

Drivers and barriers for healthcare waste minimization in Kaliningrad

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Abstract

The purpose of this thesis is to explore the possibilities of minimizing waste generation in the healthcare institutions in Kaliningrad, Russia. In order to meet this purpose the following research question is investigated: *what kind of drivers are enforcing and which barriers are hindering waste minimization in the healthcare sector in Kaliningrad?*

The research carried out among public and private medical institutions revealed that drivers and barriers in Kaliningrad healthcare establishments could be categorised as legal, financial, social, environmental and technical, and institutional.

The most significant drivers for waste minimization were named as legal and financial; the most frequently discussed barriers were financial ones. Behavioural and perceptual prerequisites were determinants for most of the financial barriers. The drivers and barriers varied for private and public institutions.

The recommendations for policy-makers and stakeholders are aimed at the development of four main areas: legal framework adapted for healthcare sector; internal and external economic incentives; waste minimization planning and persuasive methods for changing behaviour and building a waste minimization tradition.

Executive Summary

The healthcare activities are essential for human life. But with the increased environmental awareness all over the world, the healthcare sector is considered to be a large consumer of hazardous and non-hazardous materials and producer of waste of different types: from household to highly infectious and hazardous ones. The safety of the patients and the medical staff as well as quality of services rendered are primary issues, meantime the efforts to minimize environmental impacts including waste generated are not of importance or simply postponed.

This paper investigates the potential for healthcare waste minimization in the city of Kaliningrad, Russia. The scope of the present research covers the general healthcare waste management system existing in medical institutions of the city. Identification of prospects and problems occurring within the waste management system that could influence healthcare waste minimization and identification of drivers moving and barriers restraining public and private institutions towards waste minimization practices are of the most interest for this study.

According to the World Health Organization healthcare waste is waste deriving from healthcare institutions, research facilities, laboratories, mortuaries and minor sources such as physician offices, dental clinics, pharmacies and healthcare activities undertaken at home (injections, dialysis).

Most of the healthcare waste (between 75 and 90%) is similar to household waste. This waste stream could be dealt with in the way as municipal waste. The remaining 10-25% of waste is considered to be infectious (contaminated by infectious agents, chemicals, pharmaceuticals or containing sharps) and should be treated and disposed of as hazardous waste due to risk that staff, patients and environment could be exposed to.

Waste minimization in the healthcare sector is different from the concepts developed for the industry. The waste minimization techniques used in medical institutions are source reduction, resource recovery and recycling and also include waste treatment and safe disposal.

The benefits of the waste minimization in healthcare institutions are environmental protection, improved occupational safety and health, cost reductions, reduced liability, compliance with existing laws and establishing of good relations with the local public.

During this research it was observed that the waste minimization activities in Kaliningrad are directed mostly on meeting sanitary requirements. Also the term *waste minimization* has not been defined legally in federal and regional laws. In Kaliningrad the meaning of waste minimization strategy is also based on a general understanding of the term by the actors involved in healthcare waste management.

The drivers and barriers identified during the collection of empirical data through interviews with Kaliningrad stakeholders were classified as legal, financial, social (behavioural and perceptual), environmental and technical, institutional.

The legal and financial drivers were named as the most significant ones. Lack of long-term investment and state financial aid were referred to as the most important barriers.

The differences in incentives and barriers were observed for public and private medical institutions. These distinctions derived from the reason that in contrast to public healthcare facilities providing medical services to population, private companies charge their patients.

The investigation revealed that behavioural and perceptual problems affect the development of waste minimization activities in the healthcare institutions in Kaliningrad. Almost all the barriers named had behavioural or perceptual prerequisites. Change in behaviour significantly contributes to overpassing even financial barriers named by respondents during interviews.

The recommendations, given on the basis of analysis of drivers and barriers for waste minimization strategies in Kaliningrad were focused on healthcare sector showing how to strengthen the drivers and to surmount the barriers. The recommendations were prepared for decision-makers and stakeholders and covered the four practical areas: elaboration of legal background for waste minimization strategy; internal and external economic incentives development; waste minimization planning activities; and introducing of persuasive methods for changing behaviour and building waste minimization capacity in Kaliningrad.

Table of Contents

List of Figures

List of Tables

1	INTRODUCTION.....	1
1.1	THE BACKGROUND.....	1
1.2	SPECIFIC CHARACTER OF MEDICAL INSTITUTIONS	2
1.3	PURPOSE	3
1.4	SCOPE AND LIMITATIONS.....	3
1.5	METHODOLOGY.....	3
1.6	TERMINOLOGY USED IN THE PRESENT THESIS	5
1.7	OUTLINE.....	5
2	WASTE MINIMIZATION IN HEALTHCARE SECTOR.....	6
2.1	DEFINING HEALTHCARE WASTE	6
2.1.1	<i>WHO classification of the waste from healthcare sector</i>	6
2.1.2	<i>Definitions and terminology used worldwide</i>	8
2.2	LEGISLATIVE AND REGULATORY FRAMEWORK	11
2.2.1	<i>International agreements and principles</i>	11
2.2.2	<i>National law on healthcare waste management</i>	12
2.3	GENERATION AND COMPOSITION OF HEALTHCARE WASTE.....	13
2.4	WASTE MINIMIZATION	13
2.4.1	<i>Hierarchy of waste minimization techniques</i>	15
2.4.2	<i>Strategies for waste minimization in the healthcare waste institutions</i>	16
2.5	IDENTIFYING DRIVERS AND BARRIERS FOR HEALTHCARE WASTE MINIMIZATION	20
2.5.1	<i>Drivers</i>	20
2.5.2	<i>Barriers</i>	22
2.6	CHANGING ENVIRONMENTAL BEHAVIOUR.....	23
3	ANALYTICAL FRAMEWORK	25
4	OPPORTUNITIES FOR WASTE MINIMIZATION IN THE HEALTHCARE SECTOR OF KALININGRAD CITY	27
4.1	HEALTHCARE SYSTEM IN THE CITY OF KALININGRAD.....	27
4.1.1	<i>General administration and organization of healthcare services</i>	28
4.2	CURRENT HEALTHCARE WASTE MANAGEMENT SYSTEM IN KALININGRAD	30
4.2.1	<i>Legislative and regulatory framework for healthcare waste management and waste minimization</i>	30
4.2.2	<i>Definition and classification of healthcare waste</i>	32
4.2.3	<i>Generation and composition of healthcare waste in Kaliningrad</i>	34
4.2.4	<i>Healthcare waste collection, separation and neutralization, temporary storage and in-site transportation</i>	35
4.2.5	<i>Off-site transportation</i>	36
4.2.6	<i>The prehistory of the centralized healthcare waste incineration system establishment</i>	37
4.2.7	<i>Healthcare waste treatment and recycling initiatives</i>	38
4.3	COSTS FOR HEALTHCARE WASTE MANAGEMENT	40
4.3.1	<i>Internal costs</i>	40
4.3.2	<i>External costs</i>	41
4.4	ALTERNATIVE DECENTRALIZED WASTE MANAGEMENT SCHEMES IN KALININGRAD	42
4.4.1	<i>The case of the Immunopathology Centre</i>	42
4.4.2	<i>The case of the Oncologic Dispensary</i>	43
4.5	MINIMIZATION OPPORTUNITIES FOR DIFFERENT WASTE STREAMS IN KALININGRAD.....	44
5	ANALYSIS: DRIVERS AND BARRIERS FOR WASTE MINIMIZATION IN KALININGRAD HEALTHCARE INSTITUTIONS	45

5.1	IDENTIFICATION OF DRIVERS BEHIND THE HEALTHCARE WASTE MINIMIZATION.....	45
5.1.1	<i>Legal drivers</i>	45
5.1.2	<i>Economic drivers</i>	45
5.1.3	<i>Environmental drivers</i>	47
5.2	BARRIERS FOR WASTE MINIMIZATION	47
5.2.1	<i>Legal barriers</i>	48
5.2.2	<i>Social barriers</i>	49
5.2.3	<i>Financial barriers</i>	50
5.3	LEGISLATIVE FACTORS ANALYSIS.....	51
5.3.1	<i>Analysis of legislation</i>	51
5.3.2	<i>Analysis of legal drivers</i>	53
5.3.3	<i>Analysis of legal barriers</i>	54
5.4	ECONOMIC FACTORS ANALYSIS.....	56
5.4.1	<i>Analysis of drivers</i>	56
5.4.2	<i>Analysis of barriers</i>	58
5.5	SOCIAL FACTORS.....	60
5.6	ENVIRONMENTAL AND TECHNICAL FACTORS ANALYSIS.....	63
5.6.1	<i>Analysing drivers related to environmental issues</i>	63
5.6.2	<i>Opportunities for EMS implementation</i>	64
5.6.3	<i>Technical factors for further regard</i>	64
5.7	INSTITUTIONAL FACTORS ANALYSIS	66
6	CONCLUSIONS AND RECOMMENDATIONS	68
6.1	DRIVERS AND BARRIERS FOR HEALTHCARE WASTE MINIMIZATION IN KALININGRAD	68
6.2	RECOMMENDATIONS.....	68
	BIBLIOGRAPHY	70
	ABBREVIATIONS.....	75
	APPENDIX (1) THE LIST OF INTERVIEWS MADE IN KALININGRAD REGION	76
	APPENDIX (2) THE LIST OF HEALTHCARE INSTITUTIONS LOCATED TO THE CITY OF KALININGRAD	78
	APPENDIX (3) CHRONOLOGICAL LIST OF LEGAL DOCUMENTS REGULATING WASTE MANAGEMENT IN KALININGRAD HEALTHCARE INSTITUTIONS.....	81

List of Figures

Figure 2-1 OECD working definition on waste minimization	14
Figure 2-2 New and old waste management hierarchy	15
Figure 2-3 Classification of environmental tools	18
Figure 2-4 The structure of the environmental culture of a specialist	24
Figure 4-1 Kaliningrad region and the city of Kaliningrad	27

List of Tables

Table 2-1 Rates of healthcare waste generation according to the national income level	13
Table 2-2 Total healthcare waste generation by region.....	13
Table 2-3 Waste prevention vs. waste minimization according to OECD	14
Table 4-1 Waste Categorization according to hazardousness	32
Table 4-2 Sources of healthcare waste generation in medical institutions	33
Table 4-3 The fractions of wastes and their amount generated by the healthcare institutions located to Kaliningrad city in 2005.....	34

1 Introduction

1.1 The Background

Healthcare activities constitute an essential part of our life. Immunizations, diagnostic and laboratory tests, medical treatments - all these activities are used in order to protect and recover our health and in many cases to save lives.

According to Karlsson and Öhman the healthcare sector is considered to be water and energy intensive, consumer of large amounts of hazardous and non-hazardous materials and producer of polluting emissions. "The development of the healthcare sector has been prominently guided by values such as patient and personnel safety and service quality. These values are so important to the sector that efforts to minimize environmental impacts derived from its activities are sometimes not prioritized or postponed" (Karlsson and Öhman, 2005).

The World Health Organization listed the main medical waste producers which include - hospitals and other health-care establishments, laboratories and research centres, morgues and autopsy centres, veterinary clinics, blood banks and blood collection services, and nursing services for retirement homes (World Health Organization, 2006).

About 10-25 % of the total waste generated by the healthcare activities could be classified as hazardous. The hazardous waste is subdivided into several groups: infectious, anatomic, sharps, chemical, pharmaceutical, genotoxic, radioactive wastes, and heavy metal containing waste. The rest amount of waste stream (up to 75-90%) is general waste comparable to domestic waste (WHO, 2006).

At present, the waste management system including source separation, safe transportation and final disposal of hazardous waste was developed and promoted by WHO. But there are practically no environmentally-friendly, low-cost options for safe disposal of infectious (hazardous) wastes. Incineration of wastes has been widely used. Alternatives such as autoclaving, chemical treatment and microwaving were considered as possible disposal methods but they may be preferable under certain circumstances (Prüss, Giroult, Rushbrook, 1999).

Healthcare waste management involves many different risks occurring at every step of waste handling. Although treatment and disposal of healthcare wastes have the main aim to reduce possible risks, indirect health risks may occur even during these activities. Healthcare waste contains potentially harmful microorganisms which can infect patients, healthcare establishment employees and the general public, being spread into environment. Wastes and by-products can also cause injuries (radiation burns or sharps-inflicted injuries), poisoning and pollution, due to release of pharmaceutical products, antibiotics and cytotoxic drugs, toxic elements or compounds such as mercury, dioxins and furans (WHO, 2006).

Many problems started from the judgment that medical waste is a specific waste stream and attentions should be paid only after finding solutions to "ordinary" waste such as household and industrial waste. This perception resulted in the late response of authorities and organizations dealing with hygienic and environmental issues to existing situation with collection, treatment and disposal of waste from healthcare sector. The absence of waste management systems or certain weaknesses of such systems, insufficient financial and

human resources are considered the most common problems connected with healthcare wastes. Also lack of awareness concerning the health hazards or possibilities to reuse or recycle not-infected or not-contaminated items; poor control of waste management steps (from source separation and collection to disposal) could be named as hindrances for waste management and waste minimization in the healthcare sector (WHO, 2006).

There is a need in development of appropriate regulations or enforcement of existing ones. One of the very important issues is clear allocation of responsibilities in the area of waste handling and disposal. It is worth of mentioning that Polluter Pays Principle also should be applied to such specific area as medical wastes, where polluter is the healthcare institution generating waste.

1.2 Specific character of medical institutions

Waste minimization is not an easy issue when it comes to waste streams generated in the healthcare facilities.

Martin E. Levin (n.d.) in his article “How Hospitals Can Dodge the Next Environmental Bullet” raised an issue of differences between industries (manufacturing facilities) and healthcare institutions. The following section is based on Levin’s findings presented in the mentioned article. The differences, as introduced below could be regarded as impediments to the environmental protection activities. According to Levin (n.d.), identifying and analysing the hindrances to environmental laws and norms compliance is of crucial importance in order to effectively solve environmental compliance problems. This generic information obtained could be applied to waste minimization opportunities for healthcare sector.

Levin recognised that “hospitals have a human service orientation” but most of the existing regulating environmental issues documented in US were developed in order to take appropriate measures against pollution caused by manufacturing activities. In comparison with industry where each product is a result of linear process and all the inputs and outputs are already known the identification of sources of pollutants in hospitals, prediction, monitoring and control over waste streams could not be so straightforward.

In the healthcare sector the main goal is rendering sound medical services and the main input is patients with their specific and varying needs. The use of materials and the production of pollutants could be changed significantly from day to day because their amounts and compositions are defined by individual patient needs and medical treatment specificity (Levin, n.d.).

“Hospitals have multi-faceted management structure” (Levin, n.d.). In US two management chains – medical staff providing health care and administrative management supplying the first ones with all the resources needed for rendering their important services. The general environmental compliance effort of the hospital is aggravated by the fact that usually different departments control the processes involving hazardous substances use and waste generation. Also interactions of many representatives of the hospitals with government regulatory authorities could put hospital at a greater risk of non-compliances due to providing the inspectors with incomplete, misleading information. Such difficulties can result in taking the hospital away from the joint efforts in improving their environmental performance.

“Hospitals have competing valid health priorities” (Levin, n.d.). For companies or industries the compliance to environmental requirements is very important because among other reasons it is connected to the protection of public health and non-compliance can lead to high liability costs. Medical institutions have the same reason for the valuing environmental compliance, healthcare is their business.

However, hospitals very often have “specific human health priorities” that could not allow them to prioritize environmental compliance issues. The core mission of the healthcare institutions is to prevent, diagnosis and cure of serious illnesses and injuries. The staff of the medical institution could resist environmental improvement measures if they directed to the worsening of the healthcare services quality (Levin, n.d.).

1.3 Purpose

The main objective of the present thesis work is to explore the possibilities of minimizing waste generation in the healthcare sector in Kaliningrad.

In order to achieve the objectives mentioned, the main research questions needed to be answered are the following:

- 1) What are the main waste streams of the health care sector, and which problems and prospects of medical waste management should be taken into consideration?
- 2) How does the management system of healthcare waste work in Kaliningrad looking through the prism of potential waste minimization activities?
- 3) What are the main drivers enforcing/driving healthcare establishments to minimize their waste streams?
- 4) Which barriers restraining waste minimization could be named?

1.4 Scope and limitations

The present thesis work will cover healthcare waste management system in the city of Kaliningrad.

The city of Kaliningrad was chosen due to the existing initiative in the waste management of healthcare sector. During years 2004-2005 the EU (TACIS) financed project “Pilot Project on Management of Clinical Waste” resulted in creation of Healthcare Waste Management System and installation of a new incinerator in Kaliningrad Multi-Field Hospital in 2005. Already functioning new system gives background for investigations and evaluation of the existing practices for waste minimization practices application.

The thesis provides an overview and analysis of drivers and barriers for waste minimization in the healthcare sector. The research will cover non-hazardous waste that could be handled as household streams and hazardous (infectious) waste. Radioactive waste is excluded from the consideration due to different legislative requirements for management of such wastes.

1.5 Methodology

In order to evaluate which factors could facilitate waste minimization and which hinder it, several steps were involved in the research work:

- 1) literature review,
- 2) development of analytical framework,
- 3) collection of empirical data including interviews with the representatives of institutions and authorities involved into waste management in Kaliningrad,
- 4) analysis and interpretation of data collected.

The literature reviewed includes books, academic articles, newsletters and Internet homepages of healthcare organizations and local and regional authorities.

The analytical framework was developed on the basis of the mentioned literature review in order to prepare background for data collection and further analysis of empirical information. Within the analytic framework the drivers and barriers identified in Kaliningrad were analysed from the legal, financial, social and environmental point of view. These four factors were seen as key factors influencing waste minimization in the healthcare sector.

The empirical data was collected through review of official documents and guidelines on healthcare waste handling and through in-depth semi-structured interviews in the city of Kaliningrad.

Most of the interviews were made face-to-face, in several cases telephone interviews were carried out. The topic and main questions were discussed in advance by preliminary phone calls in order to give respondent an opportunity to be prepared for the meetings.

Three interviewees among public institutions were chosen as the clinics dealing with the most risky and infectious diseases: AIDS center, tuberculosis dispensary and oncologic dispensary. Representatives of three private clinics rendering services on plastic surgery were interviewed, the choice was random. Also the officials from the Department of Environmental Protection of Kaliningrad City Hall, the Department of the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region, specialists of the companies and representative of the research institute involved in waste management. The list of interviewees as well as the questionnaire are presented in Appendix 1.

In Kaliningrad most of the interviewees were aware of waste minimization but as there is no clearly defined legal term, they are implementing waste minimization in practice according to their own understanding. That is why the interviews started from the site visits and discussions on healthcare waste management system in general. Afterwards the waste minimization issues were discussed. Sometime existing worldwide practices of waste minimization were needed to be shown as examples in order to explain what practices are of interest for this research. In general, each interview lasted about an hour and a half.

Before the analysis, the data obtained from the healthcare institutions was triangulated with the information obtained from specialists of Environmental Protection Department of the City Hall and the Department of the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region.

1.6 Terminology used in the present thesis

Taking into account numerous definitions of healthcare waste, the term “healthcare waste” used throughout this thesis covers all the wastes that could be produced in the healthcare facilities. If the need to refer to specific group of waste occurred then the classification of the World Health Organization was used. In the chapters showing the findings from Kaliningrad the classification is based on the Russian Sanitary Rules and Norms in which waste streams are classified according to the fractional composition of waste.

It should be mentioned that at the moment in Kaliningrad (as in whole Russia) there is no legally defined waste minimization term. This means that interviewees have their own perception of waste minimization practices.

1.7 Outline

The present paper consists of introduction and five chapters. Chapter 2 provides a review of existing literature on the waste minimization in the healthcare sector around the world. Identification of drivers, barriers and waste minimization strategies in the healthcare sector are of primary interest in the chapter.

Chapter 3 presents the analytical framework aimed at facilitation of empirical data collection and analysis of drivers and barriers for waste minimization in Kaliningrad healthcare institutions.

Chapter 4 contains findings: general healthcare waste management system in Kaliningrad and opportunities for waste minimization.

Chapter 5 surveys the different factors driving the healthcare waste minimization and hindering it in Kaliningrad.

Chapter 6 provides conclusions and recommendations that were given for the decision-makers and stakeholders in healthcare sector in Kaliningrad.

2 Waste minimization in healthcare sector

The main task of the present chapter is to review existing literature on the waste minimization in healthcare sector. This chapter covers the existing knowledge on classification of waste deriving from healthcare sector, legislation regulating healthcare waste management issues, general information on waste minimization and specificity of waste minimization practices in healthcare institutions, upstream and downstream practices used worldwide and the identification of drivers and barriers described in literature.

2.1 Defining healthcare waste

2.1.1 WHO classification of the waste from healthcare sector

Healthcare waste consists of all the waste streams generated by healthcare establishments, research facilities, laboratories, mortuaries and minor (scattered) sources – physician’s office, dental clinics, pharmacies and healthcare activities undertaken at home – dialysis, injections etc.

Most of the healthcare waste (75-90%) is similar to domestic (household) waste including plastic, paper, cardboard, glass, etc. This waste stream comes from administrative and housekeeping activities of establishments providing healthcare and in most cases is not in contact with patients. This general healthcare waste should be dealt with in the way as municipal waste.

The rest 10-25% of waste is considered infectious and needs to be treated and disposed of as hazardous waste due to risk that humans and environment could be exposed to. The hazardous nature of healthcare waste is due to the following characteristics: waste could be contaminated by infectious agents, contain sharps, contain hazardous chemicals or pharmaceuticals, could be genotoxic or even radioactive.

The following average rates of distribution of healthcare waste Prüss, Giroult and Rushbrook (1999) offer for preliminary waste planning:

80% - general healthcare waste that could be handled as usual domestic waste stream

15% - pathological and infectious waste

1%-sharps

3%-chemical or pharmaceutical waste

Less than 1%-special waste – radioactive or cytostatic waste, pressurized containers or broken thermometers and used batteries.

The World Health Organization classifies the above mentioned 15-25% hazardous fraction of healthcare waste into 10 waste groups: (WHO, 2006b)

Classification of healthcare waste according to WHO:

- Infectious waste
- Pathological and anatomical waste
- Hazardous pharmaceutical waste
- Hazardous chemical waste
- Waste with a high content of heavy metals
- Pressurized containers
- Sharps
- Highly infectious waste
- Genotoxic/cytotoxic waste
- Radioactive waste

1. Infectious waste

Infectious waste - all waste that potentially contains pathogens in sufficient concentration to cause diseases. Discarded materials, equipment used for the diagnosis, treatment and prevention of disease that has been in contact with body fluids (dressings, swabs, nappies, blood bag) are usually included into infectious waste stream. This category also covers liquid waste such as faeces, urine, blood, sputum or lung secretions.

2. Pathological and anatomical waste

Pathological waste - organs, tissues, body parts or fluids. Anatomical waste is included into group of pathological waste as a sub-group and consists of recognizable human or animal body parts. Following the precautionary principle, in spite of the fact that pathological waste may contain healthy body parts, it should be considered as infectious waste. Due to the same reason anatomical waste is always considered as potential infectious waste.

3. Hazardous pharmaceutical waste

Pharmaceutical waste includes expired, unused, spilt and contaminated pharmaceutical products, drugs, vaccines and discarded items as bottles, vials, connecting tubing.

4. Hazardous chemical waste

Chemical waste - discarded chemicals (solid, liquid or gaseous) could be generated during disinfecting or cleaning processes. They may be hazardous (toxic, corrosive, flammable). Use and disposal procedures are usually specified on the container. Non-explosive residues or small quantities of expired products could be treated together with infectious waste.

5. Waste with a high content of heavy metals

Waste with high contents of heavy metals (cadmium or mercury from thermometers or manometers) is potentially highly toxic. Cadmium is generated mostly during usage of batteries and mercury waste originated from dentistry's residues. Waste with heavy metals content is considered as a sub-group of chemical waste but should be treated specifically.

6. Pressurized containers

Full or emptied containers or aerosol cans with pressurized liquids, gas or powdered materials.

7. Sharps

Sharps are items that can cause cuts or puncture wounds (needles, scalpels, knives, saw, broken glass). Infected or not, they are considered as highly dangerous and potentially infectious waste. They must be segregated, packed and handled in a special way in order to ensure safety of the medical and ancillary staff.

8. Highly infectious waste

Highly infectious waste could be comprised of microbial cultures and stocks of highly infectious agents from Medical Analysis Laboratories. Body fluids of patients with highly infectious diseases are also included into this category.

9. Genotoxic/cytotoxic waste

Genotoxic waste generated from drugs generally used in oncology or radiotherapy units and faeces, vomit or urine from patients treated with cytotoxic drugs or chemicals. This type of waste has high hazardous mutagenic or cytotoxic effect and should be considered as genotoxic. In specialized oncologic hospitals, proper treatment or disposal of such waste raises serious safety problems first of all for the healthcare workers.

10. Radioactive waste

Radioactive waste includes liquids, gas and solids contaminated with radionuclides whose ionizing radiations have genotoxic effects.

Last four categories are considered as highly hazardous and require special treatment different from the rest healthcare waste treatment such as disinfection or treatment with special safety rules.

2.1.2 Definitions and terminology used worldwide

In spite of the fact that WHO developed and published documents including definition and characterization of healthcare waste, the national definitions and classifications vary significantly around the world.

The terms "medical waste", "hospital waste" and "infectious waste" have often been used interchangeably worldwide. It should be pointed out that "hospital waste" is a more broad definition and covers all wastes generated by hospitals including infectious and non-

infectious waste materials, hazardous, non-hazardous waste, chemicals (Jang, Lee, Yoon, Kim, 2006).

“Medical waste” is often considered to be “potentially” infectious subcategory of hospital waste. Jang, Lee, Yoon and Kim (2006) define medical waste as potentially infectious wastes that are generated in the diagnosis, treatment, examination, or research by general hospitals, clinics, veterinary, and research centres.

Lee, Ellenbecker, Moure-Eraso (2004), conducting research of waste streams from city hospitals, medical centres and veterinary clinics in Massachusetts in their papers use the term “medical wastes” rather than “hospital waste”. They mentioned that usually in scientific literature the infectious wastes could be referred to as “biohazardous”, “health-services hazardous”, “pathological”, “biological”, “hazardous infectious”. In the articles of the mentioned authors, “infectious wastes” is term used for defining of healthcare wastes having the potential to transmit disease and requiring proper treatment before disposal.

The same group of authors (Lee, Ellenbecker, Moure-Eraso, 2004) later offered to classify medical waste into two types: general waste and special waste. General waste is not regulated and could be called non-regulated medical waste (NRMW) and does not require special handling, treatment and disposal methods. Special waste includes chemical waste, infectious waste and radioactive waste and considered to be potentially hazardous and require waste management procedures as for regulated medical waste.

In South Korea medical waste is classified as hazardous waste and subject to hazardous waster regulations according to Korean Waste Management Act 1999. Medical waste is defined as “any solid waste that is generated by medical treatment facilities and laboratory facilities operating in a hospital setting and is considered to be potentially hazardous to health” (Jang, et al., 2006).

The waste is classified into six categories such as 1) tissues; 2) absorbent cottons; 3) discarded medical plastics; 4) pathological waste; 5) waste sharps; 6) waste mixed with infectious waste (Jang, et al., 2006).

It was found some articles dealing only with infectious waste management, in which “infectious waste” definitions also vary widely.

In Japan waste materials are classified in accordance with the Waste Disposal Law of 1970 as industrial and general-household. Infectious waste materials disposed from hospitals and clinics are defined as industrial waste, and infectious waste materials are also categorized as one type of hazardous waste material (Miyazaki and Une, 2005).

Miyazaki and Une (2005) raised a question on revision of the regulation and elaboration of clear and precise definition of infectious waste for further development of handling and treatment operations intended to protect environment and humans from infections spread.

All wastes including infectious waste disposed off from medical institutions are termed medical waste in Japan. But medical waste is not defined in the Waste Disposal Law of 2003. It is worth of mentioning that infectious waste materials in Japan are considered not recyclable (Miyazaki and Une, 2005).

For example in Saudi Arabia the infectious waste problem is caused by lack of unified definition of infectious waste that leads to overdisposal of wastes e.g. incineration in spite of the fact that single use items could be replaced by reusables (Almuneef and Memish, 2003).

Mühlich, Scherrer and Daschner (2003) carried out the comparison of infectious waste management in five different hospitals. The authors have found out that in Germany and Spain classification of infectious waste was based on contamination of materials with defined pathogens. In the United Kingdom and France the hospitals classified waste according to their source and healthcare activities within which the waste was produced.

Also categories of wastes included into European waste catalogue were discussed. There is a category of waste from hospitals envisaged in the European waste catalogue, in terms of infection prevention, does not require any special precautionary measures. It means that hospital wastes are no longer automatically categorized as requiring special treatment. “No risk healthcare waste” category was approved.

Sharp objects and cytostatic agents are separated into individual categories in the European waste catalogue. The authors consider that the definition of hospital waste is a central issue in a question of waste disposal. Assessment of real and potential risk plays very serious role for prevention of an undesirable tendency to classify all the waste as hazardous (infectious). Overestimation of potential risk while developing definitions for hospital waste could result in aggravation of the problem by the sceptical attitude of the public assuming that hospital waste always poses very high risk (Mühlich, et al., 2003).

According to A. Pönkä, A. Kaski, J. Lähdevirta (1996) adoption of uniform international guidelines is among other factors restrained by various classifications of wastes in different countries. The wastes from healthcare facilities are mostly similar to municipal waste and could be divided into two classes: recyclable and non-recyclable. Also wastes needed special treatment placed in six different groups:

- infectious waste,
- biological or anatomical waste,
- waste sharps,
- radioactive waste,
- drug waste,
- chemical waste requiring special treatment.

The authors are sure that evaluating the classification of waste from healthcare facilities in different countries is necessary to take into account risk assessment of the possibilities of pathogens to be spread in the environment, climate, socio-economic development of the country, prevalence of certain diseases, existing general waste management system and ethical and behavioural rules (Pönkä, et al., 1996).

2.2 Legislative and regulatory framework

2.2.1 International agreements and principles

Some international agreements and their principles determine the potential healthcare waste should be managed. International agreements and their underlying principles are translated into national legislation in many countries as well as practical guidelines and codes of practice at healthcare facility level (WHO, 2006).

In the case of healthcare waste the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and Stockholm Convention on Persistent Organic Pollutants should be considered in order to build effective healthcare waste system worldwide.

The Basel Convention is a global agreement, which address the problems and challenges posed by hazardous waste. Healthcare Regulated Waste is one of the groups of hazardous waste covered by the Basel Convention (Secretariat of the Basel Convention, 2006).

The key objectives of the Basel Convention include: minimization of the generation of the hazardous wastes in terms of quantity and hazardousness; disposal of hazardous waste at the most close point to the source of generation; reduction of the movement of hazardous waste.

The central goal of the Basel Convention is “environmentally sound management” (ESM), which has an aim to protect human health and the environment minimizing hazardous waste production by reasonable measures. According to the convention, “environmentally sound management” achieves this aim by applying an “integrated life-cycle approach”, which means minimization of the generation of hazardous waste and strict control from the generation of a hazardous waste to its storage, transport, treatment, reuse, recycling, recovery and final disposal (Secretariat of the Basel Convention, 2006).

The Stockholm Convention on Persistent Organic Pollutants is a global treaty to protect human health and the environment from persistent organic pollutants (POPs). POPs are chemicals that become widely distributed geographically, accumulate in the fatty tissue of living organisms and are toxic to humans and wildlife (Stockholm Convention, 2006)

The list of 12 persistent organic pollutants among others contains PCBs, dioxins and furans that could be related to issues of healthcare handling and disposal. The goals of the Stockholm Convention are to take measures in order to eliminate or reduce the release of POPs into the environment (Stockholm Convention, 2006).

According to Prüss, Giroult, Rushbrook (1999:31) the following four principles should be taken into consideration when national legislation and/or regulations dealing with hazardous waste management will be elaborated:

- Duty of Care Principle

This principle states that all the waste producing organisations have a “duty to dispose of the waste safely”. It means that the healthcare facility that generates waste has an obligation to ensure the safe treatment, transportation and disposal of its waste (Tudor, Noonan, Jenkin, 2005)

- Polluter Pays Principle

This principle stipulates that “waste producers are legally and financially responsible for the safe handling and environmentally sound disposal of the waste they produce”. If the accidental pollution occurs the healthcare facility will be liable for clean up costs. The fact that the polluters should pay for the damages they impose on the environment is seen as an incentive to produce less and segregate waste properly.

- Precautionary Principle

Following this principle “one must always assume that waste is hazardous until shown to be safe”. It is important to take all measures to prevent possible harm even if some of the “cause and effect” relationships have not been fully established scientifically (European Environmental Agency, 2001)

- Proximity Principle

This principle recommends that treatment and disposal of hazardous waste should take place at the closest possible location to the source of waste generation. It will minimize the risks for transportation activities. This principle requires community to recycle or dispose of its waste within its territorial limits as much as possible.

Also Pollution Prevention Principle should be applied to healthcare waste management (USEPA, 2005):

- Pollution Prevention Principle

The principle is based on any “practice that reduces the amount of hazardous substance, pollutant or contaminant entering any waste streams or released into the environment prior to recycling, treatment or disposal”. The principle could be applied in the healthcare institutions by using environmentally preferable purchasing, hazardous material substitution, procedure modification, inventory control, training, maintenance and good housekeeping (USEPA, 2005).

2.2.2 National law on healthcare waste management

Prüss, Giroult, Rushbrook (1999) consider that national law on healthcare waste management should cover the following issues: clear definition of hazardous healthcare waste; specification of legal obligations of health care waste producer (safe waste management procedures); requirements for record-keeping and reporting, inspection system and non-compliance procedures; “designation of courts responsible for handling disputes arising from enforcement of or noncompliance with the law”.

The activities concerning healthcare waste management should be run in the healthcare facilities in accordance with all other relevant national legislation, such as regulations dealing with: general waste management issues; influence on public health and the environment; air quality; prevention and control of infectious disease; management of radioactive materials.

2.3 Generation and composition of healthcare waste

Healthcare waste consists of many different types of materials. The characterization of volumes and composition of waste stream is an important step that should be carried out in order to develop appropriate waste management strategies. Information obtained from the surveys on waste generation should be used as a base for “identifying opportunities, setting targets for waste minimization, reuse and recycling and cost reduction” (Prüss, et al., 1999).

In general, waste generation in healthcare facilities depends upon several factors such as the size of healthcare facility, waste categorization, waste management practices used (the segregation program of the healthcare wastes), the medical activities, proportion of reusable items used and proportion of the patients treated on a day-care basis.

In middle and low-income countries the healthcare waste generation is usually lower than in high income countries. Examples of different rates of healthcare waste generation according to the national income level are shown in the table 2-1.

Table 2-1 Rates of healthcare waste generation according to the national income level

National income level	Annual waste generation(kg/head of population)
High-income countries:	
-all healthcare waste	1.1-12.0
-hazardous healthcare waste	0.4-5.5
Middle-income countries:	
-all healthcare waste	0.8-6.0
-hazardous healthcare waste	0.3-0.4
Low-income countries:	
-all healthcare waste	0.5-3.0

Source: Prüss, et al., 1999

Table 2-2 Total healthcare waste generation by region

Region	Daily waste generation (kg/bed)
North America	7-10
Western Europe	3-6
Latin America	3
Eastern Asia:	
High-income countries	2.5- 4
Middle income-countries	1.8-2.2
Eastern Europe	1.4-2
Eastern Mediterranean	1.3-3

Source: Prüss, et al., 1999

2.4 Waste minimization

In spite of the fact that the term “waste minimization” is widely used there is no definition that is commonly accepted. The attempts to clearly define this term usually restrained by difficulties in finding the particular distinction between waste minimization and prevention (Pongrácz, et al., 2004:24).

“Waste minimization is preventing and/or reducing the generation of waste at the source; improving the quality of waste generated, such as reducing the hazard, encouraging re-use, recycling and recovery”.

The following definition was agreed during the workshop of OECD in Berlin in 1996:

Illustration of the definition on the Figure 2-1 shows that waste prevention is more applicable to the product (i.e. before things become waste) while the quality improvements and recycling practices are considered as waste management measures and concerned already generated waste.

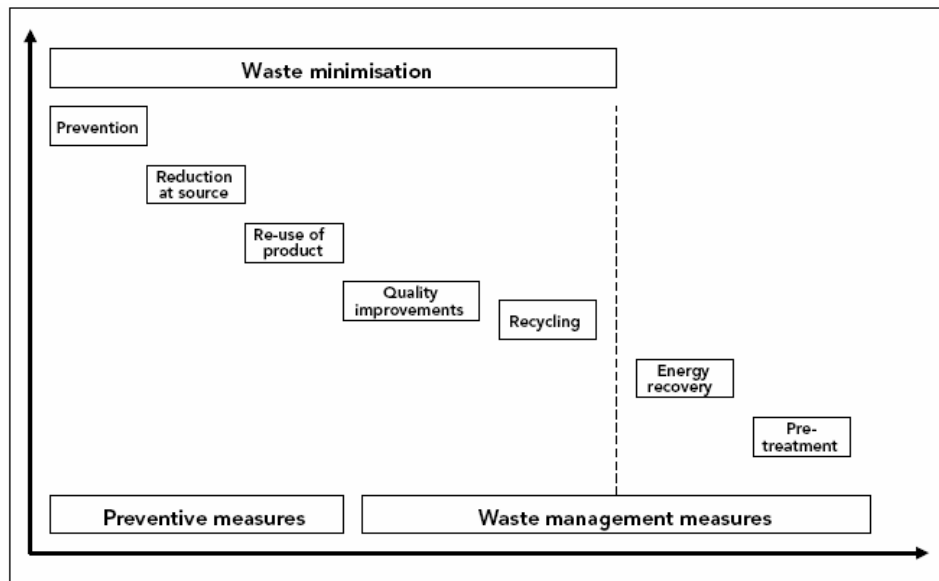


Figure 2-1 OECD working definition on waste minimization

Source: Case studies on waste minimization practices in Europe (EEA, 2002)

According to the terminological framework used in OECD, waste minimization is a broader term than the waste prevention. Not only preventative measures are included into waste minimization structure but recycling and waste incineration with energy recovery if to considered appropriate (Pongrácz, et al., 2004:24).

According to OECD (Table 2-3) waste prevention covers strict avoidance, reduction at source and product re-use, while recycling and recovery is also included in waste minimization.

Table 2-3 Waste prevention vs. waste minimization according to OECD

Waste prevention	Waste minimization
Strict avoidance	Preventing and reducing of waste
Reduction at source	Improving the quality of waste
Product re-use	Re-use
	Recycling and recovery

Source: Pongrácz, et al., 2004

Existing waste management strategies were based upon the waste management hierarchy (order of waste management alternatives). The European Council sets the hierarchy of waste management strategies in the Directive 91/156/EEC of 18 March 1991 amending Directive 75/442/EEC on Waste: waste prevention, recovery, safe disposal. However, the “old hierarchy” was applied before and still gives the following order of preferences: waste minimization; re-use; recycling; incineration; disposal.

According to (Pongrácz, et al, 2004) both of the hierarchies are considered being correct, and both concepts are applied for waste management. The new and old hierarchies are illustrated in Figure 2-2.

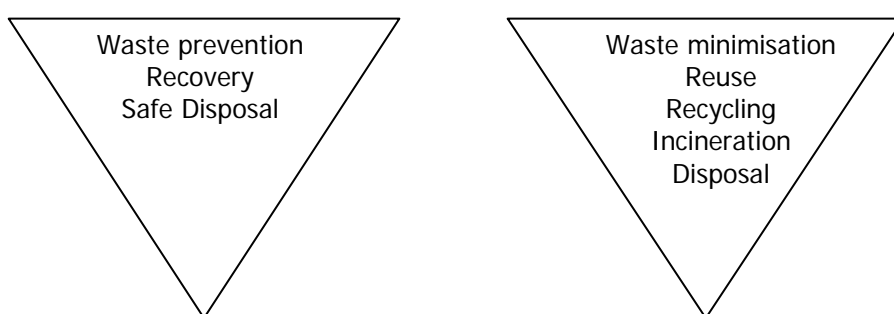


Figure 2-2 New and old waste management hierarchy

Source: Pongrácz E, et al., 2004)

According to (Pongrácz et al., 2004) the new hierarchy uses waste prevention as the most preferable option, and old one - waste minimization.

2.4.1 Hierarchy of waste minimization techniques

The following waste minimization definition is offered for healthcare sector by the Healthcare Without Harm Organization (2001):

“Waste minimization is the reduction to the greatest extent possible, of waste that is destined for ultimate disposal by means of reuse, recycling and other programs”.

The benefits of the waste minimization in healthcare institutions were stated as follows: environmental protection, enhanced occupational safety and health, cost reductions, reduced liability, regulatory compliance and improved community relations. Waste minimization techniques hierarchy was developed for healthcare waste. The hierarchy is comprised by such waste handling methods as:

- waste segregation
- source reduction (material elimination, change or product substitution, technology or process change, good operating practice, preferential purchasing)

- resource recovery and recycling
- treatment
- disposal.

Such techniques as waste segregation, source reduction, recovery and recycling will be discussed in coming sections. As *treatment* and *disposal* practices are included into the waste minimization techniques hierarchy for healthcare institutions and as this hierarchy is built not in compliance with the OECD definition of waste minimization, introduced into previous section, there is a need to discuss treatment and disposal in details.

Treatment operations, according to Healthcare Without Harm (2001:4), are operations for removing or concentration of waste that preferably should be carried out in the process and not at end-of pipe stage. The policy of Healthcare Without Harm is to apply non-incineration technologies for healthcare waste treatment such as a thermal, chemical, irradiative and biological technologies. Such methods as autoclaving and microwaving are named among the most popular thermal techniques for infectious waste treatment in the US hospitals.

Proper disposal should be undertaken only in the cases when all possible waste minimization opportunities have been exhausted. The waste should be disposed of using the method that could have the least environmental impact. Then waste could be disposed at local landfill (Healthcare Without Harm, 2001a).

2.4.2 Strategies for waste minimization in the healthcare waste institutions

Prüss, Giroult, Rushbrook (1999:58) in their book “Safe Management of waste from healthcare activities” place high emphasis on the possibilities for the significant reduction of waste generated in healthcare and research facilities. Authors suggest implementing of such policies and practices as: source reduction, use of recyclable products, application of good management and control practices and careful waste segregation. They further discuss these activities as follows:

- 1) Source reduction includes purchasing reductions such as showing preferences to less wasteful and less hazardous supplies. Other means include selection of less wasteful cleaning methods: choosing physical method instead of chemical (steam disinfection versus chemical disinfection)
- 2) Use of recyclables on site and off site. Recycling is not widely applied practice for healthcare facilities except from the recovery of silver from fixing bathes in the processing X-ray films. But the healthcare facilities could benefit from the recycling of metals, paper, glass and plastics. This leads to reduction of disposal costs or getting payments from the recycling company.

Investigation of possibilities for purchasing PVC-free plastics could contribute to recycling activities of the healthcare facilities.

A cost-effective option can be considered for health care facilities located in areas with temperate and cold climates as by way of use of heat generated by on-site incinerators for heating the premises also considered by authors.

3) Good management and control practices should be applied to the purchase and use of chemicals and pharmaceuticals. Centralised purchasing of hazardous chemicals, monitoring of chemicals flows inside the healthcare facility and careful stock management will prevent large quantities accumulation of chemicals and pharmaceuticals with expired shelf-life and foster easy and relatively cheap disposal and treatment of small amounts of residual products.

It is proposed to attract suppliers to waste minimization programmes and make them allies and responsible partners. This could be achieved by ordering products only from suppliers that provide frequent deliveries of small orders, accept returned unopened stock and offer off-site hazardous waste management facilities.

4) Careful waste segregation into different waste categories allows minimization of the quantities of hazardous waste.

Among already mentioned policies and practices Prüss, Giroult, Rushbrook (1999:59) consider possibility for safe re-use. They offer to regard such issues as reuse of medical equipment that is designed for further reuse and could be sterilized. Reusable items (such as certain sharps: scalpels, hypodermic needles, syringes, glass bottles; and containers) should be collected separately and carefully washed and sterilized. Plastic syringes and catheters should not be sterilized and only be discarded.

Karlsson and Öhman (2005) carried out the study of consumption patterns in healthcare sector and their environmental implications. As a case the Region Scania in South Sweden was chosen.

The authors investigated existing environmental strategies of the healthcare sector in order to define if their implementation could lead to a reduction in the climate impact indirectly derived from material consumption. The following internal measures to reduce the climate impact and to minimize consumption directly were offered: 1) the purchasing department should adopt environmental demands for public purchasing; 2) at the use stage the routines should be introduced that will reduce consumption and improve waste management.¹

“Green purchasing means a change in purchasing strategies leading to the consumption of more environmentally friendly products, while measures for regulating the use stage directly target consumption reduction” (Karlsson and Öhman, 2005:1073).

In their article they referred to the report “Service Sector and the Environment” in which 52 different tools that organisations could use in order to minimize their environmental impacts are introduced. These tools are divided into 5 groups:

- 1) **Input oriented tools** aimed at the reduction of environmental impacts from inputs such as demands to suppliers, training of suppliers, product substitution;

¹ According to Karlsson and Öhman - both types of measures are environmental product policy tools.

- 2) Tools for the **improvement** of the environmental performance of the organization in itself such as dematerialization, Environmental Management Systems (EMS), life cycle thinking, preventive environmental work and the training of personnel;
- 3) Tools that could be used for **evaluation** of the environmental performance of the organization, which include environmental audits, Environmental Management Systems (EMS), environmental indicators, benchmarking;
- 4) **Financial tools** : environmental insurance and environmental investments;
- 5) **Output oriented tools** dealing with the availability of information, such as environmental reporting, green labels, environmental communication.



Figure 2-3 Classification of environmental tools

Source: Karlsson and Öhman, 2005

According to the report, the healthcare sector in Sweden has applied 14 out of the 52 tools listed, which include green procurement, product substitution, supplier requirements, resource conservation, waste management, EMS, environmental auditing and others.

Concrete measures were suggested for targeting consumption in the Region Scania. These include improvement of efficiency of the use of consumables (could be achieved by using alternative products that have similar functions and less environmental and cost impacts), avoidance of unnecessary consumption, adoption of EMS routines to measure consumption quantities and consumption patterns, establishment of reduction targets and prioritization of certain product groups (Karlsson and Öhman, 2005).

In US hospitals the EMS implementation is in focus nowadays (USEPA, 2005). EMS represents new and systematic approach for achievement of effective organizational management to environmental performance through accountability, assigned responsibilities, staff involvement, environmental policies, training, corrective actions, and top-management commitment. All the constituents of the EMS should be implemented together in order to improve environmental performance of the healthcare institutions.

The EMS in hospitals challenges an organization to identify its most significant issues related to waste management and address these issues through establishment of objectives and targets. Applying pollution prevention principle in this process hospital can achieve regulatory compliance and cost savings due to reduction of waste. Economic benefit could be an internal result of such activities and outside the hospitals good relationships with community could be established (USEPA, 2005).

Kaiser, Eagan and Shaner (2001) suggest to address environmental issues proactively and to consider all the life stages of the products used in healthcare sector using upstream tactics and downstream tactics approaches. The focus on upstream activities contributes to reducing the environmental impacts of the products and services before regulatory problems occur or waste disposal cost increase.

Upstream tactics is aimed at the decreasing of environmental impacts at source (where they come from) instead of trying to solve the problem after its arising. The example of such upstream tactics is reducing mercury emissions by purchasing mercury-free thermometers. “Green” purchasing is considered to be a “promising channel” for upstream actions (Kaiser, et al., 2001).

The following constituents of “green” purchasing could be applied to upstream tactics: negotiating with product supplies, changing purchasing policy, and evaluation of medical products using tools for assessment of the environmental impact of medical products throughout the whole life cycle. The only warning existing in the case of green purchasing approach is that alternative products have to be of equal or superior clinical performance but environmental performance should be clearly shown as superior one.

The *downstream tactics* allows to improve the environmental performance and to reduce costs in the mean time. The downstream activities include operations with already generated waste: recycling programmes, waste segregation etc. Using downstream opportunities the Naples Community Hospital switched from incineration to autoclaving, decreased disposal operating costs by more than 80% and improved relationship with local community (Kaiser, et al., 2001).

Health Care Without Harm is a coalition of more than 440 organizations dedicated to the improvements in the healthcare field. Health Care Without Harm (2001b) developed steps that could be taken so as to minimize waste. It was suggested:

- 1) To establish a “Green Team” – to organize task force consisting of all employees responsible for healthcare waste management and specialists dealing with purchasing, risk management and other interested staff.
- 2) To carry out the waste audit - to take a look at all products coming to healthcare facility and leaving it in a form of recyclables, red bag waste, solid waste, food waste, laboratory chemicals, chemotherapeutic and pathological waste. It could easily happen that about 85% of the healthcare waste is non-infectious and could be treated as municipal waste.
- 3) To segregate waste carefully that will help to reduce the volume of waste, to carry out more precise assessments of waste composition and generation volumes
- 4) To educate nursing and housekeeping staff concerning how to separate waste streams
- 5) To make recycling as a priority. More than 25 materials in healthcare facilities could be recycled. It is important to collect recycling streams separately and work with waste haulers and recycling companies.

- 6) To develop purchasing practices concerning selection of reusable products rather than disposable, buying more environmentally friendly products and recyclable materials.

One of the early cases of the realization of such steps was known since 1996, when the Beth Israel Medical Center in New York City implemented an “aggressive” waste minimization plan that led to the minimization of the volume and the toxicity of the waste generated. They continue to save over 600 000 USD a year due to this initiative (Healthcare Without Harm, 2001b).

The examples given in literature revealed that significant results of waste minimization application to infectious waste can be achieved. It is not possible to prevent its generation but it is feasible to implement proper segregation at place that could bring up to a 25% of amount reduction. The European website of *Healthcare Without Harm* organization presented experience of waste minimization in clinics of Polish cities – Wolomin and Krakow. In these cases in both waste reduction programmes the ideas on waste classification improvement and separate collection of secondary materials were implemented. The reduction of infectious waste was estimated as by 16 tonnes in Wolomin and 11 tonnes in Krakow. The annual savings on disposal costs achieved by implementation of these programmes were 11 400 and 7 892 Euro respectively (Healthcare Without Harm, 2001).

2.5 Identifying drivers and barriers for healthcare waste minimization

2.5.1 Drivers

The US National Association of Physicians for Environment (NAPE) investigated incentives for improving the minimization and management waste deriving from the biomedical research at the National Institutes of Health in Bethesda, Maryland. The authors revealed the strong incentives for improving waste minimization and management in research facilities (Rau, et al., 2000):

- 1) ***Reduction of institutional health and safety hazards***

The need for reduction of potential exposure of the personnel, patients and waste management staff to safety, fire and different health hazards involved in waste management operations is emphasized. Different waste minimization practices and improvements of the waste management steps for reduction of toxicity, volume and prompt removal of hazardous materials from the working places were discussed.

- 2) ***Environmental protection***

Pollution prevention is regarded as a strategy to avoid *primary* impacts on environment due to uncontrolled releases of waste into environment and improper treatment of waste before disposal; and *secondary* impacts deriving from transportation, recycling and treatment.

- 3) ***Regulatory compliance***

In USA all the aspects of the waste management from “cradle to grave” (starting from the identification and labelling and finishing with the disposal of waste) is intensely regulated by a complex framework of Federal, state, regional and local laws, licences and permits.

Recently academic and research institutions dealing with the healthcare waste have been the targets for the EPA and state agencies in their efforts for the enforcement of the existing legislation.

The system of the penalties levying is developed against the facilities and even individuals for non-compliance. The legal acts providing the general mandates for pollution prevention and waste minimization were enacted. Among them are Solid Waste Management Act 1965, as amended by the Resource Conservation and Recovery Act of 1976 (RCRA), and the Pollution Prevention Act of 1990 all of which require the development the strategies for waste minimization. The Federal biomedical research programmes are regulated by executive orders requiring pollution prevention programmes establishment; waste reduction goals setting and recyclables use.

4) *Liability avoidance*

Potentially the generator of wastes in US never escapes the liability that could be joint or several. Both short-term and long-term liability is stipulated for producers of all types of waste but the most significant is for hazardous and radioactive waste generation. Liability for incurring the costs for remediation of environment being damaged by waste could be catastrophic.

5) *Disposal cost avoidance*

Costs for the management and disposal of waste occurring during the research programmes could consume a significant amount of the research funds. Unit costs for treatment and disposal of biomedical regulated waste are much higher than for conventional waste. That is why for many institutions the intention to avoid such costs is supported by the implementation of minimization programmes.

6) *Community relations*

Any waste management issues are of potential interest and concern for local public. The research institutions having the waste minimization programmes and providing local citizens with information on how these programmes are well managed, could avoid misperceptions and lack of confidence about the research facilities and their activities from the side of the public.

7) *Value of laboratory waste as a teaching tool*

In research facilities waste generated in small quantity is seen as a good incentive to teach researchers to how to deal with different groups of waste in order to prevent products and waste of the biomedical research being major sources of pollution.

Tudor, Noonan and Jenkin (2005:610) in the article showing the case study from the National Health Service in Cornwall, UK defined the main drivers that led to changes in attitude towards waste:

- 1) Loss of Crown Immunity in 1990 that result in requirement imposed on site (healthcare institutions) for segregation of their household and clinical waste ;

- 2) The introduction of the principle of “Duty of Care” that imposed on waste producers the obligation to guarantee the safe treatment, transportation and disposal of their waste;
- 3) Reinforcement of legislation and policies regulating general waste management. Among others the attention should be paid to the EU Landfill Directive (1999) which require Member states to reduce the amount of biodegradable waste disposed at landfill, the Special/Hazardous Waste Incineration and Pollution Prevention Control Regulations, the Proximity Principle and Producer Responsibility which govern the waste management operation from generation up till final disposal’
- 4) Public apprehensions and anxiety of the spread of such “multiple resistant” Staphylococcus aureus and Creutzfeldt-Jakob Disease (CJD) and Bovine Spongiform Encephalopathy (BSE);
- 5) Media reporting on improper clinical waste disposal and health hazards connected to such actions;
- 6) The overall Sustainable Development Strategy of the UK Government which applies to all departments. Department of Health needs to meet performance indicators and targets;
- 7) The increased costs for waste disposal that is the result of the closing down of the several on-site clinical incinerators. Disposal of clinical waste costs five-six times the cost of domestic waste collected.

2.5.2 Barriers

During the Cornwall case study (Tudor, et al., 2005) several barriers for recycling and re-use activities were identified. Some of the most typical barriers revealed were falling into two main categories:

1) Social:

- A perception that all the wastes generated in the healthcare institutions are infected
- Habits of staff and their acceptance of waste issues in changing
- Lack of participation among staff due to impression that waste is someone else’s responsibility

2) Economic:

- Lack of viable markets for recyclables in the area of the case study (South-West of the UK)
- Some of the items that could be recycled or reused were infected or contaminated that makes it unprofitable for recycling

- Lack of long-term investment for the waste management in the National Health Service.

Two behavioural patterns having negative environmental impact were found by Karlsson and Öhman (2005) during the fieldwork at healthcare institutions of the Region Scania (Sweden).

The first pattern could be classified as *lack of thinking that the consumption process could be improved due to housekeeping measures and can have potential savings*: Waste plastic bags and hazardous waste containers are seldom filled to maximum capacity that shows that Region Scania uses twice more than what is necessary.

The second pattern revealed that the staff is throwing regular waste into the containers intended for hazardous waste. That is caused by the *“misinformation, proximity of the containers or risk aversion”*.

Some barriers were identified by Lee (2002:467) as main hindrances for medical plastic waste recycling programmes implementation at healthcare institutions: the first problem for the development of the recycling programmes is a risk of transmitting infections, the second obstacle is improper or very broad classification of medical waste.

2.6 Changing environmental behaviour

The survey on public perception of municipal solid waste and recycling was carried out in England and Wales by the Environmental Agency in 2002 (Azapagic, et al., 2004:152) the problem with waste minimization and recycling strategies failed the aim of significant reduction of solid waste because of lack of public participation and lack of recycling facilities.

The general features of public perception of waste were the following: people were familiar in general with the idea of waste minimization and recycling but were claiming that they do not have enough time to sort waste and do not have easier means for waste separation. The simple waste streams as paper and glass were sorted easily; uncertainties were seen when separating chemicals and other difficult products. The considerations on the purchasing of more durable products and mending the broken possessions were “economy driven - not conscience driven”. In the case of purchasing any items economising “triumphs” over environmental responsibilities even environmentally well-educated and responsible people.

The issue of environmental culture from the simple expression became a new concept (Asafova, 2002). In Russia the concept of environmental culture is developed especially for training of students of non-environmental specialities. According to E. Asafova, the environmental culture consists of three main components, one of which is environmental convictions, values related to environment and environmental protection and certain responsibility that the person is ready to accept. Environmental education or knowledge and practical skills determine the third component – environmental behaviour and participation in environmental activities. This concept is illustrated by the figure 2-4.

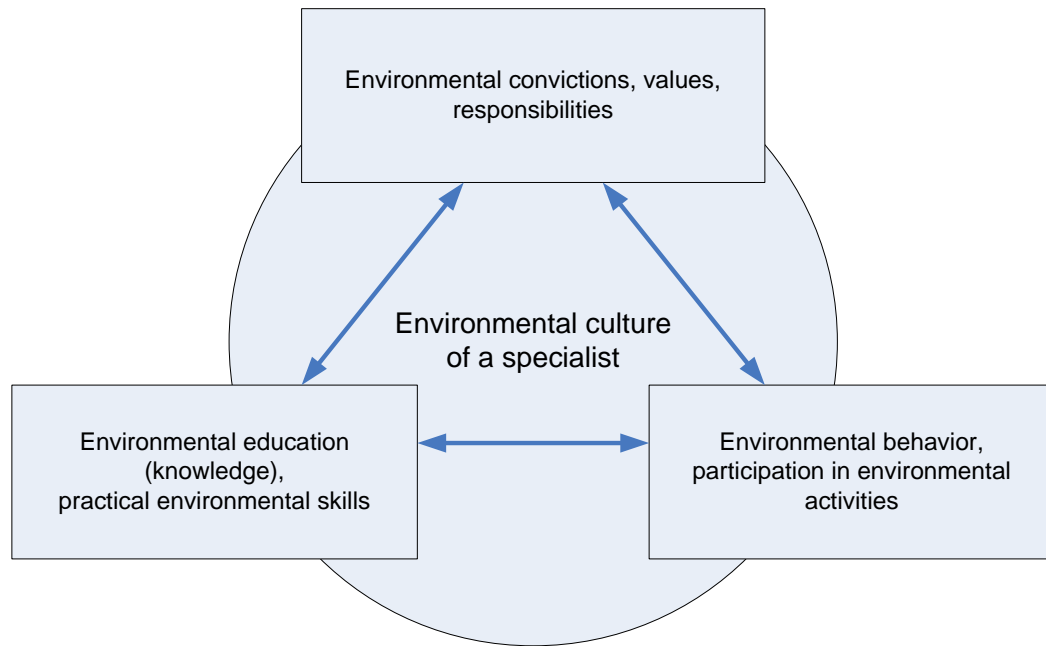


Figure 2-4 The structure of the environmental culture of a specialist

Source: Adapted from Asafova (2002)

In the case of waste minimization in the healthcare sector the concept of environmental culture could be implemented in order to overcome the mentioned social barriers.

Another way of dealing with environmental problems in institutions occurred because of behavioural and perception-related barriers is to address them through programmes for behavioural change. A model was produced by Geller, Needleman and Randall in 1990 (Sjöden, 1990:85). The model should be applied when assessing programmes aimed at immediate change of behaviour.

The five factors were identified in this model as being central for immediate effect of the mentioned interventional programme:

- transfer of specific behavioural information for providing the understanding how the behaviour should be performed
- the degree of individual involvement which is determined by the number of people activated by the programme
- the degree of external control provided by the programme. External factors controlling behaviour should be developed as for positive consequences of the behaviour and for negatives ones deriving from undesirable actions
- the extent of the social support encouraged by the programme. The programme should enable the personnel to set targets or benefit from changes in their behaviour.
- the individual participant's perception on his own ability to influence.

3 Analytical Framework

The analytical framework that is used in the present thesis is based on the literature review carried out prior to the collection of data. The framework is developed with two purposes:

- to define what kind of information should be found in order to answer research question;
- to decide how we will treat and analyse the data obtained from the empirical studies.

As stated in the Chapter 2 waste minimization is promoted by a number of drivers and restrained by a variety of barriers. Since the activities of the healthcare sector are similar in all countries it is assumed that the factors identified are also relevant for Kaliningrad. All of them were found in literature dedicated to waste minimization in healthcare sector that gives a certain background to consider that these factors could be typical for application to current situation of Kaliningrad.

The drivers and barriers will be analysed under four main factors that could be seen as key areas for the changes towards waste minimization, which should lead to the improved performance of environmental indicators of the healthcare system.

The viewpoints that should help to systematize and carry out analysis of drivers and barriers for the waste minimization in medical sector are the following:

- 1) **Legislative factors** analysis will be carried out to check if existing legislation addresses waste minimization
 - examine the definitions for healthcare waste in the existing legislative base
 - examine if there is legal background for prescription of the responsibilities and organization of staff structure in such a way that waste minimization issues could be prioritized
- 2) **Economic factors** investigation should cover:
 - *internal* financial issues such as financial incentives for the staff dealing with waste management, and availability of financial resources sufficient for implementing waste minimization activities (funds for technological and operational activities)
 - *external* financial issues dealing mostly with healthcare management and waste management such as investments into waste management sector, financing of the healthcare waste management activities.
- 3) **Social factors** - factors that dealing with
 - *public perception* of healthcare waste management and waste minimization
 - *behavioural issues* inside the healthcare institutions.

4) **Environmental and technical factors** – issues that according to their aspects are related to environmental and technical issues and somehow affect waste minimization activities implementation in the healthcare sector.

The analysis should bring us to the strategies, resources and actors to be involved into successful waste minimization process within the healthcare sector in Kaliningrad.

4 Opportunities for waste minimization in the healthcare sector of Kaliningrad city

The present chapter shows the information that was collected in Kaliningrad. The findings include general description of the healthcare system in Kaliningrad; the section on the healthcare waste management in Kaliningrad medical institutions which covers issues on healthcare waste generation, main waste management operations in healthcare facilities, and opportunities for waste minimization.

4.1 Healthcare system in the city of Kaliningrad

Kaliningrad, until 1946 – Königsberg, is the centre of the Kaliningrad region of the Russian Federation.

Kaliningrad Region is located on the southeast coast of the Baltic Sea. With an area of 15,100 km², it is the smallest region of the Russian Federation. The region is the Russian enclave due to its unusual geographic location, being entirely cut off from the rest of Russia by Lithuania and Poland (Kommersant, 2006).

Kaliningrad Region has population of 955,300 people. There are 426,000 inhabitants in the city of Kaliningrad. Kaliningrad region has the advanced industrial - transport potential and a network of highways.

Kaliningrad region has a status of Special Economic Zone which creates favourable economic climate for the development of the region.



Figure 4-1 Kaliningrad region and the city of Kaliningrad

Source: *Learn Russian in Russia*, 2006

The most developed industries in the region (Kommersant, 2006) are the fishing industry (catching and processing), engineering and metalworking, pulp and paper, coke, and mineral production: oil, amber, coal, and peat (Kaliningrad Region Government, 2006).

Kaliningrad city has a total of 49 public healthcare establishments with municipal or regional financing. There are 14 regional healthcare institutions rendering medical services in such

areas as general therapy, pediatrics, war veterans' rehabilitation and services on diagnostics, treatment and prevention of tuberculosis, oncologic and dermatovenerologic diseases, AIDS in Kaliningrad. Also the regional clinics are dealing with issues of family planning and reproduction, dental care, mental diseases and narcologic addictions treatment. Not only inhabitants from Kaliningrad but patients of the whole Kaliningrad region (residents of 21 municipalities including more than 400 thousand inhabitants) receive medical care services in the regional center (Kaliningrad Clinical Waste Project, 2005)

Municipal healthcare establishments are represented mostly by hospitals and polyclinics providing adults and children with more generalized medical services. Three federal institutions were established in order to provide numerous employees of several different branches (transport, fishing industry etc.) with healthcare services. The titles, showing specializations of these institutions, their subordination to different authorities and number of visits for polyclinics and number of beds for hospitals are presented in Appendix 2.

There are numerous amounts of private clinics in Kaliningrad: about 69 dental care clinics and approximately 70 therapeutic, family planning and plastic surgery institutions.

4.1.1 General administration and organization of healthcare services

The following authorities are governing the activities of the healthcare institutions in the city of Kaliningrad²

- Healthcare Ministry of Kaliningrad Region
- Healthcare Department of the City Hall
- District Administrations of the Kaliningrad City
- Ministry of Defense of the Russian Federation
- Department of the Interior of Kaliningrad region
- Department of the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region
- Other state and private bodies

The main roles of Healthcare Ministry of Kaliningrad region, Healthcare Department of City Hall, District Administration of Kaliningrad City, Ministry of Defense of the Russian Federation, Department of the Interior of Kaliningrad region in the waste management in the healthcare facilities are the following (Kaliningrad Clinical Waste Project, 2005):

² Personal interview with Svetlana Chernukha, specialist of Environmental Protection Department of the Kaliningrad City Hall

- Development of budgets for the healthcare institutions including expenditures on waste collection;
- Provision of institutions with legislative and statutory documents;
- Organization of training and certification of healthcare institutions specialists on hazardous clinical waste handling.

The same responsibilities on development the waste handling capacity are prescribed to the top management of the private institutions.

Medical institutions are financed from federal, regional, municipal and private budgets depending on their subordination. Thirteen largest municipal medical institutions are financed directly by the Healthcare Department of the City Hall. All other public healthcare institutions are financed by District Administrations of the city.

In the municipal budget some expense items (expenditure articles) are foreseen for municipal healthcare institutions. Such items include staff salaries; expenses for healthcare activities; food; equipment; capital repairs, running costs. Classification of the federal budget supposes that the item “running costs” includes sub-item “maintenance of premises” which covers expenses on collection and transportation of healthcare waste. Healthcare institutions as legal entities need to pay themselves for the services provided by contractors (such as municipal unitary enterprise “Chistota” (Cleanness) dealing with transportation and disposal of municipal solid waste).

Every year drawing up the budget the Healthcare Department of the Kaliningrad City Hall calculates expenditures for the collection, transportation and neutralization of healthcare waste in the framework of the budget article “running costs”.³ It was observed that there is a budget deficit in medical institutions.

Private clinics cover expenses on inventory provision as well as on collection and transportation of clinical waste from their own budgets.

At present healthcare establishments are free to take decisions on the waste management issues themselves.

Department of the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region coordinates and supervises the development and implementation of following documents by all medical establishments situated on the territory of the city:

- The instructions specifying the rules on waste handling and the personal responsibility of employees;
- Schemes of waste collection including information about waste fractures, places for

³In 2003 the municipal medical institutions calculated annual consumption of packages and containers for collection of clinical waste inside the institutions. This information was provided to the Healthcare Department and was incorporated into the budget of the year 2004.

tanks and containers, places for temporary waste storage, expenses on waste collection, transportation and removal;

- The medical institution's compliance with the sanitary norms and rules on collection, transportation and neutralization of the healthcare waste.

4.2 Current healthcare waste management system in Kaliningrad

4.2.1 Legislative and regulatory framework for healthcare waste management and waste minimization

The Russian Federation ratified the Basel Convention in 1994. The list of hazardous waste within the Convention starts with the Healthcare Regulated Waste, but in the Russian legislative system this term appeared only in 1999 after the adoption of the Federal Law "On waste of production and consumption". Until 1999 waste disposal from the medical institutions in Russia was carried out in compliance with the statutory acts regulating household waste handling and acts dealing with the activities of healthcare institutions.

Existing legal documents underwent serious changes and starting from 1999 the healthcare waste management system developed in Russia is based on international standards and rules which means that the waste minimization issue is included into waste management strategies for the healthcare sector.

A chronological list of the most important laws regulating generation, handling and disposal of the healthcare waste in Kaliningrad is given in the Appendix 3.

Below the laws and norms directly stating the need for waste minimization practices implementation are reviewed, some of the documents listed cover source separation, economic instruments regulating the waste minimization issues and licensing of activities connected to the hazardous waste handling.

The basic law for the waste management in Russia is the Federal law "On wastes of production and consumption" N 89 of 24.06.1998 which is governing handling of industrial, household and set as equal to them healthcare waste.

The present law defines the responsibilities of the Russian Federation on the waste handling as providing economic, social and legislative conditions for the most effective way of waste recycling and waste minimization at source.

Main principles of economic regulation of waste handling procedures such as minimization of waste and promotion recycling activities, requiring payment disposal of waste and giving economic incentives for the companies involved into waste handling activities are stated in this Federal law.

There is a regional law governing waste management in Kaliningrad region. At the moment the law of Kaliningrad region "On wastes of production and consumption" N 108 dated 10.01.1999; is under revision. The analysis of the draft version revealed that the law includes the issues on the waste minimization in the region as prioritized ones. The law states the main principles of waste policy in Kaliningrad region including waste minimization issues implementation of low-waste technologies and other activities aimed at waste minimization

and recycling of waste. The definitions of healthcare waste and biological waste are included into the draft version of the law.

The Sanitary Rules and Norms 2.1.7.728-99 “The rules of waste collection, keeping and removal for medical establishments (healthcare waste)”. In accordance with these rules, all healthcare waste is divided into five categories (see Section 4.2.2).

This document states new requirements result in considerable changes in strategic approaches to waste management issues at regional levels; intensification of the responsibilities of the healthcare institution in the issues of infectious diseases prevention, proper source separation and application of modern and effective technologies for recycling activities (Zueva, 2003).

The Decree of the Chief Sanitary Physician (Inspector) in Kaliningrad region “On the collection, keeping and removal of the healthcare waste in Kaliningrad” N1958 of 15.08.2005 regulates healthcare waste management issues at municipal level.

The document stipulates obligatory measures for proper healthcare waste management needed to be taken by all the healthcare institutions. The measures are the following:

- development of organizational and technical conditions for the development of waste management system in the healthcare institutions in compliance with Sanitary Rules and Norms;
- carrying out qualitative and quantitative analysis of waste generated;
- evaluation of the needs in sanitary hygienic equipment and consumables include this information into budget of the institution and to provide this information to the Healthcare Ministry of the Kaliningrad region;
- organization of the training followed by the certification for the staff dealing with the healthcare waste

All these measures could be considered as prerequisites for the further waste minimization steps implementation.

Decree of the Mayor of Kaliningrad “On the establishment of the hazardous waste management system in the city of Kaliningrad” N 706 of 05.04.06. In accordance with this document – the Clinical Waste Management Center with the unit for high-temperature incineration of healthcare waste is established in the Multi-Field Hospital.

The Coordination Board consisting from representatives of different authorities (Department of the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region and Kaliningrad City Hall) is a body responsible for interactions between authorities and healthcare institutions. Also the decree requires that biological waste, bandaging material and needles from state or private medical institutions should be utilized in the Center or another licensed provider of such a service. Specialized vehicle of the Center should transport hazardous waste from the producer to the incinerator.

According to the Federal law “On sanitary and epidemiological welfare of the population”, Federal and Regional Codes “On administrative violations” those officials who violated sanitary rules incur disciplinary, administrative and criminal liability. (Non-compliance to existing rules could be result in closure of private establishments, withdrawal of license for healthcare activities and imposed administrative liability and even criminal liability to both public and private organization).

4.2.2 Definition and classification of healthcare waste

According to the Sanitary Rules and Norms 2.1.7.728-99 “The rules of waste collection, keeping and removal of waste in medical and prophylactic institutions”:

Healthcare waste is all types of waste generated in hospitals (municipal, clinical, specialized, departmental, included into scientific research or educational institutions), polyclinics (adult and pediatric, dental), dispensaries, emergency stations; hemotransfusion stations; institutions for protracted course of therapy; healthcare research institutes and educational institutions; veterinary clinics, pharmaceutical industries, health-improving institutions (sanatorium, preventorium, holiday centres); sanitary and prophylactic institutions; forensic medical examination institutions; medical laboratories (anatomic, pathologoanatomic, biochemical, microbiological, physiological); private healthcare institutions.

All the healthcare waste is divided into 5 categories depending on the level of epidemiological, toxicological and radiological hazard:

Category A (1) – Non-hazardous waste

Category B (2) – Hazardous waste

Category C (3) – Abnormally hazardous waste

Category D (4) – Waste similar to industrial waste on its composition

Category E (5) – Radioactive waste

The description of the waste could be included into every category is shown in the table 4-1.

Table 4-1 Waste Categorization according to hazarousness

Category A (1) – Non-hazardous waste	Waste which is not in contact with biological fluids of patients and infected patients, non-toxic waste Food waste of all departments of medical and prophylactic institutions (except infectious, dermatovenerologic and tuberculous ones) Furniture, implements, broken diagnostic equipment free from any toxic elements Not-infected paper, sweeps, construction waste
Category B (2) – Hazardous waste	Potentially infected waste Materials and instruments contaminated with different fluids including blood Patients’ excretions Pathologoanatomic waste Surgical waste (organs, tissues, etc.)

	All the waste generated in infectious departments including food waste Waste of microbiological laboratories dealing with pathogenic microorganisms of categories 3-4 Biological waste of vivariums
Category C (3) – Abnormally hazardous waste	Materials being in contact with patients, suffering from abnormally hazardous infections Waste of laboratories dealing with pathogenic microorganisms of categories 1-2 Waste of tuberculosis and mycological hospitals Waste from patients suffering from anaerobic infections
Category D (4) – Waste similar to industrial waste on its composition	Expired pharmaceuticals Waste of medical and diagnostic products, expired disinfectant agents Cytostatics and other chemicals Mercury containing devices and equipment
Category E (5) – Radioactive waste	All types of waste containing radioactive components

Source: *The Sanitary Rules and Norms 2.1.7.728-99 “The rules of waste collection, keeping and removal of waste in medical and prophylactic institutions”*

Distribution of the healthcare waste depending on the sources of its generation in medical institutions is shown in Table 4-2 “Sources of the healthcare waste in medical institutions”

Table 4-2 Sources of healthcare waste generation in medical institutions

Hospital department including infectious one	Polymeric materials, metal, glass, chemical waste, food waste, mercury, paper, household waste, bandaging materials
Admission department	Biological waste, bandaging materials, polymeric waste, metal, glass, chemical waste, mercury, X-ray films, paper, rubber, plaster bandages, household waste, laboratory waste
Operational unit (dressing ward and small operating room)	Biochemical waste, bandaging materials, polymeric waste, metal, glass, chemical waste, mercury, X-ray films, paper, rubber, plaster bandages, household waste, laboratory waste
Resuscitation and intensive care department	Bandaging materials, polymeric waste, metal, glass, chemical waste, food waste, mercury, X-ray films, paper, rubber, household waste
Hemodialysis ward	Polymeric waste, metal, glass, paper, rubber, household waste, bandaging materials
Department of functional diagnostics	Metal, mercury, paper, household waste
Endomorphism ward	Bandaging materials, polymeric waste, metal, glass, chemical waste, food waste, mercury, paper, rubber, household waste
Physiotherapy ward	Metal, chemical waste, mercury, paper, rubber, household waste
Occupational therapy ward	Paper, household waste, mercury
Radiological department	Polymeric waste, metal, glass, chemical waste, mercury, paper, rubber, household waste
Laboratory of radionuclide diagnostics	Metal, glass, laboratory waste, chemical waste, radioactive waste, mercury, paper, rubber, household waste

X-ray department	Metal, glass, X-ray films, paper, rubber, household waste, polymeric waste
Specialized treatment ward	Polymeric waste, bandaging materials, metal, chemical waste, mercury, paper, household waste, glass
Clinic diagnostic laboratory	Polymeric waste, metal, chemical waste, mercury, paper, rubber, household waste, bandaging materials
Pathologoanatomic department	Biological waste, polymeric waste, metal, glass, laboratory waste, mercury, paper, rubber, household waste, films, X-ray films, bandaging materials
Blood transfusion ward	Bandaging materials, polymeric waste, metal, glass, laboratory waste, chemical waste, mercury, paper, rubber, household waste
Emergency ward	Bandaging materials, polymeric waste, metal, glass, chemical waste, mercury, paper, rubber, household waste
Centralized autoclave room	Metal, glass, chemical waste, mercury, paper, rubber, household waste
Drug store	Polymeric waste, metal, glass, chemical waste, mercury, paper, rubber, wood, household waste
Laundry	Chemical waste, mercury, paper, rubber, household waste
Disinfection department	Metal, glass, chemical waste, paper, rubber, household waste
Administrative and utility modules	Metal, glass, chemical waste, food waste, mercury, paper, rubber, wood, household waste
Storage rooms	Metal, glass, chemical waste, mercury, paper, wood, household waste
Vivariums	Biological waste, polymeric waste, metal, glass, laboratory waste, chemical waste, mercury, paper, rubber, household waste, films, X-ray films, bandaging materials, substrates and feed for laboratory animals, wood

Source: Akimkin, 2003 and Kaliningrad Clinical Waste Project, 2005

The healthcare institutions can generate up to 16 different fractions of waste. Most of these fractions could belong to different categories of hazard that makes the system of waste collection and removal quite complicated.

4.2.3 Generation and composition of healthcare waste in Kaliningrad

Total amount of healthcare waste in public medical institutions of Kaliningrad are submitted in table 4-4

Table 4-3 The fractions of wastes and their amount generated by the healthcare institutions located to Kaliningrad city in 2005

Fractions of waste	Amount of healthcare waste in medical institutions in Kaliningrad, tonnes/year	
	Total	Including hazardous
1. Biological waste	9.48	9.48
2. Bandaging materials	81.07	81.07
3. Polymeric waste	68.67	68.67
4. Metal	14.20	11.85
5. Glass	77.60	49.00
6. Laboratory infectious waste	12.10	12.10
7.1. Disinfectants	2617.00	8.61

Fractions of waste	Amount of healthcare waste in medical institutions in Kaliningrad, tonnes/year	
	Total	Including hazardous
7.2. Fixing solution	8.39	8.39
7.3. Developing solution	5.42	5.42
7.4-7.6. Other pharmaceuticals	1.31	1.31
8. Food waste	273.93	44.11
9. Mercurous waste	3.27	3.27
10. X-ray films and photo films	3.32	-
11. Paper	238.40	33.30
12. Rubber	28.56	2.70
13. Plaster bandages	23.90	-
14. Substrates and feed for laboratory animals	1.50	1.50
15. Wood	26.00	0.30
16. Sweeps, constructions waste	386.11	-
Total	3880.22	341.08

Source: Kaliningrad Clinical Waste Project, 2005

4.2.4 Healthcare waste collection, separation and neutralization, temporary storage and in-site transportation

The collection of healthcare waste is carried out at the sources of its generation (in medical wards) according to the classes of danger into color⁴ coded plastic bags and containers which is the most appropriate way to identify different categories of the waste⁵.

- *Category “A”*

“A” category waste is collected into white reusable tanks or single use plastic bags. Then the bags located on the special wheeled trolley or inside the reusable tanks (also put on a trolley) are transported and unloaded into the container used for the collection of the waste of the “A” category. The tanks should be cleaned and disinfected afterwards.

- *Category “B”*

“B” category waste after the disinfection is collected into air proof single use packages. Soft packing material (single use yellow colored plastic bags) is usually fastened to the trolley. Then the nursing or clinical staff ensures that the bag is about three-quarter full and tightly closes or seal the bag. Biological waste (arising from operating room, laboratories and

⁴ Lack of packaging material result in use of ordinary but durable plastic bags and plastic buckets which is allowed by Sanitary norms.

⁵ This subchapter is written on the base of the information from the personal interview with Svetlana Scheptseva, specialist of the Sanitary Inspection Department of the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region

microbiological strains, dangerous viral material etc) is accumulated into rigid air and water proof yellow single use tank. Disinfected sharps exposed to disinfection are collected separately into the rigid single use package which is hermetically sealed after filling. Then the packages are placed into container for “B” category waste. All the single use bags and tanks usually carry the mark “Hazardous waste. Category “B”, code of the medical institution department, title of the institution and date and the name of the responsible person.

- *Category “C”*

The entire waste category “C” first of all is exposed to the disinfection. Single use packaging material are used for collection. The soft packaging - red plastic bags are attached to trolleys. When the package is filled for $\frac{3}{4}$, the nursing or clinical staff is hermetically seal it, meeting the requirements of the safety rules for pathogenic agents of the I and II group. Vaccines, microbiological cultures and strains are gathered into rigid red package. All the single use bags and tanks usually are marked with title “Abnormally hazardous waste. Category “C”, code of the medical institution department, title of the institution, date and the name of the responsible person.

- *Category “D”*

“D” category waste such as discarded luminescent lamps and mercury containing equipment is collected into hermetically sealed tanks and stored in special rooms.

- *Category “E”*

“E” category waste is collected according to norms and rules for dealing with the radioactive substances etc.

Biological waste, disposable syringes, needles, dressing materials (only in Multi-Field Hospital), mercurious waste, X-ray films and fixing solutions are collected separately. Other fractions after disinfection are collected in reusable containers or disposable bags without marking. The waste is separated into fractions in the places of its generation (treatment, dressing and preoperational rooms) as well as in sanitary rooms/toilets.

“B” and “C” wastes are disinfected before being collected into single use packages. Disinfection is carried out by immersing waste into the special tank with disinfecting solution.

Temporary storage of collected waste is in separate containers on the territory of medical and prophylactic institutions (special room for collection of waste, open paved platform).

Transportation of the waste from the source of its generation to the places of temporary storage is carried out with trolleys and is the responsibility of nurse assistants. The chief nurse of the department is controlling how they fulfilled their functions.

4.2.5 Off-site transportation

The waste which has to be recycled is transported by the trucks of processing enterprises.

Clinical waste which is not collected separately is accumulated in the containers of municipal enterprise “Chistota” (Cleanness). Then the containers are transported by the trucks of this enterprise to the municipal dumpsite together with other household waste.

At the moment hazardous waste intended to be incinerated in the Clinical Waste Management Center (see the forthcoming subchapter) are transported using transport of the medical institution waste generator but in the nearest future (during several months) specialized transport will be used.

4.2.6 The prehistory of the centralized healthcare waste incineration system establishment⁶

Two years ago Kaliningrad was chosen as a city for the pilot project called Clinical Waste Project: New Management Scheme. This project mostly resulted in the development of the new Healthcare Waste Management System and establishment of Clinical Waste Management Centre in Kaliningrad on the basis of Multi-Field Hospital was implemented by the partners from Kaliningrad (Russia) and Aalborg (Denmark) and financed by TACIS Cross Border Cooperation Small Project Facilities. The project started in January 2004, the implementation period was 24 months.

Analysis of the situation with healthcare waste in Kaliningrad carried out by Danish experts and representatives of different Kaliningrad Authorities revealed the absence of the system for separate collection and accumulation of healthcare and their safe final disposal. In the most of the medical institutions healthcare waste was not separated properly according to the Sanitary Rules and Norms 2.1.7.728-99.

The technical capacity of the old muffle furnace⁷ was not enough for incineration of the clinical waste should be exposed to incineration. That is why most of the healthcare waste after disinfection was disposed of at the local landfill⁸ with the household waste. Only few fractions such as plastic syringes, fixing solutions, solid chemicals, and toxic waste, pharmaceuticals, food non-infected waste, and mercurous waste, X-ray and photo films were duly and safely recycled.

The Clinical Waste Management Center (CWMC) was established in Kaliningrad as part of a new Centralized Healthcare Waste Management System, which was created and promoted within the mentioned pilot project. The Center was opened on the base of the Multi-Field Hospital in order to improve sanitary and epidemiological situation in the city. The Danish experience on healthcare waste management as well as an experience of Saint-Petersburg and Irkutsk (Russia) were taken as the best practice examples. The Centre is equipped with the incinerator for centralized burning of hazardous clinical waste (biological waste, dressing materials and needles). Additionally the Centre was created with an aim to provide methodical support to healthcare establishments on clinical waste handling.

⁶Information presented in this subsection is taken from the Final Report for the Kaliningrad Clinical Waste Project provided by municipalities of Aalborg and Kaliningrad and from interviews with Kaliningrad City Hall representatives.

⁷The muffle furnace which was in operation since 1982 had capacity for incineration of 40 kg of waste per day and was not equipped with the flue gas cleaning system.

⁸The local landfill by its technical characteristics is closer to the dumpsite.

The Coordination Board with participation of representatives from the Sanitary Inspection and the City Hall and Multi-Field Hospital was established at the Center within the project and then enforced by the Mayor's Decree. The Coordination Board had aim to optimize the cooperation between medical institutions, Sanitary Inspection, Local Authorities and involved in transportation and recycling enterprises. The foundation of the Clinical Waste Management Centre in Kaliningrad and the Coordination Board allows the authorities to find out specific epidemiological and sanitary methods of clinical waste handling. It gives additional opportunity to prevent nosocomial infections spread and influence the level of morbidity of the population and to improve the environmental safety.

The Centre is financed from the municipal budget but has a right to earn some money rendering services on incineration of hazardous clinical waste and training of specialists from clinics and hospitals.

The main tasks of the Centre are:

- Incineration of three fractions of hazardous clinical waste (biological waste, dressing materials and needles) in the incinerator IN-50;
- Generating data of produced healthcare waste at the medical institutions;
- Development of short- and long-term programs on clinical waste handling;
- Development of programs and practical training, upgrading and certification of specialists on clinical waste handling;
- Organization of workshops, seminars, conferences and so on with the aim to exchange of experiences on waste handling with Russian and foreign specialists;
- Correction of waste accumulation norms depending on the profile of the healthcare institution;
- The Centre collects, analyzes and delivers information on clinical waste to the local authorities for proper development and implementation of waste management policy;
- Organization of centralized collection and safe incineration of waste;
- Development of corresponding normative documentation on clinical waste handling (dissemination of experience in Russia and abroad);
- Information and consulting services on waste handling.

4.2.7 Healthcare waste treatment and recycling initiatives

The information put in this subchapter was gathered, interviewing the healthcare institutions chief medical officers and the chief nurses, representatives of Kaliningrad City Hall Environmental Department and the Sanitary Inspection Department of the Federal

Service on the Protection of Customers and Human Welfare in the Kaliningrad region. The treatment and disposal practices were investigated for different fractions of healthcare waste.

- *Centralized incineration*

Biological waste, bandaging materials and metal needles are incinerated in the incinerator IN-50 of the Clinical Waste Management Center (CWMC). The waste is incinerated daily and incineration supposed to be carried out in two shifts 322 working days a year. The capacity of the incinerator is 20 kg of waste per hour. In these conditions it is possible to incinerate up to 0.32 tonnes of waste a day, 103.4 tonnes of waste a year. The incineration complex is produced in Russia and consists of the incinerator IN-50.02 including a combustion chamber, re-burning chamber, cyclone; dry scrubber; smoke exhauster; chimney; control and fuel systems, incinerator maintenance floor. The working temperature in the combustion chamber is about 900 °C and in the re-burning chamber is about 1150 - 1200 °C.

Natural gas is used as a fuel for burning process. Estimated annual consumption of gas is up to 26 thousand m³. The ash produced during the combustion process and after gas cleaning operations and lime after dry scrubber disposed of at municipal landfill.

Solid chemicals and expired solid pharmaceuticals are incinerated by the enterprise “Fakel” (“Torch”).

- *Disposal in landfill*

The following waste is disposed of by the municipal enterprise “Chistota” in the municipal landfill with the household waste streams:

- some polymeric waste (disinfected droppers, systems for blood transfusion);
- iron and metal scrap;
- glass;
- paper;
- food residues from infected patients;
- casts (plaster bandages);
- substrates and feed for laboratory animals;
- wood;
- sweeps and construction waste.

There is no special controlled landfill for hazardous (infectious) waste in the Kaliningrad region, moreover there is no special sector allocated for infectious waste in the area of municipal landfill.

Some private healthcare companies have contracts for household waste transportation and disposal with private company “Ilyin” and other licensed companies.

- *Discharges to a sewer*

Moderate amounts of liquid, semi - liquid or crushed solid pharmaceuticals such as vitamins, eye drops, and intravenous solutions are diluted with water and discharged into municipal sewerage system. Laboratory infectious waste after disinfection disposed of into the sewage water system.

- *Recycling*

Disposable syringes are recycled by the companies “Tonchenko” and “Baltiyskaya krovlya” (“Baltic roof”) Ltd. The plastic waste is used as additives to polymeric roofing tiles and electric products. The temperature of recycling is 200-250° C.

All other plastic wastes - droppers, systems for blood transfusion are recycled by the company “Ecoform”Ltd. The company is recycling tires and plastics into mazut (fuel oil) of high quality.

Mercurous waste including mercury thermometers, luminous and bactericidal lamps are picked up by a specialized company (“Synthesis” Ltd) and the mercury is extracted and recycled.

Since 2005 the rubber (non-infected and infected) is recycled by a new company “Ecoshina” (“Ecotire”) Ltd, producing liquid fuel.

Fixing solution, X-ray films and photo materials were picked up by a specialized joint stock company “Russian Amber”, the precious metals (silver) were extracted and used for amber jewellery production. At the moment the production process in Russian Amber is stopped and the services on collection of waste, containing precious metals are quieted for uncertain time.

- *Other ways of waste handling*

Non-infected food residues are sent to local farms for free.

4.3 Costs for healthcare waste management ⁹

4.3.1 Internal costs

Internal to the establishment costs related to the source separation and the transportation of the collected waste on-site. Direct operational costs for such consumables and equipment items are (Oven Corporation, 2006):

- plastic coloured bags with tags and locks – 5 roubles (0.15 Euro) per unit

⁹ The Euro conversion to Russian Roubles is 1 Euro is 34.19 Roubles [as by 28 August 2006]

- plastic bucket for “B” and “C” waste 2.5 l capacity – up to 25 roubles (0.73 Euro) per unit
- trolley for on-site waste bags and containers transportation – 3 600 (105.3 Euro) roubles

could be useful for the discussion of the incentives for waste minimization.

4.3.2 External costs

The following external costs paid to the contractors for the transportation, disposal and recycling were identified from the interviews with the actors involved into waste management operations in Kaliningrad.

Cost for incineration of the three types of waste: biological, bandages and needles is 123 roubles (3.59 Euro) per kg, but this service is rendered for free for the municipal healthcare institutions.¹⁰ Municipal Environmental Fund covers these expenditures of the medical establishments.

Disposable syringes bring bilateral benefits for the processing companies and the healthcare institutions. Baltiyskaya Krovlya and company Tonchenko have got plastic additives for production of tiles and electric items and there is no need for medical institutions to pay for disposal and transportation.

Since 2004 tariffs for transportation of solid household waste are regulated by a Kaliningrad City Hall only for the population. For budgetary organizations and private companies tariffs are specified by the municipal enterprise “Chistota” based on planned and estimated cost price on collection, transportation and disposal of household waste in the municipal landfill.

Budgetary healthcare institutions (municipal, regional, federal ones) as legal entities sign contracts and pay to “Chistota” for transportation and disposal of the household, disinfected potentially infected waste (which then equated to the household waste) in the municipal landfill. The tariff is 148.09 roubles (4.3 Euro) per m³ (including 18 % VAT). Private clinics pay to "Chistota" for the same services 220.07 roubles (7.05 Euro) per m³ (including 18 % VAT).¹¹

Transportation and recycling of mercurious waste is carried out by the “Synthesis” Ltd on a base of contracts and the following tariffs: luminescent lamps – 6.25 roubles (0.18 Euro) per item; bactericidal lamps – 8.70 roubles (0.25 Euro) per item and mercury thermometers – 8.70 roubles (0.25 Euro) per item. Services on recycling of mercurious waste from all the healthcare institutions except private ones are paid at the end of the year from the Regional

¹⁰ It means that federal healthcare institutions and private medical institutions need to pay 123 roubles per kg of hazardous waste. The information is obtained from the personal interview with specialist of the Environmental Department of the City Hall – Svetlana Chernukcha.

¹¹ There are separate tariffs for construction and demolition waste transportation and disposal. From the Personal interview with Maria Vershinina, chief specialist of municipal enterprise “Chistota”

Environmental Fund. To be paid by the Fund the company has to provide all the necessary reports and documentation.¹²

4.4 Alternative Decentralized Waste Management Schemes in Kaliningrad

4.4.1 The case of the Immunopathology Centre¹³

The Regional Center for Immunopathology has another legal name: Kaliningrad Regional Center for Prophylaxis and Struggle against AIDS.¹⁴ The Center renders out-patient diagnostic, therapeutical and psychological services to AIDS-patients and paid medical services to other patients.

The Center has sufficient financing from the regional budget. Also the Center has numerous partners among which local and regional authorities, local and foreign NGOs. It shows that the Center is under attention of different stakeholders and public. So the staff of the institution is struggling to have modern equipment, high quality services and implementation of good waste management practices. The institution purchases modern equipment and medical supplies that meet the requirements on safety and quality. For example in the laboratory of the Center instead of ordinary syringes and tubes for blood sampling BD Vacutainer is used. The vacuum device with the tube that allows carrying out blood sampling without contact with the blood of the patient and minimizes wasted dressing materials.

The waste management model existing in the Center could be used as a demonstration model.

The main types of waste “A” group includes office wastes such paper, cardboard and construction and demolition waste because of reparation of the building. Type “B¹⁵” waste is presented by plastics, bandaging waste textile and paper, glass, etc.; in the type “D” - only mercuruos waste such as lamps.

1) waste collection and disinfection

The hazardous waste after disinfection is collected separately into marked by color plastic bags attached to trolleys. The mercurious waste is picked up by “Synthesis” Ltd every 5 years. The needles of the plastic syringes are separated automatically into destructor where under very high temperature needles are melted.

Household waste is picked up by the municipal enterprise “Chistota”

¹² Infromation is taken from the Pilot project on Clinical waste in Kaliningrad.

¹³ Personal interview with an Epidemiologist, Assistant Head Physician of the Center of the Immunopathology Svetlana Aksenchik

¹⁴ The Center is called Immunopathologic instead of AIDS center because of the deontologic reasons.

¹⁵ No biological waste is produced in the Center

2) waste treatment

The Center has an installation “Steriflash” which is used for waste of the “B” type to be treated on-site. The installation allows moving up the waste of types “B” into waste of the “A” type. The waste is crushed in the installation and then exposed to autoclaving (sterilization by the steam and needs addition of small amount of the disinfectant). Treatment in the Steriflash installation decreases the volume of the waste up to 80%. The waste could not be identified and reused and could be recycled. The choice of such installation was driven by the composition of waste (the Steriflash should not be used for large biological waste and very coarse glass and cardboard waste).

Existing model: “*collection - on-site treatment*” (the Steriflash is an apparatus of the laundry machine size located in the building in special room) allows to avoid storage, double treatment (disinfection and treatment such as incineration), off-site transportation and *force majeure* circumstances that could be very dangerous if to take into consideration the specific character of the Center work. The installation is controlled by the specialist from the laboratory who is responsible for exploitation and records of technologic parameters keeping.

The epidemiologist of the Center is responsible for organization of the waste management issues; the chief nurse is in charge for all the practicalities. Waste planning and internal (chief nurse to the epidemiologist) and external (epidemiologist to the Department of the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region) reporting are obligatory elements of the waste management system created in the Center.

4.4.2 The case of the Oncologic Dispensary¹⁶

The Regional Oncologic Dispensary provides out-patient services and has inpatient (hospital) departments (surgery, procedure units, canteen, etc.). The Dispensary generates one and a half tonne of biological waste per year, more than one and a half tones of bandaging material, more than a tonne of polymeric waste, large amounts of glass, disinfectants, food waste and municipal household waste.

The Regional Oncologic Dispensary had a contract with the Clinical Waste Management Center (CWMC) for incineration of biological, bandaging and needles but the contract was cancelled after feasibility study carried out. The study included calculation of costs involved in waste management and cost of possible alternative solutions. Then the new waste management scheme was developed.

The biological waste after accumulation into plastic bags is kept in the 200 l barrel with formaldehyde solution. When the barrel is full the responsible chief nurse sends for municipal funeral enterprise. Then the waste from the barrel is unloaded into wooden box (coffin), transported and buried by the funeral enterprise “Alta” in the special sector of the local cemetery. This way of treatment is legal and considered as a cheaper solution in comparison with the costs of utilization in the incinerator of the Clinical Waste

¹⁶ Personal interview with the Head Physician of the Oncologic Dispensary - Dolat Geryj Dadyanov

Management Center. The rest waste streams are disposed and recycled as it is stated in the section 4.2.7.

The two case studies are given as examples of institutions seeking for better options for waste management. Both cases non-directly show that if public institutions want to reduce their costs for waste disposal they will find a solution that will meet as financial as environmental requirements.

The examples clearly show that there is a strong need to explain to the institutions management that cost reductions could be easily made if the household waste streams of the hospitals will be reduced using up-stream tactics. The issue of waste minimization promotion in Kaliningrad is considered as very important one.

4.5 Minimization opportunities for different waste streams in Kaliningrad

It should be mentioned that very few of the interviewees (with exception of specialists of the City hall environmental department and the head physician of the oncologic dispensary) came up with examples of healthcare waste minimization practices but after small explanation or giving example of foreign experience the interviewees started to expand a lot on such issues.

This example easily shows that in the healthcare sector waste minimization issues are not discussed from the environmental point of view but implemented from house-keeping and costs reduction considerations.

During interviews and site visits the following activities that could be related to waste minimization were observed:

- Centralized purchasing of chemicals allows to control the amount of chemicals (mostly disinfectants) used;
- Small deliveries of pharmaceuticals (but the driver for it is a deficit in the budget of medical institutions. Full use of pharmaceutical allows avoiding disposal costs of expired ones;
- Separate collection of plastics and rubber sent to recyclers is enforced by the possibility to decrease the weight of streams coming to the landfill and to make saving on transportation and disposal costs;
- Use of non-infected food in local farms is old and very convenient way to deal with organic waste. Composting is not widely used in Kaliningrad.

But still some waste streams such as paper, metal, glass, wood are not considered as raw materials could be recycled. All this materials are transported directly to landfill. Probably the perception that waste should be disposed anyway without seeking more economically feasible solutions leaves these materials without proper attention. Lack of recycling facilities and good – housekeeping solutions resulted in local landfill up to 240 tonnes of wasted paper derived only from budgetary institutions which “consuming” opportunities are very limited in comparison with private institutions.

5 Analysis: drivers and barriers for waste minimization in Kaliningrad healthcare institutions

The following chapter provides an overview of drivers and barriers identified and analysis of legal, financial, environmental and technical and institutional factors influencing waste minimization strategies in Kaliningrad.

5.1 Identification of drivers behind the healthcare waste minimization

There are strong incentives for improving waste minimization and management in the healthcare sector. The drivers identified in Kaliningrad and confirmed by local actors in the healthcare sector are presented here taking into account significant differences in opinions of the representatives of public and private institutions.

Interviews with head physicians, epidemiologists and specialists from local and regional authorities and private institutions and directors of private clinics resulted in the enumeration of the following drivers that could be observed in the healthcare institutions. According to the developed research framework, the drivers are classified into legal, economic, social and environmental ones.

5.1.1 Legal drivers

- Legal requirements, availability of guidelines and instructions act as drivers for waste minimization in the healthcare institutions.

Most of the interviewees mentioned that they carry out some activities such as proper separation of waste at source and separation and sending of waste streams that could be recycled, to the recycling companies. Their efforts are based on the strict rules dictated by different sanitary rules and norms and facilitated by the availability of official guidelines and instructions. This means that most interviewees are aware of legal rules and follow them.

5.1.2 Economic drivers

The economic drivers shown in this research are: willingness to avoid fines and penalties and liability costs; possibility to reduce costs incurred for the waste management; financial motives for staff (mostly for nurses) for proper fulfilment of their duties; availability of financial resources allowing to pay attention to environmental issues; possibility to work directly with suppliers contributing to application of environmental purchasing for healthcare; lack of financing for the public institutions in some cases as a driver for the centralized purchasing of small amounts of pharmaceuticals .

- Willingness to avoid fines and penalties and liability costs

The willingness to avoid fines, penalties as well as liability costs was mentioned by all the interviewees but was mostly discussed by private companies. Non-compliance is

extremely unprofitable for private institutions with whom inspecting authorities usually are very strict, because of more strict legislation and higher rates of administrative fines. Non-compliance to existing legislation and sanitary rules and norms can lead to the shutdown of the private medical institution.

- Possibility to reduce costs incurred for the waste management operations

Not all the interviewees think of the interdependency between waste minimization and costs reduction. But for several representatives of the public and private institutions to minimize waste means to decrease their costs on waste management.

- Financial motives for staff (mostly chief nurses) for proper fulfillment of their duties

Internal financial motives for staff (mostly for the nursing staff) could encourage them to fulfill responsibilities properly. This driver could be applied only to the cases of private healthcare institutions. The salaries of all the staff are much higher comparatively to the rate of salaries in for example municipal healthcare institutions. The staff fears to lose their prestigious and well-paid position.

Usually the chief physicians and chief nurses need to be trained on the issues of their area of responsibilities and to have certificates corresponding to their activity category. The training is rather expensive in Russia or abroad (Germany, Austria, Brazil)¹⁷ and usually covers among healthcare questions issues of waste management in the institutions. The trainings are paid by the private clinics so it is a strong driver to apply knowledge obtained for execution of their duties.

- Financial resources allowing to pay attention to environmental issues

Availability of financial resources allowing to pay attention to environmental issues was mentioned by the institutions with proper state financing and all the private, which does not apply to all the public clinics in Kaliningrad. As was already mentioned, availability of finances gives certain flexibility to staff of the clinics for working with waste management issues. This flexibility results in training of the staff, working on the contract base with waste management companies choosing the most appropriate way of waste handling from the point of view of services quality, environmental compliance and not from the low-price of services.

- Possibilities to work directly with suppliers

Possibility to work with suppliers directly in order to purchase products with good environmental characteristics was mentioned only by private companies. While the questions of the green purchasing and general purchasing were discussed, directors of private clinics told that 90 per cent of their suppliers are foreign companies, well-known in the market of healthcare equipment, pharmaceuticals and other products. They consider that their purchasing is much “greener” than the purchasing policy

¹⁷ According to interviews with respondents from the private clinics: Alla Gortchakovskaya, Boris Starodubchenko

could be based on Russian products and packaging. It could be important to question whether their purchasing is really related to “green” products or representatives of the company are not aware enough to prove their considerations.

- Lack of financing for the public institutions in some cases is a driver for centralized purchasing of small amounts of pharmaceuticals.

Lack of financing provided for the public institutions was named as a driver for centralized purchasing of pharmaceuticals in small amounts. This decision does not have an environmental background but the benefit of supply made in small amounts is in no necessity to dispose pharmaceutical. This fact was mentioned by representatives of the authorities and public clinics.

5.1.3 Environmental drivers

Interviews made in Kaliningrad pointed to the following environmental drivers for healthcare waste minimization: training and consultancy help of the authorities; and safety for the staff and environment. Although for the most part of interviews waste management in healthcare institutions is driven by sanitary concerns the drivers linked to environmental concerns came up in the research carried out in Kaliningrad.

- Training, consultancy help and support of local authorities

Training, consultancy help and support of Environmental Department of the City Hall and the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region was mentioned a driver for environmental decisions.

The mentioned authorities help the healthcare institutions to meet the requirements for compliance in the area of waste management. Not only trainings are organized but waste processing and recycling companies could be match made with institutions waste producers if needed (the authorities are informed on the recycling market and aware of best practices). There is a potential to increase these activities, as will be expanded in the recommendation section.

- Safety for the staff and environment

Such reasons as safety for the personnel and environment were stated by representatives of both public and private institutions. The issues of risk avoidance and environmental protection were not of priority for most of the healthcare institutions but representatives of some public and private clinics named environmental and safety reasons as very important for waste minimization.

The drivers mentioned could be regarded as forces moving the institutions to healthcare waste minimization directly or non-directly.

5.2 Barriers for waste minimization

It sounds rather unusual but most of the private clinics did not mention any barriers, their credo is “we do not have environmental or sanitary problems, because we have

enough money”, implying that they associate sanitary and environmental problems with getting into trouble with inspecting authorities.

Only in one case the head physician of a new plastic surgery clinics was anxious with the problems occurred with recycling of the waste streams and human factor. She has more than 30 years of experience and she remembers when in Soviet Union many waste streams such as glass, rubber, paper were recycled. Human factor was considered as a serious barrier for waste minimization and risk avoidance, because of lack of education, lack of orderliness in their responsibilities fulfilment etc.

On the contrary, head physicians of municipal or regional institutions could easily name problematic issues they faced with every day. This is the reason why the barriers stated only by the medical staffs of budgetary institutions, representatives of the City Hall and the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region, experts in the healthcare waste issues are listed below. The barriers are categorized as legal, financial, and social.

5.2.1 Legal barriers

The legal barriers identified in this research were related to lack of Extended Producer Responsibility applications; lack of specialists with environmental background and knowledge on waste minimization in hospitals

- No Extended Producer Responsibility principle applications aggravated by the enclave situation of the region creates a barrier for waste minimization.

Specialists dealing with recycling of healthcare waste and representatives of clinics dealing with purchasing were aware of experience of foreign countries on EPR principle and take back policies. They mentioned that Kaliningrad has specific customs regime and most of the producers are located in the mainland of Russia, so the idea of applying the EPR for several groups of products (packaging, electric and electronic device including medical ones,) is complicated. But the location of the region is not an excuse for not applying the EPR. There are some discussions on adding the EPR principles into the Russian legislation. But first, the principle should be promoted and producers should be informed on mechanisms connected to the EPR.

According to A. Kornietsky¹⁸, director of Kaliningrad Institute of Amber and Regional Resources, mentioned that the federal law on Packaging and packaging waste is under consideration since year 2002. He considers that the EPR legislation should be developed first of all for packaging. Projects within which the EPR will be applied to packaging waste could be pilot ones then the gained experience could be transferred to areas with healthcare waste that could be recycled. The EPR application to several groups of products will allow reducing the amount of waste both upstream and downstream and shifting the burden of waste management from hospitals to producer.

¹⁸ Personal interview of 24.08.2006

The head of Regional Oncologic dispensary Dolat-Geryj Dadjanov expressed his view on EPR legislation development for electric and electronic waste including medical devices. Usually clinics have large amounts of discarded equipment. During crisis years Kaliningrad region received a lot of equipment from Sweden and Germany within humanitarian aid programmes. At the moment this equipment and outdated equipment produced in Russia is changed due to new state programmes on healthcare.

- Lack of specialists with the environmental background and knowledge on waste minimization prevents hospitals from creation of capacity building for minimization practices.

Some of the chief physicians expressed their own view that waste minimization issues should be under the control of environmental specialist but source separation and handling can be done at the generation points by the medical staff. The organizational structures of the institutions should be revised because they based on regulations developed more than 25 years ago.

5.2.2 Social barriers

According to literature used to this research (Tudor, et al., 2005) the social factors influencing waste management include issues related to staff perception of waste issues and waste management activities and issues concerning environmental behaviour. The following barriers were identified while interviewing the respondents in Kaliningrad: lack of tradition for waste separation in general; health care waste handling being claimed as irrelevant responsibilities of nursing staff; different perception of waste

- Lack of tradition for waste separation in general affect waste minimization practices

Some of the chief physicians stated that they have faced with problems of source separation of healthcare waste by the nursing staff in their institutions. It took some time for nurses to get used to the system introduced in 1999 after enactment of Sanitary Rules and Norms.

The chief physicians found the answer in the problem of lack of tradition of waste separation for household waste. They consider it a behavioural habit that should be broken not only for healthcare waste separation but in housekeeping by the system of strong incentives (in the case that general waste management system will be totally changed).

- Healthcare waste handling considered as irrelevant responsibilities for nursing staff

Also in service intensive clinics, it is very tough for the nursing staff to take responsibilities on waste handling due to lack of time and knowledge. This explains the need of environmental specialist.

- Perception that waste is someone else's problem

Representatives of different authorities were surprised that sometimes medical staff considers waste as a problem of waste management companies that aggravates the possibility of waste minimization in the institutions.

- Perception that all the healthcare waste is contaminated

Some interviewees in the beginning of discussion tried to assure that waste minimization for the healthcare institutions is a complicated issue to discuss because of risks coming from the infectious and biological waste. But their perception was changing very fast after the reminding that only about 15-20 per cent of the medical waste is really hazardous but the rest could be the same as domestic waste.

5.2.3 Financial barriers

In this research also financial barriers were found. This include lack of ear-marked funds for healthcare management; lack of long-term investments into healthcare waste management system, contamination of some recyclables with chemicals and PVC.

- Lack of ear-marked funds for the healthcare waste management

No ear-marked funds for healthcare waste management limit the seeking of appropriate waste management solutions. The financing is carried out on a basis of so-called “residual principle” - the budget item covers waste management expenses only after other expenses within the budget line will be covered. This resulted in the limitation of choice among the waste management options.

- Lack of long-term investments on healthcare waste management system

Many specialists involved in healthcare waste management issues are sure that actions directed only for “proper” waste handling according to sanitary rules and norms are short term strategies. The funds should be used for solutions that could improve the waste management situation at long date. The general waste management system is incomplete and outdated.

Counting on foreign funds for development of the system was named by almost every interviewee. Since the beginning of 90ies Kaliningrad region obtained a lot of foreign finances (EBRD, EU financial instruments TACIS, LIFE – Third Countries) for capacity building and technical support. Many projects were implemented in order to improve waste management in Kaliningrad region. Many interviewees were really perturbed by the lack of interest from the state and financing from the Russian funds.

- Lack of viable markets for recyclables

Lack of viable markets for recyclables makes downstream efforts such as source separation and recycling useless because many waste streams will be not recycled in any case.

- Contamination of some recyclables with chemicals or preventing from recycling

The recycling the plastics into non-food plastic products is legal. However, there are serious discussions whether it is worth recycling from the viewpoint of risks connected to infectious agents transmission and if any worth of profit could be obtained from the processing of such materials.

The supplying of the institution with plastic is carried out without evaluation of medical products on PVC containment that could complicate the recycling process. It clearly is a limitation to minimization of healthcare waste.

5.3 Legislative factors analysis

The analysis of legal factors affecting waste minimization in Kaliningrad healthcare sector is carried out in several steps. First, the legislative base is analysed and then barriers and drivers are discussed.

5.3.1 Analysis of legislation

Waste minimization in the legislation

The legislative documents presented in the Chapter 4 showed that waste minimization in general is considered to be a prioritized strategy in waste management sphere.

Both federal and regional laws include waste minimization as one of the principles, the implementation of which could ensure economic profit and environmental safety.

At the moment, the Law of Kaliningrad region “On wastes of production and consumption” is not in force (it is under revision). However, a review of the draft law revealed that significant changes were included. In this regional law waste minimization is stated as a primary issue. Economic instruments regulating waste minimization are listed. The proposed instruments are aimed at the minimization of generated waste, increase of recycling, and the minimization of waste disposed. These instruments should be applied to facilitate the implementation of environmentally sound technologies for recycling and waste disposal and establishment and development of recycling industries.

Federal, regional and municipal programmes envisaged in this law should serve as the base for the system of organizational, scientific, social and economic activities aimed at waste minimization, recycling and prevention of negative impacts of waste on the environment.

However, generally speaking, there are no guidelines with a concrete definition what is waste minimization and its adaptation for healthcare sector. There is no special waste policy covering healthcare waste with an exception of class “B” and “C” waste incineration project in the city of Kaliningrad. For example in the US there is an Agreement signed between the Environmental Protection Agency and American Hospital Association that among other goals has a goal in the 50 % hospital waste reduction by 2010 (Messelbeck and Whaley, 1999).

In spite of the fact that this regional law in Kaliningrad is not in force, the positive trends related to the incorporation of waste minimization into legal acts could be

observed. As soon as the law will be enacted, there is a hope that programmes and policies not only for industries but also for healthcare sector will be developed. Taking into account the presence of waste minimization and economic instruments, it will be easier to promote waste minimization among healthcare institutions.

The review of waste minimization trends in legislation indicates that the new regional law (in the case of enactment) is not sufficient for implementation of waste minimization strategies. There is a need for the incorporation of waste minimization definition into at least regional documents. Specific laws and guidelines for the healthcare sector should be developed and adopted at a regional level.

The role of healthcare waste definition for waste minimization

In spite of the fact that during last years the attention of Russian epidemiologists, environmentalists and recyclers has been focused on the healthcare waste, there is still no proper, legally authorized definition of medical wastes. According to the legislative base of the Russian Federation, the explanation of which waste could be considered medical or healthcare waste is given in the Sanitary Rules and Norms 2.1.7.728-99.¹⁹ But the definition stated in the Rules is very broad, mostly covering the types of the healthcare institutions, producing wastes.

The Rules prescribe the operations needed to be implemented in order to build a waste management system in compliance with international requirements. The classification tables introduced in the Rules more clearly describe types of waste and show that the healthcare waste consists of streams that could be equal to household waste and industrial waste and typical medical or clinical waste that are considered potentially or hazardous in fact. Despite the lack of clear definition the Rules supply a table that is useful for waste minimization strategies development.

In comparison with the approaches to define healthcare waste in different countries reviewed in the Chapter 2, (Section 2.1.2. "Definitions and terminology used worldwide"); the categorization into five streams and auxiliary tables, used in Russia seem very convenient especially regarding issues of source separation and seeking safe alternative for treatment and disposal practices. That is why the definition does not make any barriers for waste minimization.

The definitions of healthcare waste and biological waste are introduced in the draft version of the new law of Kaliningrad region "On wastes of production and consumption". As the law is not enacted it is not possible to judge how the definition of healthcare waste will influence the waste minimization in the healthcare sector.

Prioritization of waste minimization among other responsibilities

According to Sanitary Norms and Rules 2.1.7.728-99 the managers (chief doctors) of large and medium healthcare institutions have to appoint a person (epidemiologist, chief nurse, deputy head on technical issues) responsible for organization of waste

¹⁹ Sanitary Rules and Norms 2.1.7.728-99 "The rules of waste collection, keeping and removal for medical establishments (healthcare waste)"

management and everyday waste management control. Such a person has to be trained on waste handling in a specialized centre and get a certificate which gives the right to organize waste management in the institution. In small and private institutions the directors or their deputies have to be trained.

The head of the healthcare institution together with the person responsible for organization of waste management has to appoint persons (among the staff) responsible for primary collection of waste and hermetical sealing of tanks (pockets, containers) in each department and ward. The person responsible for organization of waste management in healthcare institution is also responsible for the training of the staff on safe waste handling.

It means that waste management is legally included into job description of the appointed person. As there is a trend for waste minimization to be prioritized in the laws regulating waste management there is a certain possibility to prioritize waste minimization in the healthcare institutions within the policy or project on waste minimization.

At the moment there are no legal prescriptions for incorporation of environmental managers into staff structure in the healthcare facilities.

As training and certification are obligatory procedures before taking the responsibilities on the waste management and there is no possibility to have environmental manager as a member of a staff, then minimization strategies should be an integral part of waste management training. Environmental benefits and economic gains should be stressed and proved by the lectures.

Also the healthcare institutions could apply for consultancy help from the Environmental Authorities of the city and region.

5.3.2 Analysis of legal drivers

The availability of complex of legal acts and norms elaborated at different levels clearly shows that the healthcare waste management in Kaliningrad is strictly regulated. As it could be seen from the statement on the legislative drivers moving healthcare facilities towards the waste minimization – legislation in general (for example federal and regional laws) and specific rules and norms could be considered as a strong moving force.

In the cases of Kaliningrad, in both public and private institutions, the willingness to comply with all the requirements is motivated by two main reasons: financial (avoiding of fines and penalties for non-compliance) and safety reasons. The legal acts governing waste management in the healthcare sector are first of all aimed at the prevention of pathogenic agents spreading, and the prevention of the illegal reuse of sharps, pharmaceuticals etc. This power of legal acts and rules specially developed for the waste management in healthcare sector moves institutions to waste minimization indirectly through proper segregation, collection and further disposal of waste, so called down stream tactics use. But it could bring the hospitals to initial steps towards waste minimization.

The availability of comprehensive rules on healthcare waste handling makes the fulfilment of legal requirements easier for staff. Comprehensive rules also provide an

opportunity to integrate waste minimization practices in the daily work of the hospital.

5.3.3 Analysis of legal barriers

Legislation on Extended Producer Responsibility

The principle of Extended Producer Responsibility is known among the heads of public hospitals, specialists of environmental authorities and representatives of scientific institutions in Kaliningrad and the whole of Russia. But the process of the incorporation of this principle in legal documents is very slow. EPR is a concept is based on the principle that the producer of a product must bear responsibility to a certain extent for optimal recycling and disposal of the product even after it is used and discarded (Tojo, 2003).

The enforcement of the legislation regulating producer's responsibility for electronic and electric devices including medical equipment, packaging and other types of products (which are covered by EPR in different countries) could shift the burden of waste management from the healthcare institutions and authorities, decrease volumes of waste streams with packaging or electric and electronic equipment. In the present situation in Kaliningrad, the responsibilities for end-of-life management of targeted product groups will be shifted from the healthcare institutions and waste managers (municipal enterprise) to the producer.

It was previously mentioned that Kaliningrad region has complicated customs regime due to its location. Also principles of the Basel convention could aggravate the possibility of discarded products movements (e.g. the transportation routs to the mainland of Russia go through the Lithuania).

In order to avoid illegal dumping or trade the opportunities for handling and treatment of such waste in Kaliningrad region should be provided.

It is known that producers have the responsibility of recycling their products themselves or to delegate it to the third party (Tojo, 2003:13). The development of legislative framework for EPR could allow the establishment of recycling facilities on the territory of Kaliningrad, taking into account that processing of electronic waste and production of electric products and their export could be carried out within favorable financial conditions.

Prior to implementation of activities on EPR in Kaliningrad region and the city of Kaliningrad, there is need to consider experience of EPR in other countries for the evaluation of capacity building possibilities in Kaliningrad.

The Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE) among other types of products covers the medical devices with the exception of all implanted and infected products. The experience of European countries already implemented the requirements of the Directive could be of interest.

In New Zealand the Extended Producer Responsibility principles are applied to taking back schemes of sharps from home healthcare activities (Council Management of Community Sharps Waste, 2006)

Legislation regulating staff education

The lack of legal document, requiring the presence of specialists with the environmental background and knowledge on waste minimization in hospitals was discussed as a barrier for waste minimization issues.

This barrier is considered relevant for all the healthcare institutions. It is clear that the specialist with environmental background could easily reveal problems occurring with waste management system and could develop plans and programmes for waste minimization, arrange environmental trainings for the staff involved in activities with waste handling.

But the article 15 of the Federal law “On wastes of production and consumption” states that the education for waste handling for the staff member responsible for waste management in companies and enterprises. Taking into account the experience of industrial companies the person that is responsible for waste handling issues does not need to have an environmental education in some cases such as small companies limitations in financial resources could be overcome by training the head of the company. Programmes offered for such courses of education consist of modules covering among Russian waste management issues lectures, Cleaner Production principles, benefits of Environmental Management Systems (EMS) etc.

Further opportunities to increase the competence of healthcare professionals dealing with waste management issues are also available. For example, beginning from May 2003 Municipal Institution “Environmental Centre “ECAT-Kaliningrad” carries out additional professional training of specialists allowed to deal with activities on hazardous waste management. The education is carried out in accordance with the 112 hours duration program, adopted by the order of the Russian Federation Ministry of Natural Resources and adjusted with Ministry of Education. After courses completion the certification of due form is given valid for 5 years.

This experience could be used could be used as a recommendation by local authorities: to attract ECAT for training of healthcare institutions staff.²⁰

Strict sanitary norms and Rules

The problem of strict regulation on the disinfection of healthcare waste and use of chlorine and formalin disinfectants in enormous amounts was observed in Kaliningrad clinics, both private and public.

According the Sanitary Rules and Norms 2.1.7.728-99 “The rules of waste collection, keeping and removal for medical establishments (healthcare waste)” the waste of “B” and “C” could be collected into plastic bags only after disinfection. Very often the chemical disinfection is used in such cases; moreover due to financial

²⁰ The idea was discussed in the Clinical Waste Management Center Project

reasons the most popular (inexpensive and effective) disinfectants in Russia are chlorine based ones (Zueva, 2003). The norms and requirements in Russia in the issues concerning hazardous medical waste disinfection are still very strict, in spite of the fact that incineration as treatment method became widely-used. It is connected to safety reasons - chlorine based disinfectants are of wide antimicrobial spectrum and if some *force majeure* conditions appear and hazardous waste could not be incinerated (at least it is applied to “B” group of healthcare waste) then they could be considered equal to solid municipal waste and be landfilled by the licensed company. In the case of entering of disinfected waste into environment risk of different diseases transmission could be minimal. There is no precise answer to the problem of using large volumes of disinfectant agents. Last year in Kaliningrad it was accounted 2,617 tonnes of different wasted disinfectants including more than 8 tonnes of disinfectant considered hazardous waste. It should be mentioned that after disinfection the agent is discharged into the sewerage system.

Is it an “overcautious strategy” or “due care” to use disinfectants in such scale: do strict sanitary norms and rules enforce waste minimization operations?

From one point of view the disinfected hazardous waste became less risky and could be directed to recycling production meeting sanitary requirements. Thus the idea of wasted disinfectant minimization could be rejected by specialists in the healthcare sector. From another point of view disinfection increases costs of waste management significantly, can cause pollution of water bodies and allergic reactions and poisoning of medical staff. But there is a high probability that in spite of all pros and numerous cons that disinfection of hazardous waste at collection point will be carried out prior to apply any other treatment. The human factor (proper fulfillment of responsibilities) is considered when risk assessment is carried out.

5.4 Economic factors analysis

During the development of the analytical framework the division of economic factors into internal and external based on theoretical knowledge was envisaged. All the drivers enabling waste minimization identified for the public and private institutions could be characterized as internal economic factors.

5.4.1 Analysis of drivers

Why the cost reduction is a driver and how its impact could be increased?

The intention to reduce costs connected to waste management operations was named in existing literature on healthcare waste handling as an important driver (section 2.5.1. Drivers).

Interviewees (respondents) in the Federal Aids Centre and Oncologic Dispensary did not initially mention the waste management cost reductions issues, but their examples given as case studies in section 4.4 “Alternative Decentralized Waste Management Schemes in Kaliningrad” showed the need for a special triggers for driver to “work”. In the first example, the decision on the instalment of autoclaving and investments in special consumables were based mostly on health and environment protection issues because of specific needs of the patients getting the services in the Aids Centre. The rates of waste generation and types of waste streams

allowed to reduce disposal costs and to avoid liability (all the waste streams leaving the premises are household waste).

In the case of Oncologic Dispensary, the financial incentive led to the shift to another type of treatment. The trigger of change and awareness of cost reduction in this example was the evaluation and dissatisfaction with the costs incurred during the year for the incineration of biological (operational waste), needles and bandages. As a result the incinerating method was changed to burial of biological waste in a coffin at local cemetery. The burial of biological waste is considered to be legal waste disposal method in Russia.

The Head of the Oncologic Dispensary named several reasons connected to behavioural barriers such as lack of waste separation tradition, intensive and sometimes unpredictable schedule of activities of the personnel, working in several shifts a day and lack of strict division of responsibilities. These factors prevented the staff of the dispensary from introducing less radical measures than the had implemented: for example simple audit – checking what is collected into “yellow bags” with infectious waste deriving within numerous operations carried out in a dispensary, bandages and needles.

In the two cases, the decisions were based on factors not related to cost reduction. Nevertheless, it was shown that issues of cost reductions were discussed and weighed. Cost reduction activities could easily be implemented with the proper promotion of waste minimization programmes, the elaboration of policies and programmes with targets for waste minimization. These activities could lead Kaliningrad hospitals away from implementing measures intuitively and radically, from attempts to meet legal requirements and achieving financial feasibility without seeking alternative environmentally sound strategies.

Paying appropriate attention to cost reduction could bring both environmental benefits and financial profit that is of importance for clinics which are short of finances for waste management.

Willingness to avoid fines and penalties and liability costs

This driver is considered as one of the primary motivations (on the same level as legal compliance) for ongoing efforts in order to improve waste minimization in healthcare and research facilities (Rau, et al., 2000). Non-compliance is extremely unprofitable for both public and private institutions. As it was mentioned before in the section 4.2.1. “Legislative and regulatory framework for healthcare waste management and waste minimization” the administrative fines for non-compliance to environmental and sanitary-epidemiologic requirements are developed.

When carrying out any waste handling operations established range of administrative fines for non-compliance is from 15-29 Euro for public institutions and 292-585 Euro for private institutions²¹. For a comparison, the prices for one visit to a private dentistry ranges between 25-100 Euro. It is obvious that this financial driver is

²¹ It should be mentioned that in most of the cases that public institutions are not charging patients with fees for services rendered. Private institutions charge patients that is why there is such a difference in fines size.

stronger for private institutions but the burden of this punishment is also tangible for private institutions²². It should be taken into account that non-compliance of private healthcare institutions could lead to the withdrawal of the license for healthcare activity. In this case the private institution would lose also all the investments that were done in order to run their activities.

Financial resources and financial motivation of the staff

The following factor is distinctive feature of private institutions in the healthcare sector in Kaliningrad. Private healthcare institutions are not influenced by financial problems to the same extend as public institutions. This fact corresponds to observations of M. Askarian, M. Valili, G. Kabir (2004) made in private hospitals in Iran. They noted that private hospitals are more concerned on their image and quality of services provided; they can make capital investments in order to be competitive and prestigious.

The interviewees of private institutions are represented by the sector of plastic surgery. The fees charged from patients for operations and rehabilitation care can reach thousands Euro. High salaries create competition for the working positions. The possibility to invest into waste management starting from consumables and equipment and finishing with expensive training and payments to waste managing companies creates internal incentives to fulfil responsibilities in waste management properly. Furthermore, private companies are more flexible in regard to the adoption of innovations and implementation of new ideas. They can work directly with suppliers which means that they could control not only functional quality of the equipment but environmental characteristics also.

In this case, the drivers for the private companies can be seen as barriers for public institutions.

5.4.2 Analysis of barriers

Financial barrier are represented by hindering factors that could be considered as external factors.

Lack of ear-marked financing - a barrier?

As it is stated before there is no ear-marked financing for waste management operations in healthcare institutions in Kaliningrad. This barrier is typical one for public institutions of different subordination to Public Authorities. The financing of public institutions is carried out on a base of so-called “residual principle”. It means that - the budget item covers waste management expenses after many other expenses within the budget line will be covered. Taking into account constant deficit of finances in the public institutions it could be concluded that there is no opportunity for the most of the public institutions to pay for the waste management operations in full. In the case of the newly created system for hazardous healthcare waste management (dealing with biological waste, bandaging materials and metal

²² The rates of the fines are taken from the Code on the Administrative Violations of the Russian Federation.

needles), municipal medical establishments, receive services provided by the Clinical Waste Management Center for free because the service is already subsidized by the Environmental Fund.

A problem is readily apparent from the fact that the municipality subsidizes municipal clinics in their treatment of waste falling into “B” and “C” categories: biological waste, bandages and needles. Free services on incineration of infectious waste deprives numerous municipal clinics of incentives to minimize wastes of mentioned types.

While the phrase “no ear-marked financing for waste management operations” really sounds like a serious financial barrier, there are possibilities to counter-act this hindrance. If there are no resources to pay for waste treatment and disposal then it is always possible to reduce the amount of waste which could lead to significant cost reductions. It is evident that the attempts to solve the problems related to waste management inside the hospital could be more successful than to try to overcome the external barrier of budget increase.

In order to overcome problems of financial deficit within the budget item assigned for waste management operations, the possibility of waste reduction in the institution should be considered. The waste minimization using up-stream and down-stream tactics should be applied.

Lack of long-term investments

The lack of long-term investments into healthcare waste management system and in general waste management was discussed as a barrier for implementation of waste minimization practices in Kaliningrad. The mentioned barrier is tightly connected to the problem of viable markets for recyclables development. There is no well-functioning general waste management system (system that could cover both municipal and industrial streams). It was already discussed that there is a strong need of switching from the short – term strategies in healthcare waste management to long-term investments that could financially regulate the new complex and modern strategy of waste management.

At the moment in Kaliningrad as in the whole Russia there is a need for the establishment of healthcare waste management system that can be incorporated into general waste management system of the city or region. Many aspects of the waste minimization in healthcare system are dependent on the situation with waste minimization in the municipal and industrial waste streams.

There is a need for long-term investments for the creation of markets for services on different waste streams collection especially those that could be recycled or re-used. Investments should be provided for development of the infrastructure of the companies dealing with waste treatment and waste recycling. Financing of scientific research and consultancy issues for seeking of the most economically feasible but at the same time environmentally sound options for healthcare waste collection, treatment should be made.

Counting on foreign funds for development of the system was named by almost every interviewee. Since beginning of 90ies Kaliningrad region obtained a lot of foreign finances (EBRD, EU financial instruments TACIS, LIFE– Third Countries)

for capacity building and technical support. Many projects were implemented in order to improve waste management in Kaliningrad region. Many interviewees were really perturbed by the lack of interest from the Russian state and financing from the Russian funds. Healthcare is considered to be one of the prioritized areas of the public sector in the country but during last two years healthcare waste management system was build and technical equipment (incinerator and microwave oven) was installed due to TACIS funds.

Many representatives were sure that if as much as possible waste streams could be recycled it could significantly improve the situation with healthcare waste minimization.

Contamination of some recyclables with chemicals or preventing from recycling

The practice of plastics recycling into non-food plastic products in Kaliningrad is legal. However, there are serious discussions is it worth of recycling from the viewpoint of risks connected to infectious agents transmission and it is not clear what kinds of profits that could be obtained from the processing of such materials.

The supplying of public and private institution with plastic is carried out without evaluation of medical products on PVC content that could complicate the recycling process.

5.5 Social factors

No social drivers were named for waste minimization in the healthcare waste sector. The barriers discussed could be categorized as the following:

- 1) The barrier that could be classified as behavioural: *lack of tradition for waste separation*, caused by the lack of attention to the general waste management system in the absence of separation practice for household waste
- 2) Barriers related to *public perception* of healthcare waste management and waste minimization. In these cases the medical staff have the same perceptions that the general public :
 - Perception that waste handling is an irrelevant activity for responsible staff (most often for nursing staff)
 - Perception that the waste is someone else's problem (waste manager, municipality, environmental authorities, etc)
 - Perception that all the waste contaminated or waste minimization could affect quality of medical services.

It was already discussed that there is no environmentally sound waste management system for municipal waste in Kaliningrad. Lack of possibilities for separation of waste streams for different treatment and recycling purposes affects waste minimization and behaviour in such specific area as healthcare sector. Behavioural problems similar to the problems found in Kaliningrad were mentioned by M. Karlsson and D. Öhman (2005), problems of false conclusions which then influence

the perception of medical specialists on waste issues were described in the example of Cornwall case study by Tudor, Noonan and Jenkin (2005).

The trends described could be applied to problems of perception of healthcare waste in Kaliningrad. From the analysis of the social barriers and comparison with barriers detected in other countries it could be concluded that behavioural and perceptual problems restraining the waste minimization are common for Russia, Sweden and UK. Therefore when giving recommendations for overcoming these barriers it is feasible to look at what other countries have done.

The perception of medical plastic waste recycling could be regarded as possible barrier for waste minimization in Kaliningrad.

The recycling of plastic waste is considered legal and regarded as downstream strategy for healthcare waste minimization in Kaliningrad. In Russia in Irkutsk city the recycling of syringes and other medical plastic consumables into non-food plastic products has been experienced more than 18 years (Oparin, 2003:10).

Nevertheless in the Russian press there are articles in which issues of worthiness of discarded syringes recycling is discussed from the viewpoint that the risks of such recycling practices are too high.

The debate of social fairness of profits gained due to use of such material in production was observed. The article written by A. Tcharnetsky, D. Kofman and M. Vostrikov (2004), who are engineers and representatives of the top-management of “Turmalin” company – the main Russian producer of equipment for safe thermal treatment of waste - is typical article presenting such discussions.

The authors consider purchasing and recycling of medical plastics by companies illegal and risky. They even offer to introduce criminal liability for such recycling companies. Their main point of view is that all infectious waste should be incinerated, could be regarded by the stakeholders as the willingness to make the equipment produced by “Turmalin” company more competitive and to enlarge the incinerators market in the country.

From another standpoint representatives of “Turmalin” company are right in their ideas to restrict the issues of recycling of such waste in Russia. Lack of control on the production process (such as control over flue gases from the plastic melting etc), non-compliance to sanitary norms and rule and improper fulfillment of responsibilities of the producers, use of recycled medical plastic packaging for food can lead to serious health and environmental impacts. From another point of view - the discarded plastic contributing up to 20 %²³ in healthcare waste streams in Russia needed to be recycled in order to minimize use for raw material for plastic products not used for food packaging or in the healthcare sector.

In 2001 the director of Kaliningrad Institute of Amber and Regional Resources A.Kornietsky ²⁴with a group of colleagues from the Kaliningrad State Technical

²³ In Kaliningrad in 2005 the amount of plastic waste produced was estimated as 1.77%

²⁴ Personal interview of 24.08.2006

University developed a project on recycling of the medical plastics into filling for asphalt production. All the technological certificates for these activities were received from the local authorities and the project was ready to be implemented. The use of medical discarded plastic led to reducing the amount of bitumen used for the asphalt production by 15% and improved wear-resistance of the asphalt significantly. Because of unknown reasons, the expertise was not implemented in practice and the project was closed.

Taking into account all the debates and technical possibilities for recycling, this type of waste minimization strategy should be properly regarded from environmental, economic and safety standpoint. All the viewpoints should be considered for decision making in the issue of plastics recycling.

The social barriers for waste minimization are complex issues and it is not possible to overcome them only by one type of incentive (financial, regulatory) or informative solution (training on waste minimization). These problems arise from the environmental culture, environmental education and skills of medical specialist.

The already mentioned in Chapter 2 the model of environmental culture of a specialist developed by Asafova (2002) could be used for environmental education of specialists in Kaliningrad healthcare sector.

The environmental culture is a system of interrelated components. The success in long-term improvement of the environmental culture could be achieved only by developing every component and incorporating the system of environmental culture into a system of *professional culture*. It means that environmental education, responsibilities and environmental behaviour should be regarded not as features developed in environmental specialist especially hired for the hospital for dealing especially for waste management and waste minimization. The environmental culture of the medical specialist should be build while the obtaining specific medical knowledge.

Another model that could be used in Kaliningrad healthcare institutions for overcoming behavioural and perception-related barriers is a model based on five factors influencing behaviour. It was developed by Geller, Needleman and Randall in 1990 (Sjöden, 1990:85). This model should be used for evaluation of programmes that could be implemented in Kaliningrad for immediate changing of behaviour and perception towards waste management issues.

Below the factors are discussed in brief taking into account the specificity of waste minimization in healthcare sector. The factors are discussed for the application to the future programmes for increasing the existing drivers and decreasing the barriers for waste minimization.

- 1) Transfer of *specific behavioural information* providing the understanding how the behaviour should be performed. In the case of Kaliningrad healthcare sector the behavioural barriers could be counteracted due to training. This could include the dissemination on information not only in a lecture hall (videos with best practices) but close to working places by producing leaflets and posters showing how to minimize waste). The information given should demonstrate benefits of waste minimization of healthcare waste-environmental, economic and social ones.

- 2) The *degree of individual involvement* should be discussed in the institution and this factor depends on how many people participate in waste minimization programme. The share of responsibilities between the personnel in a programme taking into account the intensity of healthcare activities should be developed in advance. As they were claims that staff is lacking of time for executing waste management operations among other duties. This could be helpful for breaking the perception that the healthcare waste is not responsibility of the medical personnel and the personnel is lacking of time for certain waste management and minimization operations.
- 3) *The degree of external control* provided by the programme – factors controlling behaviour should be developed as for positive consequences of the behaviour and for negatives ones deriving from undesirable actions. The problem of external and internal financial motivation was raised already. The development of system of incentives (external coming from the local authorities) and internal (top management commitment) should be considered when starting the programme on waste minimization. The initiatives should be encouraged and the non-fulfillment of responsibilities on waste minimization should be somehow discouraged.
- 4) *The extent of the social support* should be encouraged by the programme. The programme should provide the scope for participation and initiatives for the staff. The programme should engender the medical specialists to recognize the economic and environmental benefits from changes in their behaviour.
- 5) *The individual participant's perception on his own ability to influence.* The programme should shift the perception from “waste is someone else problem” to “intrinsic motivation” that the success of the waste minimization programme in the healthcare institution depends on everyone input.

Behavioural and perceptual barriers are very important to be surmounted that is why such social issues should be considered when the complex programmes including financial, regulatory and informative components will be implemented in Kaliningrad.

5.6 Environmental and technical factors analysis

5.6.1 Analysing drivers related to environmental issues

Only two drivers were included into this group of factors. Safety for the staff and environment could not be classified as only environmental or only medical topic. The safety and environmental protection issues were considered more of medical type of drivers and were not prioritized and related to environmental issues among most of the interviewees. The reason for this could be specificity of medical institutions activities such as rendering healthcare services and dealing with wastes aimed at minimizing risks related to infections transmission prevention and ethical considerations (biological waste, bandages etc.).

In spite of all these facts the safety reasons related to humans and environment and were named as environmental driving forces for waste minimization activities in the healthcare sector. The consideration on healthcare waste handling should be made from the environmental point of view also. Improvement of environmental

performance parameters – volumes of waste, decrease of hazardousness and toxicity, elimination of product containing toxic substances (mercury, PVC, etc) could bring desirable financial benefits to the healthcare institutions.

Support in all the environmental and technological areas provided by the Environmental authorities (the environmental Department of Kaliningrad City Hall and the Federal Service on the Protection of Customers and Human Welfare) was named by all the interested in environmental issues respondents. For them not only regulating but supportive work of specialists was considered as environmental technological driver.

Consultancy help, trainings, information dissemination and seeking better options for waste management allowed institutions to apply environmental principles and to find technologic solutions for their healthcare waste management operations. The role of other successful institutions should be considered for experience exchange in areas of environmental approaches and technical improvements. Approaches to waste minimization should be based on environmental principles and ideas.

5.6.2 Opportunities for EMS implementation

Regarding experience of the US in EMS implementation for facilitating waste management and waste minimization in healthcare institutions, the question of opportunities was discussed with representatives of local authorities, healthcare institutions and the North-West Consulting Centre (dealing with issues on Certification and Standardization in Kaliningrad).²⁵

In Kaliningrad there are no healthcare institutions implementing EMS. Incorporation of EMS into general management systems is just at initial stage for industrial companies. But interviewees showed interest to the application of EMS to hospitals. D. Sergienko, the head of the Centre for Certification mentioned that development of EMS either in a set with Occupational Health and Safety certification systems or on its own will attract attention of healthcare sector soon. He referred to European and the US experience and suggested to promote financial and environmental benefits within the training courses which are planned to be arranged for the healthcare institutions personnel.

The question of facilitating waste minimization due to implementation of EMS in healthcare institutions could be started from unofficial EMS establishment in the whole institutions or small department. The advantages and disadvantages of EMS implementation should be investigated in Kaliningrad. The pilot projects could be initiated on the base of private clinics that are working harder on their image and competitiveness than public ones.

5.6.3 Technical factors for further regard

Some technical issues related to healthcare waste management such as application of incineration autoclaving and microwaving for dealing with infectious waste, were

²⁵ Personal interview of 25.08.2006

raised during the interviews in Kaliningrad but out of drivers and barriers for waste minimization context. As these questions could significantly affect or influence waste minimization in Kaliningrad medical institutions, it may be interesting and useful to carry out further research.

The three main methods of dealing with infectious waste in Kaliningrad are incineration, autoclaving and microwaving. Both methods were named as technical solutions for waste minimization (reducing their volume and hazardousness) before disposal. As it was mentioned before the term *waste minimization* has not been defined legally in federal and regional laws, it is derived from laws regulating waste management. In Kaliningrad the meaning is also based on a general understanding of what the term means.

Waste incineration seems to be the most controversial practice if to consider its contribution to waste minimization. This question is under consideration worldwide. It was highly recommended at the Berlin Workshop that the OECD should explore the role of incineration within waste minimization (OECD, 1998).

In Kaliningrad, the question of application incineration practises for treatment of infectious waste is of importance. The technical options for treatment of infectious waste are limited due to safety reasons. The new incinerator, installed on the base of Clinical Waste Management Centre, meets all the environmental requirements. The advantages of the process are the following: centralized treatment of biological waste bandaging material which amounted to 90,550 tonnes in 2005 (plus certain amount of sharps) and possibility to avoid disinfection of the mentioned streams of waste which result in reduction of used disinfectants volume by 35%.²⁶

The other techniques used in Kaliningrad are autoclaving and microwaving. Autoclaving method based on disinfection and steam sterilization that leads to the reduction of the hazardousness and the volume of the infectious waste. Microwaving is a thermal method of treatment allowing to decrease the volume of waste by 30%. Both autoclaving and microwaving are considered in literature found as more environmental and appropriate methods (Healthcare Without Harm, 2001:4). But it should be reminded that in respect to waste minimization this could be classified as treatment method which is not included into OECD definition. The Healthcare Without Harm (2001:3) organization includes non-incineration methods into waste minimization hierarchy.

Such infectious waste *treatment* practices as incineration (with energy recovery or without), autoclaving and microwaving should be investigated for possible incorporation into healthcare waste management system in Kaliningrad. The proper classification of this methods and their position in the healthcare waste management hierarchy will be of importance for further waste minimization strategies development: work on waste minimization terminology framework, development of plans and programmes, seeking for the best environmentally sound options.

²⁶ From the personal interview with Svetlana Tchernukcha.

Also there is a need to investigate the opportunity to use the heat-exchanger which is included into the equipment of the incinerator for heating of the Multi-Field Hospital where the mentioned incinerator is located. Then the incineration method could be considered as a waste minimization strategy.

5.7 Institutional factors analysis

Institutional factors were not planned to be investigated when the analytical framework was elaborated. Factors of such type were not presented in the existing literature and were not named among drivers and barriers. But after several interviews it was obvious that new centralized system for collection and treatment of infectious waste could contribute to waste minimization. Some advantages of its implementation for waste minimization activities in the city will be discussed in this section.

As a result of a pilot project and taking into account successful experiences of Danish partners and Russian cities, new centralized system for healthcare waste management was established. The healthcare system is supported by the local authorities by issuing corresponding decrees. The system has been working about a year. The newness of the system and lack of infrastructure for treatment and disposal of municipal solid and industrial waste give certain rate of flexibility in the choice of waste managing companies for the healthcare waste producers.

All the healthcare institutions are free to decide which way of waste treatment and disposal they want to apply. Their healthcare waste management options could be restrained by costs and sanitary and environmental requirements.

After the establishment of the Clinical Waste Management Centre local authorities carried out training for the medical staff promoting services of a new centre. But when analyzing costs for waste management operations in Kaliningrad it is still cheaper to dispose waste in landfill. That is why it is obvious that private institutions easily join the centralized system, but the regional clinics and even some municipal ones (despite the favorable conditions created by the City Hall for access to the Centre services) found cheaper, less environmentally friendly but still legal alternatives. The Centre is municipal one and at least it will be more efficient if all the municipal institutions were enforced to sign the contracts with the Centre.

If the incineration due to complying all the environmental requirements will be considered as feasible strategy for waste minimization the issue of making the centralized system mandatory for all the institutions could be further investigated.

Then the Clinical Waste Management Centre could gather every year qualitative and quantitative information on waste generated in the healthcare establishments working with the Centre on a contractual basis. The Centre could participate in improvement (upgrading) of the legislation on healthcare waste management and correcting the norms for healthcare waste generation.

Reporting to the Department of the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region is obligatory for all the healthcare waste producers in the region. The accessing of the most healthcare institutions to the centralized system will simplify the development of data base on healthcare waste in the region.

Mandatory centralized system has many advantages related to the waste minimization for the city of Kaliningrad:

- Centralized treatment of hazardous waste ensures reduction of volume and hazardousness and restrains alternative environmentally not sound ways of treatment and disposal;
- Controlled safe transportation due to specialized transport of the Centre and manifest system;
- Collection of quantities and qualitative data on healthcare waste contributing to further waste generation evaluation and waste minimization plans and programmes development;
- Assistance to local authorities in development and implementation of healthcare waste policy satisfying up-to-date requirements on waste minimization.

6 Conclusions and Recommendations

This chapter includes final conclusions on the drivers and barriers identified and analyzed during this research, following by provision of recommendations for the decision-makers and stakeholders in Kaliningrad.

6.1 Drivers and barriers for healthcare waste minimization in Kaliningrad

During this research it was observed that the waste minimization in Kaliningrad healthcare sector is not a new issue. But the activities on healthcare waste in healthcare institutions are directed mostly on meeting sanitary requirements. Also the term *waste minimization* has not been defined legally in federal and regional laws, only the need in waste minimization strategies is stated in laws regulating waste management. In Kaliningrad the meaning of waste minimization strategy is also based on a general understanding of the term.

The factors influencing the waste minimization in the healthcare institutions were classified as legislative, financial, social (behavioural) and environmental.

The most significant drivers for waste minimization in Kaliningrad health sector are legal and financial; the most frequently mentioned barriers were related to financial problems occurring within the institutions or arising because of lack of long-term investing and state financial aid.

The difference in financial drivers for public and private healthcare institutions was designated by the fact that the financial issues less influence the private hospitals than the public ones. But public institutions are controlled less and the fines and liability costs are lower than for private institutions.

Special attention in the research was paid to behavioural and perceptual problems for the development of waste minimization activities in the healthcare institutions in Kaliningrad. The analysis carried out showed that most of the barriers named had behavioural or perceptual prerequisites. Change in behaviour could help to overcome even financial barriers named during interviews.

Discussion of environmental drivers shows that the questions of safety are always prioritized and opportunities for waste minimization should be regarded from the environmental point of view that helps to improve environmental performance and to gain financial benefits.

6.2 Recommendations

The recommendations, given on the base of analysis of drivers and barriers for waste minimization strategies in Kaliningrad healthcare sector showing how to strengthen the drivers and to overcome the barriers are focused on the four practical areas. The recommendations are provided for the decision-makers and stakeholders in Kaliningrad

Firstly, clarificational policy documents should be developed. Such as legal documents with proper definition of waste minimization, waste minimization

guidelines specified for healthcare sector and technical, medical and environmental standards which will limit the possibilities for the choice of waste management operations by requirements for use environmentally sound techniques.

The second recommendation is to create internal incentives for waste minimization in both public and private institutions. Investments provided for development of viable markets of recyclables and will externally strengthen the incentives for waste minimization.

The third recommendation is to develop plans and programmes with targeted healthcare waste minimization at different levels. Starting with individual plans and programmes for hospital and coming to general municipal plan and programme on healthcare waste minimization.

The last solution that could be of benefit only in combination with the three given before recommendations. The elaboration of persuasive methods such as programmes aimed at changing behaviour, building traditions of waste minimization in healthcare institutions and activities on information dissemination, public relations and EMS implementation could create a strong background for implementing the above mentioned recommendations.

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Abbreviations

CWMC	Clinical Waste Management Centre
EMS	Environmental Management Systems
NAPE	National Association of Physicians for the Environment (US)
NRMW	non-regulated medical waste
OECD	Organization for Economic Co-operation and Development
PCBs	Polychlorinated biphenyls
POPs	persistent organic pollutants
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act of 1976 in US
TACIS	Technical Assistance to CIS countries programme
USEPA	United States Environmental Protection Agency
WHO	World Health Organization

Appendix (1) The list of interviews made in Kaliningrad region

Name and position of the interviewed person	Institution	Time and date	Type of interview
Interviews with representatives from local authorities			
Novokhatskaya, Elena, the head of the Sanitary Inspection Department	Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region	10:00-10:20 25-July-2006	Telephone interview
Schepteva, Svetlana, chief specialist of the Sanitary Inspection Department	Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region	9:00 -10:30 26-July-2006	Personal interview
Chernukha, Svetlana, leading specialist of the Environmental Protection Department	Kaliningrad City Hall	10:00-11:00, 26-June-2006	Telephone interview
		09:00-11.00, 09-Aug-2006	Personal interview
Interviews with representatives from public healthcare institutions			
Aksenchik, Svetlana, Assistant of Head Physician	Regional Centre of Immunopathology (AIDS Centre)	15:00-17:00 28-July-2006	Personal interview
Turkin, Evgeniy, Head Physician	Regional Tuberculosis Dispensary	15:30-16:00 21 July-2006	Telephone interview
Dadyanov, Dolat-Geryj, Head Physician	Regional Oncologic Dispensary	16:00-17:00 18-Aug-2006	Personal interview
Interviews with representatives from private healthcare institutions			
Gortchakovskaya, Alla, Head Physician	“Novyje tekhnologii” (the New technologies)-plastic surgery clinic	10:00-11:30 25-Aug-2006	Telephone interview
Starodubchenko, Boris, Director	“Brazilia” (“Brazil”)-plastic surgery clinic	18:00-18:45 21-July-2006	Telephone interview
Romanova Anna, Chief Nurse	“Medexpert” - complex medical services	11:00-11-30 17-Aug-2006	Telephone Interview

Interviews with other actors involved in waste management and other environmental issues			
Vershinina, Maria, Leading Specialist	Municipal enterprise "Chistota" ("Cleaness")	14:00 -14:30, 18-Aug-2006	Telephone interview
Sergienko, Denis, Director	North-West Consulting Centre (ISO 14 001 Certification)	10:15–11.00, 23-Aug-2006	Telephone interview
Kornietsky, Alexandr, Director	Kaliningrad Institute of Amber and Regional Resources	15:30-16:30, 24 Aug-2006	Personal interview
Semenova, Victoria, Head of department	"Vector" Ltd. (environmental consultancy company)	11:30 – 12:20, 23-Aug-2006	Telephone interview

The Questions Developed for Use During Interviews:

- Scale of the establishment (quantity of beds or visits)
- What kind of activities are carried out in the institution (services provided in the healthcare establishment)?
- Quantities of waste generated and characterization of waste?
- What kind of waste management practices are applied?
- How the waste is treated and disposed of? (Who are sub-contractors: waste handling companies). What about costs incurred for the waste management operations provided?
- Transportation services? Costs connected to transportation?
- Do you use waste planning? What is the basis for estimations?
- What kind of minimization activities are applied (if the top management is aware of such an issue)?
- Have you ever thought about green procurements, proper waste segregation as a way to minimize quantity of hazardous waste; recycling and reuse practices?
- What kind of drivers and barriers for waste minimization in healthcare institutions could be named?

Appendix (2) The list of healthcare institutions located to the city of Kaliningrad

N	Name	Out-patient departments	In-patient departments (hospitals)	
		Number of visits /day	Number of beds	Bed rate,%
Regional Healthcare Institutions				
1.	Regional hospital	413	765	101
2.	Children's regional hospital	140	365	102
3.	Rehabilitation hospital for the war veterans	155	72	106
4.	Medical station №1	780	140	99.8
5.	Regional maternity hospital №1	-	205	103
6.	Regional mental hospital №1	100	340	102.7
7.	Regional narcological dispensary	250	125	104.9
8.	Regional dermatovenerologic dispensary	350	150	101
9.	Regional TB dispensary	600	500	103
10.	Regional oncologic dispensary	110	90	102
11.	Regional dental clinic	382	-	-
12.	Regional hemotransfusion station	85	-	-
13.	Centre of immunopathology	85	-	-
14.	Family planning and reproduction centre	52	-	-
Municipal institutions				
15.	Multi-field hospital	2500	585	103.8
16.	Emergency hospital	116	420	103
17.	Municipal hospital № 1	-	180	100

18.	Municipal hospital №3	702	170	99
19.	Municipal hospital №5	238	50	100
20.	Municipal hospital №6	87	90	85.2
21.	Medical station №2	227	100	91.7
22.	Municipal infectious diseases hospital	-	260	96.3
23.	Municipal mental hospital	-	245	101
24.	Municipal Children's hospital № 1	-	100	100
25.	Maternity welfare clinic	400	20	100
26.	Municipal Children's hospital №3	-	40	100
27.	Municipal children's infectious diseases hospital	-	100	100
28.	Municipal children's polyclinics №1	160	-	-
29.	Municipal children's polyclinics №2	590	32	-
30.	Municipal children's polyclinics №4	165	-	-
31.	Municipal children's polyclinics №5	105	-	-
32.	Municipal children's polyclinics №6	120	-	-
33.	Maternity hospital №2	90	98	100
34.	Maternity hospital №3	155	70	85.5
35.	Maternity hospital №4	173	105	101
36.	Municipal polyclinics №1	480	-	-
37.	Municipal polyclinics №2	500	-	-

38.	Municipal polyclinics №6	87	90	85.2
39.	Municipal polyclinics №7	185	-	-
40.	Municipal polyclinics N 8	180	-	-
41.	Municipal dental clinic of Leningradsky district	203	-	-
42.	Dental clinic "Centrodent»	500	-	-
43.	Municipal dental clinic for children	300	-	-
44.	Municipal polyclinics for medical examinations	115	-	-
45.	Nursing home	-	30	100
46.	Municipal emergency station	420	-	-
Health care establishments subordinated to other authorities				
47.	Port hospital (Medical Centre of north-west of Russia)	350	160	86
48.	Hospital (Department of Home Affairs of Kaliningrad region)	400	60	95
49.	Hospital (Medical Department of the Railay Station)	600	136	88
	Total for 49 healthcare institutions	13 650	5 908	

Source: Pilot project 2004-2005 Feasibility study provided by Aalborg and Kaliningrad municipalities

Appendix (3) Chronological list of legal documents regulating waste management in Kaliningrad healthcare institutions

1. Branch standard 42-21-2-85 “Sterilization and disinfection of medical instruments”, “Instructions on collection, storage and scrapping of plastic disposable medical items” dated 24.03.1989 and other instructions specify the order and the responsibility of medical institutions concerning the disinfection of medical instruments, prevention of viral hepatitis spread and separation of mercurious, radioactive and polymeric waste.

2. Federal law “On wastes of production and consumption” N 89 of 24.06.1998 governing handling of industrial and household and set equal standard to healthcare waste.

- *Article 5* of the present law defines the responsibilities of the Russian Federation on the waste handling as providing economic, social and legislative conditions for the most effective way of waste recycling and waste minimization at source.
- *Article 21* states the main principles the use of economic instruments in relation to waste handling procedures such as minimization of waste and promotion of recycling activities. Such instruments include those requiring payment concerning the disposal of waste and giving economic incentives for the companies involved into waste handling activities.

3. The law of Kaliningrad region “On wastes of production and consumption” N 108 dated 10.01.1999; now is under revision. The law also regulated issues on waste minimization in the region. The law stated the main principles of waste policy in Kaliningrad region including implementation of low-waste technologies and activities aimed at waste minimization and recycling of waste.

- *Article 4* presents the principles of the waste handling system in the city among which the providing of possible waste minimization while carrying economic activities and prioritization of recycling and reuse of waste of production and consumption.

4. Sanitary Rules and Norms 2.1.7.728-99 “The rules of waste collection, keeping and removal for medical establishments (healthcare waste)”. In accordance with these rules all healthcare waste is divided into five categories.

This document states new requirements which are resulted in considerable changes in strategic approaches to waste management issues at regional levels; intensification of the responsibilities of the healthcare institution in the issues of infectious diseases prevention, proper source separation and application of modern and effective technologies for recycling activities.

5. Federal law “On sanitary and epidemiological welfare of the population” N 52 of dated 30.03.1999;

6. Federal law “On environmental protection” N 7 of 10.01.2002; stipulates the economic environmental, social conditions for minimization of the negative impact of the wastes on the environment.

7. Russian Government Decree “On approval of regulation on licensing of hazardous waste handling activities” N 340 dated 23.05.2002;

8. “Federal classified catalogue of waste” N 786 dated 02.12.2002;

9. Sanitary and Epidemiological Rules and Norms 2.1.3.1375-03 “Hygienic requirements to establishment, structuring, equipping and maintenance of hospitals, maternity houses and in-patient departments” dated 06.06.2003;

10. Federal Rules and Norms on collection and removal of radioactive waste.

11. Decree of the Chief Sanitary Physician (Inspector) in Kaliningrad region “On the collection, keeping and removal of the healthcare waste in Kaliningrad” N1958 of 15.08.2005. The document stipulates obligatory measures for proper healthcare waste management needed to be taken by all the healthcare institutions. The measures such as

- development of organizational and technical conditions for the development of waste management system in the healthcare institutions in compliance with Sanitary Rules and Norms;
- carrying out qualitative and quantitative analysis of waste generated;
- evaluation of the needs in sanitary hygienic equipment and consumables include this information into budget of the institution and to provide this information to the Healthcare Ministry of the Kaliningrad region;
- organization of the training followed by the certification for the staff dealing with the healthcare waste

All these measures could be considered as prerequisites for the further waste minimization steps implementation.

12. Decree of the Mayor of Kaliningrad “On the establishment of the hazardous waste management system in the city of Kaliningrad” N 706 of 05.04.06. In accordance with this document – the Clinical Waste Management Centre with the unit for high-temperature incineration of healthcare waste is established in the Multi-Field Hospital. Coordination Board consisting from representatives of different authorities (Department of the Federal Service on the Protection of Customers and Human Welfare in the Kaliningrad region, Kaliningrad City Hall) is a body responsible for interactions between authorities and healthcare institutions. Also the decree requires that biological waste, bandaging material and needles from state or private medical institutions should be utilized in the Centre or another licensed provider of such a service. Specialized vehicle of the Centre should transport hazardous waste from the producer to the incinerator.