

主論文

Evaluating the Effects of Air Pollution from a Plastic Recycling Facility on the Health of Nearby Residents

(プラスチック・リサイクル施設から排出される大気汚染物質と周辺住民の健康影響の評価)

[緒言]

Although plastic recycling is considered to be highly desirable as a means to conserve energy and non-renewable resources. In 2005, a plastic recycling facility in Neyagawa, Osaka Prefecture, began to manufacture pallets by dismantling, melting and molding recycled waste plastic. In response to residents' complaints, Yorifuji et al. conducted a survey in August 2006 to characterize the health effects of emissions from the facility, and respondents were categorized according to distance from the facility. To counter skepticism surrounding their results we conducted a new study to evaluate the effects of ambient air pollution from the facility on residents' health at five nearby sites—including those featured in the previous study.

[材料と方法]

Individuals over the age of 10 were randomly sampled from 50 households at each site and questionnaires were administered by public health nurses. Study sites were categorized according to distance, which was used as a proxy measure for pollutant exposure. The study was designed to improve a preceding study and to create new finding for example, the method on distribution and collection of questionnaire, and selection of study areas. The odds of residents living of 500 m and 900 m from the facility reporting various mucocutaneous and respiratory symptoms were then calculated using a group of residents living at a distance of 2,800 m as a reference group. All analyses were carried out using EpiInfo 3.5.1 software provided by Centers for Disease Control and Prevention. Ethical approval for the study was obtained from the Institutional Review Board of Okayama University at the end of May 2010 (review number 338).

[結果]

The odds of self-reported nasal congestion (OR=3.0, 95% CI: 1.02–8.8), eczema (5.1, 1.1–22.9), and sore throat (3.9, 1.1–14.1) were significantly higher among residents living at a distance of 500 m from the facility. Those living 900 m from the facility were also significantly more likely to report experiencing eczema (4.6, 1.4–14.9).

[考察]

The results of the present study confirm those of the previous analysis conducted by Yorifuji et al., and confirm that residents living at Site A, located closest to the plastic recycling facility, were more likely to experience mucosal symptoms (such as irritation of the eyes, nose, and respiratory tract) and cutaneous symptoms (such as rashes) than those living at sites D and E. Yorifuji et al. did not guide and supervise objects to fill in the questionnaires that may cause bias, therefore we improve the methods of data collection. And the results indicated that the use of public health nurses to administer the questionnaire improve accuracy. This means study method (distribution and collection of the questionnaire) did not influence the effects in the area to change study conclusion of the previous study. Residents slightly further from the facility at sites B and C also experienced some health effects despite the latter being situated on the opposite side of the facility. The finding that the magnitude of effect was smaller than at sites A and B was likely because Site C was farther from the facility than these sites. While we retained Site E from the previous study, Site D was also added to address possible confounding from automobile emissions and pollutants from gas stations—another important source of VOCs. Moreover, the inclusion of Site C, located at the opposite side of the plant from sites A, B and C, D, allowed us to test the effects of both direction and distance.

The indicated strong points of the study in the about were mainly three : independence of the observed effects of study from design and method.; existence of effects in the counterside of main study area of Yurifuji et al. from the facility ordered by dose-response relationship and elimination of road-traffic pollution effects form reference site by adding site D.

Symptoms such as itchy eyes, irritation of the nose and throat, rhinitis, nasosinusitis, dermatitis, upper and lower respiratory inflammation, and asthma are strongly associated with, and directly caused by, exposure to airborne VOCs. The elevated odds of those reporting mucocutaneous and respiratory symptoms indicative of exposure to VOCs such as organic solvents suggest that emissions from the plastic recycling facility exert harmful effects on residents. We also found a gradient in effect with increasing distance from the facility and length of time spent indoors.

Our results might be attributable to clinical manifestations of “sick building syndrome” or multiple chemical sensitivity. Furthermore, we found that as concentrations of airborne VOCs exceeded a certain threshold, symptoms of mucocutaneous irritation can occur both as a result of indoor occupational exposure and outdoor ambient exposure. The latter may occur even if the characteristic odor from VOCs cannot be detected. This suggests that the mucocutaneous and respiratory symptoms experienced by residents are very likely to be result of exposure to VOCs.

[結論]

Our results indicate that air pollution was responsible for a significant increase in reported mucocutaneous and respiratory symptoms among nearby residents. This study confirmed the effects of pollutants emitted from recycling facilities on residents' health, and clarified that difference between study designs did not depend on the study result.