Waste Management

Coordinator	Olga Zhuravleva
Credits	3 ECTS (compulsory course), 22 in-class hours
Lecturer	Olga Zhuravleva
Level	MSc
Host institution	Gorno-Altaisk State University, Department of Natural Sciences and Geography
Course duration	1 semester (the classes will be scheduled in accordance with the university timetable)

Summary

The course "Waste Management" is an important element of professional training of students majoring in Ecology and Environmental Management. It is aimed at preparation of specialists-ecologists for environmental protection activities and at development of their skills in waste management through systematic approach.

Vital activities of present-day people couple with production and consumption waste generation that is prone to cause a considerable environmental damage. To solve this problem, we need qualified specialists who are able to ensure the development and implementation of scientific and technological achievements in the sphere of waste treatment, and to produce and introduce safe and low-waste technologies of neutralization and utilization of waste.

Target student audiences

First year MSc students majoring in "Ecology and Environmental Management" and "Geography"

Prerequisites:

Required courses (or equivalents):

- Fundamentals of Nature Management;
- Basics of Industrial Ecology;
- Environmental Protection;
- Environmental Law.

Aims and objectives

The aim of the course is to provide students with systematic knowledge about the system of production and consumption waste management, including the activity in developing draft waste generation standards and waste disposal limits, and the activity in studying and introducing new approaches to waste treatment.

The objectives of the course are:

- introducing to the legislation relevant to production and consumption waste management;
- studying the approaches to organization of waste management schemes;
- revealing specific features of various methods of waste recycling and processing;
- studying specific features of technical decisions for working out the scheme of production and consumption waste management;

- introducing to the methods aimed at reducing the amount of production and consumption waste.

General learning outcomes:

By the end of the course, successful students will:

- know key concepts related to production and consumption waste;
- be aware of production and consumption waste classifications (according to its type, composition, class of hazard to the environment, and class of hazard to the man);
- be able to read labels used to mark hazardous properties of waste;
- know legal aspects that regulate the management of hazardous waste (legislative frameworks for environmental protection in the Russian Federation and EU countries, kinds of legal responsibility for environmental offences in the sphere of hazardous waste management);
- be able to use the Federal Classification Catalogue of Wastes;
- be aware of basic technological cycle stages of waste;
- be able to calculate the class of hazard to the environment and to the man;
- know the methods for reducing the negative impact of production and consumption waste to the environment;
- be aware of the technology of recycling, utilization, and burial of waste;
- know the methods of recultivation of solid waste landfill sites;
- be able to develop hazardous waste passports (certificates);
- be able to calculate the payments for the negative impact on the environment caused by production and consumption wastes;
- be able to determine the most efficient waste utilization methods and to estimate their economic efficiency;
- be able to draft waste generation norms and waste disposal limits;
- be able to apply the method for assessing the harm caused by the disposal of production and consumption waste to the environment.

Contents

The course will cover the following aspects:

Topic 1. Legal framework in the sphere of waste management in the Russian Federation and EU countries. Aims, objectives, and contents of the course. Environmental changes caused by waste impact. Basic definitions. Federal legislation in the sphere of waste treatment. Regional legislation in the subjects of the Russian Federation in the sphere of waste treatment. Laws and regulations of municipal units. The Russian Federation's international obligations regarding waste management.

Topic 2. Regulation of activities in the sphere of hazardous production and consumption waste management. Maximum permissible emissions (MPE) and their norms. Regulation of waste generation. Waste classification. Characteristics of hazardous waste. Waste hazard classes. Federal Classification Catalogue of Wastes (FCCW). Waste certification. Prevention and liquidation of emergency situations when handling wastes. State regulating, accounting, and reporting in the sphere of waste management. Regulations in the sphere of consumption waste management. The Unified State Consumption Waste Record System. Providing information for

inclusion into the Unified State Consumption Waste Record System. Environmental fee. Production control in the sphere of waste management.

Topic 3. Hazardous production and consumption waste. Licensing of activities for collection, transportation, processing, utilization, neutralization, and disposal of waste of hazard class 1-4. Use of the calculation method for determining hazard classes. Use of the experimental method for determining hazard classes. Passports of hazardous wastes. Sites for hazardous wastes disposal. Solid and industrial waste landfills. Illegal dumps. Special sites for burial of waste. Radioactive waste management.

Topic 4. Prevention of harmful effects of production and consumption waste on human health and environment. Requirements in the sphere of waste management for the design, construction, reconstruction, and overhaul of buildings, constructions, and other objects. Operation requirements for buildings, constructions, and other objects related to waste management. Requirements for waste disposal facilities. Requirements for waste treatment in the territory of municipal units. Requirements for treatment with scrap and waste of ferrous and (or) non-ferrous metals. Requirements for the development and implementation of regional programs in the sphere of waste management, including management of municipal solid waste. Requirements for the territorial schemes in the sphere of waste management, including management of municipal solid waste. Requirements for handling waste of 1-4 hazard classes. Requirements for persons involved in the collection, transportation, processing, utilization, neutralization, and disposal of waste of hazard class 1-4. Requirements for waste transportation. Transboundary movement of waste.

Topic 5. Economic mechanisms for waste management regulation. Waste disposal fee. Insurance in the sphere of waste management. Environmental damage caused by improper waste treatment and litigation. Environmental audit in the sphere of waste management.

Topic 6. Usage, neutralization, and transportation of waste. Technological processes for recycling and neutralization of waste. Neutralization and utilization of waste from waste-water treatment. Usage and neutralization of electroplating waste. Usage and neutralization of oily sludge wastes. Usage and neutralization of ash and slag wastes from electric power industry. Usage and neutralization of mercury containing wastes. Recycling of old car tires. Recycling of car batteries. Recycling of plastic waste. Organization of collection and transportation of waste. Basic requirements for transportation of waste. Requirements for waste transportation. Transboundary movement of waste.

E-learning module

Topic 7. Global environmental problems caused by waist impact. The rate of global garbage growth. The risks of biochemical pollution of the environment by unauthorized landfills. The problems of marine litter. The characteristics of modern materials decomposition in natural environment. The experience of different countries in waste management. Waste shortage in Sweden. Garbage city in Cairo. Recycling and waste management opportunities. The environmental impacts of incinerators. The role of environmental education in solving environmental problems.

Topic 8. Technology of collection, disposal and storage of waste. Characteristics of municipal solid waste (MSW). Seasonal changes in the MSW composition. Indicative norms of MSW accumulation. Waste properties. Criteria for selection of MSW management methods and location of MSW management facilities. MSW management methods. Criteria for selection of the optimal technology for MSW neutralization. Technology of MSW collection, transportation and storage in landfills. Landfill operation technologies. Organization of ecological monitoring of landfills. Establishment of a MSW landfill. Technology of waste storage in landfills. MSW composting methods and schemes. The principle scheme of MSW composting. Technology of recultivation of MSW closed landfills.

Overview of sessions and teaching methods

In the course, both traditional, such as lectures and seminars, and active teaching methods, including group discussions, case-study, and project-based learning will be used. The lectures will focus on the key topics. Seminars will follow the lectures and will be aimed at the development and reinforcement of theoretical knowledge, the formation of skills of self-guided work with literature, and the formation of ability to formulate one's thoughts briefly and to the point, as well as to express and promote one's opinion on various issues of waste management. Practical trainings will help students develop their skills in analyzing specific situations connected to production and consumption waste management and in making necessary calculations.

While working on e-learning module, the students should watch the suggested videos, study the suggested theoretical material, and complete on-line tests.

The main course assignment will be an individual project. Each student will have to perform a complex of exploratory, research, calculating, graphical and other types of work to determine the potential capacity and surface area of a solid wastes landfill, and to substantiate the best place for its location in one of the administrative centers of the Altai Republic.

The presentation of individual research works and calculations will be in the form of a conference. The students should demonstrate their practical skills in determining basic parameters of solid wastes landfills characterizing the degree of their impact on the environment, and to be able to recommend the most appropriate option for their location.

Course workload

The table below summarizes course workload distribution:

Activities	Learning outcomes	Assessment	Estimated workload (hours)
In-class activities			
Lectures	Understanding theories, concepts, methodology and tools	Class participation	8
Moderated in-class discussions	Understanding organization of the production and consumption waste management system, knowing the methods for reducing the negative impact of waste to the environment	Class participation and preparedness for discussions	8
In-class assignments	Understanding organization of the production and consumption waste	Class participation and preparedness	6

	management system, knowing the methods for reducing the negative impact of waste to the environment	for assignments	
Independent work			
Reading and discussion of assigned papers for seminars and preparation for lectures	Familiarity with and ability to critically and creatively discuss key concepts, tools and methods as presented in the literature	Class participation, creative and active contribution to discussion	30
E-learning module	Understanding information presented in the E-learning module	Quality of the tests completion	20
Work on individual project	Ability to perform a complex of exploratory, research, calculating, graphical and other types of work to determine the potential capacity and surface area of a solid wastes landfill and to substantiate the most appropriate place for its location	Quality of the project developed, visibility and informativeness of the presentation	36
Total			*108*

Grading

The students' performance will be based on the following:

- Level of preparedness for participation in class discussions and seminars (20 %);
- Performance of the course assignments (20 %);
- E-learning module (20%)
- Quality of the individual project (40%);

Course schedule

All the classes will be taught in accordance with the university timetable.

Classes	Topics
1	Lecture: Legal framework in the sphere of waste management in the Russian Federation and EU countries.
2	Lecture: Regulation of activities in the sphere of hazardous production and consumption waste management.
3	Lecture: Hazardous production and consumption waste.
4	Lecture: Prevention of harmful effects of production and consumption waste on human health and environment.
5	Seminar: Specificity of the legislation in the sphere of waste management in the Russia Federation and the European Union.
6	Practical training: Determination of waste composition, degree, and hazard class.
7	Practical training: Calculation of norms for waste generation.
8	Practical training: Revealing of generated waste with a help of schemes of material flows in technological processes.
9	Practical training: Drawing Ishikawa diagrams to reveal root causes of

	discrepancies when handling industrial wastes (case study).
10	Seminar: Hazardous waste management; waste regulations and their economic mechanisms.
11	Practical training: Usage, neutralization, and transportation of waste (case study).
12	Presentation and defense of individual projects "Variants for placement and calculation of potential capacity and surface area of a solid wastes landfill."
E-learning module	
Global environmental problems caused by waste impact.	
Technology of collection, disposal and storage of waste.	

Course assignments

- Assignment #1 – Determination of waste composition, degree, and hazard class.
- Assignment #2 – Calculation of norms for waste generation.
- Assignment #3 – Revealing of generated waste with a help of schemes of material flows in technological processes.

Assignment #1 will help students understand the specificity of waste classification by the degree of its hazard to the environment. Assignment of waste to one or another class is made with a help of calculation method. During the practical training the students will learn how to estimate index (K) characterizing the degree of waste hazard to the environment.

Assignment #2 deals with a very important issue of calculating norms for industrial waste generation. Such norms are developed for industrial waste that should be buried at special waste burial sites and (or) stored in waste storage facilities, except in cases provided by law. The students will be introduced to various calculation methods.

While performing **Assignment #3** the students will learn to draw schemes of material flows in technological processes, and to further use them for developing a complete list of generated waste.

Literature

1. Nazarov. A.I. Upravlenie tverdymi otkhodami v subyekte federatsyi: monografia. [Elektronnyi resurs] [Solid waste management in the subject of the federation: monograph]. Moscow, 2013. 211 p. URL: http://window.edu.ru/resource/798/79798

2. Pimenov A.N. Klassifikatsya otkhodov proizvodstva i potrebleniya po gruppam i vidam: uchebnoye posobie dlya vuzov. [Elektronnyi resurs] [Classification of production and consumption waste by groups and types: textbook for higher educational institutions]. Saint-Petersburg: Baltic State Technical University named after D.F.Ustinov (Voenmeh), 2014. 29 p. URL: http://e.lanbook.com/books/element.php?pl1_id=63698

3. Sokolov L.I. [i dr.] Sbor i pererabotka tverdykh kommunal'nykh otkhodov: monografia. [Elektronnyi resurs] [Collection and recycling of municipal solid waste: monograph]. Moscow: Infra-Inzheneria, 2017. 176 p. URL: http://www.iprbookshop.ru/69009.html.— ЭБС «IPRbooks»

4. Klinkov A.S. [i dr.] Utilizatsya i pererabotka tverdykh bytovykh otkhodov: uchebnoye posobie. [Elektronnyi resurs] [Utilization and recycling of municipal solid waste: textbook]. Tambov: Tambov State Technical University, 2015. 188 p. URL: http://www.iprbookshop.ru/63916.html. EBS «IPRbooks»

5. Federal'nyi zakon 24.06.1998 No. 89-FZ (red.ot 29.07.2018) "Ob otkhodakh proizvodstva i potrebleniya". [Elektronnyi resurs] [The Federal Law of 24.06.1998 No. 89-FZ "On production

and consumption waste] Free access from 8 pm to 12 pm, at weekends and on public holidays on the official website "Konsultantplus." URL: http://www.consultant.ru/

6. Khoroshavin L.B. Osnovnye technologii pererabotki promyshlennykh i tverdykh kommunal'nykh otkhodov: uchebnoye posobie. [Elektronnyi resurs] [Basic technologies for recycling of industrial of municipal solid waste: textbook]. Yekaterinburg: Ural Federal University, 2016. 220 p. URL: http://www.iprbookshop.ru/66561.html. EBS «IPRbooks»

Internet-resources

1. Spravochno-informatsyonnaya sistema "Otkhody.ru" [Reference-information system "Waste.ru"]. [Official website]. URL: http: www.waste.ru

2. Nauchno-prakticheskiy zhurnal "Tverdye bytovye otkhody" [Scientific and practical journal "Municipal solid waste"]. [Official website]. URL: http: www.solidwaste.ru

3. Spetsyalizirovannyi zhurnal "Spravochnik ekologa" [Specialized journal "Ecological reference book"]. [Official website]. URL: http: www.profiz.ru/eco

4. Otraslevoi portal [Industry's portal].[Official website]. URL: http: www.recyclers.ru

5. Mezhdunarodnaya assotsyatsya po tverdym otkhodam [The International Solid Waste Association]. [Official website]. URL: http: www.iswa.org

6. Koalitsya "PRO Otkhody" [Coalition "ABOUT waste"]. [Official website]. URL: http: www.proothody.com

7. Zhurnal "Ekoprogress" [Journal "Ecoprogress]. [Official website]. URL: http: http://экопрогресс.рф

8. Karta punktov vtorsyr'ya "Vtoraya zhizn' veshchei" [The map of recyclable material collection stations "The second life of things"]. [Official website]. URL: http: www.recyclemap.ru