BASEL CONVENTION TECHNICAL GUIDELINES on Household Wastes

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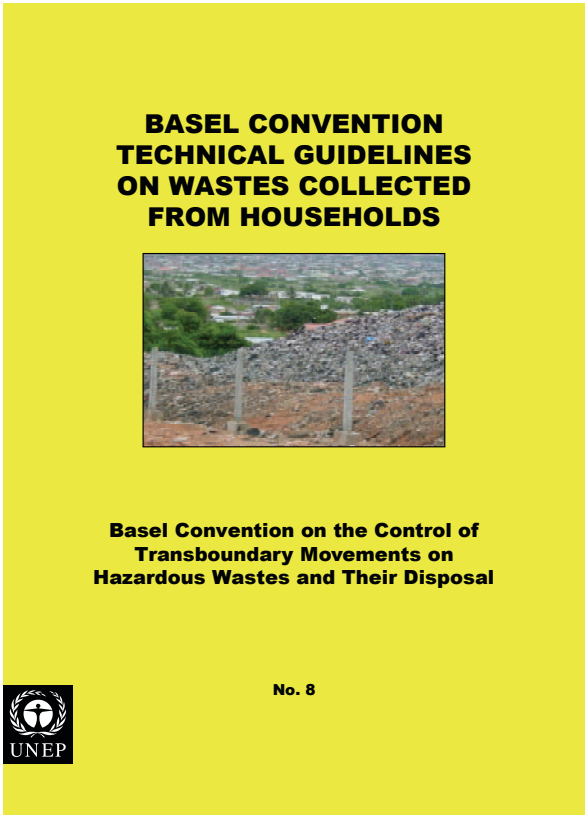

The Malaysian solid waste management structure and system took a big leap after the introduction of the National Strategy Plan for Solid Waste Management by the then Ministry of Housing and Local Government in 2005. Subsequent to this, the Solid Waste and Public Cleansing Act, Act 672 was enacted in 2007. Along with this, the Solid Waste and Public Cleansing Corporation Act, Act 673 was also enacted simultaneously.

The National Strategy Plan for Solid Waste Management linked its vision to one of the key thrust policies of Vision 2020 that is pursuing environmentally sustainable development to reinforce long-term growth which strengthens Malaysia's commitment to the Rio Declaration of 1992.

The "Technical guidelines on wastes collected from household" issued by the United Nations Environment Programme (UNEP) which was adopted by the meeting of the conference of the Parties to the Basel Convention will serve as a good guide for the stakeholders including engineers involved in the solid waste management industry from the Basel Convention perspective.

ABOUT BASEL CONVENTION

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted on March 22, 1989 by the Conference of Plenipotentiaries in Basel, Switzerland, in response to a public outcry following the discovery, in the 1980s, in Africa and other parts of the developing world of deposits of toxic wastes imported from abroad.

The overarching objective of the Basel Convention is to protect human health and environment against adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes as "hazardous wastes" based on their origin and/or composition and their characteristics, as well as two types of wastes defined as "other wastes" – household waste and incinerator ash.

INTRODUCTION TO THE GUIDELINES

Household wastes are not normally regarded as hazardous, since they consist almost entirely of

materials, which have been handled by individuals before being discarded. However, such wastes can be extremely variable in their composition, depending to a large extent on the lifestyle of the generator. For example, it can be expected that in the countries where almost everything bought is associated with wrapping materials, the packaging waste very often comprises a significant part of household waste. There will also be foodstuffs adhering to it or unusable material derived from foods preparation, such as vegetable peels, meat scrapes and bones, which make it unattractive for recycling. Also present in waste collected from households are such items as batteries and other electrical components, some of which may contain mercury, containers in which are present residues of oils, paints, pool chemicals, caustic materials, sterilizing agents, bleaches, medicines, etc. Although these constitute a small portion of waste collected from households, they are particularly problematic due to their hazardous characteristic, variability in chemistry and associated high recovery costs. There may be in addition, aerosol canisters, caustic materials, sterilizing agents, bleaches, medicines, disposable baby's nappies or diapers, animal faeces and its associated litter along with discarded foodstuffs which rapidly degrade and become offensive by virtue of their smell. Such wastes are attractive to vermin, flies and scavenging animals and birds.

For all these reasons there is a need to control and give special consideration to household wastes and carry out practices which demonstrate environmentally sound management. Such wastes could also be generated in offices, commercial establishments and hotels, etc.

ENVIRONMENTAL IMPACT OF HOUSEHOLD WASTE

Inadequate collection, transport or improper disposal of household waste can have adverse environmental impacts, such as:

- Air pollution and unpleasant odours;
- Potential health hazards from accumulation of polluted water, which provide breeding grounds for mosquitoes and attract flies, vermin. Also, injuries from infected sharps;
- Loss of productive land due to the presence of non-biodegradable items;
- Contamination of soil, ground and surface waters by leachate with resultant environmental effects or health hazards; and
- Contamination of the marine environment through direct or indirect discharge of waste.

Waste Avoidance and Minimization

One of the leading principles of waste management is the source reduction principle, by which the generation of waste should be reduced to a minimum in terms of quantity and/or hazard potential. Therefore, the problems associated with waste disposal would not be so significant if materials did not need to be discarded as waste in the first place. The marketing of goods in reusable containers, which could be returned to the supplier and be reused, is one example. Waste generation could sometimes be reduced if commodities were available in bulk quantities to a retailer who sells the goods in smaller quantities, thereby eliminating the need for as much packing. Packaging of goods for aesthetic reasons could be discouraged, as could the supply of a small item in a large package for marketing reasons. Of course packaging often serves important functions such as controlling spoilage and otherwise facilitating the distribution and marketing of goods.

Segregation at Source

It is essential to segregate domestic waste into various components such as combustibles material, reusable material, recyclable material, organics, etc. at the household level. Combustible material includes paper, cardboard, dry leaves and twigs. Reusable material could be bottles, cans and plastic bags. Recyclable material could be paper, plastics, glass and metal scraps. Organic material includes vegetable and fruit peelings and other food wastes.

To promote recovery operations, and to prevent household waste causing pollution or damage to human health, it is most important to segregate recoverable and hazardous waste, if present, at the source of generation. Segregation can also occur downstream. In developed countries, with possibilities to introduce separate

Various types of household waste

collection schemes, this is a major challenge in relation to the proper management of household waste. In developing countries, it is more common practice to separate and reuse all valuables from household waste.

Collection and Transport

Households usually keep waste to be discarded in designated containers. These may be metal or plastic dust-bins or plastic and paper bags. In large buildings and apartment blocks, centralized containers are sometimes provided into which occupants place their waste. In most developed countries, it is usual for household waste to be collected from premises on a regular basis since food waste, in particular, decays rapidly.

In cities and urban areas, waste is collected for disposal in specially designated vehicles fitted with compaction equipment to increase the payload, which can be transported, often over significant distances to sanitary landfill site. In large conurbations, it has been found economically viable to transfer the collected waste to railway containers for transport to a landfill site; large barges are also used for transport on water. In some instances, waste is bailed to facilitate mechanical handling.

Recovery Operations

The next important principle in respect of waste avoidance and minimization is recovery of recyclable components to the greatest possible extent. In many industrialized countries, sophisticated recovery programmes have been introduced for household waste. Nevertheless, too many valuable resources are still lost from inadequate separation, collection and recovery systems, most often due to the unsustainable market for several recovered waste materials.

In some developing countries, components of waste streams are usually segregated and used. Combustibles may be used as fuel either as such, or after densification. Paper may be used in small-scale paper/cardboard making and plastic wastes can also be reused in applications not requiring high quality and clean material.

The segregation, recycling and reuse of domestic waste is important. Segregation, recycling and reuse of household waste can have a major impact on the economies of some developing countries. People involved in waste segregation can be brought into the formal sector and remunerated for their work. Valuable items, 'pickings' can be sold through intermediaries to small recycling entrepreneurs. The entire recycling activity, including transportation, generates employment. The economic status of all those employed in recycling is improved.

It is possible to produce compost from the putrescible fraction of household waste.

The waste is piled in a heap formed in rows and the waste is turned over or windrowed at regular intervals. Also, it is possible to put the sorted waste into a horizontal perforated drum, resembling a rotary kiln, which has been fitted with flight tubes and rotate the drum very slowly such that the passage of the waste to the other end of the drum takes several days.

Both these processes rely on aerobic biodegradation taking place to produce a product resembling compost. The presence of contaminants both organic and inorganic in compost that originates from unsegregated materials can make the compost unusable.

Threshold values of concentrations of such contaminants must be assessed.

Disposal Operations

Historically, household waste has been disposed of by land filling. As communities became larger and more premises were built, usually at a higher density, particularly in urban areas, the area needed for the disposal of waste increased. Also, as society has developed, there have been significant changes in the composition of wastes collected from households, particularly with a change in the fuel used for heating purposes. This led to designated areas of land being set aside which became the local waste disposal site. In addition to decomposition, predators and fires on such sites reduced the volume of waste considerably.

Nowadays, because of the ever increasing volume of waste requiring disposal and an increasing need to protect the environment, sophisticated means of collection, transport, treatment and disposal need to be used. At the landfill site, the waste is deposited in layers in prepared cells and compacted to decrease its volume. It is then covered, at least daily, with a suitable soil likematerial to deter vermin, flies, birds and other scavengers but also to prevent injuries from sharps.

Some biodegradation of the putrescible fraction in the household waste will have commenced before it was collected and will continue during its transportation. Further processing by, for example, wet pulverization also will promote enhanced degradation. Some countries prohibit the addition of liquids to landfills for the purpose of accelerating degradation, being more concerned with the increased production of leachate resulting from such practices. Once in a landfill site the rate of degradation will increase rapidly, particularly in the presence of moisture. However, if the density of the waste is increased significantly to assist its handling and transportation, the ease with which moisture can gain access to the waste mass is decreased, which can result in a delay in the onset of degradation. Initially, the degradation is aerobic producing hydrogen and carbon dioxide as the principal by-products.

As the oxygen in the mass of waste is used up, anaerobic conditions become established and the principal by-products are methane and carbon dioxide. Since methane is a highly flammable gas and in confined spaces can be explosive, special measures are needed to vent it from the landfill. At sites where the quantity of landfill gas produced is significant, harnessing it for use as a fuel is practised. It is possible to obtain usable gas quantities for several tens of years.

At the same time as landfill gas is produced, other organic compounds are formed.

Many of these are soluble in water and become dissolved in any surplus moisture in the landfill site to produce a liquid mixture termed leachate. Leachate can be highly polluting.

Some countries strike a balance between high volumes of gas production and low pollution potential of leachate and the reverse to control the pollution by leachate. In any case it is necessary to prevent leachate migration away from a landfill site since it can continue to produce landfill gas away from a landfill site. Also, it is necessary to

Landfill waste site

prevent it from contracting and mixing with ground and surface water.

To ensure that waste deposited in a landfill site is more rapidly degraded it can be pulverized before landfilling. The process is usually carried out under wet conditions to reduce dust and, since the waste needs to be wet to promote maximum production of landfill gas, biodegradation occurs quickly after the waste has been landfilled.

In parallel with the land filling of household waste, since many of its constituents are combustible, incineration is another option. Its attraction lies in the fact that large land areas are not removed from use for other purposes for an indefinite period of time, and surplus heat can be produced. Because household waste contains a large variety of materials, including those which are not combustible, plant used to incinerate such waste needs to be rugged and versatile to cope with a highly variable feedstock both in terms of waste composition and calorific value.

Because the waste is not easy to feed to and through an incinerator it is usual practice to use furnaces based on either the chain or rocking grate principle or to a lesser extent a rotary kiln. To ensure high combustion efficiency the temperature range at which the furnace is operated and burns waste and the time during which the waste reaches and is maintained at furnace temperature and turbulence within the furnace chamber, all need to be strictly controlled, the so-called "3Ts Principle" – Temperature, Time and Turbulence exemplifies this requirement for good combustion.

Waste delivered to an incinerator by a collection vehicle usually discharges its load into a large hopper from where the waste can then be removed by grab crane or bucket conveyer and fed to the incinerator furnace at a controlled rate. Ideally, the furnace should be operated on a continuous basis, thus ensuring that waste is not left in the hopper for an extended period of time. As indicated above, decomposition of the waste can take place in the hopper, which rapidly produced hydrogen, methane and carbon dioxide to give a gas concentration, which is hazardous. Also, it provides a suitable breeding ground for vermin and particularly flies, the eggs of which will in all probability have been laid in the waste before it was collected from a household.

To meet increasingly more stringent limits on the concentration of gaseous and particulate emissions released to the atmosphere from an incinerator, it is necessary to clean the off-gases before they are released. At one time electrostatic precipitators were considered to provide sufficient removal of particulate matter in the gas stream.

However, to deal with acidic constituents it is now necessary to use equipment that controls acid gas, such as dry lime injection prior to passing the gases through an electrostatic precipitator or wet (chemical) scrubbing. In addition to such control equipment, the height of the chimney from which the gases are released may need to be increased to aid their dispersion and ensure that ground level concentrations of constituents in the gases are environmentally acceptable

An incinerator which is operated efficiently should produce a furnace ash (bottom ash), which contains only inorganic materials. However, in practice, it can be expected that some organic carbonaceous material will be present at trace concentrations.

Normally, the ash is landfilled at a site from which releases of leachate to ground and surface water are prevented. This is required because any water-soluble materials in the ash can be dissolved in leachate and could result in concentrations of pollutants in ground and surface water.

In addition to solid wastes, household liquid waste is an environmental problem.

Liquid waste disposed into sewer drains into surface water courses. This causes pollution of the aquatic environment with resulting health hazards. Therefore municipal wastewater must be collected and properly treated before discharging to surface water courses.

Household Waste Management Option

It is possible to segregate waste, either with the co-operation of the waste generator or after collection. Wastes which are not suitable for recovery and hence segregation will need to be collected and disposed of in approved facilities.

The biodegradable fraction contained in wastes collected from households may, depending on its storage conditions, decompose in its storage container or collection receptacle. For health, hygiene and aesthetic reasons there has been a move towards the use of plastic or paper sacks in which the waste is kept to await its collection. At the same time this means of waste storage is advantageous to those employed in collecting the waste since then they no longer have direct contact with it. Further, its subsequent handling, be it at a transfer station, incineration plant or landfill site, will be easier and more hygienic.

In respect of transfer stations, used principally for bulking and packaging wastes for onward road or rail transport to a disposal facility, in most climates the waste will be degrading to an extent which will require it to be handled by mechanical means for health and safety reasons. Likewise, there should be no direct physical contact with the waste by plant operators at its final destination.

CONCLUSION

Wastes collected from households consist almost entirely of materials which have been handled by individuals before being discarded, and would not normally be regarded as possessing hazard properties. However, care needs to be exercised over such materials soon after they are discarded, and are regarded then as wastes, since hazardous materials may be present in small quantities.

The presence of biodegradable constituents in household waste demands care in their recovery treatment and disposal. Until the pathogens present in the waste have been either destroyed or die, there is always the possibility of the waste presenting a threat to human health (toxicity) and the environment (ecotoxicity) by virtue of their presence.

With respect to management of household waste practices may vary widely among countries. Care should be taken to ensure compliance with domestic requirements. Problems associated with recovery, treatment and disposal of household waste include:

- Lack of available sites for sanitary landfill;
- Inadequate data on type and quantity of waste generated;
- Separate collection and treatment of liquid waste is expensive, and when disposed to sewers without treatment can cause harm to the environment; and
- Residue remaining after the treatment of municipal wastes require disposal with particular care.

THE NEXT LAP

The recent move by the Malaysian Government to enforce waste separation at source is timely and appropriate as one way to reduce waste entering the landfill. This is in spite of the fact that the Solid Waste and Public Cleansing Act, Act 672 created a provision of waste separation way back in 2007. Likewise, other recommendations in the above guidelines such as waste composting warrant some serious thought in bringing about a sustainable environment. ■

REFERENCE

KPKT : The National Strategy Plan for Solid Waste Management.

UNEP - Basel Convention on the control of transboundary movements on Hazardous wastes and their disposal. Basel convention technical guidelines on wastes collected from households.