

The management of waste from medical activities

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Abstract: Romania, in order to build incineration installations and for applying the provisions of the Directive on emissions of pollutants to air, water and soil of the existing incineration and co-incineration installations, has allocated funds and has attracted also other sources of funding. Legal medicine adds serious biological threats due to toxic, toxicological and biological hazards such as viruses, germs. In order to implement the neutralization system of medical waste through thermal sterilization, treatment and final disposal of waste we present case studies for illustration.

Key Words: environmental protection, EU environmental policies, waste policy, waste prevention policy, medico-legal.

EU policies on waste management highlights the importance of an integrated approach to waste management, which includes the construction of installations of waste disposal together with measures of waste prevention and recycling, in accordance with the hierarchy of principles: prevention of waste production and the negative impact of it, waste recovery through recycling, reuse and safe final disposal of waste, where there is no possibility of recovery [1-3]. Legal medicine and its laboratories add important serious biological threats due to toxic, toxicological and biological hazards such as viruses, germs. Biological warfare and chemical warfare may overlap: toxins produced by living organisms is considered under the provisions of both the Biological Weapons Convention [1] and the Chemical Weapons Convention [2] and its annexes [3].

MATERIALS AND METHODS

The first important progress made by Romania towards the harmonization of environmental legislation was in December 1995 by adopting the Framework law for environmental protection (Government Emergency Ordinance no. 195/2005 on environmental protection), which introduced important principles regarding the

legislation and policy of environmental protection, such as the “polluter pays” principle [4-6].

Also, “the principle of preventive action” is one of the principles underlying this ordinance on environmental protection, as amended and supplemented.

RESULTS AND DISCUSSION

In order to implement the obligations that Romania has assumed according to the Implementation Plan of the European Council Directive 2000/76 / EC on waste incineration, annex to the Complementary Position Document of Romania, Chapter 22 “Environment”, by G.D. no. 1862/2005 approving the project “Hazardous waste incineration and sterilization of medical waste” was allocated from the Environmental Fund, in the form of grants, reimbursable or mixed, for the construction of incinerators and sterilisers [7, 8].

CONCLUSIONS

A) In 2009 within the project “Health care reform phase II” Component 1 “Maternal and neonatal healthcare” carried out by the Programs Implementation Unit PMU APL2 of the public health authority, was

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initiated the procurement procedure ICB 9 “Procurement of equipment for healthcare of mother and child” for nine NEWSTER 10 type sterilizers [9].

NEWSTER10 system is a device designed to treat solid sanitary waste potentially infectious to achieve the sterilization, physical change, dehydration, reducing the volume and weight of them.

The machine and its components must be used only to treat sanitary solid waste, containing liquids potentially contaminated by pathogens from hospitals, laboratories, medical research centers, dialysis centers and wards for contagious diseases.

The sterilization process consists in heat treatment by destroying proteins in a moist environment, with the maximum temperature of over 150 degrees at the end of the cycle. The duration of a cycle is 30 minutes, and the processing capacity of 30-40 kg / h waste with 10% humidity.

In 2011 there were purchased nine NEWSTER10 neutralizing systems, of which a number of 6 installations are found currently in sanitary units under the public health authority and a number of 3 installations can be found at health units subordinated to local public administration.

From the explanations submitted by health units above, who received NEWSTER10 installations in 2011 have resulted the following:

Health Unit C proceeded to bringing into service of the installation only on March 3rd, 2015 (though the acquisition was made in 2011), after obtaining the environmental authorization, the first steps in obtaining environmental authorization being performed after 3 years respectively since March 2014. In the period 2011-2015, the system did not work not only because of a lack of environmental authorization, but also because of a lack of specialized personnel. Although the installation was not used from the date of bringing into service, i.e. April 2011 to March 3rd, 2015, the entity has proceeded to its depreciation from April 2011 to 2016;

Unit B, even if it held an environmental authorization, it brought into service the installation only in 2014, respectively after three years, whereas lacked qualified personnel;

Unit A has brought into service the two installations in February 2011. The installations worked three months until April 2011, they were closed because they did not met the requirements of environmental

protection legislation, namely the environmental authorization for the installation of these neutralization systems. One of the key factors of the closure of these installations was the lack of wastewater treatment installations to ensure the quality of wastewater in city sewers in the parameters imposed by GEO no. 195/2005 on environmental protection. Thus, for obtaining the environmental authorization is required to install and to bring into service the wastewater treatment installation, an investment amounting to an estimated 500,000 euros. Although the installation has worked only three months, the entity proceeded to its full amortization, contrary to the provisions of OMEF no. 3.471/2008 approving the Methodological Norms on the reassessment and amortization of fixed assets owned by the public institutions.

The health unit E has not requested an environmental authorization as the installation is damaged from 2011, immediately after receiving it. Also they have taken steps to repair it, asking the company that supplied a price offer for service contract facility;

Health unit D brought into service the installation NEWSTER10 type in March 2011, but it did not work due to lack of personnel. Although the installation did not work, the entity proceeded to its depreciation.

B) In 2013, within the investment objective “Clinical Emergency Hospital building refunctionalisation with 300 beds”, the regional health Unit has been equipped with a neutralization system type NEWSTER NW10 [9].

The NW10 NEWSTER installation was acquired on October 18th 2013 by the Directorate under the public health authority, with a purchase value of 627,000 lei.

We note that the installation was brought into service by the regional health Unit immediately upon receipt, respectively on October 18th 2013, according to the Minutes regarding the installation and bringing into service No. 11883 / October 18th 2013.

In order to conduct an analysis of the savings that would be achieved by sanitary units which operate with neutralization installations of medical waste, but which have not been used due to those described above, it has been requested to the regional health unit the submission of the situation of the quantities of waste treated with their own facilities and the cost of that treatment.

Although the regional health unit has the NEWSTER 10 installation since 2013, the required

Table 1. Sanitary units under the Authority responsible for ensuring public health systems benefiting from neutralizing NEWSTER10

No.	Name of health unit under the Ministry of Health	No. of installations
0	1	2
1	Health Unit A	2
2	Health Unit B	1
3	Health Unit C	1
4	Health Unit D	1
5	Health Unit E	1

situations were submitted for the period 2013-2014.

In 2013 the regional health unit has treated the quantity of 5,869 kg of medical waste with its own installation and the treatment costs were 3,310 lei, ie 0.56 lei/ kg of waste treated.

In order to calculate the savings that would have been obtained if medical waste generated would have been treated with their own installations provided, there were requested to the sanitary units A, C, beneficiaries of such installations but who not used them, the situations concerning the quantities of waste generated and treated with third parties including the costs of this treatment.

Based on the situations received, was proceeded to the application of the cost of 0.56 lei/kg of treated waste obtained by regional health Unit on the amount of waste treated by economic operators by the two entities, according to Table 2.

The table shows that in 2013, Unit C treated an amount of 104,421 kg of medical waste with economic operators for which the costs were 761 thousands lei, i.e. 7.29 lei/kg waste treated and the sanitary Unit A treated a quantity of 6,295 kg, the treatment costs 31 thousands lei, i.e. 5 lei / kg treated waste.

If the same quantities were treated with their own installations provided, taking into account the cost of 0.56 lei/kg waste produced by regional health Unit, the treatment costs were 58,000 lei for Sanitary Unit C and 3,000 lei for sanitary Unit A.

The total savings in the estimated amount of

730,000 lei which would have been obtained in 2013 due to the treating of medical waste with their own installation supplied were of 702,000 lei for Sanitary Unit C and 28,000 lei for Sanitary Unit A.

In 2014, the regional health Unit treated quantity of 45,450 kg of medical waste with its own installation for which its own costs of treatment were 59,000 lei, i.e. 1.28 lei/kg treated waste.

Based on situations on the quantities of waste generated and treated with third parties, including the costs of this treatment received by the Sanitary Unit C and Sanitary Unit A, entities benefiting from such facilities but not using them, was proceeded to the implementation of the cost of 1.28 lei/kg waste treated on the amount of waste treated by economic operators in 2014, according to Table 3.

From the table above results that in 2014, the Health Unit C treated an amount of 115,760 kg of medical waste treatment with economic operators for which the treatment costs were 666,000 lei, i.e. 5.76 lei/kg waste treated and the Sanitary Unit A a quantity of 6,299 kg, the treatment cost being 25,196 lei, or 4 lei/ kg.

If the same quantities were treated with their own installations supplied taking into consideration a cost of 1.28 lei/kg waste produced by regional health Unit in 2014, the treatment costs would have been 148,173 lei for sanitary Unit C and respectively 8,063 lei for sanitary Unit A.

The total savings in estimated amount of 535,000 lei which would have obtained in 2014 due treating

Table 2. Situation on the amount of waste treated by operators, the unit price and annual cost of use and maintenance of the neutralization installation in 2013

Health unit	Data on waste production (Kg/ year) / Waste Code		The total amount of waste (kg)	Unit price economic operators (lei/kg)	Value of economic operators service (lei)	Cost / kg when using installation NEWSTER (lei/kg)	Annual operation and maintenance costs for neutralization installation (lei)	Savings (lei)
	Stabbing-cutting waste code 18 01 01 (18 01 03*)	Infectious waste code 18 01 03*						
0	1	2	3 = 1+2	4	5 = 4*3	6	7 = 3*6	8 = 5-7
Unit C	18.883	85.538	104.421	7,29	761.229	0,56	58.476	702.753
Unit A	0	6.295	6.295	5,00	31.475	0,56	3.525	27.950
TOTAL	18.883	91.833	110.716	X	792.704	X	62.001	730.703

Table 3. Situation on the amount of waste treated by operators, unit price and annual cost of use and maintenance of the neutralization plant in 2014

Health unit	Data on waste production (Kg / year) / Waste Code		The total amount of waste (kg)	Unit price economic operators (lei/kg)	Value of economic operators service (lei)	Cost / kg waste treated its own installation (lei/kg)	Annual operation and maintenance costs for neutralization installation (lei)	Savings (lei)
	Stabbing-cutting waste code 18 01 01 (18 01 03*)	Infectious waste code 18 01 03*						
0	1	2	3 = 1+2	4	5 = 4*3	6	7 = 3*6	8 = 5-7
Health unit C	11.230	104.530	115.760	5,76	666.778	1,28	148.173	518.605
Health unit A	0	6.299	6.299	4,00	25.196	1,28	8.063	17.133
TOTAL	11.230	110.829	122.059	X	691.974	X	156.236	535.738

medical waste with their own installations would have been of 518,000 lei for Sanitary Unit C and 17,000 lei for Sanitary Unit A.

It follows that in the period 2013 - 2014, the total savings that might be obtained from the two hospitals sampled were estimated to 1,266,000 lei, given that this service would be provided with installations for neutralizing NEWSTER10 in the endowment of these entities.

With regard to access by public health authorities of European funds for equipping hospitals with neutralization installations of medical waste in the period 2012-2014:

In 2012, the public health authority submitted to the environmental Authority the request for inclusion in the category of eligible beneficiaries of the Sectorial Environment Operational Programme 2007-2013 for Priority Axis 2, "Development of integrated waste management and rehabilitation of historically contaminated sites".

At the end of 2012, the public health authority has been notified by the European Commission about the approval on its inclusion in the category of eligible beneficiaries, allocating for the project (including a total of 300 health units subordinated to the public health authority and respectively under local public authorities) the sum of 50,000,000 Euros. On January 23rd 2013, a meeting took place at the Environment and Climate Change Authority with the European Commission/DG Regio regarding the projects that Romania is going to fund the next period through the Sectorial Environment Operational Programme. On this occasion, the public health authority presented a paper on the "The neutralization of hazardous medical waste resulted from hospital activity".

Referring to the project of the public health authority, the representatives of the European Commission recommended to make the arrangements for the appointment of the consultant for preparing the grant application, establishing a list of hospitals that will be equipped with installations for neutralizing hazardous medical waste procured through this project, developing a realistic timetable for implementation and the creation of partnerships including hospitals which are not subordinated to the Authority responsible for ensuring public health, to implement this project.

After consulting over 230 sanitary units, a total of 170 expressed their desire to be equipped with such equipment, assuming the related operating costs. Out of the total of 170 hospitals, the public health authority has selected a number of 88 hospitals to equip in the first phase.

Thus, in December 2013, the public health authority submitted to the Management Authority SOP Environment the grant application for the project entitled "Neutralizing hazardous medical waste in

hospital activity" funded by the Sectorial Environment Operational Programme 2007-2013 from the European Regional Development Fund (ERDF) and the State budget, Title 56 - "Projects financed by external funds (NEF) post-accession".

The grant application and the feasibility study, documents resulting from consultancy services under contract no. 37/June 26th 2013 in worth of 80,000 lei, was paid by the public health authority from the state budget.

This project is a continuation of PHARE 2006/ 018-147.03.03 / 4.8 / 4.9 "Improving internal management of hazardous waste generated by health institutions in line with European standards" initiated by public health authorities in 2008 and developed in 2009 with projections to 2020 [10].

The objective of this strategic project was equipping health units with installations for neutralizing medical waste and imposing as solution for the disposal of hazardous waste from hospitals, the method of neutralization through processes accepted at EU level, with minimal environmental impact: autoclaving and shredding (including neutralizing fluids from the process) and compacting the waste.

Environment and Climate Change Authority – has communicated to the public health authority that "has interrupted the funding application assessment until the clarifying of the issues mentioned above".

In conclusion, non-managing of medical waste according to European standards led to the fact that:

The public health authority has incurred expenditure from the state budget, including insurance premiums, interest, commissions and other costs related to external credit for the purchase of installations, some of which have not been put into operation and have never worked or worked a smaller number of years of life as compared to their normal duration.

If health units would be treated quantities of waste, which according to the law may be subject to this process, with NEWSTER10 installations, would have been obtained between 2012-2014 savings estimated in amount of 1,854,000 lei (approx. 413,633 Euro) with which they could purchase 4 neutralization installations NEWSTER10, taking into account the rate of 4.4821 lei/euro in force on December 31st 2014 and the unit price of 99,439 euro for a such installation [11].

It is important in the cycle of waste in legal medicine to provide adequate means in order to protect the environment and to succeed to neutralize biological and chemical hazards. Generally speaking, it is an important endeavour in medicine, not just in specialized fields, because of the risks and sometimes due to not so small quantities.

Conflict of interest. The author declares that he has no conflict of interest concerning this article.

References

1. Biological Weapons Convention accessed on 10th October 2016 [[http://www.unog.ch/80256EE600585943/\(httpPages\)/04FBBDD6315AC720C1257180004B1B2F?OpenDocument](http://www.unog.ch/80256EE600585943/(httpPages)/04FBBDD6315AC720C1257180004B1B2F?OpenDocument)].
2. Chemical Weapons Convention, accessed on 10th October 2016. [https://en.wikipedia.org/wiki/Chemical_Weapons_Convention]
3. Chemical Weapons Convention annexes accessed on 10th October 2016 [<https://www.opcw.org/chemical-weapons-convention/annexes/annex-on-chemicals/>].
4. Strategia Națională de Gestionare a Deșeurilor pentru perioada 2003 – 2013, accessed on 10th October 2016 [<http://www.mmediu.ro/beta/wp-content/uploads/2013/01/2013-01-11-DGDSP-SNGD.pdf>].
5. Strategia națională de gestionare a deșeurilor, accessed on 10th October 2016 [www.juridice.ro/wp-content/uploads/2013/03/2013-01-18-DGDSP-SNGD_v2.doc].
6. Tratatul de la Amsterdam NAT/538. Al șaptelea Program de acțiune pentru mediu (PAM) și monitorizarea celui de-al șaselea PAM” accessed on 8th October 2016 [http://ec.europa.eu/romania/documents/eu_romania/tema_24.pdf].
7. Lutz Ribbe, raportor. Avizul Comitetului Economic și Social European privind cel de-al șaptelea Program de acțiune pentru mediu (PAM) și monitorizarea celui de-al șaselea PAM (aviz exploratoriu) accessed on 10th October 2016 [https://webapi.eesc.europa.eu/documents/anonymous/ces1052-2012_ac_ro.doc].
8. Directiva 75/442/EEC modificată prin Directiva 2006/12/EC accessed on 9th October 2016 [http://www.apdmgalati.ro/Co-Wanda/services/documente/DE/en/Directiva%202006_12_CE_05.04.2006.pdf].
9. Guvernul României. Ordonanța de Urgență nr. 195/2005 privind protecția mediului, accessed on 8th October 2017 [http://mt.gov.ro/web14/documente/domenii/Ordonanta_de_urgenta_nr_195_din_2005.pdf].
10. Directiva Consiliului Europei 2000/76/CE privind incinerarea deșeurilor accessed on 8th October 2016 [http://www.mmediu.ro/beta/wp-content/uploads/2012/05/Directiva_2000_76_CE.pdf].
11. HG nr. 1862/2005 pentru aprobarea proiectului “Incinerarea deșeurilor periculoase și sterilizarea deșeurilor provenite din activități medicale”, accessed on 10th October 2017 [<http://lege5.ro/Gratuit/gezdenjzg4/hotararea-nr-1862-2005-pentru-aprobarea-proiectului-incinerarea-deseurilor-periculoase-si-sterilizarea-deseurilor-provenite-din-activitati-medicale>].
12. Mediu 2010 – “Viitorul nostru, Opțiunea noastră”, adoptat prin Decizia nr. 1600/2002/CE accessed on 9th October 2017.