



Community perception of odour pollution from landfills

Zaini Sakawi, Sharifah Mastura S A, Othman Jaafar, Mastura Mahmud

¹Earth Observation Centre, University Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia

Correspondence: Zaini Sakawi (email: zaini@ukm.my)

Abstract

Odour pollution from landfill is one component of pollutants that affects human environment. Issues and odour complaints from the landfill had been made through the media, official channels and local public protests. This paper analyses feedback from the people living within 2 km radius of a landfill to gauge their perception and experience of being affected by odour pollution. One part of the study involved a perception survey to determine the influence of landfill odour on social, health, and comfort levels. The other part determined the level, duration and intensity of the unpleasant odours. The results showed that the strong offensive smell was normally experienced following rainfall events. Meteorological factors such as wind speed and wind direction were also considered to assess the acceptability of the local community of the smell nuisance. The findings also showed that the smell from the landfill had caused daily discomfort. In conclusion, the findings point to the imperative of mitigating measures being taken by the authorities concerned.

Keywords: community perception, landfill, local public, mitigating measures, odour intensity, odour pollution

Introduction

The study of odour pollution from landfill operation has been carried out in many developed countries like the USA, Europe, Japan and Korea but most research is focused on approaches to the measurement of odour as exemplified by studies by Nicolas *et al.* (2006), Roman *et al.* (2008), Capelli *et al.* (2008), Snidar *et al.* (2008) and Littaru (2007). Odour measurement using a dynamic olfactometer is widely practiced in European countries while the triangle odor bag method was performed in Japan (Iwasaki 2002). Similar studies were also undertaken by Li (2004) and Hobb *et al.* (2006). Besides the odour measurement method, comparison and control were also carried out together with qualitative assessment on the perception of community. In some instances the perception studies has also included dispersion modeling as was done by Sarkar and Hobbs (2002), Sarkar *et al.* (2003), Roebuck *et al.* (2004) and Laister *et al.* (2002).

This study seeks to identify the perception of the community regarding the source of the malodour, time of occurrence, duration, locations and the influence of environmental factors. In addition, it takes a look at the local community perception of the impact of odour on human and physical environment, and ultimately on sensory odour intensity detected by the human nose. This is in contrast to previous studies that usually employed panels of experts and sniffing team trained to detect odour intensity. The importance of this study lies in the fact that in Malaysia while numerous complaints related to bad smell had been highlighted in various media, the country is yet to see any scientific research being conducted regarding landfill odour pollution. Presently there are no specific guidelines in Malaysia on pollution and odour measurement

method as normally used in developed countries such as USA, European countries, New Zealand, Australia, Japan and Korea. These developed countries have their own guidelines pertaining to the measurement method of odour concentration based on the percentage volatiles evaporation rate of emission.

Material and methods

Questionnaire survey

A total of 190 questionnaires were carried out within 2 km radius of the landfill. Sensitive receivers of the study involved exclusively the residents within the study area. The respondents were interviewed in the vicinity of their homes during the survey to ascertain their own perception of the landfill odour impacts. They were requested to grade the odour intensity as strong, medium, weak or simply no odour detected.

Location of landfill site and sensitive receivers

The study was conducted at two active disposal sites, namely the Pajam and Ampar Tenang landfills involving 110 and 80 respondents respectively. The respondents were divided into four categories namely residents of traditional village, modern housing, shops and institutions such as schools and training centres.

Results and discussion

Community background

The gender composition was almost even with 52.9% male and 47.1 % female. The respondent minimum age was 16 while the maximum was 75. In terms of age group, the 31 – 40 years old was the highest with 40.0% followed by 21-30 years (25.8%), 41-50 years (16.8%), 16-21 years (13.2%) and over 50 years (4.2%)

About 48.4% of the respondents had attained secondary level of education with 28.9% at upper secondary and 19.5% lower secondary. Respondents who had achieved tertiary education was divided into two categories namely college and university level at equal representation of 16.8% each. The remainder (18.0%) comprised older individuals with primary or informal education.

Although 180 (84.7%) of the respondents agreed that the landfills were the source of malodour, not all (175 or 92.1%) were bothered by the smell. Of the total 190 respondents, 106 (55.8%) have made some kind of complaints regarding the foul smell. The remaining 84 (44.2%) respondents that did not make any complaint due to various combination of reasons; 74 (38.9%) did not know where to make the complaints, 56 (29.5%) did not care and 60 (31.6%) thought others would make the complaints on behalf of the rest. For those respondents who made the complaints, most (42.1%) did so directly to the local authorities. Some had done so through a combination of other methods namely elected representatives (14.2%), housing associations (11.6%), and electronic media such as email, television and telephone (11.6%).

This study found that the occasions during the day when malodour was detected could be divided into four different periods, i.e. morning (6am to 10 am), noon (12pm to 2 pm), afternoon (2pm to 4 pm), night (8pm to 10 pm) and whole day. The survey found that the period when foul odour were frequently detected was at night (31.1% of respondents) followed by afternoon (21.6%), noon (11.6%) and morning 7.4%). Interestingly 54 (28.4%) of the respondents claimed the foul smell were detected throughout the day. Overall 172 (90.5%) of the respondents strongly opined that foul smell was the biggest environmental problem that they were facing.

Four main scenarios of the frequency of the odour pollution were assessed. These were once a day, once a week, once a month and the whole day. The survey found that the smell would eventually disappear but the rate of disappearance was uncertain and perceived by 41.0% of the respondents as dependent on the general weather situation. In this vein, 9.5% thought the direction of the wind was the main determinant while 3.7% attributed it to the heat. In responding to the foul smell eventual disappearance, 15.3% said it happened after more than six hours followed by one to two hours (17.4%) and three to four hours (11.1%).

Odour pollution caused by weather conditions

Weather is one of the environmental components that may influence the frequency and intensity of odour experienced by the respondents. According to Zaini (2009) and Laister (2002) the influence of weather elements such as wind direction, wind speed, temperature and humidity can affect the concentration of odour carried from the landfill. The findings of this study showed that 92.6 percent of respondents agreed that the smell of pollution in the vicinity of their local landfills was associated with the weather. Based on the survey, 40.6 percent of respondents agreed it was influenced by factors of wind, rain and hot weather. Of this, the influence of the wind was perceived as the highest (30.5%), followed by rain (22.6 %) and hot weather at just 6.3% (Figure 1).

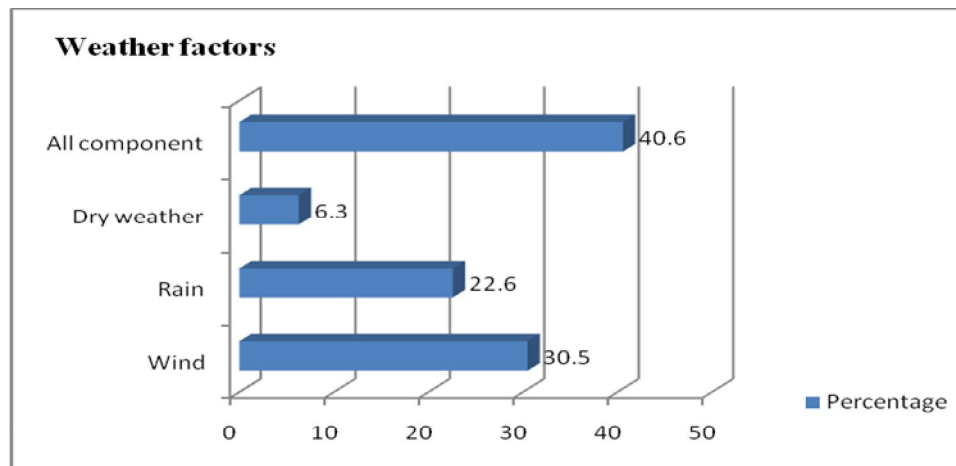


Figure 1. Influenced of weather on odour concentration

The community perception of detectable odour was divided into three locations; indoor, just outside the house and outdoor (parks, roads, etc.). The result of the study showed that 50.5% of the respondents perceived the worst odour detected just outside the house followed by outdoor (8.4%) and indoor (3.7%). Another 37.4% of the respondents were not certain where the worst smell was normally detected. The big difference on the perceived foul odour between indoor and just outside the house was probably due to the general community practice of closing all doors and windows thus preventing bad odour from entering indoor. The foul smell was less discernable when one passed through the vicinity in an air conditioned car or walked in the parks. This was probably the reason for the low score of perceived bad smell outdoor.

Odour intensity

In terms of odor intensity, sense of human nose is very important to determine the scale of detectable odor. Based on the survey, the community perception of odor intensity can be classified into four main classes; no smell, weak unpleasant smell, medium malodor and strong odor. The strong odor intensity is perceived by 74.2% of the respondents followed by medium

malodor (16.3%), weak smell (8.4%) and no smell (1.15). Figure 2 shows the odor intensity on perceived by the respondents.

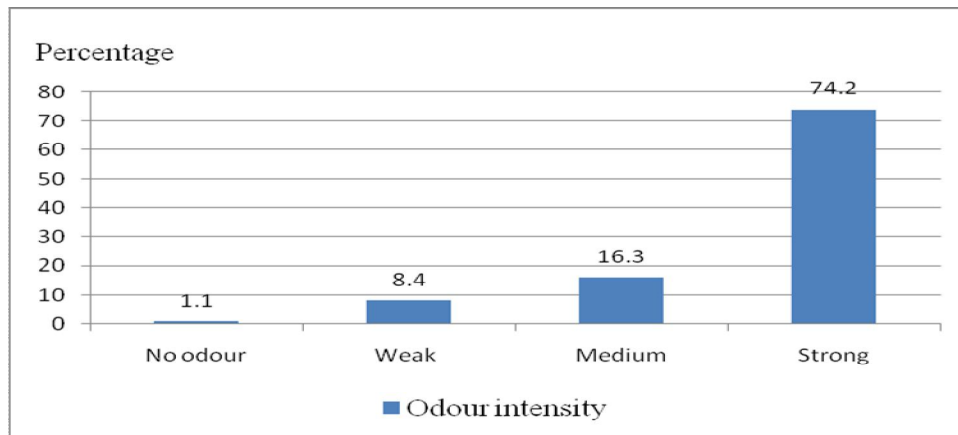


Figure 2. *Odour intensity perceived by the respondents*

Odour impact on the physical and human environment

Finally the study focuses on the perceived impact of odour on human health and physical environment. The result of the survey indicated that 83.7% of the respondents felt the bad smell had affected the tranquility and quality of their life. At the same time 80.5% of the respondents perceived the foul smell as associated with their ill health. With respect to the physical environment, only 13.2% of the respondent related the bad smell to the corrosion of household utensils and appliances. Figure 3 shows the perceived diversity of impacts by the respondents.

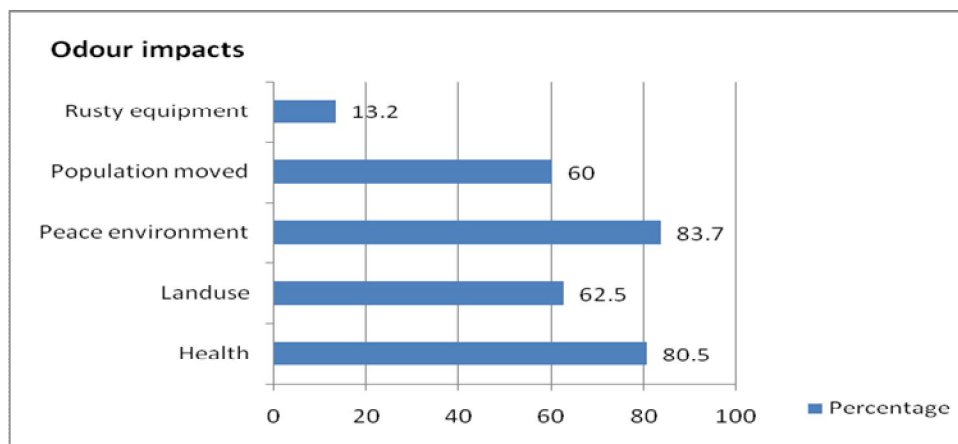


Figure 3. *Odour impact on the physical and human environment*

Conclusions

This study represents an early effort to understand the issues pertaining to odour that emanated from landfill sites. Admittedly, the issue itself was not new and had often been reported in the print and electronic media but thus far, however, there was no specific studies on this subject. The contribution of this study is empirical evidence that the bad odour coming from the landfill was disruptive to the everyday life of the local public. It was established that the bad smell was a

constant nuisance to the outdoor activities of the residents. The “peak” malodour was more often experienced during the night necessitating residents to shut all windows and doors to reduce the sensing of the bad smell. The study also indicated that the periods and intensity of bad smell could be influenced by the weather, in particular, the wind direction. Hopefully this study will contribute some valuable information to the Malaysian Department of Environment in formulating and developing guidelines on odour pollution from landfills.

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