

Research Article

Perception of Odour Pollution Impact from Waste Treatment Plant on Health, Psychology and Physiology of Sensitive Receivers

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Abstract: This study examined the impact of WTP operation on health, psychology and physiology of the sensitive receivers at Taman Semarak, Bandar Baru Nilai, Negeri Sembilan. Building WTP around residential areas is a necessity for treating domestic waste water. Poor management of WTP and inefficient waste treatment adversely impact the physical and human environment. One major impact of WTP operation is odour pollution. The sensitive receivers were residents living about 200 m from the WTP at the Taman Semarak. Data was obtained through a survey of the 100 sensitive receivers. The findings indicated that there were influences of odour from the operation of WTP on the sensitive receivers in the vicinity. Almost 2/3 of the sensitive receivers confirmed the health, psychological, physiological impact due to the WTP operation.

Keywords: Health, odour pollution, physiological effect, psychological effect, waste treatment plant

INTRODUCTION

Odour pollution is an issue which has gained increasing attention by the communities around the world. This awareness can be seen via the mass media highlighting and exposing escalating odour pollution issues almost on daily basis. Major contributors are waste products such as solid wastes, liquids and gases. Among top odour contributors are landfills, recycling centres, waste water treatment plants, rubber and oil palm factories, livestock farms and other sources. The impact is not limited to common health issues but also the psychological and physiological. Malaysia is yet to have an efficient odour management system to manage odour issues from the various sources.

Odour refers to property or quality of a source that can affect, stimulate or received by the olfactory sense (Sakawi *et al.*, 2012). Science of smell (2004) defined odour as a quality of an element that can be detected by the olfactory sense in the form of aroma, fragrance or foul odour. Yong (2004) stated that odour is an element of an environment that is difficult to analyze and presented. Although there is a clear difference, yet it is difficult to distinguish between chemical analysis measurement and sensory evaluation. Generally, odour is produced by one or more unstable chemical compound entering human olfactory organ. Odour can be classified into two categories, pleasant and unpleasant.

There have been various studies on odour pollution abroad. Yet, there are limited Malaysian studies on the issues due to lack of expertise and instruments for

odour measurement. The scope of odour studies is not limited to impact on general well-being as noted by Nicell and Tsakaloyannis (2003), NRCCO (1979) and Shusterman (1992). Studies also covered perception issues (Sakawi *et al.*, 2011; Whitherspoon and Barnes, 2009) origin and source of odour (Applied Environmental Research Centre, 2001; Sironi *et al.*, 2005; Stern, 2007), sampling and analysis of odour (Zarra *et al.*, 2009; Sironi *et al.*, 2007; Sakawi *et al.*, 2011; Davoli *et al.*, 2003; Romain and Nicolas, 2009; Drew *et al.*, 2007); and odour control (Morcet *et al.*, 2003; Chen *et al.*, 2003; Otieno and Magagula, 2001; Fukuyama, 2004; Iwasaki, 2004; Bedogni and Resola, 2002; Hurst, 2005).

Due to the severity of the WTP odour issues, this study therefore examined the operation of the WTP and impact of odour pollution on the surrounding residents. A WTP collects and treats domestic waste water produced by human activities. Sewage or wastewater from domestic, commercial and industries should be treated to ensure clean water is recycled into the environment through rivers and coastal waterways. Health and quality of life of the communities could be better maintained if the country has excellent sewage infrastructure (Report on Sewage Development, 2004). Malaysia has three sewage management practices namely public sewage treatment, private sewage treatment plant and individual septic tank (IWK Service Report, 2003).

The WTP in residential areas does affect the residents in the area. Processing of wastewater in open

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Fig. 1: WTP Taman Semarak, Bandar Baru Nilai (Fieldwork, 2012)

areas with wind movement may cause unpleasant odour to spread around the vicinity of the WTP. The odour could adversely affect the residents in the area. This study therefore focused on the sensitive receivers within 200 radius of the WTP to learn the effects of odour on their health, physiological and psychological aspects. Nevertheless, human perception varies from individual to individual; and so do the psychological effects of the type of odour received. An objective analysis of the odour is therefore challenging. The ability to detect odour is as varied as the individuals perceptions. The sensitive receivers odour reaction also vary according to their gender, age and health status (Sakawi *et al.*, 2012).

There have been many studies abroad on various odour issues related to management, impact, measurement, mitigation strategies and others. Specific study on odour measurement, particularly on H₂S as main pollutant from WTP was conducted by Sivret and Stuetz (2012). While, studies on method of treatment based on features of the waste water using chemical sensor system was conducted by Ziya *et al.* (2009) and Zarra *et al.* (2009). Studies on control and management conducted, included those by Kumar *et al.* (2010) on evaluation of the efficiency of WTP operation; alternative steps to reduce odour effect from WTP (Giuliani *et al.*, 2012; Estrada *et al.*, 2011) on WTP technologies using biotrickling filtration as the most effective method to reduce odour concentration.

MATERIALS AND METHODS

Sets of questionnaires were used in this field study to obtain the data from the sensitive receivers. Purposive sampling involved 100 sensitive receivers living within 200 m from the WTP at Taman Semarak, Bandar Baru Nilai, Negeri Sembilan (Fig. 1). The

sensitive receivers were the residents and business people in the area. The data was processed and analyzed using the Statistic Package for Social Science (SPSS). The data was interpreted using descriptive statistics to reveal the perception of the respondents on themselves, intensity, duration of odour and impact on their psychology and physiology and overall health.

RESULTS

Background of the respondent: This section discusses the findings of the study, particularly the background of the respondents, such as gender, age, ethnicity and education. These are vital information to understand the variance in respondents perception of the odour intensity from the WTP. The perception of the respondents on their psychological and physiological health are also elaborated. The impact on their well-being and quality of life are also highlighted.

Out of 100 respondents interviewed, 59% of them were males and 41% females (Fig. 2). Majority of the

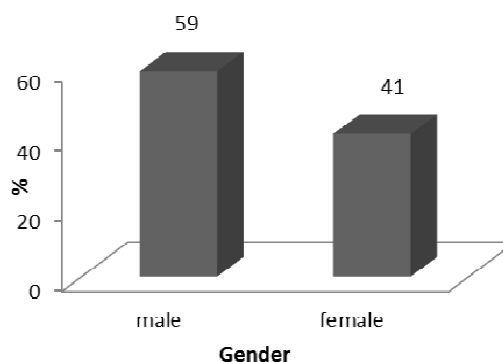


Fig. 2: Respondent gender (Fieldwork, 2012)

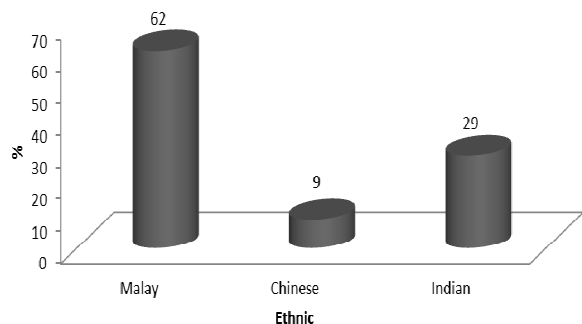


Fig. 3: Respondent ethnic (Fieldwork, 2012)

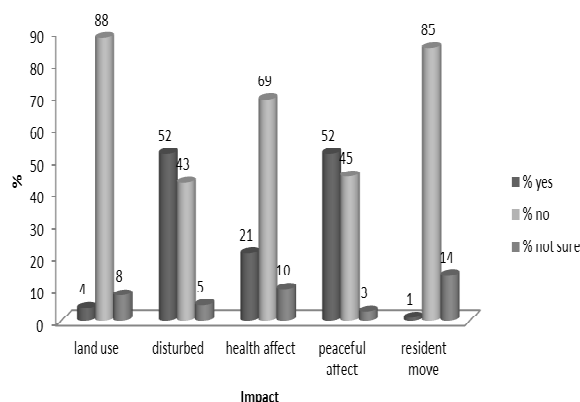


Fig. 4: WTP impact on local population and environment (Fieldwork, 2012)

respondents were Malays (62%), Indian (29%) and Chinese (9%) (Fig. 3). In terms of age group, 10% were those 20 years old and below, 17% aged 20 to 29; and 28% were those 30 to 39 years old. Meanwhile 23% were those aged 40 to 49 years old and the rest of the respondents were 50 years old and above (Table 1).

WTP impact on local population and environment:

WTP is required in residential and commercial areas given its functions to process waste water before re-releasing them into the environment. Despite this necessary function, there exist negative effects on the residence and environment. The negative effects are the odour-caused discomfort and irritation to the residents, particularly the sensitive receivers.

Figure 4 shows more than 50% of the respondents indicated that they were disturbed and irritated by the WTP in their area due to the odour issues. About 52% respondents felt their wellbeing was affected and had to limit their outdoor activities. More than 40% revealed that they did not experience any disturbance not irritation, due to their homes being comparatively farther in distance from the WTP.

Nevertheless, 85% of the respondents indicated that they were reluctant to move despite the odour issues from the WTP. The rising cost of new homes

made it costly for them to acquire more comfortable homes and environment. The health of the residents were affected by about 21% due to the WTP. Even though the percentage of health issues was rather low, there is possibility that it might increase if preventive measures are not taken. About 88% respondents noted that land use and development in the area was not affected despite the WTP odour issues.

Intensity of odour generation: The respondents used their nose as a smelling sensor to detect the intensity of the odour within 200 m of the WTP. The odour intensity perceived by the respondents varied according to their age, distance and gender. The scales for the intensity ranged from no odour, less odourous, moderately odourous and highly odourous.

Figure 5 shows the findings with 60% of the respondents experienced odour issues from the WTP at the Taman Semarak. The odour level most perceived by the respondent was at moderate level (45%). About 10% of the respondents indicated strong odour at their places. This may be attributed to their proximity to the WTP. Less odour was indicated at 6%. No odour was indicated at 39%, this could be due to distance and weather factors that did not distribute much odour in their area.

Health impact: The building and operation of WTP may bring negative effects to sensitive receivers if it is



Fig. 5: Intensity of odour generation (Fieldwork, 2012)

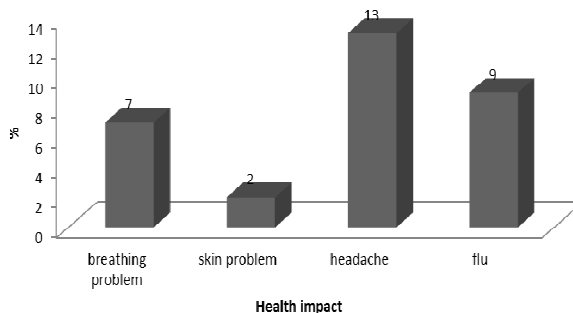


Fig. 6: Health impact (Fieldwork, 2012)

Table 1: Respondents background

Age	(%)	Education level	(%)
20 years and below	10.0	No formal education	1.0
20-29 years	17.0	Primary school	6.0
30-39 years	28.0	Lower secondary certificate	30.0
40-49 years	23.0	Upper secondary certificate	48.0
50-59 years	13.0	Collage certificate	8.0
60 years and above	9.0	University	7.0
Total	100.0	Total	100.0

Fieldwork (2012)

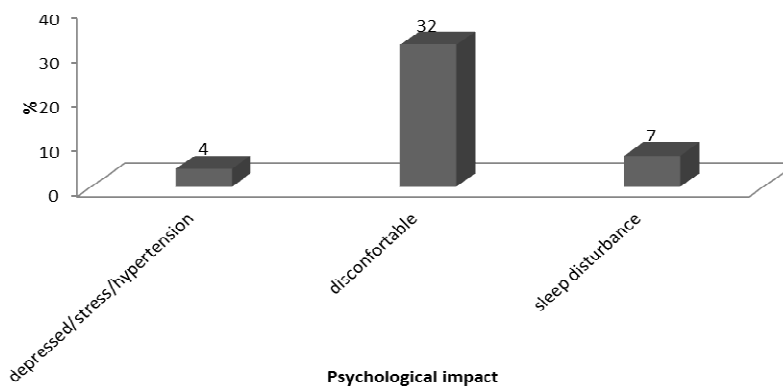


Fig. 7: Psychological impact (Fieldwork, 2012)

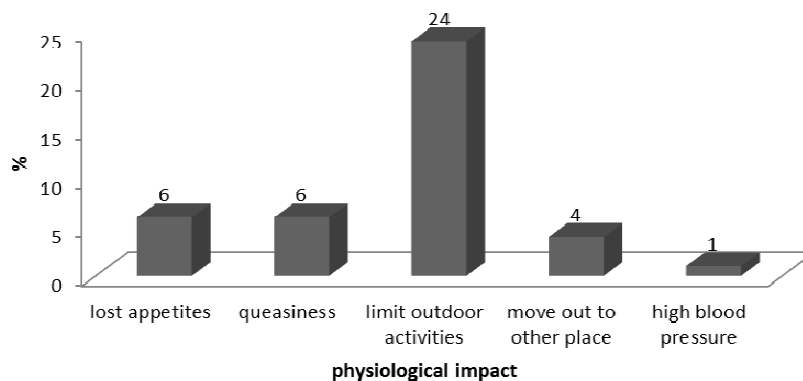


Fig. 8: Physiological impact (Fieldwork, 2012)

not properly managed by the authority concerned. Results of the study indicated that the residents did experience health issues due to the odour produced by the WTP. Eventhough the complaints were not of critical ailments, if let to persist, may turn worse and make solutions difficult.

Figure 6 shows an impact of odour pollution from the WTP on the health of residents around the Taman Semarak WTP. The common ailments indicated were headache/dizziness at 13%. Headache or dizziness occurred when intensity of odour generated from the WTP was high and persisted over a long period. Respondents also complained of cold and flu which persisted over a long period. Breathing problems also afflicted the residents, with 7% indicated that they occasionally suffered athma, sore throat and allergies.

Psychological impact: Other than general health issues, the odour could also affect the psychology of sensitive receivers. Psychological reaction is one that involves changes to one's feeling or emotion. Some people may be able to adapt to environmental change quite readily even in uncomfortable circumstances. However, majority often find that living with constant odour as highly unpleasant.

Figure 7 shows the impact of odour pollution from the WTP operation at the Taman Semarak. About 32% of the respondents found the odour discomforting. They began to feel the discomfort and irritation when there were strong wind and after rains. Some suffered sleeping difficulties (7%) when the odour occurred at night. Some residents also suffered various forms of stress (4%). Nevertheless, they had no choices, with the high cost of new homes, the prospect of leaving their

present homes and purchase new ones elsewhere look daunting.

Physiological impact: Physiological reaction is a behavioral reaction. The respondents' physiological reaction could be a form of antisocial behavior as a result of the odour issues. They also experienced poor appetites when the odour invaded their homes. The problem was quite persistent given the regular generation of odour from the WTP.

Figure 8 shows the physiological impact of the WTP odour at Taman Semarak, Nilai. The most obvious impact was that the odour forced a limitation on residents outdoor activities (24%). About 4% opted to move out to other place to escape the odour. Those who lost their appetites and complained of dizziness constituted 6% of the respondents. The odour issues were perceived as may probably persist over a long period before any chance of returning to normalcy.

DISCUSSION

Generally, the results of the study indicated that odour pollution is becoming a more serious problem in Malaysia. The issues of odour pollution are not only limited to that generated from the WTP but also those from livestock farms, industries, factories, landfills and others. The study indicated that generation of odour from the WTP posed problems to the residents at the Taman Semarak. This is obviously evident when more than 60% of the respondents indicated that they were affected by the WTP generated odour.

Generation of odour from the WTP affected the sensitive receivers' health, physiologically and psychologically. Even though the effects may not be so obvious, if persist may lead to far more serious consequences to the residents. Evidently, the residents experienced psychological and physiological issues when they felt irritated with the odour. Some had to move themselves out of the predicament to other places with fresher air and more conducive environment. Health-wise, the residents suffered headaches and respiratory problems. Some residents have acquired some level of immunity to the odour due to their longer duration of stay.

The impact indicated that the management of WTP has not yet achieved a satisfactory level. The building of WTP should take into consideration the required critical distance to residential and business areas. Suitable distance could be about 300 m, for only residents about 250 m and below suffered the odour issues. Furthermore, the authorities should undertake tree planting both around the residential areas and around the WTP as buffer zone to the WTP odour and neutralizer of surrounding air.

CONCLUSION

The results of the study indicated that sensitive receivers in the vicinity of the WTP had been

continuously exposed to the odour issues that affect their health, psychologically and physiologically. The sensitive respondents have been clearly in the range of harmful exposures of the WTP generated odour. Even though their overall percentage was quite moderate, persisting problem may lead to worse case scenario in the near future. In summation, all relevant authorities should ensure the issues found their solutions firstly through proper management of the WTP operations.

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