

Community Perception of Odor Pollution from the Landfill

Z. Sakawi, Sharifah, S.A. Mastura, O. Jaafar and M. Mahmud

Earth Observation Centre, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia

Abstract: Odor pollution from the landfill is one component of pollutants that affect the human environment. Issues and odor complaints from the landfill had been made through the media, official complaints and protests of the people living near the landfills. This study attempts to get the feedback from the people living near the landfill. It was conducted within 2 km radius of the landfill. Part of the study involves a perception survey to determine the influence of odors on the social, health, welfare and discomfort level. The study also determined the levels, duration and intensities of the unpleasant odors. The results showed that the strong smell is normally experienced following rainfall events. Meteorological factors such as wind speed and wind direction were also considered to assess the acceptance of the local community towards the smell nuisance. The findings also showed that the smell from the landfill has caused daily discomfort as result of intermittent or continuous malodorous from the community feedback.

Key words: Community perception, landfill, odor intensity, odor pollution

INTRODUCTION

The studies of the odor from landfill operation have been carried out in many developed countries like the USA, Europe, Japan and Korea. Most research is focused on approaches to the measurement of odor as exemplified by studies by Nicolas *et al.* (2006), Roman *et al.* (2008), Capelli *et al.* (2008), Snidar *et al.* (2008) and Littaru (2007). Odor measurement using a dynamic olfactometer is widely practiced in European countries while the triangle odor bag method was performed in Japan (Iwasaki, 2004). Similar studies were also done by Li (2004) and Hobb *et al.* (2003). Besides the odor measurement method, comparisons and controls were also carried out together with a qualitative assessment on the perception of community. In some instances the perception studies had 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 to the source of the malodor, with reference of the time of occurrence, duration, locations and the influence of environmental factors. In addition, this study aims to look at community perceptions on the impact of odor on human and physical environment, and through the sensory odor intensity detected by human nose. This is in contrast to studies that usually employ panels of experts and sniffing teams trained to detect the odor intensity. This study is very important to Malaysia because numerous complaints related to bad smell have been received in various media, yet no specific research has been done perviously. Presently in Malaysia there are no

specific guidelines on pollution and odor measurement method which are normally used in developed countries such as the USA, the European countries, New Zealand, Australia, Japan and Korea. These developed countries have their own guidelines relating to the implementation, measurement method, and odor concentration based on Percentage volatiles evaporation rate of emission.

MATERIALS AND METHODS

Questionnaire survey: A total of 190 questionnaires were carried out within 2 km radius of the landfill during April 2010. The respondents (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 perception on odor impacts. They were requested to grade the odour intensity as strong, medium, weak or simply no odor detected.

Location of landfill site and sensitive receivers: The study was conducted at two active disposal sites, namely the Pajam and Ampar Tenang landfill. It involved 110 and 80 respondents in the landfill of Pajam and Ampar Tenang respectively. The respondents were divided into four categories namely residents of traditional village, modern housing, shops and institutions such as school and training centre.

RESULTS AND DISCUSSION

Community background: In terms of gender, the composition of the respondents is almost even with

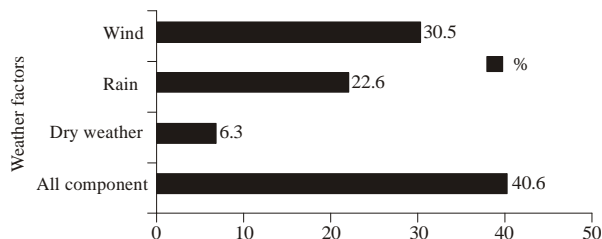


Fig. 1: Influenced of weather on odor concentration

52.9% males and 47.1% females. Minimum age of the respondent was 16 years old, while the maximum age was 75 years. In terms of age group, the 31-40 years old range was the highest represented 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 have attained secondary level of education where 28.9% at upper secondary and 19.5% only at lower secondary. The respondents that have achieved tertiary education was divided into two categories namely college and university level, with equal representation of 16.8% each. The reminder (18.0%) are older generation with perhaps just primary or informal education.

Although 180 (84.7%) of the respondents agreed that the landfills were the source of malodor, only 175 (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. For those respondents who made the complaints, most (42.1%) did so directly to the local authorities. Some have done so through combination of other methods namely elected representatives (14.2%), housing associations (11.6%), electronic media such as email, television and telephones (11.6%).

This study found that the occasions during the day when malodor were detected can be divided into four different period, i.e. morning (6 a.m. to 10 a.m.), noon (12 p.m. to 2 p.m.), afternoon (2 p.m. to 4 p.m.), night (8 p.m. to 10 p.m.) and the whole day. The survey found that the period when foul odor 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 on the frequency of odor pollution were assessed. They are once a day, once a week, once a month and during the whole day. The survey found out that the smell will eventually disappear but the

rate of disappearance was uncertain and perceived by 41.0% of the respondent as dependent on the general weather situation with 9.5% thought the direction of the wind was the main determinant while 3.7% related it to the heat. In response to the eventual foul smell disappearance, 15.3% said it happened after more than 6 h followed by 1-2 h (17.4%) and 3-4 h (11.1%).

Odor pollution caused by weather conditions: Weather is one of environmental component that may influence the frequency and intensity of odor received by the respondent. According to Sakawi *et al.* (2009) and Laister (2002) the influence of weather such as wind direction, wind speed, temperature and humidity can affect the concentration of odor carried from the landfill. The findings of this study showed 92.6% of respondents agreed that the smell of pollution in the vicinity of their homes landfill was associated with the weather. Based on the survey, 40.6% of respondents agreed it is influenced by factors of wind, rain and hot weather. Of this amount, the influence of the wind is perceived high (30.5%), followed by rain (22.6%) and hot weather at just 6.3% (Fig. 1).

Community perception on detectable odor is 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 was odor detected just outside the house followed by outdoor (8.4%) and indoor (3.7%). Another 37.4% of the respondent was not certain where the worst smell was normally detected. The big difference on the perceived foul odor between the indoor and just outside the house was probably due to the general community practice of closing all doors and windows thus preventing the bad odor entering into their home. The foul smell was less discernable when one is passing through in an air conditioned car or walking in the parks. This was probably the reason for low perceived bad smell outdoor.

Odor 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

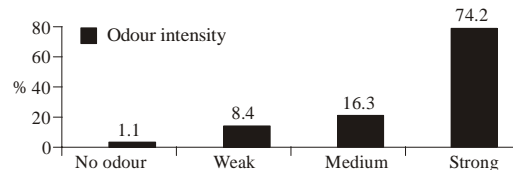


Fig. 2: Odor intensity perceived by the respondents

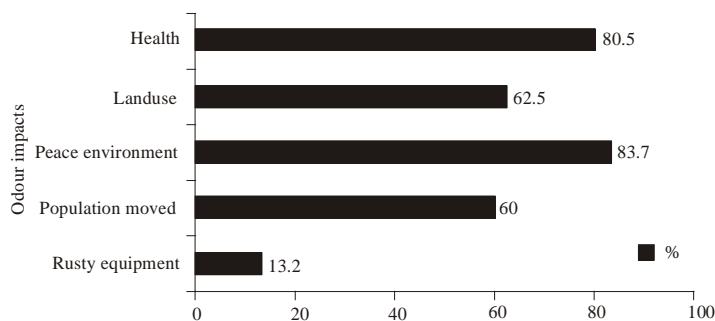


Fig. 3: Odor impact on the physical and human environment

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.

Odor impact on the physical and human environment:

Finally the study also focused on the perceived impact of odor on human health and physical environment. The result of the survey has indicated that 83.7% of the respondents felt the bad smell had affected the tranquility and quality of life. At the same time 80.5% of the respondents perceived the foul smell was associated with their health effect. With respect to the physical environment, only 13.2% of the respondents related the bad smell with corrosion of households utensils and equipment. Figure 3 shows the perceived diversity of impacts by the respondents.

CONCLUSION

This study is an important and early effort to understand the issues related to odor that emanate from landfill sites. This issue is not new and has often been reported in the print and electronic media. Thus far there is no specific study that relates the problems and perception of odor on the communities living within the vicinity of landfills. This study clearly showed that the bad odor coming from the landfill is disruptive to the everyday life of the communities. First and foremost the bad smell is a constant nuisance affecting the outdoor activities of the communities. The “peak” malodor is more often experienced during the night necessitating the communities to shut all windows and doors to reduce sensing the bad smell. The study also indicated that the

periods and intensity of bad smell can be influenced by the weather in particular the wind direction. Hopefully this study will contribute some information to the Department of Environment in formulating and developing guidelines on odor pollution from the landfills.

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