ECRONICON OPEN ACCESS

EC NURSING AND HEALTHCARE
Short Communication

Disposal of Medical Waste as a Problem of Medical Organizations

Stolyarov Stanislav Alekseevich*

Associate Professor of the Department of Public Health and Healthcare of the Federal State Budgetary Educational Institution of Higher Education of the Altai State Medical University of the Ministry of Health of Russia, Russia

***Corresponding Author:** Stolyarov Stanislav Alekseevich, Associate Professor of the Department of Public Health and Healthcare of the Federal State Budgetary Educational Institution of Higher Education of the Altai State Medical University of the Ministry of Health of Russia, Russia

Received: June 24, 2022; **Published:** July 28, 2022

Medical waste is an immediate or potential threat to human health and the environment. Their main danger lies in the high content of volatile substances, toxins, as well as various microorganisms, including pathogens. Medical waste includes dressings and suture material (bandages, napkins, etc.), surgical waste (removed organs and tissues, embryos, amputated limbs), metal (medical instruments, needles for syringes, etc.), glass and plastics (ampoules, jars, vials, test tubes, disposable syringes, etc.), rubber (gloves, tubes, etc).

Medical organizations generate waste of different fractional composition and degree of danger, which can be divided according to the degree of their epidemiological, toxicological and radiation hazard into five classes: "A" Non-hazardous; "B Dangerous (risky)"; "B" Extremely dangerous; "G" Waste, composition close to industrial; "E" Radioactive waste [7].

WHO classifies medical waste as hazardous and attaches great importance to its disposal, otherwise, infection of medical personnel and the public with dangerous infectious diseases, primarily parenteral hepatitis and HIV infection, may occur [2]. Only in the Altai Territory, more than 900 medical workers with chronic viral hepatitis B and C are registered at the dispensary, and about 8600 people are carriers of hepatitis B and C viruses, which is caused, among other things, by contact with medical waste. The number of medical personnel whose activities are associated with an occupational risk of infection with viral hepatitis B and C is over 25 thousand people.

In recent years, the amount of medical waste has increased all over the world (only in Germany it has increased by 2 times, while their volume has increased by 4 times). In France, the mass of medical waste is about 700 thousand tons. in year. This is largely due to an increase in demand for medical services, an increase in the number of organizations providing them, an increase in healthcare funding, as well as the emergence of new medical technologies for providing medical care and patient care (disposable syringes and systems, pads and diapers, medicines and vaccines, etc). A large increase in medical waste is also observed in Russia: if in 1979 their amount was, on average, 0.550 kg per day per 1 bed, reaching 200 kg per year, then by 2002 the amount of such waste had doubled and amounted to 1.15 kg per day - about 400 kg per year (Table 1).

Authors	Accumulation of solid waste in hospitals per 1 bed, kg		
	Per day	Per month	Per year
Pokrovsky V.A. (Russia, 1979)	0,550	16,6	200,0
Environmental Protection Agency Experts (EPA, USA, 1989)	5,8	174	208,8
Losonci D. (Hungary, 1978)	10,0	300	360,0
Trescher I. (France, 1993)	0,64	19,2	230,4
P. Oparin (2002) - Irkutsk region	1,15	34,6	416,0

Table 1: *Comparative characteristics of the formation of municipal solid waste in medical institutions.*

At the same time, the average amount of infected waste from the total amount of medical waste is 15%, varying depending on the profile of the hospital from 5.5 to 23.1% [4]. A significant part of medical waste in Russia uncontrollably ends up in landfills along with household waste or is disposed of indiscriminately, thereby creating a threat to the spread of infectious diseases.

Despite the fact that the procedure for the collection and disposal of medical waste in Russia is regulated by the Rules for the collection, storage and disposal of waste from medical institutions, however, the actual state of affairs in terms of the efficiency of collection, storage and disposal of medical waste is far from desirable. According to a number of data, no more than 10% of medical organizations have a system for the disposal of medical waste that meets the necessary requirements. The reasons are very different: lack of funding; lack of persons responsible for the collection and disposal of medical waste; underestimation of the importance of the problem; unwillingness to work in a new way; lack of proper control by the inspection bodies; lack of information on the organization of the waste management system in medical organizations. All this can lead to the emergence of nosocomial infections, the risk of infection of the population and the deterioration of the ecological state of the environment [1]. In many Russian medical organizations, the problem of collection, storage and disposal of medical waste is solved unsatisfactorily. So disposable bags for medical waste are available only in 62% of hospitals. In most medical organizations, due to insufficient funding, black household bags are used - 37.9%. Trolleys for collecting and transporting waste are used in 87.6% of medical organizations. Refrigerators for storing food waste are available only in 35.5% of hospitals. Disinfection of containers for storing all types of waste is carried out only in 5.1% of the surveyed 217 institutions [2]. At the same time, about 247 thousand tons are produced annually in Moscow alone. medical waste, of which only 10% is recycled. The average growth in the generation of various types of waste over the past 10 - 15 years is quite stable and amounts to 3 - 4% per year, which does not reduce the above concerns [8].

The current practice of disposing of waste from medical organizations along with household waste creates conditions for the spread of infectious pathogens through the reuse of disposable items. Although class B waste after disinfection is allowed to be taken to municipal solid waste landfills, the disinfection of medical waste used is not capable, in some cases, of ensuring the destruction of all pathogens of infectious diseases. Studies show that medical waste after disinfection with traditional preparations continued to be a source of pathogens in 50 - 69.2% of cases [8]. Due to the fact that the main danger of medical waste lies in the high content of pathogens (1000 times more than in municipal solid waste), their heat treatment is necessary. In addition, disinfectants used to decontaminate medical waste (usually chlorine-containing ones) expose personnel working with them to the risk of acquiring serious diseases caused by the penetration of disinfectant vapors into the body. According to leading scientists of the country, medical waste should not be in a landfill.

Existing technologies for the disposal of medical waste are becoming more complex, and on-site disposal systems are becoming more expensive, while transporting waste to remote disposal facilities is becoming increasingly difficult for a number of reasons. Therefore, the choice of the optimal disposal method should be made taking into account a whole range of conditions:

1. Specifications: Availability of proper tests of the purchased system; compliance of its technical parameters with existing standards, compliance with them of all components and materials used in the manufacture and operation equipment; absence of deviations in the performed operations; provision by the supplier (manufacturer) of warranty service during the required period of operation.

2. Reliability of the supplier: Whether the purchased equipment is in sufficient demand and popularity; what are the obligations of the company from which it will be purchased regarding quality, warranty and service.

3. Accounting for external conditions: Determining the degree of environmental pollution that is inevitable during the operation of any system, including pollution of the atmosphere and wastewater.

4. Occupational hazard for operating personnel: The presence of factors that adversely affect the personnel operating the installation (compliance of factors with existing standards, the degree of contact with harmful chemical compounds, noise and vibration levels,

the risk of exposure to radiation, automation of the operating cycle of the system or the performance of any operations manually the degree of possible risk, etc).

5. Recyclable waste: What types of waste can be processed using a particular installation. Does its design provide for special packaging of the processed material? Is there additional equipment for handling specific material (needles, syringes, scalpels, contaminated waste, chemotherapeutic agents, metal products, etc.)?

6. Waste processing. What are the physical, chemical and biological characteristics of the residues formed after waste processing, and what is the possibility of their further storage or destruction.

7. Is there a permit from the competent authorities for the operation of the purchased installation and can such a permit be obtained in principle (if a medical organization is located in residential areas, then decentralized thermal waste disposal is unacceptable and it is necessary to resort to the services of incinerators).

8. Economic side of the issue. What is the best way to recycle from a financial point of view?

But it is not enough to purchase the necessary equipment, you need to properly build a system for managing the disposal of medical waste. Its organization involves several stages [1,6]:

1. Appointment of a person responsible for the disposal of medical waste (epidemiologist or chief nurse), who must undergo mandatory training in courses at a specialized training center. Such a person calculates the needs of a medical organization in materials and equipment for the implementation of a medical waste disposal management system, appoints those responsible for the process of collecting, storing, transporting and removing (neutralizing) medical waste in each unit and trains them.

2. Determining where to store medical waste and purchasing related equipment:

    - Packages of six sizes (900*800, 1000*600, 800*700, 500*600, 330*600, 330*300);
    - Containers for used needles;
    - Containers for organic and microbiological waste;
    - Tanks and wheel supports to them.

3. Determination of the necessary equipment for the disposal of medical waste and its acquisition.

4. Operation of the medical waste disposal system.

It should be noted that the sanitary standards of many countries (USA, France, etc.) do not allow manual processing and sorting of medical waste. Based on this, A.M. Gonopolsky back in 1995 proposed a technology for their disposal, which has not lost its relevance even now.

At the first stage, the primary collection of medical waste is carried out at the places of their generation, where hand carts are installed with disposables fixed in them.

Plastic bags: The trolleys have places for fastening open packages, equipped with a pedal mechanism for opening the lid above the package. The filled bags are delivered on trolleys to a room where standard manual devices are installed for their sealing by heat sealing and special metal honeycomb containers for their removal.

At the second stage, medical waste is transported to the place of their processing. The filled containers with the medical waste packed in them are rolled out to the cargo area, a special vehicle equipped with a lifting and transport mechanism is delivered to it, with the help of which the waste containers are lifted, installed and fixed inside a metal fully closed body in two tiers. The routes of special vehicles are coordinated with the relevant Department of the State Road Safety Inspectorate of the constituent entity of the Russian Federation and local services of the State Sanitary and Epidemiological Supervision. When transporting medical waste, protection against their accidental release into the environment is provided at three levels: sealed plastic packaging, a metal container for collection and a metal body for transportation.

The third stage is plasma processing, the technology of which is based on the plasma-arc remelting of any unsorted medical waste (toxic, infected, etc.) in a sealed two-chamber caisson furnace with a liquid bath and plasma heating of the under-roof space. Automatic loading of waste, hermetically packed in plastic disposable bags, is carried out by a lifting and transport system with a carousel-type positional loader, which includes a coaxial plasma torch, which provides high-temperature gas protection of equipment from infection and pollution by waste. The gas cleaning system includes a bubbling chamber of the furnace and a system of high-temperature thermochemical catalytic filters made of activated carbon, basalt and mullite fibers, and ensures the purification of exhaust gases from all types of harmful substances (including dioxins) at the level of sanitary standards. There are no liquid drains. Regeneration and utilization of heat of exhaust gases is provided. The equipment has a system of automatic control and monitoring of the process, part of which is the control of sterility and environmental safety at all stages.

It should be noted that such a system is ideal and cost-effective for large cities, but with its productivity from 500 to 10,000 tons/year, it can hardly be installed in a central district hospital in a region with a low population density.

The most important component of the functioning of the medical waste disposal system is the verification of its work, which should be carried out by regulatory authorities. It must include the following points:

1. Checking the availability of relevant documentation at the facility:

    - Officially published normative documents (SanPiN 2.1.7.728-99 "Rules for the collection, storage and disposal of waste from healthcare facilities", SanPiN 2.1.3.1375-03 "Hygienic requirements for the placement, arrangement, equipment and operation of hospitals, maternity hospitals and other medical hospitals", guidelines 3.3.2.1761-03 "Procedure for the destruction of vaccines and toxoids unsuitable for use", "Sanitary and epidemiological requirements for the organization of collection, neutralization, temporary storage and disposal of waste in healthcare facilities", etc.);

    - Production control plan, which should include the disposal of waste of different hazard classes (internal or departmental control over the safety of disposal should be carried out at least once a month);

    - Administrative documents of the administration of a medical organization, in which: the person responsible for the collection and disposal of medical waste is determined, with a detailed indication of his functions; a scheme for the collection and disposal of medical waste is approved, agreed with the territorial department of Rospotrebnadzor;

    - Certificates confirming the training of medical personnel in the technology of collection, storage and disposal of medical waste;

    - A briefing log on the rules of waste management, which should be carried out quarterly, as well as when hiring;

    - Agreements with specialized organizations involved in the disposal of medical waste licensed by the Federal Service for Environmental, Technological and Nuclear Supervision (usually a license is issued for a period of up to 5 years and its validity must not expire), the permitted type of activity must be indicated in the annex to the license (for example, collection and transporta-

tion of class B and C medical waste to disposal sites); hazardous properties of waste - the content of pathogens of infectious diseases; types of waste - materials and instruments contaminated with secretions (blood, patient discharges, pathological waste, operational waste (organs, tissues, etc.), food waste from infectious diseases departments, biological waste from vivariums, waste from phthisiatric, mycological hospitals, laboratories working with microorganisms of 1-4 pathogenicity groups);

- Agreements with a specialized organization on the disinfection of garbage chutes (if the medical organization has them);
- It is necessary to compare the availability of contracts with payment documents for disinfection, removal and disposal of medical waste and conduct cross-checks, because a number of medical organizations (especially private ones), although they enter into agreements with specialized organizations for autoclaving, collection of medical waste and their disposal (which is one of the conditions for obtaining a license for them to engage in medical activities), but often they cannot (or do not want to) pay for these services and dispose of medical waste as normal household waste.

1. Inspection of the improvement and sanitary maintenance of the territory, where it is necessary to pay attention to the equipment of garbage collection sites, the regularity of garbage collection and methods of direct disposal of class B and C medical waste, and other types of waste.

2. Evaluation of the methods used for the collection and disposal of wastes of different hazard classes in the places of their formation, storage and destruction.

3. Checking the availability and sufficiency of consumables (disposable packages with hazard class markings, racks, carts, containers, etc.). The best practice is to regularly replace filled containers with medical waste with clean, decontaminated ones, through the involvement of organizations that ensure the circulation of containers (replacement system).

4. Conducting an examination of the premises for the temporary storage of medical waste (the premises must be kept clean - daily cleaning and disinfection should be carried out, they should not contain foreign objects; exhaust ventilation is required, equipment with containers; there must be a water supply; walls, floor and ceiling must be made of materials available for disinfection Preferably a room for temporary storage of class B and C medical waste, equipped with a stationary ultraviolet irradiator.

5. Checking the organization of the collection and disposal of food waste by medical organizations (especially for infectious diseases departments), incl. the presence of refrigerators for food waste.

6. Checking the availability of local facilities for waste disposal in medical organizations (incinerators and facilities where other principles of disposal are applied: grinding, disinfection with disinfectants, autoclaving, microwave ovens). Checking the availability of certificates for these installations and compliance with the rules for operating the equipment.

7. Verification of compliance with the working conditions of medical personnel for the collection, storage and disposal of medical waste.

Based on the examination of the listed issues, expert conclusions are made on the compliance of the collection, temporary storage and disposal of medical waste with the current sanitary rules and regulations.

Thus, we can state the fact that the problem of medical waste disposal is not only administrative and economic, but also to a greater extent environmental, hygienic, epidemiological, and also economic, which is of great national economic importance for Russia.

Bibliography

1. Vasyutina LF and Skibinsky MA. "Medical waste is a key decision". *Chief Nurse* (2006): 1.
2. Glinenko VM and Khrapunova IA. "Examination of the disposal of medical waste in medical facilities". *Chief Nurse* (2006): 1.
3. Gonopolsky AM. "Plasma processing of medical waste". *Medical Market* (1995): 17.
4. Oparin PS. "Hospital waste - the problem of disposal and methods for studying their quantitative accumulation". *Chief Nurse* (2002).
5. The procedure for the use, collection, storage, transportation, destruction, disposal (recycling) of self-locking (self-destructive) CP-syringes and single-use injection needles. Guidelines". *Chief Nurse* 8 (2006): 127-135.
6. Sanitary norms and rules: 2.1.7. Soil, cleaning of populated areas, domestic and industrial waste. Sanitary protection of the soil. Rules for the collection, storage and disposal of waste from medical institutions.
7. Shchipanov MM and Chebotaev VV. "On the issue of the disposal of medical waste in Moscow". *Chief Nurse* (2006): 1.
8. Doucet PE. "New technologies for the destruction of medical waste". *Medical Market* (1994): 14-16.
9. Segall RR., *et al*. "Development and Evaluation of a Method to Determine Indicator Microorganisms in Air Emissions and Residue from Medical Waste Incinerators". *Journal of the Air and Waste Management Association* 141 (1991): 11.

Volume 4 Issue 8 August 2022