International POPs Elimination Project

Fostering Active and Efficient Civil Society Participation in Preparation for Implementation of the Stockholm Convention

Healthcare waste incineration in Romania

Environmental Experts Association

Romania
April 2006

About the International POPs Elimination Project

On May 1, 2004, the International POPs Elimination Network (IPEN http://www.ipen.org) began a global NGO project called the International POPs Elimination Project (IPEP) in partnership with the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP). The Global Environment Facility (GEF) provided core funding for the project.

IPEP has three principal objectives:

- Encourage and enable NGOs in 40 developing and transitional countries to engage in activities that provide concrete and immediate contributions to country efforts in preparing for the implementation of the Stockholm Convention;

- Enhance the skills and knowledge of NGOs to help build their capacity as effective stakeholders in the Convention implementation process;

- Help establish regional and national NGO coordination and capacity in all regions of the world in support of longer term efforts to achieve chemical safety.

IPEP will support preparation of reports on country situation, hotspots, policy briefs, and regional activities. Three principal types of activities will be supported by IPEP: participation in the National Implementation Plan, training and awareness workshops, and public information and awareness campaigns.

For more information, please see http://www.ipen.org

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The views expressed in this report are those of the authors and not necessarily the views of the institutions providing management and/or financial support.

This report is available in the following languages: English

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Abbreviations

POPs	Persistent Organic Pollutants
DDT	Benzene, 1, 1' – (2, 2, 2, - Trichloroethylidene) bis (4 – chloro)
HCB	Hexachlorobenzene
PCDD	Poly Chlorinated Dibenzo – p – Dioxins
PCDF	Poly Chlorinated Dibenzo Furans
PCBs	Poly Chlorinated Biphenyls
PAHs	Poly Aromatic Hydrocarbons
NIP	National Implementation Plan
ICIM	National Institute of Research – Development for Environmental Protection
UNIDO	United Nations Industrial Development Organization
UNEP	United Nations Environmental Program
GEF	General Environmental Facilities
NGO	Non Governmental Organizations
PPC	Public Power and Cogeneration

Activity and how it generates POPs

Persistent Organic Pollutants (hereinafter mentioned as POPs) are chemicals that remain intact in the environment for long periods, are extremely toxic to humans and wildlife, are in accumulative in the fatty tissues, are volatile, and have a global circulation through atmosphere and seawater.

The Stockholm Convention on Persistent Organic Pollutants focuses on reducing, and where appropriate, the elimination of 12 POPs of international concern. These include nine pesticides: aldrin, chlordane, dichlorodiphenyltrichloroethane (DDT), dieldrin, endrin, heptachlor, hexachlorobenzene (also an industrial chemical and unintended by-products), mirex and toxaphene; two industrial chemicals – polychlorinated (PCBs – also unintended by-products) and hexachlorobenzene (HCB); and four by-products – polychlorinated dibenzo-p-dioxins (PCDD) and dibenzo-furans (PCDF) as well as HCB and PCBs.

Sources:

POPs emission sources are situated in four main economic sectors: agriculture, industry, transportation and energy, but other notable sources include waste landfills and incineration plants.
Healthcare wastes incinerators are an acknowledged major source of POPs (and other pollutants like heavy metals).
At one time there were 7 incinerator operating plants in Romania, but today only one remains as a working facility. This is an elderly plant in Bucharest with a capacity of 5 tonnes of waste per hour, as specified by the Romanian National Implementation Plan of the Stockholm Convention. The other 6 incineration plants have been abandoned.
Although the amount of hospital wastes incinerated has increased slightly, the incineration of municipal waste is not popular in Romania.

Other sources of POPs:

Other sources of POPs are represented by the PCBs and [other] POPs stocks.
The stationary sources of POPs in human settlement areas are hospital incinerators. These are located in most of the municipal hospitals and are not adequately equipped to eliminate dioxins emissions from the resulting gases;

Municipal wastes are not incinerated in Romania. Usually, these are landfilled.

History of activity in country

Health-care waste includes all the waste generated by health-care establishments, research facilities and laboratories. In addition, it includes the waste originating from "minor" or "scattered" sources—such as that produced in the course of health care undertaken in the home (dialysis, insulin injections, etc.).
Between 75% and 90% of the waste produced by health-care providers is "general" health-care waste, assimilated as domestic waste, being transported to the landfill.

This waste comes mostly from the administrative and housekeeping functions of health-care establishments and may also include waste generated during maintenance. The remaining 10 – 25% of healthcare waste is regarded as hazardous and may create a variety of health risks.

The present report in concerned exclusively with hazardous health-care waste subject to burning/incineration activities.

The categories of health-care waste and the major sources for these are specified in the following tables.

Table 1	
Categories of health-care waste	
Waste category	**Description and examples**
Infectious waste	Waste suspected to contain pathogens – e.g. laboratory cultures; waste from isolation wards; tissues (swabs), materials, or equipment that have been in contact with infected patients; excreta Cultures and stocks of highly infectious agents; waste from autopsies, animal bodies, and other waste items that have been inoculated, infected, or in contact with such agents are called highly infectious waste.
Pathological waste	Human tissues or fluids – e.g. body parts; blood and other body fluids; fetuses
Sharps	Sharp waste – e.g. needles; infusion sets; scalpels; knives; blades; broken glass
Pharmaceutical waste	Waste containing pharmaceuticals – e.g. pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals (bottles, boxes)
Genotoxic waste	Waste containing substances with genotoxic properties e.g. waste containing cytostatic drugs (often used in cancer therapy); genotoxic chemicals
Chemical waste	Waste containing chemical substances – e.g. laboratory reagents; film developer; disinfectants that are expired or no longer needed; solvents
Wastes with high content of heavy metals	Batteries; broken thermometers; blood-pressure gauges; etc.
Pressurized containers	Gas cylinders; gas cartridges; aerosol cans
Radioactive waste	Waste containing radioactive substances e.g. unused liquids from radiotherapy or laboratory research; contaminated glassware, packages, or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides; sealed sources

Source of data: A. Pruss, E Giroult and P. Rushbook: Safety management of healthcare wastes, Geneva, WHO, 1999

Table 2	
Major sources of health-care waste (in accordance with the legislation)	
Producers	Types of producers
Big producers	County and District Hospitals University hospital Research Institutes on Medicine and Pharmacy Drugs National Agency Legal Medicine Institute County Legal medicine Services Pre-clinical Units from Medicine and Pharmacy Universities Production and Storage Units for drugs and biological products

Mean producers	Health-care centers and dispensaries Transfusion centers Blood banks and blood collection services Laboratories Hospital prosecutor services Pneumology Hospitals Medical and dental clinics Private hospitals and clinics
Small producers	Dental labs Mental health labs Long-term health-care establishments and hospices Recovery hospitals Balneology treatment facilities Mortuary and autopsy centers Medical centers within other types of institutes, factories, schools, high schools and kindergartens Cosmetics and other treatment types centers Pharmaceutics units Optical centers Acupuncture centers

Source of data: A. Pruss, E Giroult and P. Rushbook: Safety management of healthcare wastes, Geneva, WHO, 1999

Hazardous heath-care waste generated by medical activities

Table 3

The estimation of hazardous heath-care waste generated by medical activities base on Public Health Directorates

Year	Estimation level	Mean Quantities (tones/year)	Mean Values (tones/an)
2000	41 Counties	12 491	15 031
	Bucharest	2 538	
2001	41 counties	16 521	19 059
	Bucharest	2 538	
2002	41 counties	14 782	17 604
	Bucharest	2 822	

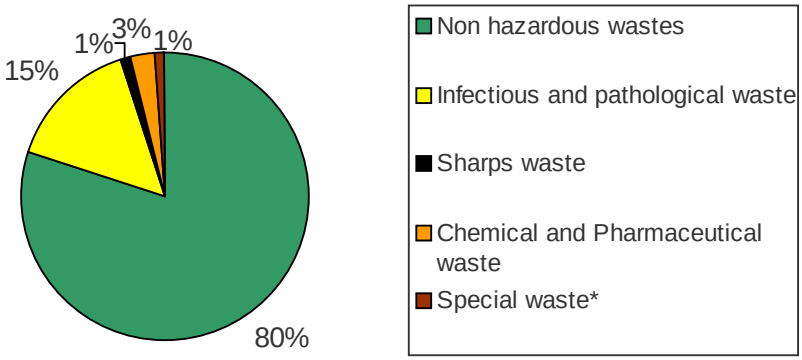
Source: Sanitary Engineering Department – Bucharest Public Health Institute

The health-care waste categories are usually burned in crematories or incinerated.

Following the provisions of the Ministry of Health and Family the health-care waste producer (as per mentioned classification) has the following obligations:

- To decrease the quantity of waste that must eventually be eliminated
- To promote the re-use and recycle of fractions of the health-care waste
- To collect and separate at the point of production the hazardous from non-hazardous waste.

Health-care waste composition



- Cytostatics, pressured recipients, broken thermometers, waste batteries, waste resulted from the nuclear medicine laboratories

Source: Sanitary Engineering Department – Bucharest Public Health Institute

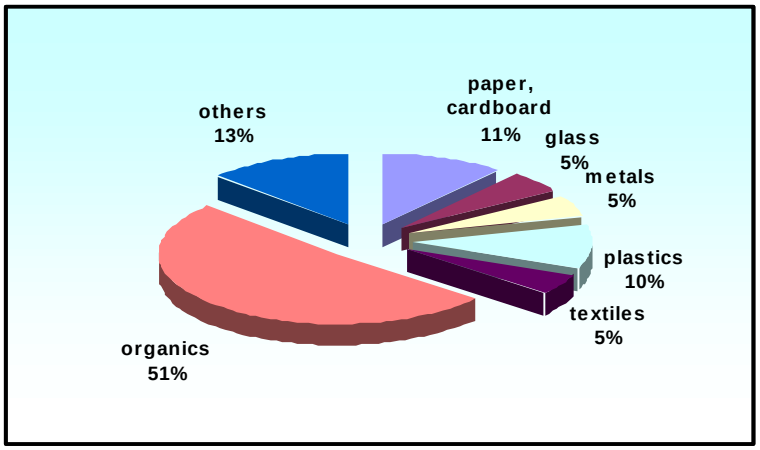
The non-hazardous health-care waste is assimilated as domestic waste.
In accordance with the Romanian National Waste Management Strategy the average percentage domestic waste composition for 1998 to 2002 is specified in the table 4.

Table 4

Average percentage domestic waste composition for 1998 to 2002

Components	1998		2002	
	%	kg/inh. · year	%	kg/inh. · year
Paper, cardboard	13%	34	11%	39
Glass	6%	16	5%	18
Metals	5%	13	5%	18
Plastic	9%	24	10%	35
Textiles	6%	16	5%	18
Biodegradable	53%	139	51%	179
others	8%	21	13%	46
Total	**100%**	**263**	**100%**	**352**

Figure 1 Average percentage domestic waste composition in 2002



Source: Romanian National Waste Management Strategy

Also the National Waste Management Strategy concerning the health-care (medical/clinical) waste the main objectives are specified in table 5

Table 6 (page7/8) specifies the health-care waste crematories situation in 2002.
Table 7 (page 9) shows the time schedule for the closure of crematories as specified in the Protocol concluded between the environmental and health authorities.

Table 5			
Categories of hazardous waste	**Sub-categories**	**Main objectives**	**Subsidiary objectives**
5. Waste arising from medical activities and research institutions (clinical waste)	• Infectious waste (codes 18.01.01 ; 02 and 03) arising in medical and research units • Hazardous waste, other than infectious waste	5.1. Separate collection of infectious and hazardous waste (other than infectious waste)	5.1.1. Reducing the quantities of infectious and dangerous clinical waste by hospitals by means of separate collection (by waste categories) and final disposal in an environmentally sound and economically efficient manner
		5.2. Separate collection of non-hazardous waste	
		5.3. Safe disposal of clinical waste without affecting staff or public health	5.3.1 Setting up environmentally sound temporary waste disposal sites for infectious and hazardous wastes
			5.3.2 Banning the landfilling of hazardous wastes without pre-treatment, before it is fully inert. Moreover, pre-treatment methods for infectious and hazardous waste that transfer pollutants to other environments shall also be banned.

Source: Romanian National Waste Management Strategy

Crematories and Incinerators in 2002

Table 6

Crematories and Incinerators

#	County	Crematory	Incinerator	County Hospital	District Hospital	Town Hospital	Specific Hospital	Village Hospital	Medical Centers	Sanatorium	Observations
1.	Alba	13		1	4	6				2	
2.	Arad	8		1		4	1	1	1		
3.	Arges	10		1	2	3	4				
4.	Bacau	9		1	2	2	3	1			
5.	Bihor	16	2	1	1	4	7		3		
6.	Bistrita	3		1		2					
7.	Botosani	5		1		2	1	1			
8.	Braila	3		1			2				
9.	Brasov	8		1		5	2				
10.	Buzau	9		1	1	2	1	3	1		
11.	Calarasi	4		1	1	2					
12.	Caras Severin	7		1	1	4		1			
13.	Cluj	7			2	2	3				
14.	Constanta	12		1	3	2	2		1	3	
15.	Covasna	4		1		3					
16.	Dambovita	9		1		4	2	1	1		
17.	Dolj	11		1		5	2		3		
18.	Galati	11			2	1	6		2		
19.	Giurgiu	8		1			4	1	2		
20.	Gorj	8		1	1	4		1		1	
21.	Harghita	7		1	1	4	1				
22.	Hunedoara	9		1	4	1			1	2	
23.	Ialomita	5		1	2	1		1			
24.	Iasi	18		1	1	3	13				
25.	Maramures	8		2		4	2				
26.	Mehedinti	6		1		4			1		
27.	Mures	8		1	6	1					
28.	Neamt	3		1	1					1	
29.	Olt	5		1	1	3					
30.	Prahova	2		1			1				+18 improvised crematories

31.	Salaj	1		1							
32.	Satu-Mare	3		2			1				
33.	Sibiu	4		1	1	2					
34.	Suceava	5	1*	1	4						
35.	Teleorman	9	1	1	2	1	3	1	1		Incinerator- Ziminicea Hospital
36.	Timis	15	1*	1	2	4	5		3		
37.	Tulcea	5		2		2		1			
38.	Vaslui	9		1	2	1	1	4			
39.	Valcea	6		2		2	2				
40.	Vrancea	7		1		6					
41.	Ilfov										
42.	Bucuresti	27**	2								Incinerator- Hematology Center and Mercator (private)
	Total	327	7	42	47	96	69	17	20	9	

* There is an incinerator, but it is not specified what the medical units is for

** The above table doesn't take into account on hospitals that are not part of the Ministry of Health network.

There are reported 420 medical units (41 counties)

Source: Sanitary Engineering Department - Bucharest Public Health Institute

Table 7

Planned closing stages of health-care waste crematories

County	Year				
	2004	2005	2006	2007	2008
Alba	0	1	6	2	1
Arad	13	0	4	0	0
Arges	0	4	4	4	2
Bacau	0	3	4	0	0
Bihor	16	0	0	0	0
Bistrita-Nasaud	0	0	0	1	0
Botosani	1	3	3	3	0
Brasov	0	4	8	0	0
Braila	0	2	1	2	1
Buzau	1	2	2	1	1
Caras-Severin	0	1	3	0	0
Calarasi	1	2	3	1	0
Cluj	1	1	3	0	0
Constanta	0	1	4	2	3
Covasna-	1	1	1	1	0
Dambovita	0	5	3	1	4
Dolj	1	2	3	4	0
Galati	0	2	5	2	1
Giurgiu	0	1	4	1	0
Gorj	0	2	4	0	2
Harghita	0	0	2	1	2
Hunedoara	2	1	0	1	7
Ialomita	0	0	3	1	0
Iasi	1	2	6	2	2
Maramures	0	4	3	0	0
Mehedinti	0	1	2	1	1
Mures	0	0	4	2	0
Neamt	0	6	0	4	0
Olt	1	0	0	0	7
Prahova	0	1	1	0	0
Satu Mare	0	0	0	0	0
Salaj	0	0	0	0	1
Sibiu	0	0	0	0	7
Suceava	3	2	4	1	0
Teleorman	2	3	2	1	1
Timis	7	6	1	0	0
Tulcea	0	0	2	0	2
Vaslui	1	1	2	1	0
Valcea	0	0	2	2	0
Vrancea	0	1	3	1	2
Bucuresti	0	1	11	9	11
Ilfov	0	4	0	0	1
Amount per year	**52**	**70**	**114**	**52**	**58**
Total amount	**346**				

Mechanistic description of how the activity generates POPs

Stationary emission sources in human settlement areas are the crematories and hospital waste incinerators. Many hospitals are still using crematories instead of incinerators, (as seen from the table 4). These incinerators are located in most municipal hospitals and are not adequately equipped to eliminate dioxins emissions from the resulting gases;

In accordance with the legislation the medical waste should be collected and separated from other wastes generated by medical activities. Hazardous waste should be collected in special packaging, and then temporarily landfilled at a specific place within the medical unit before being transported to the final disposal point. One of the methods suggested by the Protocol agreed between the Ministry of Environment and Waters Management (No. 4132/ IJ / 04.10.2004), Ministry of Health (No. 45861/IB/06.10.2004) and National Authority Environmental Guard (No.10973/05.10.2004) is the use of sterilizers and incinerators.

A number of studies on medical waste incineration by the United States Environmental Protection Agency (US EPA) have identified the incineration of hospital wastes as the third largest source of dioxin air emissions, and the contributor of about 10 percent of the mercury emissions to the environment from human activities. Many other hazardous pollutants have been identified in the emissions of medical waste incinerators including: arsenic, ammonia, benzene, bromodichloromethane, chloroform, lead etc.

Waste Incineration

The most important sources of POPs, (such as dioxins) in Romania are hospital waste incineration and municipal waste incineration.

Both levels of releases are specified in the tables 5 and 6 below

Table 5

Emission of POPs from Other Sources

Pollutant	Activity	Year		
		1989	**1995**	**2001**
Dioxins (g I-TEQ/year)	Hospital Waste Incineration	11.71	16.8	22.7
	Municipal Waste Incineration Plants	2.19	2.19	2.19
TOTAL DIOXINS (g I - TEQ/year)		**13.9**	**18.99**	**24.89**
PCB (g/year)	Hospital Waste Incineration	66.76	127.08	159.6
	Municipal Waste Incineration Plants	232.14	232.14	232.14
TOTAL PCB (g/year)		**299**	**359.2**	**391.7**
PAHs (g/year)	Hospital Waste Incineration	**0.042**	**0.04**	**4.14**
	Municipal Waste Incineration Plants	6,351	6,351	6,351
TOTAL PAHs (g/year)		**6351.04**	**6351.04**	**6,535.14**

Source: POPs Inventory - Romania

Table 6			
POPs Emissions in Air from Hospital Waste Incineration			
#	**Year**		
	1989	**1995**	**2001**
Anatomic Waste (tones/year)			
With special abatement measures (particle abatement)	*2.102*	*2.02*	*207*
Dioxin g I – TEQ/year	0.0003	0.0003	0.034
PAH(g/year)	0.042	0.04	4.14
With no special abatement measures	*4062*	*4405*	*6385*
Dioxin g I – TEQ/year	6.7	7.27	10.53
Without Anatomic Waste ***(tones/year)***	*3341*	*6358*	*9127*
With special abatement measures (particle abatement)	3.2	3.6	1147
Dioxin g I – TEQ/year	0.00048	0.00054	0.172
With no special abatement measures	3338	6354	7980
Dioxin g I – TEQ/year	5.01	9.53	11.97
PCB (g/year)	66.76	127.08	159.6
TOTAL: Dioxin g I – TEQ/year	**11.71**	**16.8**	**22.7**
PCB (g/year)	**66.76**	**127.08**	**159.6**
PAH (g/year)	**0.042**	**0.04**	**4.14**

EF PAH: 0.02mg /tone (for clinical waste)

Source of data: POPs Inventory – Romania

One of the most important aspects of the dioxin releases from burning/incineration of health-care waste is there is no equipment capable of measuring the dioxin air releases.

Environmental, Socioeconomic, and Health Consequences

The socioeconomic and health consequences are hard to define since no official studies have been made in this direction. Environmental consequences are defined by the dioxins characteristics.

One important aspect is the notification in 2004 of a Romanian NGO called Mare Nostrum who is active in the environment field in Constanta, Constanta County. Their concerns are about the existence of a health-care waste incinerator build in the middle of the city neighbored by 2 500 people and located at 50 m from a kindergarten with 150 children. In February 23-29, 2004, the neighbors notified Mare Nostrum and the mass media of a number of health concerns including vertigo's, pains at the lips and nose, and headaches due to the uncontrolled incineration process during the night.
Mare Nostrum NOG started a court case against the owner of the incinerator. The main problem underlined by the company issuing the EIA Report for the incinerator was that in Romania there is no equipment to quantify the air emission for dioxins.

The newspaper articles of the Mare Nostrum organization developed against the incineration are in the annex.

Responsible parties

In 2004 a Protocol between Ministry of Environment and Waters Management (no.4132/4.10.2004), Ministry of Health (no. 45861/6.10.2004) and Environment Guard (no. 10973/5.10.2004) was signed establishing, in accordance with the legislation in force, the environmental conditions for hospital crematories till their closure in 2008.
The calendar for this was in compliance with Directive no. 2000/76/EC convening wastes incineration transposed into Romanian legislation by Governmental Decision no.128 / 2002 (Official Journal no. 160/6.03.2002)

Following this protocol the crematories could be replaced by sterilizers and incinerators.

The objective of the protocol is: To define the methods of surveillance and control of the existing crematories to be closed; the regulation of the crematories functioning during the transition period till 2008; an elaboration of the selection criteria of sterilizers to assure the full inert status of the hazardous health-care wastes treated.

The estimated costs specified by the Romanian Position Paper (Chapter 22 – Environmental Protection) for the implementation of Directive no. 2000/76/EC includes those for the implementation of the other two directives: Directive no. 94/67/EC on the incineration of hazardous waste and Directive no. 89/369/EEC on the reduction of air pollution from new municipal waste incineration plants) and are approximately 4.25 billion Euro.

The cost for the implementation of Directive 2000/76/EC evaluated under EPIQ Programme is 3,471 billion Euros, and consists of capital and operational costs.

According to the above-mentioned assessments, the necessary amount for the implementation of Directive 2000/76 is between 3.5 and 4.25 billion Euros.

The Ministry of Health and Family has issued the Order no. 219/ 2002 for the approval of the Technical Norms concerning the heath-care waste management and the Methodology for data collection for the national data base concerning the waste resulting form medical activities (Official Journal no.386 / 6.06.2002).

The liability to fulfil the obligations of the mentioned regulation lies with the health-care waste producer. The order is not applicable to radioactive waste for which there are special regulations.

The Stockholm Convention on Persistent Organic Pollutants was ratified by the Law no. 261/2004 published in the Official Journal no. 638 / July 15, 2004.

The convention requires the development of a National Implementation Plan (NIP), in order to provide a framework for a country to develop and implement, in a systematic and participatory way, priority policy and regulatory reform, capacity building, and investment programs.

The Romanian National Implementation Plan (NIP) have been elaborated within the UNIDO/GEF financed and implemented project “Enabling Activities to Facilitate Early Action in the Implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs) in Romania”, being endorsed by the Governmental Authorities.

The draft of NIP had been sent to the Ministers before and their endorsement had been obtained. The letter asking the Ministers to endorse NIP of Stockholm Convention had been signed by:

Mrs. Speranța Ianculescu – Minister of the Ministry of Environment and Water Management.
Mr. Miron Mitrea – Minister of Transport Construction and Tourism
Mr. Dan Ioan Popescu – Minister of Economy and Commerce
Mr. Petre Daea – Minister of Agriculture, Forest and Rural Development
Mr. Marian Săniuță – Minister of Administration and Interior
Mr. Ovidiu Brânzan – Minister of Health

One of the NIP development phases is priority setting of key objectives and measures as well as instruments and defining actions. The results have been eleven key objectives. The key objectives are focused on a common approach to solving the key problems related to human health and environment protection - problems caused by POPs production and use.

For the present report:

key objective no.5:

To reduce POPs emission nuisance from waste incinerators

and

the associated measures:

5.1. To reduce emissions nuisance of dioxins, HCB and PCBs from hospital waste incinerators, municipal, sanitary-veterinary incinerators and crematory

5.2. Reducing emissions from cement kilns firing hazardous waste

are the most significant.

The liability to fulfill the legislation provisions as well the mentioned protocol is at follows:

- Medical Units - To close the crematories and replace them with sterilizers and incinerators
- Ministry of Health – to monitor the medical unit's activities in this matter
- Environmental Guard to control and fulfill the environmental obligations

Alternative practices

Alternative practices to burning waste in crematories and incineration will be non incineration technologies based on the following basic processes, such as:

1. Thermal processes: are those that rely on heat (thermal energy) to destroy pathogens in the waste. Category divided into low-heat, medium heat, and high heat thermal processes
2. Chemical processes: employ disinfectants such as dissolved chlorine dioxide, bleach, peracetic acid, or dry inorganic chemicals in order to enhance exposure of the waste to the chemical agent
3. Irradiative processes: irradiation – based technologies involving electron beams, Cobalt-60, or UV irradiation
4. Biological processes: employ enzymes to destroy organic matter.

Recommendations of NGO

The recommendations of Environmental Experts Association is in accordance with the actual situation of health care waste management, including final disposal, and are focused on the following pollution prevention principles:

Hazardous waste incineration has multiple impacts on the environment: air, water, waste and other effects. Main environmental problems are coming from aspects such as:

- Poor control of the processes that include the use of the maximum incinerators capacity
- Non-compliance with the national legislation on waste management and incineration
- Non-existence of equipment for measuring uncontrolled toxic compounds releases
- Poor environmental and health education of the hospital staff, including workers, about possible dangers and impact of POPs
- Lack of funding for specific hospital activities concerning health care waste management

Following all these above mentioned aspects Environmental Experts Association recommendations on health care waste management are focused on the following possible activities:

- The promotion of information projects to increase worker and public awareness on what the incineration of health care waste involves in terms of health and environment
- Implementation of waste minimization plans in the hospitals
- Use of non-incineration Medical Waste Treatment technologies
- Measurements and monitoring of POPs, such as dioxins releases
- Use of Best Available Technologies and Best Environmental Practices

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