operating together, as would be the case for an industrial building with communal treatment facilities. In order to achieve substantial savings in pollution control costs, it is therefore essential that communal treatment facilities should be considered wherever factories discharging effluents are located in close proximity.

References

Nash, J. M. (1989), *ISWA Country Paper—Hong Kong*, Environmental Protection Department, Hong Kong Government Technical Paper.

Nash, J. M. (1990), Evolution of hazardous (chemical) waste disposal facilities in Hong Kong, *Waste Management and Research* **8**, 163–164.

REPORT:
PUBLIC HEALTH ASPECTS OF A SOLID WASTE SCAVENGER COMMUNITY IN THAILAND. By Nipapun Kungskulniti, East-West Center, Honolulu, Hawaii.

Scavenging from open-dump sites is almost universally opposed in industrialized countries primarily because of potential liability claims and obvious public health hazards. Indeed one of the justifications for sanitary landfills in the U.S.A. is the fact that daily cover keeps scavenging and also rat infestation to a minimum. However scavenging for recyclables from open-dump sites as a way of making a living has existed for a long time and is still practised in the shadow of many cities. Scavengers and their families, as well as the communities in which they live, are surrounded by the insanitary working and living conditions of the open-dump environment.

Bangkok, the capital city of Thailand, covers 1600 km^2 and has over 5.5 million inhabitants. The Bangkok Metropolitan Administration (BMA) is the city's political and administrative authority. The management of solid waste is the responsibility of the BMA's Department of Public Cleansing (DPC). Over 4000 tons per day of municipal solid waste are collected and taken to three disposal sites: On-Nooch (in the east), Nong-Khaem (in the west), and Ram-Intra (in the north). All three contain open-dumping areas, small composting plants and small incinerators to burn materials rejected by the compost processing equipment.

A case study to demonstrate some dimensions of the public health risk to this group of people and their community was undertaken at On-Nooch Dump Site, Bangkok, Thailand.

The On-Nooch 0.9 km^2 disposal site in the east draws from a radius of 25 km, within the city. It has been in operation since 1964 and is the largest and oldest of the three disposal sites (ERL 1988, Wilson 1988 *a,b*). There are two composting plants with two incinerators to handle material rejected for composting, as well as a large open-dumping area. Primary compost, compost that is of insufficient quality, as well as ash from the incinerator is placed in the open dump. The amount of waste delivered to On-Nooch site is around 1500 tons per day including some small-industry wastes and hospital and medical clinic wastes. Only about 400 tons per day of incoming waste can be processed by the composting/incinerating facilities, and the remainder is dumped in the open-dumping area. Smouldering fires are frequently present at the site.

It is estimated that over 400 day-scavengers and around 40 night-scavengers appear at the On-Nooch Open Dump area to retrieve recyclable materials to resell to vendors as their primary source of income. The dump contains two tipping areas and two runways to access each tipping point which include a turn around area. The runways and turning

areas are paved with planks to prevent the heavy trucks from sinking into the solid waste. There are 13 and 15 unloading spots which radiate outward from the two tipping floors respectively. Around 10–15 scavengers are located at each unloading spot (Fig. 1) while other scavengers roam after the compacting tractors. Shelters are built from recovered materials on the dump as scavenger waste depots and shaded resting areas (Fig. 2). Restaurants and food vendors are present in spite of the unsanitary conditions of the nearby tipping spots. Thus, this mountain of garbage is full of human activity regardless of the odorous, contaminated, polluted, and unsightly environment. Information derived from interviewing 297 scavengers at this open dump site (Fig. 3) will be presented in a dissertation by the author.

Scavengers are predominantly in the 16 to 35 age group and 2/3 of them are male. Few have more than a primary school education. Their income ranges from 20 to 300 baht per day with an average of 85 baht per day (the Bangkok minimum wage is 78 baht per day). Less than half of them have worked more than five years at this job, but more than half work every day in the week. Nearly all wear hats and some form of foot covering, but few have protective arm covering and over a third wear loose (untucked) trousers. Nearly all of them report cuts or injuries from their work and many report headaches or internal problems. Surprisingly, 3/4 of them are able to take two or more baths per day. There is a significant use of a stimulating drug (Appine-Tab), most of which occurs on the dump site.

Resaleable, re-usuable and edible items are all retrieved. Reclaimed materials are sold daily in the late afternoon to middlemen or owners of small businesses who go to the dump site. Some scavengers carry out further sorting, washing and cleaning of collected items at their home compounds in the community bordering the dump site. The scavenger community population numbered 1929 in October 1988 (Van der Bossche 1988). Most of this community is engaged in scavenging and reclaiming activities but a

Fig. 1. Scavengers territorily located at each unloading spot.

Fig. 2. Shelter built from recovered materials on the dump.

Fig. 3. Interviewing scavengers at dump site.

number do have other jobs. A segment of this community are squatters while the majority rent or own their homes. Piles of recovered materials are commonly seen as well as sorting, cleaning and drying activities. Burning off coatings to reclaim valuable metal is also seen. Most parts of the community are surrounded by or sited directly over polluted water, a mixture of rainwater, domestic waste and dump leachate. The congested human settlement lacks any drainage system for the low-lying land. The better-off members in the community have running water systems and electricity from the city. Others gain access to these services by indirectly purchasing them from the better-off members. The practice of storing water in containers such as big jars and barrels is common.

Scavengers and their community continually encounter adverse working and living environments. They bear direct exposure to wastes and are exposed to pollutants from reclamation activities and disposal processes. Contamination from toxic substances and infectious germs from industrial, hospital and medical clinic wastes are also plausible sources of disease since these wastes enter the municipal solid waste stream or are dumped separately on the site. Fecal matter is also frequently found in these solid wastes. Moreover, many consumer products contain hazardous substances such as insecticides, solvents, etc.

Despite their adverse working and living conditions the scavenging community enjoys a higher standard of living than comparable regions of the city. Current studies may show whether it is possible to detect the expected adverse health effects against the background of better economic status. As a precautionary measure toxic and hazardous waste from industries and infectious and sharp wastes from hospitals and clinics should be separated from the waste stream and disposed of separately from the open dump.

Further steps to improve conditions would include a health education campaign for scavengers and their community so that they can gain knowledge, adopt attitudes, and develop skills to improve their overall personal hygiene practices and safety. The importance of prevention over cure should be stressed in such a hazardous environment. As a first step, the scavenger community should be educated to avoid contaminated, toxic or infectious wastes. An awareness of the need to improve the sanitary conditions of households and the community as a whole should be emphasized. Food vendors and restaurant owners at the dump must be included in the education program so that the special issue of food sanitation is addressed.

Better methods of retrieving recyclable materials and disposing of wastes should be developed. This means assisting the scavengers to work in improved facilities and in an improved environment. The idea of dispossessing them is strongly discouraged. These people are assets, they make a contribution to society's overall economic well-being by having jobs, income, and by serving an important waste recycling and disposal function. Their skills can be applied to sorting recyclable materials which is impossible or inefficient using mechanical retrieval methods. The goal should be to create a sanitary solid waste sorting facility where they could be organized to work under healthy and safe conditions.

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References

Environmental Resources Limited. Promoting Private Sector Involvement in the Production of Energy and Other Useful Products from Urban Solid Waste in Bangkok. *Final Report to Commission of the European Communities and Ministry of Industry of Thailand.* Project ADE/933/85/07

Van den Bossche, A. (1988), *Mother and Child Health Program, Samakhitham Community, Bangkok.* A report to Foundation for Slum Child Care, Bangkok.

Wilson, D. C., Bourgeois, J.-M. & Vicharangsan, K. T. (1988*a*), A new solution to solid waste problems in developing country cities. (L. Andersen, & J. Møller, eds.) In *ISWA-88 Proceedings,* vol. 1, 455–462, Copenhagen.

Wilson, D. C., Bourgeois, J. M. & Khun, T. N. (1988*b*), Innovation in solid waste management for developing cities. (P. Hills *et al.*, eds.) In *Proceedings of the Conference on Pollution in the Urban Environment (POLMET '88), Hong Kong,* vol 2, 16–21. Vincent Blue Copy Co. Ltd.

REPORT:
CEMENT KILN INCINERATION OF OUT-DATED AGRICULTURAL CHEMICALS IN PAKISTAN.

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As the result of a series of unfortunate circumstances Pakistan has over 5000 tons of outdated pesticides in 212 formulations, distributed in some 2700 stores and warehouses all over the Punjab province (Halimie 1984; Chehaske & Marcil 1989). A World Environment Center (WEC)—US EPA team that visited some of the stores in 1987 found very little useable material. There is in addition some 3000 tons of contaminated material that must be taken care of.

Clearly, the total and safe disposal of 8000 tons of overaged chemicals and contaminated materials is going to cost a significant amount of money. However, the magnitude of the problem and the potential severity of a major fire and/or ground water contamination incident makes a final solution highly desirable.

Another aspect of the problem is illustrated by the experience of the WEC/USEPA team that visited 26 stores in 1987. They had to cut short their visit because their mere presence was endangering workers. The problem stemmed from a quite natural desire on the part of local storekeepers and quite possibly from orders from the Field Assistants. As news spread ahead of where the team were to visit next, the store was hurriedly swept and otherwise cleaned. The activity was still in progress at a number of the sites visited. In some cases young boys were sweeping up clouds of toxic materials so that the floors would look clean. Clearly, management of a widespread disposal program will have to be put into the hands of carefully trained individuals.

Pakistan's case has not been singled out because it is particularly egregious. It is not. It is simply a matter of the availability of background material. And Pakistan is not the only country that the World Environment Center has had experience with of this sort. Several other developing countries have been seen to have similar problems and even the U.S.A. had stocks of outdated agricultural chemicals. Quite clearly this is a widespread problem. Furthermore, and most significantly, Pakistan is among the few countries that is actually doing something about the problem.

The causes of the excessive stocks of pesticides has been reviewed by Ghouri (1979) and by Halimie (1984). Halimie stated that beginning in 1963:

> The yearly procurement of pesticides exceeded the sale and as a result there had been accumulation of stocks. In certain cases, not a single carton of product could be sold because farmers could not be motivated or the specific pest did not appear at all