For Information
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Legislative Council Panel on Health Services
Legislative Council Panel on Environmental Affairs

Administration's Response to Submission by Greenpeace

Introduction

Greenpeace submitted a paper to the Chairman of the Legislative Council Panel on Health Services. The submission stated the undesirable effects of incinerating clinical wastes at the Chemical Waste Treatment Centre (CWTC), and suggested alternative disposal methods. Many of the materials and arguments brought forwarded by Greenpeace are US-biased. Others quoted the World Bank's "Dangerous Medicine: Promoting Medical Waste Incineration in Third World Countries". Many of the claims demonstrate Greenpeaces' ignorance of the current situation in Hong Kong. This paper sets out the Administration's response to the issues raised.

Clinical Waste Management Strategy

2. On the overall strategy to tackle clinical waste, the Administration agrees with Greenpeace on two aspects:

(a) To reduce waste by using more reusable items, decrease the amount and toxicity of waste generated, and minimize packaging and buying products that are durable rather than disposable. This is in line with our on-going waste reduction strategy.

(b) To segregate clinical waste from the municipal waste stream so as to minimize the amount of wastes that require special disposal treatment.

3. The Hospital Authority (HA) has implemented waste segregation measures, resulting in significant decreases in clinical waste quantities. HA's hospitals are producing only about 0.13 kg of clinical waste per bed per day. This represents a 78% reduction compared with the production rate in 1989.

This waste production rate is very low compared with other developed countries (e.g. about 1 kg per day per bed in the US). The Department of Health (D of H) has also adopted similar practice in Government clinics. The Hong Kong Medical Association will issue guidelines to private practitioners on proper clinical waste handling procedures where waste segregation will be an important element.

Clinical Waste Treatment and Disposal

4. Greenpeace has made a number of assertions on which it bases its argument that incineration at CWTC is wrong. Many of these assertions are simply incorrect:

(a) Incineration of clinical waste is the main source of air-borne dioxin and mercury and will cause harm to public health

There is little scientific evidence which suggests that incineration of clinical waste at the CWTC will directly cause harm to health. The guidelines issued by the World Health Organization (WHO) in 1998 stated that the tolerable daily intake rate of dioxins is 1 to 4 picogramme per kilogram of body weight.

The average of dioxin emissions at the CWTC is 0.022 nanogramme per cubic metre (ng/m3) compared with the statutory emission limit of 0.1 ng/m3 (US adopts 2.3 ng/m3 and 0.6 ng/m3 as the emission limits for existing and new incinerators respectively). Even at the statutory limit, the environmental impact assessment shows that the maximum dioxin intake by the most affected sensitive receivers would be below the WHO's tolerable daily intake level by a factor of 100,000. The impact on health is very low.

The average mercury emission is 0.034 milligramme per cubic metre (mg/m3) compared with the statutory emission limit of 3 mg/m3. The mercury emission limit will be further tightened to 0.2 mg/m3 when incinerating clinical waste (US adopts 0.55 mg/m3).

Dioxins are also emitted from other combustion processes. HA advised that recent mutagenicity studies indicate that particulate

emissions from clinical waste incinerators are less mutagenic (able to cause changes in the genetic material of living cells) than emissions from wood stoves, automobile engines and residential furnaces.

(b) Burning clinical waste will unnecessarily create toxic substances like dioxin, mercury, acidic gases and other harmful chemicals

The incinerator in the CWTC comprises a rotary kiln, a secondary combustion chamber, and an air pollution control system. The rotary kiln and the combustion chamber can operate up to 1,200 degrees Celsius at which temperature all hazardous chemicals such as dioxins are destroyed. The design of the incinerator has also catered for the prevention of reformation of dioxins. The air scrubbing system will eliminate virtually all acidic gases such as sulphur oxides and nitrogen oxides. We are not sure what “other harmful chemicals” Greenpeace refers to. However, contaminants in the gas are removed by the gas cleaning systems which include activated carbon injector, spray dry absorber and fabric filter bags. The resulting emission contains only carbon dioxide, steam and traces of chemicals within current control limits.

To ensure safety, the bottom ash and scrubber ash are stabilized by mixing with cement. After testing for compliance with the leaching requirements, the stabilized ash is sent to landfills for disposal. The average dioxin level in the ash is 0.04 parts per billion (ppb) compared with the limit of 1 ppb as required under the service contract concluded with the CWTC contractor. The average mercury level in ash is less than 0.02 ppm compared with the contract limit of 0.1 ppm.

(c) Many materials from hospitals and clinics such as paper, batteries, discarded equipment, do not need to be incinerated, and that their incineration will emit toxic substances. Some such as gowns, linens, bedpans, urinals, dishwaste, etc are reusable.

There is a fundamental misunderstanding by Greenpeace on the types of clinical waste we intend to dispose of by incineration. In Hong Kong, not all waste generated from hospitals, clinics and

laboratories are regarded as clinical waste. The definition of clinical wastes, as described in the information paper circulated to Members, are confined to those obnoxious, infectious or bio-hazardous in nature that require special handling. Non-infectious materials, batteries paper, gowns, linens, bedpans, urinals, dishware, etc, are not classified as clinical waste. We have no intention to burn these materials in the CWTC. They are segregated and disposed of in the municipal waste stream.

(d) Medical waste contains more plastics per volume and much of this plastics is Polyvinylchloride (PVC)

It is wrong to suggest that clinical waste in Hong Kong contains a high proportion of PVC containing plastics. The amount of PVC items in the clinical waste stream is not significant because the plastic contents of clinical waste are mainly from syringes, gloves, sharp boxes etc. which are made of polyethylene and latex (treated rubber), not PVC. These materials do not emit dioxins upon incineration. Those wastes from hospitals/clinics that contain PVC (e.g. baby diapers with plastic linings etc.), are segregated and disposed of as municipal solid waste. They will not be incinerated at the CWTC under the proposed Clinical Waste Control Scheme. The Code of Practice for Management of Clinical Waste would specify that plastic sharp boxes should be made of materials other than PVC and the plastic bags for containing clinical waste shall be made of polyethylene.

(e) Mercury in medical waste accounts for 20%

Wrong. It is simply not possible for clinical waste in Hong Kong to contain 20% as mercury waste. Mercury is chemical waste, not clinical waste and would be recycled rather than incinerated. HA hospitals segregate the mercury waste from clinical waste for separate treatment. Secondly, medical instruments containing mercury are gradually being replaced by electronic devices. The threat of having mercury in the clinical waste stream will be significantly reduced in the near future. Thirdly, even if a small quantity of mercury (e.g. from a broken thermometer) is mixed with

clinical waste and incinerated, the air pollution control equipment of the CWTC incinerator will be able to control the mercury level in the stack gas to be within the statutory emission limit.

(f) The Greenpeace suggests that what we want is to have the waste disinfected before disposal at landfills, in which case, autoclave, microwave systems, and chemical disinfection are better alternatives.

We need more than just disinfecting clinical wastes. The main objectives of clinical waste management is to render these materials harmless by destroying the infectious pathogens, and removing their obnoxious appearances. Simple disinfection is not acceptable for treating body parts.

(g) Various technologies have been developed to sterilize and reduce the volume of medical waste without incineration.

We are not aware of any technology apart from incineration that can achieve both volume reduction and sterilization at the same time. The alternative technologies (autoclave, microwave systems and chemical disinfection) do not reduce volume.

Alternative Technologies

5. Some of the alternative technologies are widely used by medical and research laboratories to sterilizing used medical equipment and small quantity of laboratory and microbiological cultures. These technologies have the following disadvantages:

(a) The environmental risks in using large-scale autoclaving, microwave systems and chemical disinfection equipment for treating clinical waste is not well documented. Such treatment methods may emit unknown volatile organic compounds which can be equally hazardous. If each hospital installs its own equipment, the staff, patients and nearby residents will be exposed to these risks.

(b) The alternative technologies mentioned cannot treat all types of

clinical wastes. For example, the physical hazards of sharps and the obnoxious nature of amputated human limbs are not removed. These wastes, even after treatment by the alternative technologies, should not be disposed of as ordinary municipal solid waste.

(c) Autoclaves, microwave systems and chemical disinfection equipment cannot remove the toxicity or destroy the residual amount of cytotoxic drugs, pharmaceuticals and other chemicals in the syringes and sharps. Such residual drugs and chemicals may pose hazards to the public and waste disposal operators even after the treatment process.

The residual amount of drugs or chemicals like mercury may be vaporized during the autoclaving or microwaving process. Such equipments are normally not fitted with sophisticated air and water pollution control facilities, the vaporized chemicals can escape into the environment. If such equipment is fitted the costs involved will increase enormously.

(d) The operating temperatures of autoclaving and microwave clinical waste are normally 131^{o}C and 95-100^{o}C respectively. They are much lower than that of incineration and the effectiveness of destroying pathogens is much lower. The presence of cold spots or incomplete mixing with disinfectants can also lead to incomplete destruction of pathogens.

(e) The alternative technologies do not achieve the same volume reduction as incineration. These processes require the addition of either water, steam or chemicals which will then increase the weight of the waste.

Comparing the costs between incineration and autoclaving

6. The capital and operating costs as quoted in Greenpeace's submission apparently include only the costs of the package plant and its operation. The costs of land, related infrastructures, installation and other associated waste management facilities such as waste reception, cold storage facility, waste tracking and de-contamination equipments, etc., have not been included.

7. The operating cost (e.g. $0.15 per lb for autoclaving) provided by Greenpeace is unrealistically low. This has probably not taken into account the costs for waste reception, tracking, handling, storage, disposal of the treated waste and treatment of the effluent discharges.

8. The cost of a centralized autoclave is roughly in the same order, if not more than the CWTC option. A comparison of costs between a centralized autoclave facility and the CWTC option with a daily capacity of 10 tonnes of clinical waste is shown in the following table:

Items	**Cost ($M)**	
	Autoclave Facility	CWTC Option
Capital Cost		
Package plant/ CWTC Incinerator Modifications	33[1]	23
Civil, building and E/M works	42	23
Associated facilities and equipment	7	8
Design, project administration	6	4
Contingencies	8	6
Sub-total (A)	**96**	**64**
Annual Operating Cost		
Reception, storage, waste tracking, decontamination	7	7
Treatment / Incineration	8	15
Sub-total (B)	**15**	**22**
Land Cost (0.5 ha)	75	0
Annual opportunity cost **(C)**	**3**	**0**
Additional cost for handling human tissues, organs etc which cannot be treated by autoclave **(D)**	**0.8**	**0**
Total Cost for 10 years operation (A+10B+10C+10D)	**284**	**284**

The cost comparison shown above has not taken into account the cost required for consultant fees in site search, preparatory studies, environmental impact studies, engineering feasibility, site investigations, tender preparation, etc. These cost could add another $10M.

9. An autoclave facility would require additional emission control system

[1] Cost figure is based on Greenpeace's submission plus 25% overseas installation cost. A total of 2 units of package plants are required in order to handle 10 tonnes per day of clinical waste.

which has to be tailor made by taking into consideration the possible volatile organic chemicals and other substances that need to be filtered. Further detailed study and design work will be required, so the cost could not be easily estimated. This would, however, be quite significant.

10. Public perception on medical waste is another key element in waste management practice that we need to take into consideration. The public will still regard clinical waste as obnoxious and objectionable even when it has been disinfected. They would expect that they be totally destroyed and become unrecognizable. Autoclaving and other technologies could not achieve this.

Risk comparison

11. It is generally accepted that a per year risk of 1 in 1,000,000 represents a reasonable upper bound beyond which measures to achieve a further reduction in the risk would not be justified in terms of the benefit gained.

12. A press release issued in November 1998 by the Hong Kong Council on Smoking and Health stated that "based on the 1995 data in Hong Kong, of 3,244 coronary heart disease (CHD) deaths, smoking caused 640. In other words, an average of 9 persons in Hong Kong will die from CHD everyday, of which 2 are killed by tobacco". The risk of smoking well exceeds the 1 in 1,000,000 acceptable risk indicator.

13. On the other hand, the risk estimated as a result of the insignificant dioxin emission by the CWTC is below 1 in 250,000,000, or 0.004 per million over a lifetime. This can be compared with other known risk factors as shown below[2]:

Causes	Risk per million per year
Cancer	2,800
Road accidents	100
Construction	92
All manufacturing industries	23

[2] This is extracted from the Tolerability of Risk from Nuclear Power Stations, Health and Safety Executive (HSE)

Lightning	0.1

14. We understand that the California authorities have spent over US$20 million in control measures on dioxins, with no appreciable results.

Conclusion

15. The Greenpeace has made valid recommendations on waste separation, reduction and reuse as the key strategies in clinical waste management. The Administration fully supports these and they are already part of our framework in the clinical waste control scheme and waste management in general. However, while appreciating Greenpeace's concerns about the potential risk associated with incineration of clinical waste, we found many of the criticisms are either not applicable to the Hong Kong situation, inappropriate, or inaccurate. The incinerator in the CWTC is designed and equipped to handle all types of clinical wastes, and is capable of controlling the emission within the most stringent standards. Incineration at the CWTC is safe, environmentally sound, cost-effective. Other alternative disposal methods put forward by Greenpeace could complement, but not replace incineration.

Planning, Environment and Lands Bureau
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