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Revisiting the Issues on Incineration Technology*

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The phase-out after three years and the eventual ban on all types of incinerators as stipulated by the 1999 Clean Air Act evoked howls of protests from users, manufacturers, government agencies and environmental technologists. NGOs, led by Greenpeace, lobbied in Congress for the total ban citing the negative effects of the use of incinerators on health and environment. However, those who are against the total ban policy contended that the old model incinerators are the ones causing hazardous emissions and that the problem can be remedied by the use of modern incinerators. Banning incinerators could create more problems as industries and hospitals will be left with no means to properly dispose their toxic and hazardous wastes (THWs). The alternative methods to effectively treat THWs are not yet commercially available locally and are quite expensive to import. The readily available alternative methods are not that effective in disposing THWs. With the ban, hospitals and industries may either continue using their old incinerators clandestinely or dispose their THWs untreated or ineffectively treated together with other solid wastes; thus multiplying the health and environmental problems which the ban originally sought to address. The government should, therefore, rethink its decision to include modern incinerators in its incineration ban.

Introduction

The 1999 Clean Air Act specifically stipulates the phase out after three years and the eventual ban on all types of incinerators in the Philippines, among its other provisions. The ban aimed to minimize air pollution and improve air quality in cities and municipalities. The decision of Congress to ban incinerators was heavily influenced by the successful lobbying of NGOs led by the local chapter of the Greenpeace International. The ban triggered howls of protests from users, manufacturers, government agencies, and environmental technologists, which justified the use of modern incinerators. According to the pro-incineration advocates, the state-of-the-art incinerators are environmentally safe because they are equipped with high temperature (>1,000 °C) combustion chambers and pollution control facilities that are capable of destroying toxic and hazardous wastes (THWs) and producing clean emission.

* This paper is based on the study, "Baseline Study of Incinerators", conducted by Dr. Candido Cabrido for the UPCIDS.

Although the ban prevailed and will stay as decided by Congress, the issue remains at the backstage and ready to spring back to life anytime the garbage crisis erupts. The lingering concern now is what will happen after the three-year moratorium has elapsed and how will the government manage the disposal of THWs, which comprise about 60 percent of the total wastes produced in Metro Manila.

This paper is directed mainly at the implications of the ban considering the baseline data on the status of incinerators still in use until it is phased out.

The study was conducted under the UP Center for Integrative and Development Studies (CIDS) Program. The need for the baseline study on incinerators was identified from the initial exploratory studies, roundtable discussions, and consultation meetings conducted by the Solid Waste Management Program of UPCIDS. Data from the UPCIDS initiatives revealed that various kinds of waste management technology with particular focus on incineration, have been used by various sectors such as hospitals, industries, cities and municipalities in the disposal of their wastes especially those which are toxic and hazardous. The growing number of incinerators including the future possibility of large scale ones (i.e., centralized incineration system) proliferating as a means of disposing municipal and city wastes was viewed by some sectors as a threat to environmental quality because of the considerable volume of air pollutants that they will possibly emit. The lack of built-in pollution control equipment and poor maintenance of existing incinerators are seen as the two alarming reasons why incinerators are considered as a pollutive waste disposal technology.

In particular, the baseline study addressed the following questions:

- What are the types and models of incinerators currently being used and sold in the local market?
- Which establishments use incinerators in disposing their wastes, especially THWs?
- How many of the incinerators currently being used have obtained Environmental Compliance Certificates (ECCs)?
- How many of the incinerators currently being used have adequate pollution control facilities?
- What are the issues raised against the use of incinerators?

- What are the possible implications of banning incinerators as stipulated under the Clean Air Act?

The baseline study aimed to establish the baseline data and information on the use and state of incineration technology in the country. The objectives of the study are:

1) to provide baseline information and data on the users and types of incinerators in use;
2) to examine the issues and arguments raised against the use of incinerators; and
3) to project the possible implications of banning the use of incinerators in the country.

The baseline data can be used in projecting the possible implications of banning incinerators as a means of disposing toxic and hazardous wastes. Some scenarios can be anticipated resulting from the ban. The facts presented, findings, conclusions and recommendations of the study will serve as a useful input in addressing some of the hotly debated issues about incineration.

Given limited resources and time, the study focused its efforts on generating data and information on incinerators from reliable sources of secondary data supplemented by a rapid survey of establishments identified and reported to be using incinerators to dispose their wastes. Interviews of key informants were also conducted to obtain their views concerning the issues raised against incinerators. These interviews were done to supplement the information gathered from newspapers, magazines and reports regarding the issues on incineration. The secondary data and information on incinerators were obtained from the Presidential Task Force on Waste Management (PTFWM), Environmental Management Bureau (EMB), Department of Health (DOH) and various local suppliers of incinerators. Among the government agencies requested for data/information, only the Laguna Lake Development Authority (LLDA) declined to share their database on industries operating around the lake that use incineration technology. For primary data and information a two-page survey form was sent to all identified users of incinerators through mail (postal and electronic mail) and fax, whichever was available to the

respondents. The written communication was followed-up by telephone calls and follow-up letters.

Incineration as a Means of Waste Disposal

Incineration involves the reduction of the volume or mass of wastes through controlled combustion. Incineration can achieve a 75 percent weight reduction and 85-90 percent volume reduction. The ash generated is usually disposed in a landfill while its slag content can be used as clinker for road construction.

The performance of incinerators can be measured in terms of their:[1]

1) Efficiency in destroying and removing toxic and hazardous wastes;
2) Reducing the volume of waste for disposal in landfills; and
3) Reducing or removing residual emissions of hydrogen chloride, particulate matters, organic waste, products of incomplete combustion, hazardous metal emissions; and hazardous compounds in ash and control device effluents.

There are many types of incinerators currently in use here and abroad. The major ones include hearth, modular, fluid bed and grate types.

1) Hearth type incinerators
2) Fixed hearth incinerator
3) Modular, starved air incinerators
4) Fluid bed incinerators

Modern state-of-the-art incinerator such as waste-to-energy plant has stringent anti-pollution control features which are as follows:[2]

- two or more combustion chambers or zones;
- combustion temperature of over 1,000 °C with at least 2 seconds retention time;
- heat to energy conversion that reduces the high temperature combustion gases from over 1,000 °C down to 150 °C for anti-pollution control to operate;

- utilizing sub-micron, membrane type bag filters with absorbent injection that assure compliance with the European Community standards, which is the highest in the world;
- acid-neutralizing packed tower scrubbers assure acid-free emissions;
- ashes are inert and safe since they are exposed to over 1,000 °C for dioxin/furan destruction and used as fillers for blocks and road works.

The use of waste to energy facility is expanding in advanced countries as listed below in Table 1.[3]

Table 1.

Country	No. of waste-to-energy plants
Germany	49
France	170
Denmark	38
Italy	94
Netherlands	8
Sweden	23
Switzerland	30
United Kingdom	34
USA	168
Japan	1,873

Technical, Environmental, and Health Implications of Incineration

There are disadvantages in the use of incinerators such as the following:

1) Building a centralized incineration facility entails high capital cost. A centralized plant with a capacity to service the volume of THWs generated in Metro Manila (i.e., 4,500 tons per day) requires a capital of about $810 million. Decentralized facilities were evaluated to be a more financially viable option for industries and hospitals.

2) Incinerators without adequate pollution control equipment emit heavy metals, dioxin and furans, which are linked to cancer and neurological disorders.

3) Ash and residues from old incinerators (built in the 1960s, 1970s, and 1980s contain toxic metals which can pollute groundwater when buried in landfills; and,

4) Incineration encourages a "throw away society" and wastes valuable resources if wastes are not sorted out before incinerating them.

The primary concern over the use of incinerators is their impact on environment and health. Environmental effects caused by incinerators are due to pollutant emission they release which affects the quality of surrounding and ambient atmosphere. The effects will trigger chain reactions that will further cause deterioration in the quality of environment. Health hazards will arise from deteriorated environmental condition and may cause severe or slight damage to health. The combustion performance of an incinerator and its pollution control equipment are the primary factors that affect the quality of the emission. The components of wastes that are burned are also critical factors that determine the quality of emission produced.

The various pollutants emitted through incineration and their health effects are provided in the table below (Table 2).

Table 2. Major pollutants emitted by incinerators and their effects on health

Pollutant	Health Concern
Airborne Particulate	Eye & throat irritation
CO	Cardiovascular, nervous & pulmonary systems (emphysema, bronchitis)
HC (Hydrocarbons)	Various Compounds – specific health hazards
Sulfur Dioxide	Respiratory tract irritation
Nitrogen dioxides	Respiratory illness and lung damage
Lead	Retardation and brain damage in children
Benzene (including dioxins and furans)	Multisystem Cancer
PVC	Lung and Liver cancer
Mercury	Brain, renal and gastro intestinal diseases

State of Incineration Technology in the Country

Government Policies on Incineration

Prior to the passage of the Clean Air Act, there were already several environmental laws and standards regulating the use of incinerators. These laws and regulations include Presidential Decree No. 1152 (Environment Code), PD 1586 (EIS System) and DAO No. 37 Series of 1996 (EIS System Guidelines), RA 6969 (Toxic and Hazardous Waste Act) and DAO No. 29 Series of 1992 (Rules and Regulations on Toxic and Hazardous Wastes), and DENR Administrative Order No. 14 Series of 1993 (Air Quality Standards). Enforcement of these laws by the DENR was fraught with difficulties due to its limited resources and capability. The Clean Air Act was designed to address these limitations aside from imposing the production of cleaner fuels.

The gaseous and refuse products of incineration which cause air, water and land pollution are the primary concerns of the government in regulating the use of incinerators. The use of incinerators is regulated by the country's laws on air pollution control and toxic and hazardous waste disposal. Emission from incineration is specifically covered under the DENR Administrative Order No. 14 series of 1993, which sets the Air Quality Standard rules and regulations on emission.

Presidential Decree 1152 (Philippine Environment Code). Section 45 of PD 1152 contains the Solid Waste Disposal Policy. It allows sanitary landfilling, incineration, composting and other methods of disposal approved by competent government authorities. Section 47 mandates that the local government concerned shall regulate the installation and establishment of incinerators under its area of jurisdiction.

DAO 96-37 (EIA system guidelines). The Environmental Management Bureau (EMB) of DENR adopted the EIS system (PD 1586) and provided guidelines for its implementation under DAO 37 Series of 1996. Certain provisions of DAO 96-37 apply to the use of incinerators. A review committee from the Environmental Impact Division-DENR evaluates the EIA report submitted by the proponent of an incineration project and endorses the issuance of permit depending upon the results of the impact assessment. Incinerators that have over two tons daily capacity are required to submit an Environmental Impact Assessment (EIA) and to secure an ECC.

Republic Act 6969 (Toxic and Hazardous Wastes Act) and DAO 92-29 (Implementing Rules and Regulations). The Toxic and Hazardous Wastes Act (RA 6969) defines hazardous wastes as by-products, side-products, process residues, spent reaction media, contaminated plant or equipment or other substances from manufacturing operations and as consumer discards of manufactured products which present unreasonable risk and/or injury to health and safety and to the environment. This law's implementing guidelines (DAO 29 Series of 1992) classifies hospital wastes which are pathogenic and infectious as a type of hazardous waste. It also explicitly considers incineration as one of the treatment options in the disposal of hazardous wastes.

As of August 1999, the EMB was only beginning to draft guidelines on the standards and requirements for Treatment, Storage and Disposal (TSD) Facility for extremely hazardous wastes. Among the requirements under this guideline is the acquisition of an Environmental Compliance Certificate (ECC) and valid Permits to Operate in compliance with PD 1586 (EIS System) and PD 984 (Pollution Control Law).

All hospitals are required to register as hazardous waste generators under RA 6969. Permits for hospital incinerators are issued or granted by the Presidential Task Force on Waste Management (PTFWM). A guideline on the operation of incinerators has been issued and currently being implemented by the Task Force. The DENR Regional Offices and the LLDA monitor the compliance of incinerators to Air Quality Standards.

DAO 14 (Air Quality Standards). Standard and Permissible Emission of air pollutants are governed under section 59, 60, 62 of DAO 14 Series of 1993. Table 2 of section 59 sets the National Emission Standards for source specific air pollutants (NESSAP). Section 60 sets the emission standard for sulfur compounds and section 62 establishes the national ambient air quality standards for source specific air pollutants. Incinerators are considered as a stationary source of air pollutants under the specifications of DAO 14. Particulate matter emission of incinerators is governed under Section 58: Maximum Emission Limits in mg/Ncm for Particulates in Stationary Sources. This provision sets the limit of PM at 200 mg/Ncm for incinerators installed in 1993 and thereafter and 300 mg/Ncm for those installed after 1978 and before 1993. Owners or operators of existing sources constructed before 1978 are required to comply with the 1978 emission standards.

National Emission Standards for Source Specific Air Pollutants (NESSAP) sets the concentration limit at the point of emission of the source. Table 2 of section 59 of DAO 14 provides the maximum permissible limits of specific air pollutants and shows the method of analysis for concentration determination.

Section 60 provides for the maximum permissible emission limits for sulfur oxides in stationary source. Under this provision, incinerators are classified under "Other Stationary Sources." The limit set for existing sources is 1.0 gm/Ncm as SO3 while for new sources is 0.2 gm/Ncm as SO3. A lower limit is set for newly installed facilities to prevent further increase in pollution of air environment.

Tables 3 & 4 of Section 62 of DAO 14 contain the ambient air quality standard for sources of air pollutants. The sampling is done at an elevation of at least 2 meters above the ground and conducted at a downwind distance of five to twenty times the stack height or at the property line. Fugitive emission of particulates, duct fumes, gases, mists, odorous matters, vapors or any combination that escape from the building or equipment is prohibited and section 63 of the said administrative order mandates the adoption of control measures to prevent air pollution.

Section 64 contains the provision on source monitoring, record keeping and testing of emission. Appropriate equipment is required to be installed for monitoring samples of emissions in the stack and ambient air quality around the source. Number 5 of Section 63 mandates that no facilities shall be operated without pollution control equipment in proper operation.

1999 Clean Air Act. The Clean Air Act (CAA) provides that the emission of dioxins and furans into the air shall be reduced by application of most progressive techniques. It also mandates that all average values of dioxin and furans measured over the sample period of a minimum of six hours and a maximum of eight hours must not exceed the limit value of 0.1 nanogram/cum.

Section 20 of the Act bans the use of incinerators. It specifically states that "Incineration, hereby defined as the burning of municipal, biomedical and hazardous wastes, which process emits poisonous and toxic fumes, is hereby prohibited; Provided, however, that the prohibition

shall not apply to traditional small-scale method of community/ neighborhood sanitation "siga", traditional agricultural, health and food preparation and crematoria; Provided further, that existing incinerators dealing with bio-medical wastes shall be phased out within three years after the effectivity of this Act; Provided finally, that in the interim, such units shall be limited to the burning of pathological and infectious wastes, and subject to close monitoring by the DENR."

The CAA appropriates an amount of P750 million for the initial implementation of the Act. About P300 million is appropriated to the DENR; P200 million to the DTI; P150 million to the DOTC; and P100 million to the DOE. But since the government does not presently have the money to fully implement the Act, it has to rely on an ADB loan of US$300 million to implement the provisions of the Act. Sustaining the enforcement efforts required under the Act after the ADB assistance has expired can be a difficult feat for the government.

Agencies Regulating and Monitoring Incinerators

The installation and operations of incinerators fall under the responsibility of three departments of the government: DENR, DOH and MMDA. Under the DENR, four entities, namely: the EMB, the Presidential Task Force on Solid Waste Management (TFSWM), LLDA and DENR Regional Offices are responsible for monitoring the compliance of incinerators used by industries and hospitals. The DOH through its Environmental Health Services (EHS) is also mandated to monitor the proper use and operations of incinerators by hospital establishments. For Metro Manila, the disposal of city and municipal solid wastes is managed by the MMDA under its Solid Waste Management Division. MMDA operates the sanitary landfills that service the Metropolitan Manila.

Presidential Task Force on Waste Management-Environmental Impact Assessment Division– DENR. The EMB-DENR particularly its EIA Division and Air Quality Division regulates the issuance of permit and monitoring of incinerators. In the EIA Division, a project management office of the Presidential Task Force on Waste Management (PTFWM) is assigned to evaluate and review proposed solid waste management facilities including incinerators. A project proponent is required to submit a project document incorporating the technical aspects of the proposed facility. Evaluation is done to determine whether the proposed solid waste

management facility conforms to the Integrated Solid Waste Management System Framework adopted by the government since 1994 for the implementation of waste disposal schemes. The PTFWM is in the process of establishing a database on the existing incinerator facilities used in the manufacturing industry and hospitals. From time to time, the PTFWM, in coordination with the Air Quality Section of the Environmental Quality Division of EMB and the appropriate Regional Office, conducts a site investigation of some incinerator facilities that were reported to be violating environmental laws and standards.

The EIA Division of EMB also requires proponents of incinerator facilities with a capacity of over 2 metric tons daily to submit EIAs. A Review Committee commissioned by EMB evaluates the EIAs and specifies the requirements that should be stipulated in the Environmental Compliance Certificate (ECC) issued to the proponent. DENR regional offices and Laguna Lake Development Authority (LLDA) monitor compliance to environmental laws and standards by establishments using incinerators.

DENR also regulates toxic and hazardous wastes under Republic Act 6969. It is responsible for regulating treatment facilities such as incinerators to ensure that designs, emissions and residual management comply with standards promulgated in RA 6969 and other environmental laws.

Toxic and Hazardous Waste Section-Air Quality Division – EMB. The THW Section of Environmental Quality Division of EMB drafted a guideline on standards and requirements for Treatment, Storage and Disposal (TSD) of hazardous waste. This guideline contains regulations on the proper use of incineration as a disposal treatment for extremely hazardous wastes. It requires incineration facilities to secure ECCs and applicable valid permits to operate in compliance with PD 1586 (EIS system) and PD 984 (Pollution Control Law).

The THW Section also registers industrial hazardous waste generators. It requires a permit for establishments to transport their waste to authorized incineration facilities.

Environmental Health Service–Department of Health. The Department of Health (DOH) through its Environmental Health Services (EHS) monitors and regulates the use of incinerators by public and private

hospitals. The EHS developed a Hospital Solid Waste Management Program in 1992 that includes incineration as one of the management options in the disposal of hospital wastes provided they comply with DENR's regulation on emission and ambient air quality standards.

The DOH has also published and circulated through a Memorandum Circular in 1990 the National Policies and Guidelines on Hospital Waste Management. It has also produced an operations manual on the proper handling and management of hospital wastes. The DOH inspectors are responsible in seeing to it that hospitals comply with regulations concerning proper disposal of wastes.

New organizational set up under the Clean Air Act. Under the Clean Air Act, a Governing Board will be created for designated airsheds to effectively carry out the air quality improvement action plans in these areas. The Board shall be composed of the DENR as chair and the Provincial Governors, City/Municipal Mayors, a representative each from concerned government agencies, NGOs, People's organizations and the private sector of the designated airsheds as members.

The DENR is directed to monitor discharges from industries while the DOTC is mandated under the CAA to monitor motor vehicles. The DENR in collaboration with the DOST, other agencies, the private sector, the academe, NGOs and POs is mandated to establish a National Research and Development Program for the prevention and control of air pollution.

Survey of Incineration Technology

Users and Types of Incinerators

Based on different sources of information (e.g., DOH, DENR-EMB, various suppliers, CIDS report, 1998), 60 establishments (38 hospitals and 22 industries) were reported to have incinerators. Thirty seven establishments (18 hospitals and 19 industries) comprising 61.6 percent of those identified to have incinerators were sent survey forms to profile or inventory the characteristics of their incinerators. About 41.5 percent of those surveyed responded while 56.7 percent did not respond. Only two firms claimed that they do not have incinerators as reported in other studies. The profile of the incinerators owned by 31 establishments identified by EMB/DENR and incinerator suppliers was made through the

use of available secondary data and information. A total of 117 establishments, mostly hospitals, were reported as being serviced by the incinerators of the Integrated Waste Management, Incorporated (IWMI). The IWMI presently services 114 hospitals, clinics and laboratories and three industries in Metro Manila. Four of the hospitals serviced by IWMI were covered in the survey; two of them reported to have newly acquired incinerators. IWMI has three units of incinerators (Shenandoah model) with a capacity of 650 kg/day each and equipped with water scrubber. An ECC was issued to the company in 1992.

A total number of 177 establishments are dependent on incineration to dispose their toxic and hazardous wastes. About 37 percent of these establishments have their own incinerators while 63 percent contract the services of IWMI to incinerate their wastes comprising mostly of THWs.

Six out of eight industries surveyed acquired their incinerators in the 1990s with four of them installing a new incinerator within the last five years. Most (six) of the incinerators do not have adequate pollution control facilities required to clean up particulates and acid gasses' emissions such as bag filter and wet scrubber. Only two of the firms obtained an ECC for the operation of their incinerators. Of the eight firms surveyed, three have incinerator models with capability to burn wastes at temperature above 1,000°C.

The list of users of incinerators that were covered in the survey was obtained by the research team from EMB, PTFWM and various suppliers of incinerators. The PTFMW of EMB in collaboration with DOH and LLDA should verify the presence or absence of incinerators in these establishments to be able to complete their inventory for the purpose of monitoring industries and hospitals using incinerators. It is possible that some establishments may try to hide and continue using their incinerators because of the high cost involved in contracting the disposal and treatment of their THWs. Others may be courageous enough to dispose their THWs just like any ordinary wastes that end up in dumpsites or sanitary landfills.

Dealers/Manufacturers and Models of Incinerators

The models of incinerators currently being used or available in the country include the following:

- Ferro Model
- Hoval Incinerator Model
- Shenandoah Incineration System
- ASSISTCO installed incinerator model
- Industron High-tech Thermal waste converter
- Spronz model incinerator
- Scholer model incinerator

Disposal of Toxic and Hazardous Wastes (THWs): Implications on Technology

Disposal of THWs

Metro Manila generates about 450,000 metric tons of THWs annually and this is projected to reach about one million metric tons by the year 2004.[4] Schaare[5] also reported that we produce about 600 tons of toxic wastes and 60 tons of pathological wastes daily requiring incineration to destroy them.

The 170 hospitals in Metro Manila have a total bed capacity of 29,429. Estimated waste generated range from a low of 14,714 kg/day (14.7 MT/day) based on DOH standard of 0.5 kg/bed/day, to a high of 64 MT/day based on National Development Company (NDC) survey of selected hospitals.

The feasibility study conducted by the Pasig River Rehabilitation Program (PRRP) in 1993 revealed that the average hazardous hospital waste generation could reach 4,600 kilograms per day.[6] The DOH survey in 1995 estimated that public hospitals alone generate more than 1,000 kilograms of hazardous wastes per month.[7]

The National Development Company estimated that hospitals pay about P55 per kilo to dispose their waste. Only 19 of the 45 government hospitals have budget for waste management but this budget allocation of P50,000–P100,000 per year may not be sufficient.[8] Incinerator service costs about P40 per kilo and a government hospital spends an average of P812,000 annually for incinerator service for a year.

Alternative Disposal Methods

The banning of incinerator and the limited service life of landfills create an option for other means of waste disposal. New technologies to dispose wastes include high and low temperature plasmas, molten salt, molten steel, pyrolysis, wet oxidation, distillation and centrifugal or filtration separation.[9] However, most of these new technologies are not yet commercially available and they are quite expensive to acquire for a developing country. Another limitation is that they have limited applications.

Trade Agreements

According to ENRAP,[10] banning of incinerators might possibly violate the WTO policy on free trade. Section 1, Article XI of the GATT only allows measures such as tariffs, duties, charges and technical standards based on accepted international standards and scientific evidences in regulating the importation of products. The provision discourages the outright banning of any product that meets internationally accepted standards and quality. In 1980, GATT made a ruling that "one cannot impose a ban on the importation of a product if other less trade distorting mechanisms like stricter technical standards are available." The banning of incinerators under the Clean Air Act is contrary to this WTO provision and may draw retaliatory trade reactions from exporters of incinerators.

Summary and Analysis of Survey Results

The results show that a large percentage (>50 percent) of the incinerators currently being used by hospitals and industries were installed/operated during the 1990s. Fifteen percent of the incinerators being used were installed during the 1970s and 1980s indicating that they are old models and therefore considered less efficient in treating THWs thereby emitting more pollutants. This is due to the fact that most old incinerators do not burn at temperatures higher than 1000°C. About 30 percent of those inventoried did not provide any data on the year their incinerators were installed. Assuming that these were of the 70s or 80s vintage, about half of those inventoried would therefore have old incinerators. This finding is substantiated by the results of the evaluation of the combustion temperature of incinerators inventoried. Based on the model of incinerators as reported by their users, the specifications on operating or combustion temperature were derived by the researchers. A slightly more than half (56 percent) of the models presently being used

have the capacity to burn waste at temperatures greater than 1000°C. This means that about 44 percent of the incinerators operating are inefficient and pollutive.

A big portion (56 percent) of incinerator users have less than one ton of waste being incinerated daily. On the other hand, eight percent of users (about four establishments) have the capacity to incinerate more than two tons per day while 13 percent has one to two tons daily capacity. Twenty-one percent did not provide data on the capacity of their incinerators. Perhaps, these respondents either do not know the exact capacity of their incinerators or the volume of wastes they incinerate varies from time to time. Incinerators with capacity of over two tons are required to secure an ECC but only two of them (50 percent) were able to do so. Only about 30 percent of those surveyed have permit to operate and location clearance. Some of those that did not provide data on tonnage capacity may have also possibly violated the ECC requirement.

It is interesting to note that 67 percent of those inventoried do not have any pollution control equipment while 28 percent has inadequate pollution control equipment installed. A satisfactory pollution control facility for an incinerator should include a dust filter (e.g., bag filter) to control particulates and a wet scrubber to remove acid gases.

The findings above support Schaare's[11] observation that most incinerators used in Philippine hospitals and industries operate below 800°C and without pollution control facilities. They are small sizes capable of handling wastes of 1 to 5 tons per day and will not be able to comply with U.S. or European Union emission standards. This study, however, showed that about 50 percent of incinerators currently in use have the capacity to increase their combustion temperature to above 1,000°C with some retrofitting made.

Pros and Cons of Incineration Technology

Government agencies such as the DENR, DOST, FPA, MMDA, and DOH endorsed the use of modern incinerators as a safe means of disposing THWs.[12] The Philippine Council on Sustainable Development (PCSD) also registered in Congress its support to modern incinerators as a means of disposing THWs.

NGOs and private sector organizations which supported the use of modern incinerators include: Philippine Business for Environment (PBE), Environment and Natural Resources Accounting Project (ENRAP) of DENR, Metropolitan Environmental Improvement Program (MEIP) of the DENR, National Press Club (NPC), Philippine Pollution Prevention Roundtable (P3R), Asian Institute of Strategic Studies (AISS), American Chamber of Commerce of the Philippines, Inc. (ACCPI) and Philippine Sugar Miller's Association (PSMA).

Foreign institutions such as the Swedish embassy, World Health Organization (WHO), and United Nations Environmental Program (UNEP) also support the use of modern incinerators.[13]

On the other hand, some NGOs led by Greenpeace are against the use of incinerators including modern incinerators and support their total ban. The NGOs that registered this position in Congress include: Haribon, Concerned Citizens Against Pollution (COCAP), Waste Recycling Movement of the Philippines (WRMP), Environmental Legal Assistance Center (ELAC) (Visayas), and Cebu Environmental Initiatives for Development Center, Inc. (CEIDIC).

The anti-incineration group is worried about the high dioxin emission from incinerators. They claim that there are far more safer and cost-effective alternatives to incineration such as autoclaving and microwaving because these use non-burn technology. The group, headed by Greenpeace, also doubts the DENR's capability to adequately monitor emissions from incinerators. They, therefore, advocate for the banning of incinerators as a means of preventing further emission of pollutants such as dioxins and heavy metals from fouling the air and exposing the population to health hazards. With Greenpeace's successful lobbying, Congress passed the Clean Air Act with a provision banning the use of incinerators. The succeeding sections discuss the possible implications of an incinerator ban.

The Ban and the Need for Appropriate Technology for Toxic and Hazardous Wastes Disposal

Proper treatment and disposal of THWs now poses a big problem to both waste generators and government in the absence of a technically

acceptable and economically viable alternative technology that can be employed immediately in place of incineration.

Not all kinds of wastes can be recycled. In particular, toxic and hazardous wastes (THWs) cannot be recycled and have to be destroyed to prevent or minimize exposure of the public to their health effects. THWs such as PCBs, oil, solvent, paint, lacquer, glue, adhesive, pesticide, medical wastes contaminated with HIV/AIDS, Hepatitis B, Cholera, typhoid, and other contagious microorganisms are usually destroyed through incineration.

Banning incineration may bring back the old practice in some hospitals (about 20 percent of hospitals) of mixing their THWs altogether with their general waste.[14] It will be difficult for EMB and DOH to monitor numerous and simultaneous violation of the Toxic and Hazardous Waste Act (RA 6969). DENR-EMB and DOH simply do not have the resources to monitor the waste disposal of about 170 hospitals and 360 health centers operating in Metro Manila alone. Add to this the several industries using incinerators.

Banning incineration will possibly result in the disposal of a large portion of THWs generated by hospitals and industries in dumpsites and sanitary landfills creating massive land, air, and surface water and groundwater pollution. Unsafe disposal of THWs will greatly expose the public to various health hazards. The health impacts of improper disposal of THWs will possibly be much greater than the effects of allowing old incinerators to operate. Since the Clean Air Act allows open burning in backyard or "siga", it is possible that some of the hospital wastes will be disposed through this method.

Results of the survey conducted in this study showed that majority (six out of eight) of the respondent industries have acquired their incinerators in the 1990's and 50 percent of these industries have installed new incinerators within the last five years. In the case of hospitals, five out of eight respondents have installed new incinerators within the last three years. This indicates an improvement in compliance to the requirements of THW disposal by some hospitals and industries before the passage of the Clean Air Act. Industries and hospitals were then starting to internalize proper disposal of THW through the use of better incinerators. Banning incinerators may alter this desirable behavioral

pattern and force them to go back to the old practice of disposing wastes because of the unfeasible options left to them to dispose THWs. They may not be able to afford the cost of plasma destruction assuming that this expensive facility becomes available and accessible to them for a fee. Other options left to dispose THW such as autoclaving and microwaving may not work for industrial and chemical wastes and may only be appropriate for some types of medical wastes.

Some unscrupulous operators may take advantage of the incinerator ban by disposing their THWs together with ordinary solid wastes without treatment. Waste disposal contractors may do the same when the incinerators they use are no longer allowed to operate. Poor monitoring by the government will most likely encourage this unsafe and illegal practice of THW disposal. Before, it was relatively easier to identify those improperly disposing their THW by knowing whether they have incineration facilities or not and the type of their incinerators. With incineration ban and poor monitoring of proper THW treatment, it would be extremely difficult to keep an eye on every hospital and industry. With its aim of solving the air pollution problem, the incineration ban would just be transferring the pollution problem to land (sanitary landfill sites) and exacerbate groundwater and surface water pollution. Then we may possibly have a cleaner air but dirtier water. When our legislators realize this, their reaction may be to create another law, this time a Clean Water Act or a Solid Waste Management Act hoping to solve the repercussions of the Clean Air Act. Improvement in environmental quality cannot be guaranteed by passing laws. We already have too many environmental laws to regulate pollution and yet our environmental problems are even getting worse. Our government should find other means of solving the pollution problem other than passing laws. There may be better solutions than restrictive regulations in which we already have too many.

Conclusions and Recommendations

Schaare[15] estimated the measurement of dioxins and furans to cost about P200,000 to P500,000 per test. At present, the DENR-EMB cannot afford this extremely high cost of monitoring dioxin emission. Furthermore, DENR-EMB does not have yet the technical capability and facilities to do measurements of dioxins and furans if ever they will attempt to do so. Thus, the best way to regulate the emission of dioxin and furan in accordance with standards set is to impose the use of

modern incinerators equipped with the necessary pollution control facilities as a replacement of old and pollutive incinerators.

The use of modern incinerators would facilitate the monitoring of the disposal of THWs because the type of incinerators being used and the presence of pollution control devices will determine whether a particular incinerator will meet environmental standards or not. The absence of incinerators or the inability of a hospital or industry to contract out incineration of its THWs will mean that it is most likely that its wastes are not safely disposed. Their THWs are probably dumped together with other wastes, burned openly in the backyard or buried elsewhere.

From the results and findings of this study, several conclusions and recommendations are put forward:

1) Many hospitals and industries can readily comply with a regulation to use modern incinerators with combustion temperature of above 1000°C and to install the required pollution control facilities through retrofitting of their existing new incinerators.

2) Allowing the status quo (i.e., hospitals and industries to continue using their old incinerators), and air pollutants (including dioxins and furans) emitted by incinerators will continue to threaten the health of exposed population.

3) Monitoring of incinerator users would require a reliable and updated inventory. The EMB needs to update its database on incinerators to prepare for the full enforcement of the Clean Air Act.

4) Monitoring dioxins and furans is too expensive and the EMB has inadequate laboratory facilities and technical capability for such job. It is more doable for EMB to monitor compliance of firms to the use of high temperature incinerators equipped with adequate pollution control facilities which will ensure the destruction of dioxins and furans thereby producing cleaner emission.

5) Banning the use of modern incinerators with appropriate pollution control facilities meeting stringent environmental quality standards will possibly create more environmental problems than solve the air pollution problem considering the government's limited capacity and capability to

enforce environmental laws and standards and to monitor compliance of firms.

6) Other alternative technology to treat THWs such as autoclaving and microwaving are not as effective and efficient as high temperature incineration while plasma destruction is too expensive and not economically feasible at the moment.

7) The best policy option to properly manage solid waste is to adopt a hierarchy of waste management schemes involving source reduction, waste segregation, reuse, recycling and high temperature incineration of THWs.

8) Waste-to-energy incineration plant equipped with appropriate pollution control facilities is a viable option to dispose THWs without causing air pollution.

9) Banning incineration will create more environmental problems because the available alternative methods that could be immediately employed by industries and hospitals (microwaving, autoclaving) are not effective in disposing THWs.

The possible reactions of hospitals and industries to the incineration ban can be any or a combination of the following:

1) continue using their old incinerators clandestinely;
2) dispose their THWs untreated or ineffectively treated together with other solid wastes to dumpsites or sanitary landfills;
3) contract out disposal and treatment of wastes to entities which may not have the proper facilities to treat THWs;
4) burn their wastes openly in the backyard *(siga)*, which is allowed under the Clean Air Act;
5) adopt alternative technology, which may not be effective in destroying THWs.

How will the government ensure that hospitals and industries do not resort to these five unacceptable reactions? Are there feasible (i.e., cost effective and environmentally efficient) alternative technologies which the industries and hospitals can avail of?

Legislature enacts stringent laws which our current institutional infrastructures and regulatory systems cannot effectively enforce. Standards become useless because they are not taken seriously by some firms. These firms usually take the risk of violating stringent laws and standards because there is more chance that they can somehow get away with them. Although we are replete with environmental laws, our regulatory agencies are very much deficient in enforcing them. They lack the resources and capability to enforce the multitude of environmental laws involving a lot of firms and establishments. Regulatory agencies are simply overwhelmed with the implementation of numerous environmental requirements given their limited capability and resources. Government must find other means to improve compliance of firms to environmental standards.

A hierarchy of waste management as recommended by EMB, MMDA and other solid waste experts should be adopted as a matter of policy by the government in the disposal of solid wastes including THWs. Waste management should involve the following measures:

1) waste reduction or minimization at the source;
2) waste recycling and reuse;
3) waste recovery;
4) treatment of THWs (i.e., incineration, plasma destruction, pyrolysis, etc.);
5) waste conversion to energy; and
6) waste disposal to landfills.

State-of-the-art incineration remains to be the most cost-effective means of disposing THWs inasmuch as these types of waste cannot be recycled or reused. The government should therefore rethink its position of including modern incinerators in its enforcement of an incineration ban.

A number of follow-up studies are needed to address some of the issues and gaps in the use of incinerators. The proposed studies and actions to be taken should include the following:

1) EMB should verify status of non-respondents to complete inventory of incinerator users and come out with more comprehensive assessment.

2) EMB should establish a monitoring system for the disposal of THWs by industries and hospitals to ensure their proper treatment.

3) DOST should examine the possibility of instituting a Technology Assessment Office, which will screen out all types of technology entering the country. This will prevent the dumping of old and obsolete technology (e.g., incinerators) in the country.

4) EMB should examine the feasibility of monitoring dioxin and furan emissions (estimate cost and capability building requirements) as required under the Clean Air Act.

5) PTFWM should examine the feasibility of a centralized or decentralized waste-to-energy technology to replace incineration as a means of THWs destruction. It should also start studying the viability of adopting plasma destruction technology vis-à-vis waste-to-energy schemes.

6) DENR should quantify the environmental and socioeconomic repercussions of banning incinerators and the ways and means of softening their effects.

7) Congress' Ecology Committee should examine the possibility of amending the provision of the Clean Air Act banning incineration technology or allowing the use of modern incinerators under its Implementing Rules and Regulations. ❁

Endnotes

1 Environmental Protection Agency, 1988.
2 Schaare, 1999.
3 Ibid.
4 Environmental and Natural Resources Accounting Project (ENRAP), 1999.
5 Schaare, 1999.
6 Pasig River Rehabilitation Program (PRRP), 1993.
7 Department of Health (DOH), 1995.
8 DOH, 1995.
9 ENRAP, 1999.
10 Ibid.
11 Schaare, 1999.
12 Balmes, June 1999; Gonzales, June 1999; Mendoza, March 1999.
13 Eriksson, May 1999; PLG, May 1999.

14 Environmental Management Bureau, 1988.

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