggered by exposure to landfill gases, namely asthma, shortness of breath, dizziness, skin diseases, and sore eyes. The data were then analyzed for the identification of the current health status. In addition, respondents were also asked to give additional information if there are family members who suffer from asthma by giving details of the number of patients with asthma per household, gender, age, illness duration, and duration of stay in a residential area for the purpose of assessing the linkages between the number of the asthmatic patient and air quality within the surrounding living area. 289 heads of household were randomly selected as the respondents for this study. These respondents represented the community who are living in the residential area within 1.0 kilometer radius from the study areas. The determination of 289 as sample size was based on Krejcie and Morgan's sample size calculation (1970).

Meanwhile, qualitative data was obtained by observing the air quality in the study areas. To get a detailed result, the study areas were divided into four radius boundaries of (1) 0.0 to 0.25 kilometer, (2) 0.25 to 0.5 kilometer, (3) 0.5 to 0.75 kilometer, and (4) 0.75 to 1.0 kilometer from the ex-landfills. An air monitoring station was placed in each area radius, which means that there were 16 air monitoring stations to detect the landfill gases. Methane, oxygen,

carbon dioxide, ammonia, and hydrogen sulfide were selected as the gas parameters for the study based on their importance as parameters to determine the ex-landfill's stability (Ministry of Housing and Local Government, 2004) and their effects to human health, especially to children, the elderly, and individuals with problems related to respiration (World Health Organization, 1998; Vrejheid, 2000; Vrejheid *et al.*, 2002). The landfill gases were observed for three consecutive days between three time periods: (1) 8.30 a.m. to 9.30 a.m., (2) 12.30 a.m. to 1.30p.m., and (3) 4.30 p.m. to 5.30 p.m. in March 2014. During the studied period, the weather was dry and hot, without any rainfall.

Results and Discussion

Descriptive statistics of percentages were used to achieve the two objectives set in this study, which are:

- i. to identify the current health status of the communities living nearby the ex-landfills that have not being developed and ex-landfills that have been developed as public parks.
- ii. to identify the number of patients with asthma and examine its relationship with the surrounding air quality status.

Table 1 shows a comparison between the present health statuses perceived by the community living in the vicinity of an ex-landfill that has been developed as a public park with community in the vicinity of an undeveloped ex-landfill. 14.5% of the community within the public park identified their health as "excellent" compared to 6.1% at ex-landfill that has not been developed. The perception of excellent health status felt by the community at the ex-landfill which has been developed as public park was supported by the frequency in obtaining health services data, where 50.0% of the community obtained health services with a range of 1 to 6 times a year. Those data clearly showed that there were differences in the level of health between the two communities. The frequency rate of less than 12 times for obtaining health services was higher for communities living around ex-landfills which have been developed as public parks (82.3%) compared to communities living around undeveloped ex-landfills (41.2 %). The higher percentage refers to the quality of good health as stated by Brender *et al.* (2011), where frequency of less than 12 times a year for obtaining health services is an indication of good health for people living nearby the landfill area.

Table 1: Community self- assessment's on health status

Study area (ex-landfill condition)	Sample size	Frequency (%)									
		Perception toward status of health (self and family)					Frequency in obtaining health services (times/year)				
		Excellent	Good	Fair	Not		1-6	7-12	13-18	19-24	>24
					really good	Bad					
<i>(1) Not being develop</i>											
Jinjang Utara	120	5 (4.2)	88 (73.3)	25 (20.8)	2 (1.7)	0 (0.0)	13 (10.8)	30 (25.0)	50 (41.7)	21 (17.5)	6 (5.0)
Banting	11	3 (27.3)	8 (27.7)	0 (0.0)	0 (0.0)	0 (0.0)	7 (63.6)	4 (36.4)	0 (0.0)	0 (0.0)	0 (0.0)
Total	131	8 (6.1)	96 (73.3)	25 (19.1)	2 (1.5)	0 (0.0)	20 (15.3)	34 (25.9)	50 (38.2)	21 (16.0)	6 (4.6)
<i>(2) Develop as public park</i>											
Worldwide Landfill Park	113	7 (6.2)	95 (84.1)	10 (8.8)	1 (0.9)	0 (0.0)	48 (42.5)	44 (38.9)	14 (12.4)	5 (4.4)	2 (1.8)
Taman Pasif Kuantan	45	16 (35.6)	22 (48.9)	6 (13.3)	1 (2.2)	0 (0.0)	31 (68.9)	7 (15.6)	3 (6.7)	2 (4.4)	2 (4.4)
Total	158	23 (14.5)	117 (74.1)	16 (10.1)	2 (1.3)	0 (0.0)	79 (50.0)	51 (32.3)	17 (10.8)	7 (4.4)	4 (2.5)
Overall total	289 (100%)	31 (10.7)	213 (73.7)	41 (14.2)	4 (1.4)	0 (0.0)	99 (34.2)	85 (29.4)	67 (23.2)	28 (9.7)	10 (3.5)

In summary, the data in **Table 1** shows that the increase in the community's perception of public health was inversely associated with the frequency of obtaining health services. Indirectly, it proved that the surrounding of a living environment affected human's perception towards the level of their perceived health. In support of Juliana *et al.* (2002) opinion, which states that the living environment influences the health of the specific group of human, this study proved that ex-landfills that were redeveloped as public parks could provide a better living environment to the communities compared to ex-landfills that have not been developed. The results of this study may also be an indication of public acceptance towards the implementation of ex-landfills as public parks' proposal in Malaysia.

Table 2 shows the number of asthmatic patients in the respondent's household within the study areas. Asthma was selected as the health indicator in this study due to the findings of literature review that showed air-borne disease that is often associated with landfill gases is

asthma. According to Miller (1996) and Vreijheid (2000), even though landfill gases could not give direct effect to human health, they could become triggers to respiratory distress symptom, particularly to the elderly and children.

Table 2: Asthma patient – according to specific study area

Study area	Sample size (house hold)	Number of patient / Frequency (%)	Patient's information				Living duration (year)
			Number of patient/ household	Age (year)	Sex (Male (M)/ Female (F))	Duration of illness (year)	
Jinjang Utara	120	17 (14.2)	1	53	M	4	(4)
			2	60 / 50	M / F	6 / 5	(5)
			1	12	M	12	(3)
			1	45	F	6	(1)
			1	50	F	10	(1)
			1	50	F	3	(3)
			1	43	F	10	(2)
			1	7	M	4	(2)
			2	43 / 14	F / F	10	(3)
			1	17	M	2	(2)
			1	29	F	5	(3)
			1	62	F	10	(3)
			1	37	F	10	(4)
			1	30	F	10	(3)
1	30	M	10	(3)			
1	20	F	6	(2)			
1	10	M	5	(2)			
Banting	11	0 (0.0)					
Total	131	17 (12.9)					
Worldwide	113	5 (4.4)	1	30	F	7	(3)
Landfill Park			1	30	F	10	(2)
			1	20	M	5	(2)
			1	35	M	5	(3)
			1	60	M	5	(4)
Taman Pasif	45	5(11.1)	1	17	M	1	(2)
Kuantan			1	43	F	10	(2)
			1	7	M	7	(1)
			1	27	F	20	(3)
			1	25	M	1	(2)
Total	158	10 (6.32)					

The analysis found that the number of asthmatic patients in the community living within the ex-landfill which has not been developed was higher than the community living in public park from ex-landfill with a difference of 7 patients (25.9%). 7 households (12.9%) in the residential area nearby the ex-landfill which has not yet being developed had asthma, with a total number of 19 patients. All of the patients live in the radius of 1.0 kilometer from Jinjang Utara ex-landfill area. Out of the 19 patients with asthma, 3 (15.8%) with age between 0 to 12 years, 13 (68.4%) with age between 13 to 50 years, and 3 (15.8%) with age over than 50 years. The number of female patients was higher than male patients with a difference of 26.4%. The analysis also revealed that the duration of illness of the 19 patients (100.0%) was less than 18 years. Since Jinjang Utara ex-landfill was only closed in the year 1996, this question arises: Does the ex-landfill still produce landfill gases that could trigger the asthmatic symptom that is being faced by the community in its surrounding area?

Meanwhile, 10 households (6.32%) with 10 asthmatic patients lived within 1.0 kilometer radius from the ex-landfill which has been developed as public park. 5 patients (50.0%) from Worldwide Landfill Park study area and 5 others (50.0%) from Taman Pasif Kuantan. Out of the 10 asthmatic patients, only 1 patient (10.0%) aged over 50 years old and 1 patient (10.0%) aged below 12 years old. Somehow, the data also revealed that 2 patients from Taman Pasif Kuantan suffered from asthmatic symptom after the ex-landfill has been redeveloped. Therefore, it could be assumed that landfill gas emission is the cause of the disease.

However, the landfill gas data (**Table 3**) shows that these assumptions are wrong. The data shows zero reading for hydrogen sulfite at the atmosphere within 1.0 kilometer radius from Jinjang Utara ex-landfill, Worldwide Landfill Park, and Taman Pasif Kuantan. This means that there was no association between the landfill gas emissions with the asthmatic symptom faced by the communities living within those areas. This opinion is based on the United States Environmental Protection Agency (2004) that stated only hydrogen sulfide could trigger asthmatic symptom.

Table 3: Landfill gas within 1.0 kilometer radius from ex-landfill sites

Study area / Station	Parameter (gas/ppm) / Day														
	Hydrogen sulfide			Ammonia			Methane			Carbon dioxide			Oxygen		
	D1	D2	D3	D1	D2	D3	D1	D2	D3	D1	D2	D3	D1	D2	D3
K1/S1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	20.9	20.9	20.9
K1/S2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	20.9	20.9	20.9
K1/S3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.3	20.9	20.9	20.9
K1/S4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.6	20.9	20.9	20.9
Average	0.00			0.00			0.00			0.58			20.90		
K2/S5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	1.3	2.6	20.9	20.9	20.9
K2/S6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	4.3	5.6	20.9	20.9	20.9
K2/S7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	2.6	2.7	20.9	20.9	20.9
K2/S8	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.3	1.3	20.9	20.9	20.9
Average	0.03			0.00			0.00			2.76			20.9		
K3/S9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	1.3	20.9	20.9	20.9
K3/S10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.3	20.9	20.9	20.9
K3/S11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	20.9	20.9	20.9
K3/S12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	20.9	20.9	20.9
Average	0.00			0.00			0.00			0.55			20.90		
K4/S13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	2.3	20.9	20.9	20.9
K4/S14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	2.3	20.9	20.9	20.9
K4/S15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.0	1.3	20.9	20.9	20.9
K4/S16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	2.3	20.9	20.9	20.9
Average	0.00			0.00			0.00			1.19			20.90		

Note: K1-Jinjang Utara ex-landfill; K2-Banting ex-landfill; K3-Worldwide Landfill Park; K4-Taman Pasif Kuantan; D1-Day 1, D2-Day 2, D3- Day 3

Table 3 data also shows zero reading for ammonia gas in the atmosphere of Worldwide Landfill Park and Taman Pasif Kuantan. This data directly indicated that the development of public park has successfully eliminated the bad odor issue that has been perceived by the local community as the main factor that needs to be addressed for the success of ex-landfill redevelopment (Mazifah *et al.*, 2014). In addition, the zero reading for methane gas shows that the Jinjang Utara and Banting ex-landfills are ready for new redevelopments as these ex-landfills comply with the gas parameter standard set in the Assessment of Landfill Stability (Ministry of Housing and Local Government, 2004). The data also indicates the presence of carbon dioxide in each of the study area, with the readings in the ex-landfills that have been developed as public parks lower than ex-landfills without developments. However, since the gas amount was less than 10% from the atmosphere volume (or less than 10,000,000 ppb), the presence of carbon dioxide gas could not cause any asphyxiation symptom that would affect

oxygen deprivation (United States Environmental Protection Agency, 2004). Oxygen deprivation could not occur due to the fact that the concentration of oxygen was 20.90 ppm in each of the study area. Therefore, it could be concluded from the landfill gas data that the development of public parks from ex-landfills will not give any harm to the community health if the development follows the policy standards and procedure set by the government.

Conclusion

This study has proven that the development of urban public parks from ex-landfills have positive impacts on the community's health. The urban public parks developments on ex-landfills are identified to improve the health status perceived by the community. This study also proves that there is no relationship between the presences of landfill gas emission with asthmatic symptom that is being faced by the communities living next to public parks that have been developed from ex-landfills. Thus, it could be concluded that the redevelopment of public park from ex-landfill is an appropriate future development that could serve as a social recreation area to fulfill the needs of urban community to have a safe and healthy urban living environment. However, it is recommended that further research should be conducted for air quality in order to produce stronger evidence that could prove that there is no association between the ex-landfill gas emissions with the community's health risk. This study is very important in ensuring the support and acceptance of the development of public parks on ex-landfills, which are considered as a new field of urban physical development in Malaysia. As a summary, this study suggests the need for the Local Authority as the administrator of future ex-landfill redevelopments to ensure that the issues relating to landfill gas emission to be solved according to the standards prior to the development of the urban public parks. Therefore, the proposal to redevelop 296 urban public parks from ex-landfills will be widely accepted by the community, and the development will be able to improve the health quality of the Malaysia society.

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References

- Abd. Mutalib, J. (1999). Perancangan bandar dalam taman. In Osman, M.T., Mustafa Kamal, M.S, Norizan, M., Nordin, A. B and Abdul, A.O. *Ke arah Negara Taman: Wawasan dan cabaran*. Kuala Lumpur: Institut Arkitek Landskap Malaysia. ATSDR (Agency for Toxic Substances and Disease Registry). (2012). *Brownfield redevelopment*. <http://www.atsdr.cdc.gov/sites/brownfield>. Brender, J., Maantay, J. and Chakraborty, J. (2011). Residential proximity to environmental hazards and adverse health outcomes. *American Journal of Public Health* 101: 37-52.
- Department of Town and Country Planning Peninsular Malaysia. (2010). *National Urban Policy*. Kuala Lumpur: Department of Town and Country Planning Peninsular Malaysia. Department of Statistics. (2012). Population and housing census in Malaysia. Kuala Lumpur: National Printing Department.
- George, F. (1991). *Recycling derelict land*. Institution of Civil Engineers. London: Thomas Thelford Ltd. Geshwind, S.A., Stolwijk, J.A, Bracken, M., Fitzgerald, E., Stark, A., Olsen, C. and Melius, J. Risk of congenital malformations associated with proximity to hazardous waste sites. *American Journal of Epidemiology* 135, No. 11: 1107-1207.
- Heartzman, C., Hayes, M., Singer, J. and Highland, J. (1987). Upper Ottawa street landfill site health study. *Environmental Health Perspectives* 75: 173-195. Ismail, N. (1999). Landskap Negara: ke arah merealisasikan Negara Taman. In Osman, M.T., Mustafa Kamal, M.S, Norizan, M., Nordin, A. B and Abdul, A.O. *Ke arah Negara Taman: Wawasan dan cabaran*. Kuala Lumpur: Institut Arkitek Landskap Malaysia.
- Juliana, J., Zalina, H., Nasir, M.T., Syarif, H.L and Jamal, H.H. (2002). Perbandingan pengaruh persekitaran kediaman terhadap serangan asma di antara kanak-kanak Kuala Lumpur dengan Terengganu, Malaysia. *Jurnal Kesihatan Masyarakat* Jilid 8: 51-62.
- Ministry of Housing and Local Government. (2004). *The study of safe closure and rehabilitation of landfill sites in Malaysia*. Kuala Lumpur:
- National of Housing and Local Government. National Landscape Department. (2010). *National Landscape Policy*. Kuala Lumpur: National Landscape Department.

- National Landscape Department. (2012). *Public park directory in Malaysia*. Kuala Lumpur: National Landscape Department.
- National Physical Planning Council. (2004). *Laporan Mesyuarat Perancangan Fizikal Negara Bilangan 2/2004*. Kuala Lumpur: Prime Minister Department.
- National Solid Waste Department. (2012). *Solid waste Lab 2012*. Kuala Lumpur: National Solid Waste Department.
- Krejcie, R.V. and Morgan, W.D. (1970). Determining sample size for research activities. *Educational and Physiological Measurement* 30: 607-610.
- Lisa, S., Lorenzo, G. and Derek, P. (2003). The human health impact of waste management practices: A review of the literature and an evaluation of the evidence. *Management of Environmental Quality: An International Journal* 14, No. 2: 191-213.
- Mazifah, S., Azahan, A. and Kadir, A. (2013). Urban ex-landfill as built environment: community perception. *Conference Proceeding International Conference on Architecture and Built Environment*. UIA: Kulliyah of Architectural and Environmental Design.
- Mazifah, S. and Azahan, A. (2014). Urban ex-landfill redevelopment in Malaysia: community perception. *The International Journal of Humanities & Social Science* Vol 2 Issue 7: 26-31.
- Miller, A.B. (1996). Review of community-based epidemiologic studies on health effects of hazardous wastes. *Toxicology and Industrial Health* 12, No.2: 225-233.
- PEMANDU (Performance Management and Delivery Unit). (2010). *Economic Transformation Programme: A roadmap for Malaysia*. Putrajaya: Prime Minister Department.
- United States Environmental Protection Agency. (2010). *Landfill gas and monitoring*. <http://epa.gov.ttn.atw/landfill>.
- Vreijheid, M. (2000). Health effects of residence near hazardous waste landfill sites: A review of epidemiologic literature. *Environmental Health Perspective* 108 (Supplement 1): 101-112.
- Vreijheid, M., Dolk, H., Armstrong, B., Boshi, G., Busby, A., Jorgensen, T. and Pointer, P. (2002). Hazard potential ranking of hazardous waste landfill sites and risk of congenital anomaly. *OccupEnvironment Med* 59 (11): 768-776.

World Health Organization. (1998). *Health effect from landfill: Impacts of the latest research – Report on a WHO Meeting*. Copenhagen: WHO Regional Office for Europe.