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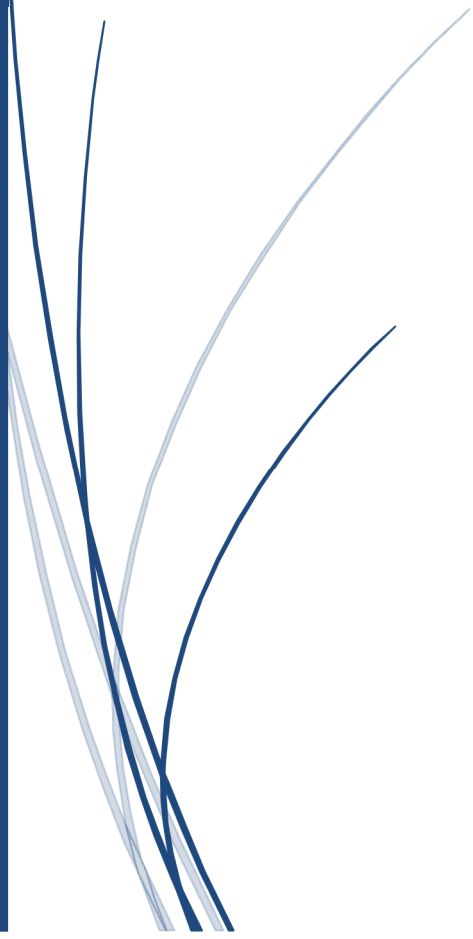
RESEARCH ON THE CURRENT ENVIRONMENTAL LEGISLATION PRACTICES IN THE OECD* COUNTRIES, RUSSIA, AND BRAZIL

Research Report

** OECD countries for which the research was performed (in accordance with the Technical Specifications): United Kingdom, Norway, Germany, USA and Canada*



KAZENERGY Assosiation

EXECUTIVE SUMMARY

This report provides information on the results of the research of current environmental legislation practices in OECD countries, Russia, and Brazil. Goals and objectives of the research, as well as the detailed methodology for data collection and report writing, are disclosed in *About the Research* section. *Environmental Regulation* section presents data on the practices of implementation of environmental regulations based on the use of best available techniques with detailed information on the categories of regulated enterprises, types of environmental standards, regulated pollutants, and approaches for determining emission and discharge standards for pollutants in the countries studied. Practices of environmental regulations during gas flaring, wastewater injection, and disposal of sulphur at open-air storage sites are highlighted separately *in the Oil and Gas Sector* section, taking into account the specifics of environmental regulation in the oil and gas industry, to reflect the most pressing issues for the members of KAZENERGY Association.

To disclose information on the regulations of generation, accumulation and disposal of waste in the countries studied, the *Waste Management* section has been prepared. The section also provides key terminology in the field of waste management, information on waste classification, as well as the practices of waste management systems, in particular, in OECD countries.

Environmental Permits and *State Environmental Expertise* sections contain a description of the procedures for approving project documentation and obtaining environmental permits. Considerable attention has been paid to the requirements for obtaining integrated environmental permits in the *Environmental Permits* section. Features of the transition period of Russia to the emission regulation based on the best available techniques, and accordingly, on obtaining integrated environmental permits are also described in the relevant section.

Detailed information on the conduct of state inspections is disclosed in *Environmental Control System* section. Principles for determining the responsibility of natural resource users for environmental crime, environmental damage, legacy contamination and non-compliance with environmental protection measures are reflected in *Responsibility of Natural Resource Users* section.

Environmental Payments section presents data on types and amounts of payments made by natural resource users. This section also provides information on the intended purpose of the funds raised, and measures to incentivize enterprises to utilize green technologies and practices.

The main characteristics of existing systems for greenhouse gas emission regulations are provided in the relevant section. In addition to information on greenhouse gas emission trading systems, the section contains data on mechanisms for regulating the price of carbon credits and state support tools for the most energy-intensive and competitive industries.

Final sections disclose information on the practices of conducting environmental audits and requirements for the implementation of environmental insurance in the countries studied.

CONTENTS

LIST OF ABBREVIATIONS

AMS	Automated Measurement Systems
BOD	Biological Oxygen Demand
SEC	State Environmental Control
SER	State Environmental Expertise
ERU	Emission Reduction Units
EETS	European Emission Trading System
Ps	Pollutants
ITD	Information and Technical Directory
CEP	Comprehensive Environmental Permit
VOC	Volatile Organic Compounds
CDM	Clean Development Mechanism
NEI	Negative Environmental Impact
ADS	Allowable Discharge Standards
BAT	Best Available Technique
NGO	Non-governmental Organizations
EIA	Environmental Impact Analysis
SPNR	Specially Protected Natural Reservations
EP	Environmental Protection
E	Environment
OECD	Organization for Economic Co-operation and Development
MAE	Maximum Allowable Emission
MAL	Maximum Allowable Level
APG	Associated Petroleum Gas
WGSDL	Waste Generation Standards and Waste Disposal Limits
PEM	Production Environmental Control
SPA	Sanitary Protection Area
JI	Joint Implementation
CER	Certified Emission Reductions
ETS	Emission Trading System
REM	Remote Emission Monitoring
FCCW	Federal Classificatory Catalogue of Wastes
COD	Chemical Oxygen Demand
AAAQO	Alberta Ambient Air Quality Objectives
AER	Alberta Energy Regulator
AMS	Automated measuring system
AQMS	Air Quality Management System
BAT	Best Available Technology
BATEA	Best available technology economically achievable
BLIER	Base-level industrial emission requirements
BREF	Best Available Techniques Reference Document
CAAQS	Canadian Ambient Air Quality Standards
CCA	Climate Change Agreements
CCIR	Carbon Competitiveness Incentive Rugulation
CCL	Climate Change Levy
CCS	Carbon capture and storage
CEAA	Canadian Environmental Assessment Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CETESB	Companhia Ambiental do Estado de São Paulo
CONAMA	Conselho Nacional do Meio Ambiente (Ministry of environment, Brazil)

CPF	Carbon Price Floor
CPS	Carbon price support
DOI	Department of the Interior
EA	Environmental Assessment
EAB	Environmental Appeals Board
EEM	Environmental Effects Monitoring
EIS	Environmet Impact Statement
EITE	emissions-intensive trade-exposed sectors
EMAS	Eco-Management and audit scheme
EPEA	Environmental Protection and Enhancement Act
FONSI	Finding of no significant impact
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brazilian Institute of the Environment and Renewable Natural Resources)
ISO	International Organization for Standardization
MI	Meta intermediária (Intermediate Objective)
MRV	Monitoring, Reporting, and Verification
MSR	Market Stability Reserve
NEPA	National Environmental Policy Act
NORM	Naturally Occurring Radioactive Materials
NPRI	National Pollutant Release Inventory
OGA	Oil and Gas Authority
OMA	Operator Monitoring Assessment
OWL	Oilfield Waste Liability
PF	Padrão final (Final Standard)
PM	Particulate Matter
PRTR	European Pollutant Release and Transfer Register
RGGI	Regional Greenhouse Gases Initiative
SDWA	Safe Drinking Water Act
UIC	Underground Injection Control
US EPA	United States Environmental Protection Agency
WLA	Wasteload Allocation

ABOUT THE RESEARCH

1.1. Research Objectives

Prerequisite for this research is the beginning of a reform of the environmental regulation system of the Republic of Kazakhstan (hereinafter referred to as the RK). The result of the ongoing transformations of the environmental legislation should be the adoption of a new Environmental Code of the RK (hereinafter referred to as the Code). At the time of preparation of this Report, a Concept of the Draft Environmental Code project (dated August 15, 2018) has been developed, which contains the results of the legal review of Kazakhstani legislation and the required changes to the norms of the Code. The document also presents certain practices of foreign experience in the field of environmental protection regulation. According to the Concept, best practices of environmental regulation in OECD countries must be considered when developing a new Code.

Thereby, the Association of Legal Entities "Kazakhstan Association of Oil-Gas and Energy Sector Organizations "KAZENERGY" (hereinafter referred to as the KAZENERGY) conducted a detailed research of environmental legislation in some OECD countries (Great Britain, Norway, Germany, USA and Canada), Russia, and Brazil.

The purpose of the research is the study and fair presentation of information on the current environmental legislation in the countries studied. *The research objective* is a detailed study of the following areas of environmental regulation:

- state and public administration practices in the field of environmental protection;
- environmental regulation;
- conduct of state environmental expertise;
- environmental permits;
- implementation of best available techniques (BAT);
- waste management;
- greenhouse gas emissions regulation;
- environmental inspections (state, production, public);
- environmental monitoring, background studies;
- environmental payments;
- responsibility of natural resource users;
- environmental insurance;
- environmental audit.

1.2. Research methodology

Professional consultants of international company, EY, were involved in the preparation of the research. The countries studied were selected taking into account the maturity level of environmental legislation and the presence of oil and gas industry. In the event of difference in legislative requirements between the administrative divisions of individual countries, examples of best practices in the environmental regulation of oil and gas enterprises were considered.

The planned and unapproved legislation amendments were not taken into account, except for Russia, where, since 2014, reform of environmental law has been carried out.

When analyzing international experience in European countries, the general requirements were described at first, followed by a description of the national legislative requirements in Great Britain, Norway, and Germany.

Sources of information were the official legislative databases of the countries studied, as well as the official reports and researches of international organizations such as the OECD, World Bank, and the European Commission. Additional information was obtained during the interviews with EY experts in the countries studied.

It should be noted that the used foreign terminology was (as necessary) adapted to Kazakhstani practice. A clear distinction was made when significant differences were identified.

Information on environmental payment rates is provided as of 2017, unless indicated otherwise. The conversion of national currencies into US dollars was done according to the average exchange rate for 2017, according to the official website of the National Bank of Kazakhstan.

It should be noted that the research did not entail a critical assessment of information, as well as comparison of international and Kazakhstani practices. The report does not provide recommendations on implementation of the considered environmental regulation practices, amendments and / or supplements to the current environmental legislation of the RK.

2. ENVIRONMENTAL REGULATION

Environmental regulation in OECD countries is carried out on the basis of emission/discharge limits provided by BAT implementation. BAT does not entail only the relevant technologies, but also processes, approaches, and practices that ensure prevention and reduction of negative impact on the environment. BAT available for implementation in EU and Russia are provided in approved directories (BREF, ITD BAT). It should be noted that enterprises are not obligated to adopt specific technologies and equipment specified in the BAT directories. The main criterion for the selection of any technology is the provision of a high level protection of the environment.

Apart from that, the directories contain information on emission levels provided by BAT application. These emission levels are then adopted as the established emission limits. At the same time, the emission levels may be expressed both as gross values or concentrations of pollutants at the pollution sources, as well as specific operational indicators of the above-mentioned technologies.

It is noteworthy, that the main criterion for adopting emission levels as the emission limits is not exceeding the established environmental quality norms at the assessment points approved for a specific facility. In OECD countries, the quality norms include both sanitary and hygienic (impact on human health) and environmental indicators (impact on individual components of the environment, such as flora and fauna). All the while, sanitary protection zone determination practices in the studied OECD countries are absent.

In the event then BAT implementation is technically and economically infeasible, the relevant authorities may issue a temporary non-compliance allowance period not exceeding one year, provided that during the period other activities to protect the environment will be carried out.

2.1. Russia

2.1.1. An approach to environmental regulation in Russia, based on BAT

By the Order No. 398-r[1] of the Government of Russian Federation, dated March 19, 2014, a series of measures aimed at ceasing the utilization of outdated and inefficient technologies, and transitioning to the principles of best available technologies (BAT), was approved. During the same year, a list of application fields for BAT was

[1] RF Government Order dated March 19, 2014 No. 398-r On a Package of Measures Aimed at Avoiding the Use of Outdated and Inefficient Technology, Transition to the Principles of Best Available Techniques and Implementation of Modern Techniques (as amended and supplemented)

approved[2], along with a step-by-step establishment schedule of information and technical directories (ITD) for 2015-2017 .

Within the framework of encouraging smooth transition to BAT, starting from January 1, 2020, application of reduction coefficients to fee rates, down to even 0 (total cancellation of emission and discharge fees) during BAT implementation, as well as tax incentives for entities implementing and designing BAT,has been provided.

Best Available Technology is technology for producing goods, labor performance, and provision of services determined on the basis of modern achievements of science and technology, and the best combination of criteria for achieving environmental protection goals, subject to the availability of technical opportunities for its application[3].

The application of BAT is aimed at comprehensive prevention and (or) minimization of negative impact on the environment. Thus, emissions, discharges, generation and disposal of production and consumption waste are regulated within the framework of ITD BAT[4].

Information and technical directory on best available technologies (ITD BAT) is a document of national standardization system, approved by the federal executive authorities in the field of standardization (Rosstandart). ITD BAT contains systematized data in a particular field and includes a description of the technologies, processes, methods, practices, equipment, etc[5]. ITS BAT is one of the key aspects of the transition of industry to the principles of state environmental regulation based on BAT.

According to the Decree No. 1458 of the Government of Russian Federation dated December 23, 2014, the authority to develop BAT directories is entrusted to the Federal Agency for Technical Regulation and Metrology (Rosstandart)[6.] Today, the legal status of ITD, as a regulatory document, is enshrined in Federal Law No. 162 dated June 23, 2015 On "Standardization in the Russian Federation"[7]. Rosstandart determines the technological processes, equipment, technical methods, practices in BAT for a specific field of application.

The procedure[8] to determine technology as BAT, as well as development, actualization and publication of ITD BAT is established by the Government of the Russian Federation.

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[2] RF Government Order dated December 24, 2014 No. 2674-r On Approval of the List of BAT Application Fields (as amended and supplemented)
[3] FZ No. 7 On Environmental Protection
[4] ITD BAT 2016
[5] Federal Law dated June 29, 2015 No. 162 On Standardization in the Russian Federation
[6] RF Government Decree dated December 23, 2014 No. 1458 On Technique Determination as the Best Available Technique, as Well as Developing, Updating and Publishing Information and Technical Directories on the Best Available Techniques
[7] Federal Law dated June 29, 2015 No. 162 On Standardization in the Russian Federation
[8] Rules for technique determination as the best available technique, as well as developing, updating and publishing information and technical directories on the best available techniques

Designation of technology to BAT is carried out according to the following criteria[9]:

- the lowest level of negative impact on the environment per unit of time or volume of products (goods) produced, work performed, services provided, or other indicators stipulated by international treaties of the Russian Federation;
- economical efficiency of its implementation and utilization;
- application of resource and energy efficient methods;
- period of its implementation;
- industrial implementation of this technology at two or more facilities that negatively impact the environment.

Development of ITD BAT includes the following mandatory stages:

- establishment of a working group, including experts of interested federal executive authorities, state scientific organizations, profit and non-profit organizations, including state corporations, to develop a directory and approve its content;
- collection and analysis of data necessary for the development of the directory;
- development of the draft directory that shall include the following sections:
    - analysis of the key issues of the industry;
    - informative list of applied technologies and indicators;
    - determination of technology as BAT;
- public discussion of the draft directory;
- inspection by the Technical Committee;
- dispute resolution by the Interdepartmental Council (if any);
- approval of the directory.

ITD BAT are developed taking into account technologies, equipment, raw materials, and other resources available in the Russian Federation, while also taking into consideration climatic, economical, and social features. International BAT directories, including European BREF directories may be used during their development.

Application fields of BAT include economic and (or) other activities that have a significant negative impact on the environment, and also technological processes, equipment, technical practices and methods used in the implementation of economic and (or) other activities.

Currently, in accordance with the step-by-step establishment schedule[10]of the best available technology directories for 2015–2017, 51 ITDs have been developed and approved for such industry applications as natural and associated gas processing, fuel combustion at large plants for power generation, coal mining and beneficiation,

[9] Order of the Ministry of Industry and Trade of the Russian Federation dated March 31, 2015 No. 665 On Approval of Methodological Recommendations for Determining the Technique as the Best Available Technique

[10] RF Government Order dated December 31, 2014 No. 2178-r On the Gradual Creation of the BAT Chart of Industrial Directories in 2015–2017

oil refining, oil production, waste recycling and utilization, disposal of production and consumption waste, etc.[11]

The following specific ITD BAT have been developed for the regulation of emissions and pollutant discharges[12]:

- 'Wastewater treatment for production of goods, labor performance, and provision of services at large enterprises;'
- 'Wastewater treatment using centralized water disposal systems in settlements, urban districts;'
- 'Wastewater and exhaust gas treatment (handling) systems in the chemical industry;'
- 'Purification of emissions of harmful substances into the atmosphere during the production of goods, as well as labor performance and provision of services at large enterprises, etc;'

ITD BAT contain the following information[13]:

- indication of the specific type of economic and (or) other activities (industry, part of the industry, production) in the Russian Federation, including the used raw materials, fuel;
- description of the main environmental issues pertaining to a particular type of economic and (or) other activity;
- methodology for determining BAT;
- description of the best available technology for a particular type of economic and (or) other activity, including a list of main technological equipment;
- technological indicators of BAT;
- methods applied during the implementation of technological processes to reduce their negative impact on the environment, and not requiring technical retooling or reconstruction of the facility negatively impacting the environment;
- assessment of benefits of BAT implementation for the environment;
- information on the limitations of BAT implementation;
- economic indicators distinguishing BAT;
- information on the latest BAT, regarding which research and development works have been carried out, including experimental-industrial implementation;
- other information relevant to the practical implementation of BAT.

The review of technologies determined as BAT is carried out at least once in ten years.

[11] Rosstandart. BAT Directories-2017
[12] Rosstandart. BAT
[13] Federal Law On Environmental Protection dated January 10, 2002, No. 7-FZ, Art. 28-1

From January 1, 2015, the Federal Law No. 219 dated July 21, 2014 On "Amendments to the Federal Law On Environmental Protection and Certain Legislative Acts of the Russian Federation" entered into force, and it tightens requirements for environmental regulation and issuance of environmental permits based on technological limits.

Technological limits are established on the basis of technological indicators contained in ITD BAT. Technological indicators include pollutant concentrations, the volume and mass of emissions, pollutant discharge, production and consumption waste, water and energy resources consumption, *per unit of time or unit of produced goods, work performed, and services provided*[14]. The practice of developing technological indicators contained in BAT directories in Russia is based on using the results of a comparative intra-industry analysis of environmental performance and resource efficiency of the best practices of Russian enterprises.

The emission limits calculated in the project documentation must not exceed the established technological indicators of BAT.

At present, the methodology for setting emission limits based on technological indicators is under development. The final decision regarding the approach to the determination of emission limits has not yet been made. Thus, the possibilities of setting limits on the basis of specific technological indicators for the production in total, as gross values (tons / year), and rationing emissions at the source of emission/discharge in the form of pollutant concentrations (mg / m^3) are being considered.

2.1.2. Categories of Regulated Enterprises

Facilities that negatively impact the environment, and are subject to regulation in Russia, are classified into 4 categories according to the extent of negative environmental impact[15]:

- *Category I* - facilities that cause significant negative impact on the environment and are related to BAT application fields;
- *Category II* - facilities that cause moderate negative impact on the environment;
- *Category III* - facilities that cause insignificant negative impact on the environment;
- *Category IV* - facilities that cause minimal negative impact on the environment.

[14] Federal Law On Environmental Protection dated January 10, 2002, No. 7-FZ, Art. 1

[15] 'On approval of the criteria for classifying facilities that negatively impact on the environment, to facilities of I, II, III and IV categories'

The following factors are taken into account[16] when establishing criteria based on which facilities are classified into relevant categories:

- environmental impact levels of the types of economic and (or) other activities (industry, part of the industry, production);
- toxicity level, carcinogenic and mutagenic properties of pollutants contained in emissions and discharges of pollutants, as well as hazard classes of production and consumption waste;
- classification of industrial facilities and production, etc.

In particular, facilities that carry out economicactivities for the extraction of crude oil and natural gas, including the processing of oil and natural gas, are considered as category I facilities, according to these criteria.

A facility that negatively impacts the environment is assigned to the corresponding category during its registration for the state record of facilities negatively impacting the environment. The category of the facility may be changed during the update of the accounting information of the facility negatively impacting the environment.

From January 1, 2019, amendments to the Federal Law No. 7-FZ On Environmental Protection dated January 10, 2002 enter into force, according to which allowable emission / discharge limit establishmentswill only be made for category I and II facilities.

For a total transition of all production facilities to the new system of environmental regulation a transition period has been established: from 2019 to 2025. In accordance with the Order No. 154 On Approval of the List of Facilities that Negatively Impact on the Environment...[17], of the Ministry of Natural Resources and Environment of the Russian Federation dated April 18, 2018 only 300 enterprises whose contribution to total emissions (discharges) of the Russian Federation is at least 60%, are subject to receiving IEP during the first stage of the transition period (2019-2022). Additionally, obligation to transfer to IEP shall be applied to all new enterprises of category I between 2019-2022. During the second stage (2022–2025), all other enterprises of category I will be transferred to CEP. Moreover, legal entities and individual entrepreneurs who carry out economic and (or) other activities at category II facilities, must submit a declaration of environmental impact, according to N-219 FZ[18]. Detailed information on the procedure for obtaining IEP is provided in Environmental Permits Section.

[16] Federal Law On Environmental Protection dated January 10, 2002, No. 7-FZ
[17] Order of the Ministry of Natural Resources and Environment of the Russian Federation of April 18, 2018 No. 154 'On Approval of the List of Facilities Belonging to Category I that Negatively Impact on the Environment, which Contribution to Total Emissions, Discharges of Pollutants in the Russian Federation is not less than 60 Percent'
[18] Federal Law dated July 21, 2014 No. 219-FZ On Amendments to the Federal Law on Environmental Protection and Certain Legislative Acts of the Russian Federation

2.1.3. List of regulated pollutants

Pollutants for which state regulation measures are applied in the field of environmental protection, are determined by:

- taking into account the toxicity level, carcinogenic and (or) mutagenic properties of chemical and other substances, including those with a tendency to accumulate in the environment, as well as their ability to transform into compounds with greater toxicity in the environment;
- taking into account state environmental monitoring and social-hygienic monitoring data;
- if any pollutant measuring techniques (methods)[19] exist.

List of pollutants for which state regulation measures are applied, is approved by the Order No. 1316-r[20] of the Government of Russian Federation dated July 8, 2015.. It includes 254 substances for the atmosphere; 249 substances for water and 63 substances for soil. The list is approved for 10 years and is subject to review upon the expiration of the set period, or no later than 1 year after the acceptance of international obligations of the Russian Federation in the field of environmental protection, requiring state regulation measures not included in the list.

In addition, according to the requirements of federal legislation[21] in order to comply with hygienic standards, the maximum allowable levels of physical impact (radiation, noise, vibration, magnetic fields)[22] are set, at which there is no adverse effect on human health and the environment.

2.1.4. Types of environmental standards

In order to regulate the emissions volume of pollutants in Russia, the environmental quality standards and standards for allowable environmental impacts are established.

Environmental Quality Standards are standards set in accordance with physical, chemical, biological, and other indicators for assessing the state of the environment, following of which ensures a favorable environment. Environmental quality standards are established to assess the state of the environment, in order to ensure favorable standards of living, rational use of natural resources, preservation of natural ecosystems, genetic funds of plants, animals, and other organisms.

Environmental quality standards are set in the form of maximum allowable concentrations (MAC) of harmful substances, as well as harmful microorganisms and other biological substances that pollute the air, water and soil, and standards for

[19] Federal Law dated January 10, 2002 No. 7-FZ On Environmental Protection, Article 4.1 Pollutants
[20] List of pollutants for which measures of state regulation are applied in the field of environmental protection
[21] RF Government Decree dated March 02, 2000. No. 183 On Emission Limits of Harmful (Polluting) Substances into the Air and Harmful Physical Impacts on it
[22] Resolution of the Chief State Sanitary Doctor of the Russian Federation dated June 21, 2016. No. 81 'On approval of SanPiN (Sanitary Rules and Regulations) 2.2.4.3359-16 Sanitary and Epidemiological Requirements for Physical Factors at Workplaces'

maximum allowable levels (MAL) of negative physical impacts on the environment (radiation, noise, vibration, magnetic fields, etc.)[23].

The maximum allowable concentration (quantity) (MAC) is the amount of pollutant in the environment (soil, air, water, food), which, with a permanent or temporary effect on a human, does not impact their health and does not cause adverse effects on their offsprings. MAC is calculated per unit of volume (for air, water), mass (for soil, food products), or surface (for working people's skin exposure).

Maximum Allowable Levels (MAL) of harmful physical impacts are standards set in accordance with the levels of allowable impacts of physical factors on the environment, following of which ensures the environmental quality standards are achieved.

Ambient air quality standards include the MAC of the harmful substance in the air of the working area, one-time MAC limit and daily average MAC.

- **The maximum allowable concentration of a harmful substance in the air of the working area (MAC_{wa})** is the maximum concentration that, during daily (except weekends) work for 8 hours or for a different duration (but not more than 41 hours a week), should not cause diseases or other health problems, which can be detected by modern methods of research, in the process of work or in the remote periods of life of present and subsequent generations. The term working area should consider the space up to 2m above the ground level, on which there are places of permanent or temporary stay of employees.
- T**he maximum allowable one-time concentration (MAC_{ot})** is the maximum concentration of a harmful substance in the air of populated aggregates that does not cause reflex (including subconscious) reactions in the human body (odor sense, changes in the eye illumination sensitivity, etc.) within 20 minutes of inhalation.
- **The maximum allowable daily average concentration (MAC_{da})** is the maximum concentration of a harmful substance in the air of populated aggregates, which should not have direct or indirect impact on a human if consistently (for years) inhalation.

Water quality standards are developed for consumption of water for drinking, public-household use, and fishery, and are determined in accordance with current legislation[24].

- **The maximum allowable concentration in the water body used for drinking and public-household use (MACw)** is the maximum concentration

[23] Federal Law dated January 10, 2002 No. 7-FZ 'On Environmental Protection'
[24] Resolution of the Chief State Sanitary Doctor of the Russian Federation dated April 30, 2003. No. 78 'On Implementation of Sanitary-Hygienic Standard 2.1.5.1315-03'

of a harmful substance in water that should not directly or indirectly impact the body of the exposed person during their life, does not have impact on the health of subsequent generations, and should not worsen the hygienic conditions of the water consumption.

- **The maximum allowable concentration in the water body used for fishery (MACwf**) is the maximum concentration of a harmful substance in water that should not have a harmful impact on the populations of fish, primarily commercial fish.

The standards for allowable environmental impact when performing economical and (or) other activities are standards set in accordance with indicators of the impact of economical and other activities on the environment, and which comply with environmental quality standards. The standards for allowable impact on the environment include:

- allowable emission standards, allowable discharge standards;
- technological standards;
- technical standards[25];
- waste generation standards and waste disposal limits;
- standards for allowable physical impacts (levels of heat, noise, vibration and ionizing radiation, electromagnetic field strength, and other physical impacts)[26];
- standards for allowable withdrawal of environmental components[27];
- standards for allowable anthropogenic stress on the environment[28].

2.1.5. Regulation of pollutant emissions into the atmosphere

In accordance with the environmental legislation of the Russian Federation[29], legal entities having sources of air pollution are required to do inventory of sources of harmful (polluting) substances and to develop a draft of maximum allowable emissions into the atmosphere (MAE). Carrying out any financial and economic activities without the MAE project is prohibited for all users of natural resource that have sources of the ambient air pollution. However, according to Federal Law No. 219[30], the current legislation is being amended, and from January 1, 2019 the

[25] *standards set for engines of mobile sources of environmental pollution in accordance with the levels of allowable environmental impact;*
[26] *standards set in accordance with the levels of allowable environmental impacts of physical factors, and in compliance with which the environmental quality standards are ensured;*
[27] *standards established in accordance with the restrictions about the volume of their withdrawal in order to preserve natural and natural-anthropogenic objects, ensure the sustainable functioning of natural ecosystems, and prevent their degradation;*
[28] *standards set in accordance with the value of the allowable cumulative impact of all sources on the environment and (or) individual components of the environment within specific areas and (or) basins and if they are observed, the sustainable functioning of natural ecological systems is maintained, and biological diversity is preserved;*
[29] Federal Law dated January 10, 2002 No. 7-FZ 'On Environmental Protection'
30 Federal Law dated July 21, 2014 No. 219-FZ On Amendments to the Federal Law on Environmental Protection and Certain Legislative Acts of the Russian Federation

development of the MAE project is not required for facilities of categories III-IV under Federal Law No. 7, with the exception of radioactive or highly toxic substances, as well as substances with carcinogenic and mutagenic properties (substances of I, II hazard classes).

Maximum allowable emissions are considered as the standard of maximum allowable emissions of harmful (polluting) substances into the atmosphere, which is set for a stationary source of air pollution with regard to technical standards for emissions and background pollution of the atmosphere, provided that this source does not exceed the hygienic and environmental standards for the ambient air quality, allowable (critical) loads on environmental systems, other environmental standards.

The basis for performing work on the regulation of pollutant emissions into the atmosphere is the outcome of inventory of emissions of harmful (polluting) substances into the air and their sources (in relation to existing owner entities), and project documentation data (in relation to new and / or reconstructed owner entities). Based on the data of inventory results, the sources of emissions and pollutant lists that are subject to state accounting and regulation are determined in accordance with current regulatory documents.

The MAE standards for a particular stationary emission source and the owner entity are established for the conditions of the regulatory equipment installation and utilization, as well as the normal state of systems and devices of ventilation and dust and gas purifying equipment. This takes into account the actual maximum capacity of the equipment over the past three years and the possibility of changing it during the period of validity of the established MAE standards.

The criterion for accepting the calculated emission values as MAE is not exceeding the standards for the ambient air quality (MAC) at the border of sanitary protection zone(SPZ) of an enterprise based on the results of calculating the dissipation of ground-based pollutant concentrations in the atmosphere. In addition, with the implementation of the obligations of enterprises of category I to establish standards for pollutant emissions into the atmosphere, based on BAT, the calculated values of MAE will have to meet the requirements of technological indicators. Standards of MAE into the atmopshere are set as maximum one-time values (g / sec) and gross annual values (tons / year).

Sanitary Protection Zone Requirements

Legislative regulation on the organization, development, and establishment of the SPZ regime in Russia is, in general, similar to Kazakhstan's practice[31]. It should be noted that the IEP implementation will not entail the abolition of mandatory requirements for SPZ organization for hazardous production facilities. Thus, the condition for the approval of MAE standards will be not exceeding both hygienic

[31] Resolution of the Chief State Sanitary Doctor of the Russian Federation dated September 25, 2007 No. 74 On the New Edition of Sanitary Rules And Regulations SanPiN 2.2.1/2.1.1.1200-03 'Sanitary Protection Areas and Sanitary Classification of Enterprises, Structures, and Other Facilities'

standards at the SPA border and technological standards determined on the basis of BAT.

2.1.6. Regulation of pollutant discharges

In accordance with the environmental legislation of the Russian Federation, all legal entities that have stationary sources of pollutant discharges into water bodies at their enterprises, are obliged to conduct an inventory of discharges, and to develop and approve a draft project on allowable discharge standards (ADS). Carrying out financial and economic activities without ADS draft project is prohibited for all users of natural resource who have stationary sources of pollutant discharges into water bodies. However, according to Federal Law No. 219[32], the current legislation is being amended, and from January 1, 2019, the development of the ADS project is not required for facilities of categories III-IV under Federal Law No. 7, with the exception of radioactive and highly toxic substances, as well as substances with carcinogenic and mutagenic properties (substances of I, II hazard classes).

Allowable discharge standards (ADS) are the mass of pollutant in the wastewater, which is the maximum allowable level for discharge in accordance with the regime established at this point of water body per unit of time, in order to ensure the water standard quality in the monitoring section. The monitoring section when discharging wastewater (including drainage water) into water bodies for drinking, household, and fishery , is located at a distance of no more than 500 meters from the discharge point.

ADS is calculated in accordance with the Methodology for the Development Of Allowable Standards for Discharge of Substances and Microorganisms in Water Bodies for Water Consumers, which determines methods for calculating ADS values into the following water bodies: watercourses, reservoirs and lakes, inland waters, and territorial seas of Russian Federation[33].

For substances of hazard classes 1 and 2 for all types of water consumption, ADS is determined so that for substances with the same limiting hazard indicator (an indicator characterized by the highest harmless concentration in water, which determines the earliest and most likely negative impact in the event of detecting the chemical substance in water, in a concentration exceeding the MAC) contained in the water body, the sum of the ratios of the concentrations of each substance to the corresponding MAC would not exceed 1.

If the background pollution of a water body by any indicators does not allow to ensure the standard water quality at the control point (monitoring section), then the ADS for these indicators is developed based on the attribution of regulatory

[32] Federal Law dated July 21, 2014 No. 219-FZ 'On Amendments to the Federal Law on Environmental Protection and Certain Legislative Acts of the Russian Federation' (as amended and supplemented)
[33] A Technique for the Development of Allowable Standards for Discharge of Substances and Microorganisms, in Water Bodies for Water Users

requirements for the composition and properties of water in water bodies to the wastewater itself, including drainage water.

ADS values are developed and approved for existing and forecasted water consuming organizations. The development of ADS values is performed both by the water consuming organization and on its behalf by the design or research organization. If the actual discharge of the current water consuming organization is less than the calculated ADS, then the actual discharge is taken as the ADS. At the same time, the actual content of pollutants in wastewater, including drainage water, is determined as the maximum concentration value for the last calendar year of accident-free operation of the enterprise.

The ADS values of the forecasted and constructed (reconstructed) water consuming organizations are determined as part of the construction (reconstruction) projects of these organizations. If, when revising or adjusting the previously set ADS, it turns out that the design value of the discharge of the water consuming organization under construction (reconstruction) is less than the calculated ADS, the design value of the discharge is assumed as ADS.

When developing ADS, the recalculation of the mass of a substance discharged per hour (g / h) to the mass of a substance discharged per month (t / month) is made by multiplying the allowable substance concentrations by the volume of wastewater, including drainage water, for the corresponding period.

2.1.6.1. Wastewater discharges to land

By Federal Law No. 7 “On Environmental Protection' and Federal Law “On Water Supply and Sanitation”[34], only water bodies and centralized water disposal systems are considered wastewater discharge facilities.

At present, the methodology for establishing, and the procedure for approving the standards for allowable discharges of substances and microorganisms to collecting areas have not been developed, therefore the procedure for issuing permits for discharging substances and microorganisms into land has not been established as well. However, until recently, this issue was regulated by imposing fines for excess emissions in the event of unauthorized discharges to the land. A fine for negative impact due to wastewater discharge into land has not been established in the new edition of Federal Law No. 7. Hence, the legal status of regulating wastewater discharges into the terrain has not yet been defined, which is the cause of environmental disputes.

[34] Federal Law 'On Water Supply and Sanitation' dated December 07, 2011, No. 416-FZ

2.1.6.2. Offshore wastewater discharges

General requirements for the protection of marine waters in the exploration and development of offshore oil and gas fields are defined in the National Standard of the Russian Federation GOST 53241-2008. According to this standard, the discharge of the following substances, liquids and wastes into the sea is prohibited:

- oil based drilling fluids or fluids with the addition of petroleum hydrocarbons;
- drilling reagents;
- lubricants;
- waste solutions after chemical cleaning of boilers, utilization boilers and desalination plants;
- unburned products of testing wells and solid waste (residue resulting from sludge in tanks);
- filtration products, residues of bulk reagents, waste generated during the preparation of seawater for injection into reservoirs;
- waste of the energy complex;
- waste generated by regular cleaning of pipelines, garbage and other solid waste.

In addition, water disposal and disposal of waste into the marine environment at facilities located in the highest fishery category, sanitary protection zones and specially protected natural ecosystems is not allowed. The standard also defines the requirements according to which water disposal and disposal of wastewater is prohibited if it can be rationally used (recycled or reused) using the best available technologies.

The discharge of waste, treated wastewater, cooling, ballast, stormwater, as well as drilling wastewater obtained during testing and hydraulic fracturing, maintenance of wells, stimulation of flow, hydrostatic testing and other drilling and field operations is allowed if the following requirements are fulfilled:

availability of developed and approved environmental, fisheries, and sanitary and epidemiological standards for each pollutant discharged into the sea; compliance with MPC standards outside the mixing zone at a distance of 250 m and more in any direction from the place of discharge. At the same time, the exact boundaries of the control target shall be established by the authorized body taking into account local conditions;

- compliance with toxicity limit values and indicators of permissible concentration of oil in discharged water and waste (see table below);
- neutralization of liquids with a high content of acids;
- exclusion of highly toxic substances with a maximum permissible concentration of less than 0.001 mg / dm3 or LC_{50} (for 96 hours) less than 0.1 mg / dm3, etc. from the composition of the wastewater.

Table 1. General requirements for limiting the drainage and disposal of wastewater and waste during the development of offshore oil and gas fields

Type of withdrawn and removed products	**Indicator**	
	Oil concentration	**Toxicological**
Waste Water Based Mud	-	LC50 (96 h) not lower than 3000 mg / dm^3
Used water-based drilling fluid during the passage of oil-bearing horizons	The average concentration of oil during discharge period is 29 mg / dm^3 with a maximum deviation of 40 mg / dm^3	LC50 (96 h) not lower than 3000 mg / dm^3
Used oil based drilling mud	Discharge is not allowed	
Sludge from water based drilling fluids	Average concentration during discharge - 1 g / kg with a maximum deviation of 2 g / kg	-
Sludge from oil-based drilling fluids	Discharge is not allowed	
Formation/produced water	Average concentration during discharge - 29 mg/dm^3 with max. - 40 mg/dm^3	LC50 (96 h) not lower than 10 ml / dm3
Formation sand, sediments and other solid waste contaminated by oil	Discharge is not allowed	
Ballast, stormwater, technological and other liquid wastes contaminated by oil	Discharge is governed by sanitary regulations.	LC50 (96 h) not lower than 10 ml / dm3
Cooling waters	Discharge is allowed	
Brine Desalination Plants	Discharge is allowed	
Domestic and sanitary drains	Discharge is governed by sanitary regulations.	
Solid waste	Discharge is not allowed	

Within the limits of territorial waters, discharge of treated and disinfected domestic wastewater is allowed. At a distance of 250 m from the place of discharge, the following degree of treatment should be ensured:

- BOD5 - 3 mg O_2 / dm^3;
- the content of suspended particles in sea water is 0.75 mg / l;
- if the index is not more than 1000;
- size of particles - not more than 25 mm;
- pH - 6.5-8.5.

The content of pollutant components in the treated water discharged into the sea must meet the following requirements:

- active chlorine (residual) - not more than 1.5 mg / dm^3;
- ammonium nitrogen - not more than 2.9 mg / dm^3;

- nitrites - no more than 0.25 mg / dm^3;
- nitrates - no more than 40 mg / dm^3;
- phosphates - no more than 2.0 mg / dm^3;
- synthetic surfactant - 0.5 mg / dm^3;
- dissolved oxygen - not less than 4.0–6.0 mg / dm^3.

2.2. European countries

2.2.1. General approach to regulations in European countries

The Industrial Emissions Directive 2010/75/EU is the main legislative instrument to regulate emissions of industrial facilities in the EU countries. The main objective of the Directive is to protect health of the population and the environment through BAT implementation. BAT in the EU refers to 'the most effective modern technologies for various activities, processes and methods of operation, which demonstrate the practical feasibility of using specific technologies as a basis for establishing permits for pollutant emissions into the environment in order to prevent pollution, or, when impossible, to minimize emissions into the environment in general.' It should be noted that technologies include not only technical tools, but also processes and approaches to reduce the negative impact on the environment[35]. Directive outlines the criteria for determining BAT to be implemented to reduce environmental impact. For example, such criteria could be energy and resource efficiency, ensuring the reduction of release of hazardous pollutants into the environment, access and speed of technology implementation, reduction of technological risks, etc.

The EU Commission is responsible for developing BAT directories, and during this process experts from EU countries, as well as representatives of public and scientific organizations in the field of environmental protection are engaged. This work of the Commission results in BAT industry directories called BREF (*Best Available Techniques Reference Document*). BREF data is reviewed every 5 to 7 years, updated, finalized, and expanded. The development cost for a single directory is about € 3 million (US$ 3.39 million). At present, 34 BREF directories have been developed in the EU. They are divided into two groups: the first one covers production processes related to one or more specific industries (vertical BREF), and the second one applies to all sectors of the economy (horizontal BREF).

In addition to the information on various BAT, these directories also contain information on emission limit levels that can be achieved by the implementation of a particular technology. Each country is entitled to establish morestringent emission level values, depending on local geographical conditions, technical equipment of facilities and the economic feasibility of BAT implementation. Emission limits

[35] Directive 2010/75/EU on industrial emissions

specified in the BREF directories, are accepted as emission standards and are set at the source of emissions and discharge of pollutants[36]. In the absence of a developed BREF directory for a particular type of activity or technological process, the participating countries set emission limits in accordance with their regulations and technical guidelines, taking into consideration the BAT implementation.

Emission limits must not only meet the requirements of the BREF directories, but also ensure the achievement of the environmental quality objectives, set at the European level. In Directive 2008/50 /EC, the environmental quality objectives are presented as concentration limits for a range of pollutants (NO_x, SO_2, CO, PM_5, PM_{10}, Pb, CH), determined on the basis of their impacts on human health and the ecosystem in general.

2.2.2. Categories of Regulated Enterprises

Annex 1 to the Industrial Emissions Directive presents types of industrial activities which require obtaining environmental permits[37]. In addition, each of the EU member states may determine its own list of regulated fields of activity. For example, in Germany, the emission limits are set for enterprises that utilize *plants* related to regulated activities. The list of regulated plants is approved by the Federal Government in coordination with the Federal Council (Bundesrat) by issuing Regulations, which, in addition to regulated plants, also define plantsfor which the setting of emission limits and obtaining environmental permits are not required.

According to the Emission Control Law, the [38]*plant* is:

- any operating enterprise or stationary production facility;
- any mechanisms, equipment, or other non-stationary technical devices, as well as land, marine, and air transport;
- any premises for the storage or disposal of materials or for the performance of activities that may cause emissions into the environment, with the exception of communication lines used for public transportation.

The list of regulated plants is specified in *Annex 1* of the 4th Regulation to the Emission Control Law. Plants,emissions of which are subject to regulations, are divided into 10 main categories by types of production activities[39]:

1. heat and power generation;
2. mining, processing and production of construction materials (grail, sand, cement, glass, etc.);
3. ferrous and non-ferrous industry;
4. processing industry, including production of chemical compounds and medications, as well as oil and gas processing;

[36] Directive 2010/75/EU on industrial emissions, Article 15
[37] Directive 2010/75/EU on industrial emissions, Annex 1
[38] Bundes-Immissionsschutzgesetz
[39] Verordnung über genehmigungsbedürftige Anlagen— 4. BImSchV, Anhang 1

5. surface treatment with organic substances, production of rubber and plastic coatings;
6. wood processing;
7. production of food products, animal feed, and other agricultural products;
8. recovery and disposal of waste and other materials;
9. storage, material processing operations;
10. other activities.

2.2.3. List of regulated pollutants

The EU environmental regulation system regulates pollutant emissions into the atmosphere (emissions), water bodies (discharges), as well as production and consumption waste management activities and physical impact factors (noise, electromagnetic rays).

The Industrial Emissions Directive provides a list of pollutants, emissions and discharges of which are recommended to be regulated. At the same time, EU member states are entitled, at their discretion, to change the list of pollutants depending on their significance in the structure of industrial production. Maximum allowable concentrations of pollutants and other regulated parameters of environmental quality should be established on the basis of BAT.

The list of pollutants, emissions of which into the atmosphere are regulated, includes[40]:

1. Sulphur dioxide and other sulphur compounds
2. Nitrogen dioxide and other nitrogen compounds
3. Carbon dioxide
4. Volatile organic compounds
5. Metals and their compounds
6. Dust, including particulate matters (PM-10; PM-2.5)
7. Asbestos (particulate matters, fibers)
8. Chlorine and its compounds
9. Fluorine and its compounds
10. Arsenic and its compounds
11. Cyanides
12. Substances and mixtures with proven carcinogenic or mutagenic properties
13. Polychlorinated dibenzodioxins and polychlorinated dibenzofurans

Regulated substances in wastewater discharges are:

1. Organohalogen compounds and substances that can form such compounds in the aquatic environment
2. Organophosphorous compounds

[40] Directive 2010/75/EU on industrial emissions, Annex 1

3. Organotin compounds
4. Substances and mixtures that are carcinogenic or mutagenic, or may impact reproduction in or through the aquatic environment
5. Resistant hydrocarbons, and persistent and bioaccumulated organic toxic substances
6. Cyanides
7. Metals and their compounds
8. Arsenic and its compounds
9. Biocides and plant protection products
10. Suspended substances
11. Substances for eutrophication (in particular, nitrates and phosphates)
12. Substances that negatively impact the oxygen balance (and can be measured using such parameters asBOD, COD, etc.)
13. Substances listed in Annex 10 of Directive 2000/60/EC.

2.2.4. Types of environmental standards

Emission Limit Values are determined in BREF directories, and analogues for each can alternatively be developed by each EU country independently. As an example, in Germany, the emission limit values are set in technical guidelines and in the Emission Control Law Regulations. Currently, in Germany, 34 Regulations have been approved under the system of comprehensive environmental permits, some of which are horizontal, i.e. determining general administrative provisions on the emission regulation. Vertical regulations, in turn, are developed for certain types of production plants (combustion plants, internal combustion engines, incinerators, biological waste treatment plants, cooling systems, etc.) and special groups of substances (volatile organic compounds, hydrocarbons, timber dust). There are also a number of Regulations governing water management issues not included in the comprehensive environmental permits (Wastewater Regulation[41], Surface Water Regulation[42], Groundwater Regulation[43]).

The *emission limit values* accepted as environmental standards are based on the BAT implementation and should not exceed the established *environmental quality standards*. In addition, local conditions for the location of production facility (climate, terrain features, etc.) are taken into consideration when establishing emission standards. Such a composite approach requires careful assessment in each case to ensure that the established emission standards ultimately included in the comprehensive environmental permit, meet the criteria for both BAT and environmental quality standards, as well as local conditions.

The values of the ambient air quality standards are defined in Directive 2008/50/EC *On ambient air quality and cleaner air for Europe*[44]. For each of the identified

[41] Gesetz zur Ordnung des Wasserhaushalts (Wasserhaushaltsgesetz – WHG)
42 Verordnung zum Schutz der Oberflächengewässer (Oberflächengewässerverordnung—OGewV)
43 Verordnung zum Schutz des Grundwassers (Grundwasserverordnung—GrwV)
[44] Directive 2008/50/EC on ambient air quality and cleaner air for Europe

pollutants, allowable concentrations (mcg/m^3), averaging periods, and allowable number of cases when the limit values are exceeded, have been determined.

The criterion for setting environmental quality standards in Europe is to ensure a safe level of pollutant impact, both on human health and on individual components of the environment, such as vegetation, soils and ecosystems in general.

EU standards for ambient air quality that ensure a safe level of impact on human health are provided in Table 2.

Table 2.. Quality standards of ambient air for human health[45]

Pollutant substance	**Maximum allowable concentration, mcg / m^3**	**Averaging Period**	**Allowable number of cases of excess per year**
Benzene (C_6H_6)	5	1 year	-
Lead and inorganic lead compounds contained in particulate matters (PM-10), expressed as Pb	0.5	1 year	-
Particulate matters (PM-10)	40 50	1 year 24 hours	- 35
Sulphur Dioxide (SO_2)	125 350	24 hours 1 hour	3 24
Nitrogen Dioxide (NO_2)	40 200	1 year 1 hour	- 18
Carbon Dioxide (CO)	10 *	maximum of 8 hourly averages per day	-

** – mg / m3*

For sulphur dioxide and nitrogen dioxide, the values of the ambient air quality standards have been determined, ensuring respectively safe levels of impact on ecosystems and vegetation (Table 3).

[45] Directive 2008/50/EC on ambient air quality and cleaner air for Europe

Table 3.. Ambient air quality standards for ecosystems and vegetation (on the example of Germany)[46]

Pollutant substance	**Maximum allowable concentration, mcg / m^3**	**Averaging Period**	**Natural resource**
Sulphur Dioxide (SO_2)	20	Year or winter period (from October 01 to March 31)	ecosystems
Nitrogen Dioxide (NO_2)	30	1 year	vegetation

To protect soil from the negative impacts of pollutants due to their settling on the ground surface, the quality standards have also been determined (Table 4)

Table 4. Quality standards for soils (on the example of Germany)[47]

Pollutant substance	**Maximum allowable concentration, mcg / (m^2*d)**	**Averaging Period**
Arsenic and its inorganic compounds (expressed as Arsenic – As)	4	1 year
Lead and its inorganic compounds (expressed as Lead—Pb)	100	1 year
Cadmium and its inorganic compounds (expressed as Cadmium—Cd)	2	1 year
Nickel and its inorganic compounds (expressed as Nickel—Ni)	15	1 year
Mercury and its inorganic compounds (expressed as Mercury—Hg)	1	1 year
Thallium and its inorganic compounds (expressed as Thallium—Tl)	2	1 year

According to Directive 2009/50/EC, the EU countries, as part of their obligations to ensure high quality of ambient air, should establish *relevant targets for the ambient air quality*. The target is the level of emissions set to prevent or reduce harmful impacts on human health and / or the environment in total, which has to be achieved to a possible extent or within a specified period.

Ambient air quality targets are determined for pollutants listed in Table 5.

Table 5. Ambient air quality targets (on the example of Germany)

Pollutant substance	**Quality target**	**Averaging Period**	**Achievement Date**
Particulate matters (PM–2.5)	20 mcg / m^3	1 year	January 01, 2020
Ground-level ozone (human health)	120 mcg / m^3	maximum of 8 hourly averages per day	-

[46] Technical Instructions on Air Quality Control—TA Luft
[47] Technical Instructions on Air Quality Control—TA Luft

Pollutant substance	Quality target	Averaging Period	Achievement Date
Ground-level ozone (vegetation)	6 mcg / m^3*.h	May–July	-

2.2.5. Regulation of emission reduction issues

In Europe, the issues of reducing emissions into the ambient air are regulated by EU Directive 2001/81/EC 'On National Emission Limits for Certain pollutants in the Ambient Air', according to which each country must determine emission limits in order to ensure a high environmental quality.

In order to implement these measures, Germany took on the obligation to reduce anthropogenic emissions of the following pollutants compared to the level of 2005:[48]

- sulphur dioxide: by 21% by 2020 and by 58% by 2030;
- nitrogen oxides: by 39% by 2020 and by 65% by 2030;
- volatile organic compounds (VOC): by 13% by 2020 and by 28% by 2030;
- ammonia: by 5% by 2020 and by 29% by 2030;
- Particulate matters PM2.5: by 26% by 2020 and by 43% by 2030.

2.2.6. Regulation of pollutant emissions into the ambient air

Emission standards for pollutants into the atmosphere are the emission limit values in the comprehensive environmental permit determined by the competent authority. Emission standards are set for each regulated pollutant and at each significant source (chimney stack) of emissions as a mass pollutant concentration (mg / m^3) in dry vent gases under standard conditions (273.15 K; 101.3 kPa).

The emission standard value is determined on the basis of concentration limits provided by the implementation of BAT and specified in the Emission Control Law Regulations and the TA-luft technical guidance, depending on the type of activity and the production technology used. However, if the results of calculations of the dissipation of ground-level pollutant concentrations show that the standards established for the ambient air quality are exceeded, then by decision of the competent authority, more stringent emission standards may be established than those specified in the Regulations. At the same time, for existing plants for which the compliance with environmental quality standards is technically impossible, less stringent emission standards than for new plants may be set.

Compliance with ambient air quality standards is checked at approved *assessment points* in the pollutant emission impact area. The assessment of compliance (non-exceedance) is performed both with regard to quality standards for human health, and for components of the natural environment (vegetation, ecosystems).

[48] Verordnung über nationale Verpflichtungen zur Reduktion der Emissionen bestimmter Luftschadstoffe—43. BImSchV

The *emission impact area* is the area within a circle with a radius exceeding the height of the emission source by 50 times. For a set of sources, the impact area is calculated as the sum of the impact areas of special pollutant emission sources. Within the area of impact, the assessment points should be determined in such a way that:

- they reach maximum impact values determined from the results of modeling ground-level concentrations of pollutants and taking into account the appropriate averaging period for each substance;
- background pollution from existing sources is taken into account.

The number of assessment points depends on the averaging period set for a particular pollutant—thus, substances for which both daily (short-term maximum impact) and annual values of ambient air quality (long-term impact) are determined, are usually assessed at 2 corresponding points, whereas, for substances of only annual value, one assessment point is usually set.

Assessment points for compliance with quality standards for ecosystems and vegetation should be set at a distance of at least 20 km from agglomerations and at least 5 km from other urban and industrial areas. The justification for determining the location and number of assessment points should be presented in the Production Monitoring Plan.

If the enterprise emissions contain pollutants for which the quality standards have not been set, they should be assessed taking into consideration possible negative environmental impact[49]. The purpose of such assessment is to determine the type and degree of impact of individual substances on the area investigated, as well as significant hazardous and negative consequences for the population and the environment. The assessment of the pollutants impact should be based on the best practices and scientific achievements. During the assessment process endangerment of the population's health is always considered as the most significant factor, while the negative consequences for natural components are recognized as significant based on the results of consideration of the following aspects:

- purpose for the use of land as determined in land use plans;
- conditions determined by land and technical plans;
- definitions and decisions according to the Clean Air Plans;
- distribution of land use rights between the neighboring areas;
- measures scheduled or taken to restore the environment.

In separate cases, if, according to the results of dispersion modelling, the standards established for environmental quality were exceeded at any of the assessment points, an emission permit may be issued only if the following conditions are met[50]:

- the contribution of the pollutant assessed does not exceed 3% of the annual value of the quality standard established for this substance and provided that

[49] Technical Instructions on Air Quality Control – TA Luft, Sec. 4.8
[50] Technical Instructions on Air Quality Control – TA Luft, 4.2.2-4.2.3

the company undertakes to implement the advanced technology that exceeds in its environmental indicators the minimum emission values provided by the BAT implementation;

- the company assumes the obligation to take environmental measures (replacing fuel or raw materials with more environmentally friendly ones, making changes in production technology, changing emission parameters to improve the pollutant dissipation conditions, etc.) to ensure compliance with the quality standards for a period not exceeding 1 calendar year, specified by a competent authority.

2.2.7. Regulation of pollutant discharges

2.2.7.1. Discharges of treated wastewater to surface water bodies

Annex 6 Regulations on Surface Waters contains water quality standard values for surface water bodies (rivers, lakes, cross-border, and near-shore waters) for 67 specific pollutants[51]. The annual average or maximum allowable values of standards, expressed in mcg / l for dissolved matters and in mg / kg for suspended solids, have been determined. Exceeding half of the established quality standard value is considered significant.

In the Groundwater Regulation (*GrwV*), the quantitative status (groundwater level) and chemical status (limit values of pollutant concentrations in mg / l or mcg / l) are determined as criteria for assessing the groundwater[52].

Wastewater discharge issues are regulated by Water Resource Law (*Wasserhaushaltsgesetz*)[53]. The objects for regulation of pollutant discharge into wastewater are surface and groundwater bodies. The main condition for the regulation of wastewater discharges is compliance with water quality standards and the implementation of measures to prevent any negative impact on their environmental and chemical status.

When regulating wastewater discharges into a surface water body *(direct discharge)*, the following conditions must be met:

1. The amount and pollution of wastewater are kept at a minimum level, which is achieved by the use of modern technologies;

2. The discharge does not lead to violation of requirements for the water quality of the receiving water body, and other requirements;

3. There are treatment plants utilized, or other equipment necessary to ensure compliance with the requirements of paragraphs 1 and 2.

[51] Verordnung zum Schutz der Oberflächengewässer, OGewV, Anlage 6
[52] Verordnung zum Schutz des Grundwassers (Grundwasserverordnung—GrwV)
[53] Gesetz zur Ordnung des Wasserhaushalts, WHG

Discharge standards are set according to the Wastewater Regulation (Abwasserverordnung)[54] that defines the PS limit values in wastewater discharges for 57 industries, including hydrocarbon production and oil refining, based on the BAT application. The limit values of pollutants in wastewater discharges are considered to be minimum requirements, and if discharges can negatively impact the water quality of the receiving water body, then more strict standards may be set by decision of the competent authority. Such a decision, as a rule, is taken based on the results of water quality modeling calculations.

Discharge limits are established for wastewater discharges into a water body, and compliance with the requirements is monitored at the sampling site as part of the obligations of water users to monitor the quality of water resources consumed. The sampling sites are determined according to national standards – DIN 38402-11 (A11), DIN EN ISO 5667-1, etc.[55]

The standardized pollutants are set in concentration values in mg / l and / or as values for the substance flow in mg / h. Physical quantities such as temperature (t), pH, and wastewater flow (l / s) are used as other controlled parameters.

Wastewater discharge into public treatment plants is separately standardized as an *indirect discharge*. Furthermore, in addition to the parameters listed above, the regulated indicators are established for the sections of the water course before and after the treatment plants.

2.2.7.2. Treated Wastewater Discharges to the land

The treated wastewater discharges to the land through infiltration systems are regulated by the legislation on the groundwater protection[56,57]. The key regulatory mechanism is implementation of necessary and acceptable measures to prevent contamination of groundwater by pollutants, as determined by the competent authority[58,59]. In the UK, for all types of wastewater discharges that may negatively impact, directly or indirectly, the groundwater quality, it is necessary to assess the groundwater conditions of the area, the possibility of natural water treatment in soils, and the negative impact on the groundwater.[60] Treated wastewater discharges to the land can be allowed, subject to the groundwater quality standards. At the same time, under the conditions of environmental permit, the technical and management measures will be defined to prevent groundwater pollution.

[54] Verordnung über Anforderungen an das Einleiten von Abwasser in Gewässer, AbwV
[55] Verordnung über Anforderungen an das Einleiten von Abwasser in Gewässer, AbwV, Anlage 1
[56] DIRECTIVE 2006/118/EC on the protection of groundwater against pollution and deterioration
[57] Guidance. Discharges to surface water and groundwater: environmental permits
[58] At the same time, the EU Directive on the protection of groundwater defines the minimum amount of regulated pollutants in groundwater, the standards for which must be established by the EU member states themselves
[59] Environmental Permitting Guidance Groundwater Activities
[60] Environmental permitting guidance: Groundwater activities

2.2.7.3. Regulation of storm / rainwater discharges

Surface runoff discharges from industrial sites in EU countries are regulated by the BREF directories.[61][62][63] According to industrial BAT directories, the best practices are the following: separate stormwater runoff, prevention of mixing of stormwater with industrial wastewater, avoiding pollution of stormwater by industrial substances, and using the stormwater collected in production processes or in administrative buildings. Stormwater discharges can be discharged directly into water bodies, if the natural resource user provides the conditions under which the accumulation and storage of stormwater do not cause pollution[64]. In case of pollution, the stormwater should be directed to treatment plants or treatment ponds, from which further discharge into surface waters, or further use for natural resource management is possible.

2.2.7.4. Offshore wastewater discharges

Discharges of produced water and pollutants into the sea is regulated by internal legislative acts of the countries studied, developed in accordance with the recommendations of the Oslo-Paris Convention (OSPAR), which was ratified by Germany, Norway and the United Kingdom in 1998. Application of the BAT and best environmental practices (BEP) is the general requirement of produced water discharge management. These BAT and BEP should aim to reduce the total volume of discharged water (for example, through re-injection), as well as to reduce the petroleum hydrocarbons and other pollutants concentrations in the discharges. According to OSPAR recommendations 2001/1 (as amended), operators of offshore installations should not exceed the monthly standard for the content of petroleum hydrocarbons in water at 30 mg / l (performance standard for dispersed oil) and annual total oil discharges should not exceed 85% of actual annual total oil discharges estimated in 2000. In the countries studied, a standard of 30 mg/l is used as an average monthly standard for permissible discharges. Dilution of treated or untreated produced water to reduce the concentration of petroleum hydrocarbons is prohibited. In the UK, there is also a maximum allowable discharge of petroleum hydrocarbons in the amount of 100 mg / l.

Operators of offshore installations, whose technical characteristics do not comply with the standard of 30 mg/l during discharges, should submit to the Offshore Industry Committee the content of an improvement programmes, which should include the following information:

- for offshore installations discharging not more than 2 tonnes of dispersed oil per year, the average monthly concentration of dispersed oil, thequantity of

[61] Best Available Techniques (BAT) Reference Document for Waste Treatment
[62] Best Available Techniques (BAT) Reference Document for Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector
[63] Best Available Techniques (BAT) Reference Document for Large Combustion Plants
[64] Best Available Techniques (BAT) Reference Document for Large Combustion Plants

produced water discharge, the total total quantity of dispersed oil discharges and the type of treatment equipment installed;

- for offshore installations discharging more than 2 tonnes of dispersed oil per year, the details as in indent above together with full account of measures taken or planned in order to achieve compliance with performance standard of 30 mg / l.

During the discharge of displacement water, drainage and ballast water, the operators of the installations should not exceed the average monthly standard of 40 mg / l.

In addition to complying with the above standards, operators performing зкщвгсув water discharges should conduct a risk assessment as recommended by OSPAR 2012/5. The risk assessment procedure includes the following steps:

- data collection: chemical composition of produced waters, physical characteristics; volume of produced waters; chemicals that have been added to produced waters; chemical, physical and biological characteristics of sea waters.
- hazard assessment: the first stage of a risk assessment that determines the potential for adverse effects on the marine environment. The assessment includes the determination of "predicted no effect concentrations" (PNEC) on the flora and fauna of marine ecosystems.
- exposure assessment: the assessment includes the determination of "predicted environmental concentration" (PEC) around offshore installations.
- risk characterization: determined according to a comparison of the calculated PEC and PNEC data at the distance determined from the dispersion simulation.
- risk management: if, based on the results of risk characterization, it is established that PNEC> PEC, then operators need to apply all kinds of BAT to reduce the risk of negative effects on the marine ecosystems.

The regulation of discharges of other pollutants into the sea is carried out in accordance with national requirements developed on the basis of OSPAR recommendations 2002/2 (as amended). For example, discharges of pollutants are allowed only under the condition that the operator has received a permit to use chemicals at offshore facilities and their subsequent discharge into the sea (offshore chemicals permit).

2.3. Brazil

2.3.1. Categories of Regulated Enterprises

Federal Law 10.165[65] determines categories of types of production activities that are subject to obtaining environmental permits:

High polluting potential:[66]

- mineral production and processing;
- metal industry;
- pulp and paper industry;
- leather industry;
- chemical industry;
- trade, transportation, storage of chemical and hazardous products.

Medium polluting potential:

- non-metallic mineral production;
- mechanical engineering;
- electronic equipment production;
- wood industry;
- fabric and footwear industry;
- tobacco industry;
- food processing industry;
- natural resources utilization (wood, animal and vegetation).

Low polluting potential:

- rubber production;
- plastics production;
- recreational activity.

2.3.2. List of regulated pollutants

CONAMA resolutions establish lists of regulated emissions and discharges of pollutants into the environment at the federal level. At the same time, Brazil's local state authorities are entitled to modify this list depending on the local conditions and the specifics of the technological process, at their discretion.

Regulated air quality parameters include[67]:

[65] Lei 10.165, De 27 De Dezembro De 2000
[66] The polluting potential is determined according to Annexes VIII and IX of Law 10.165
[67] CONAMA Resolution 3\1990, p392

- total amount of particulate matters;
- sulphur dioxide (SO_2);
- nitrogen dioxide (NO_2)
- Carbon Dioxide (CO);
- Ozone (O_3);
- non-inhalable particles;
- fume.

Regulated wastewater discharge parameters are[68]:

- *water quality specifications*, which include such physical / technical parameters such as pH, temperature, presence of sedimentary materials, grease oils, floating substances, indicators of total organic carbon and biological oxygen demand (BOD);
- water quality standards, which include such parameters as content of organic and inorganic substances.

Quality reference values for soil include[69]:

- organic carbon;
- pH;
- cationic exchange potential;
- content of silt, sand;
- content of oxides of aluminum, iron, manganese;
- content of chemical elements and substances.

2.3.3. Types of environmental standards

In Brazil, maximum emission limits and national quality standards have been established to protect the ambient air from pollution.

Maximum emission limit is maximum allowable amount of pollutants that may be emitted by a source of the ambient air pollution. [70] Maximum emission limit is set for different categories of industrial sources, depending on their location and operational capacity. At the same time, more stringent limits are set for sources located in protected areas, as well as for new sources of pollution. Maximum emission limit values are provided in the corresponding CONAMA Resolutions[71].

National ambient air quality standards are provided in the form of concentrations of pollutants, the excess of which in the air can pose a threat to human health or negatively impact the animal and plant world. For each of the parameters set, the

[68] CONAMA Resolution 357\2005, p309
[69] CONAMA Resolution 420\2009, p748
[70] CONAMA Resolution 5\1989, p389
[71] CONAMA Resolutions

allowable concentrations in mcg / m ^{3} for different averaging periods (annual, daily, hourly) are determined.

Ambient air quality standards include *primary and secondary standards*. Primary standards relate to concentrations of pollutants exceeding of which is hazardous to human health, and considered as *maximum allowable emission levels*. Secondary standards relate to concentrations of pollutants that are not hazardous to human health, but may cause minimal harm to animals and plants, and the environment in total. Secondary standards are usually considered as *desired emission levels*.

Ambient air quality standards in Brazil are provided in Table 6.

Table 6. National ambient air quality standards[72]

Indicator	Averaging Period	Primary standards	Secondary standards
Particulate matters	Annual average geometrical concentration	80 mcg /m^3	60 mcg /m^3
	Daily average concentration	240 mcg /m^3	150 mcg /m^3
Fume	Annual average arithmetical concentration	60 mcg /m^3	40 mcg /m^3
	Daily average concentration	150 mcg /m^3	100 mcg /m^3
Coarse particles	Annual average arithmetical concentration	50 mcg /m^3	
	Daily average concentration	150 mcg /m^3	
SO_2	Annual average arithmetical concentration	80 mcg /m^3	40 mcg /m^3
	Daily average concentration	365 mcg /m^3	100 mcg /m^3
CO	Average concentration within 8 h.	10,000 mcg /m^3	
	Average concentration within 1 h.	40,000 mcg /m^3	
O_3	Average concentration within 1 h.	160 mcg /m^3	
NO_2	Annual average arithmetical concentration	100 mcg /m^3	100 mcg /m^3
	Average concentration within 1 h.	320 mcg /m^3	320 mcg /m^3

To ensure high quality of *surface waters* in Brazil, the standards for wastewater discharges and water quality standards have been established.

Wastewater discharge limits *include wastewater discharge conditions* and *wastewater discharge standards*.

According to Brazil's legislation[73], wastewater discharge conditions are regulated for direct and indirect discharges. *Indirect discharge* is the discharge that occurs as a result of wastewater treatment (purification) before entering the receiving water body. *Direct discharge* is wastewater discharge without pre-treatment. Direct

[72] CONAMA Resolution 3/1990, p.392
[73] CONAMA Resolution 430

discharge can be allowed only provided that the discharged water meets the established conditions and standards.

Effluent release conditions include the following requirements:[74]

- PH value: 5–9.
- Temperature below 40 ^{0}°C; the temperature difference with the receiving object should not exceed 3 ^{0}°C in the mixing zone.
- Sedimentary materials: up to 1 ml / l within 1 hour.
- Oils and grease substances:
    - mineral oils: up to 20 mg / l;
    - vegetable and animal oils: up to 50 mg / l.
- Absence of floating substances.

Effluent release standards indicate the maximum content (mg / l) of organic and inorganic parameters in wastewater[75].

Additionally, *water quality standards* have been established—the maximum levels of substance concentrations in mg / l, which should not be exceeded in water bodies. Quality standards are established for each class of fresh (5 classes), saltish (4 classes), and saline waters (4 classes). The second Section of the CONAMA Resolution 357 provides quality standards for all classes of the above mentioned water types[76].

2.3.4. Regulation of emission reduction issues

In Sao Paulo State, subjects for regulation must develop the Emission Reduction Plan for Stationary Polluting Sources (*PREFE*) and update it once in three years. PREFE Plan must contain the following: [77]

- emission sources inventory;
- monitoring stations inventory with description of monitoring methodology;
- research on potential emission reduction rate;
- interaction with state programs on regulating climate change issues;
- research on fiscal stimulating measures to reduce emissions into the atmosphere.

[74] CONAMA Resolution 430
[75] Conama Resolution 430, p. 342. Section 2. Effluent Release Conditions and Standards
[76] CONAMA Resolution 357/2005, p. 300
[77] Sao Paulo State Decree 59.113/2013

Ambient air quality objectives in Sao Paulo

In Sao Paulo, by State Decree No. 59.113/2013[78], the *ambient air quality objectives have been established*, which contain Intermediate objectives (MI – Meta intermediária) or Final standard (PF – Padrão final):

- *intermediate objectives (MI)* are set as temporary values and must be achieved on a staged basis;
- final standard (PF) is determined by assessing the degree of damage to public health. The Final standard is the final objective of MI.

Intermediate objectives must be implemented in three stages:

1. *Intermediate objective. Step 1 (MI1)*—pollutant concentration values in the ambient air, set by law;
2. *Intermediate objective. Step 2 (MI2)*—pollutant concentration values in the ambient air, to be implemented after assessments performed at the MI1 stage by agreement with competent authorities;
3. *Intermediate objective. Step 3 (MI3)*—pollutant concentration values in the ambient air, to be held within a certain number of years after completion of the MI2 stage. Duration of Step 3 is determined by competent authority.

Intermediate steps are not applied to Final standards for substances such as carbon dioxide, particulate matters, and lead. Final standards for other substances are implemented upon completion of the MI3 stage. Intermediate objectives (MI1, MI2, MI3) and final standards for SO_2, CO, NO_2, O_3, solids, lead, are provided in Annex 1[79].

2.3.5. Regulation of pollutant emissions into the ambient air

In order to reduce the anthropogenic stress and improve the quality of the ambient air in Brazil, a system of territorial zoning was introduced, in accordance to which the following zones were allocated depending on their purpose:[80]

- Class 1 zones include two types of protected areas—zones where any emissions into the ambient air are prohibited, and specifically protected areas (recreational, hydrothermal, hydromineral zones);
- Class 2 zones are areas where the air pollution level is regulated by the requirements of secondary quality standards;
- Class 3 zones are areas where the air pollution level is regulated by the requirements of primary quality standards.

[78] Sao Paulo State Decree 59.113/2013
[79] Sao Paulo State Decree 59.113/2013
[80] CONAMA Resolution, p. 389

It should be noted that when establishing emission standards for individual sources of the ambient air pollution, its location relative to the existing system of environmental zoning must be taken into account.

For instance, CONAMA Resolution No. 8 set the maximum emission limit from *external combustion*. The process of external combustion involves burning of fuel material at the following types of plants: boilers, steam generators, electric power generation plants, furnaces, thermal energy recovery plants, incinerators, etc. Maximum emission limit is set according to the source of the specific environmental zone and its nominal thermal power (Table 7).[81]

Table 7. Maximum emission limit into the ambient air by class of zones for external combustion processes [82]

Zone	Particulate matters (in total)	SO_2	Limit consumption of fuel material
N < 70 MW			
Class 1 zones	120 g / mln kcal	2,000 g / mln kcal	3,000 tons / year
Class 2 and 3 zones	1) 350 g / mln kcal (fuel oil);	5,000 g / mln kcal	N/A
	2) 1,500 g / mln kcal (mineral coal)		
N ≥ 70 MW			
Class 1 zones	polluting sources are prohibited		
Class 2 and 3 zones	1) 120 g / mln kcal (fuel oil); 2) 800 g / mln kcal (mineral coal)	2,000 g / mln kcal	N/A

The Annex of Resolution CONAMA No. 382 provides determination of emission limit values for various types of stationary sources and types of production activities:[83]

- heat production when burning fuel oils;
- heat production when flaring natural gas;
- heat production when burning wood materials;
- gas turbine power generation;
- oil refining processes;
- pulp production processes;
- secondary lead smelting processes;
- aluminum smelting;
- glass melting processes;
- portland cement production;
- fertilizer manufacturing;
- ferrous industry.

[81] CONAMA Resolution 8, p. 396
[82] CONAMA Resolution 8\1990, p. 396
[83] CONAMA Resolution 382, p. 398

The emission limit values given in CONAMA Resolutions are set for each source and are accepted as standards for maximum allowable pollutant emissions into the atmosphere. Emission standards for sources for which the emission limits are not defined in the Resolutions, are established by the competent authority taking into account the specific features of individual production process and local conditions. Compliance with the emission standards is checked at the points of emission of chimney stacks and air vents during the emission monitoring performed by the natural resource user.

The natural resource user should verify compliance with the standards for the ambient air quality at the air monitoring stations in the area closest to the enterprise territory. The obligation for installation of monitoring stations is one of the conditions for obtaining an environmental statement. The location of such stations is agreed with the competent authority that takes into account such factors as characteristics of the technological process, location of pollution sources, proximity of residential areas, and background air pollution[84].

2.3.6. Regulation of PS discharge into water bodies

2.3.6.1. Pollutant discharge regulation at onshore facilities

The objects of regulation of wastewater in Brazil are surface and groundwater bodies. Values of wastewater discharge standards are taken[85] as pollutant standards in wastewater discharges for surface water bodies. Standards are set as the pollutant concentration in the value of mg / l at the wastewater discharge point.

In addition to monitoring standards at discharge points, the natural resource users should monitor the concentrations of pollutants in the *mixing zone*. The mixing zone is considered as the area of the receiving facility, calculated theoretically and agreed upon by the competent environmental protection authority. The mixing zone extends from the point of wastewater discharge and is bounded by a surface in which a balance of physical and chemical parameters is reached, as well as a biological balance of discharges and waters of the receiving facility. The established surface water quality standards should not be exceeded outside the mixing zone.

Article 6 of CONAMA Resolution No. 430 provides for *exceptional* cases in which the competent authority may issue a permit for to wastewater discharge, parameters of which do not meet the discharge standards. Such permit may be obtained if the following conditions are met:[86]

- providing a reliable justification that the scheduled discharges are within the scope of public interest;

[84] CETESB Board decision 10P. Ambient Air Quality Monitoring
[85] Conama Resolution 430, p. 342. Section 2. Effluent Release Conditions and Standards
[86] CONAMA Resolution 430, p. 340

- research on possible impacts on receiving waters at the expense of the natural resource user;
- setting requirements for wastewater treatment;
- determination of the maximum duration of the period during which the competent authority may allow exceeding the established discharge standards;
- setting measures aimed at neutralizing the possible negative impacts of such discharges.

2.3.6.2. Regulation of wastewater discharges into groundwater bodies

In Brazil, the wastewater discharge into groundwater bodies is allowed at the federal level, subject to compliance with the quality standards of the receiving groundwater. A direct discharge without quality regulation may be carried out into groundwater of class V with a total mineralization of > 15,000 mg / l, while discharge into groundwater of classes I-IV should not lead to changes in the characteristics of these waters (classification and groundwater quality standards are given in CONAMA Resolution 357)[87].

2.3.6.3. Pollutant discharge regulation at offshore facilities

CONAMA Resolution No. 393 sets conditions for wastewater discharges at oil and gas platforms.

To regulate the oil and gas industry discharges into sea waters, the following standards are set for the concentration of hydrocarbons:

- monthly average concentration is 29 mg / l;
- daily maximum value is 42 mg / l.[88]

Concentrations of pollutants in wastewater discharges of oil and gas offshore facilities should not exceed the quality standard values for saline waters set by CONAMA resolution No. 357[89]. At the same time, the requirements for compliance with quality standards do not extend to the mixing zone, which is defined as a section of water within a radius of 500 m from the source of discharge for offshore facilities.

Wastewater discharge standards for oil and gas facilities within 12 nautical miles (~ 22 km) from the coast are determined by the competent authority based on research on the nature of wastewater dispersion, submitted by natural resource user.

[87] CONAMA Resolution 396, p. 326
[88] CONAMA Resolution 393, p. 323
[89] CONAMA Resolution 357/2005, p. 300

Wastewater discharge at a distance of 10 km from specifically protected natural reservations and 5 km from environmentally vulnerable terrains is prohibited[90].

2.4. Canada

2.4.1. Categories of Regulated Enterprises

In Canada, the regulation of emissions into the environment is carried out mainly at the provincial level. The cross-border pollution, activities in the Arctic waters, and nuclear energy issues are regulated by the Government of Canada at the federal level. Competent Canadian environmental authorities independently determine the regulated activities. Thus, in the province of Alberta, the following activities are subject to environmental regulation[91]:

- Waste management facilities:
  - industrial processing of hazardous waste of more than 10 tons per month;
  - storage facilities for hazardous waste with a storage period of more than 1 year or a storage volume of more than 10 tons per year;
  - waste incineration plants;
  - landfills with an annual volume of waste burial of more than 10 tons, etc.;
- Chemical production:
  - chemical production plants;
  - chemical substance storage facilities;
  - sulphur production or processing plants;
  - sulphur storage facilities;
  - fertilizer plants;
  - fertilizer storage facilities;
  - explosive substances production plants;
  - pesticide production plants;
  - petrochemical plants;
  - coke or carbon production plants, etc.;
- Construction industry:
  - construction materials production plants;
  - insulation materials production plants;
  - cement plants;
- Food and products of animal origin production;
- Metal production and working:
  - metal plating plants;
  - foundry shops;

[90] CONAMA Resolution 357, p. 300
[91] Activities Designation Regulation 276/2003 (with exceptions)

    - lead smelting plants;
    - metal production plants;
    - steel plants;
- Mineral processing (glass and limestone production);
- Wastewater treatment plants;
- Oil and gas industry:
    - oil refinery plants;
    - oil sand processing plants;
    - improved recovery of oil sands or heavy oil;
    - acid gas processing plants;
    - oil storage tanks;
    - gas synthesis plants, etc.;
- Electric power plants;
- Service works on hydraulic testing, washing of railway cars, etc.
- Wood processing;
- Biotechnological production;
- Recultivation of production facilities.

2.4.2. List of regulated pollutants

In Canada, a list of more than 300 pollutants and their compounds subject to state accounting and control has been approved at the legislative level[92]. All regulated substances are classified into the following 5 groups depending on their threshold level in industrial emissions (as concentration or mass), which may negatively impact human health or the environment[93]:

- *1A Group Main Substances*: includes 184 substances, such as acrylamide, benzene, chromium compounds, copper, hydrogen sulphide, formaldehyde, methanol, toluene, etc.
- *1B Group Other Threshold Substances:* includes 19 substances that can pose a hazard to human health and the environment even in low concentrations. This group contains compounds of lead, mercury, selenium, thallium, cobalt, etc.
- *Group 2 Polyaromatic Hydrocarbons*: includes 31 substances used as industrial chemicals, as well as contained in tailings of mining enterprises. This group includes substances such as benzopyrene, fluorene, methylcholanthrene, chinoline, etc.
- *Group 4 Dioxins, Furanes, and Hexachlorobenzene*: includes 18 substances generated from waste incineration, production of chlorinated solvents, metal smelting, power generation, iron and steel production, pulp and paper production, titanium dioxide pigment production, cement production, magnesium production, and wood storage using pentachlorophenol.

[92]National pollutant release inventory
[93]NPRI Substance list

- *Group 4 Criteria Air Contaminants* includes 7 substances generated as a result of stationary fuel combustion and lead to air quality degradation, smog and acid rain formation. This group includes the following substances: particulate matters (TPM, PM_{10}, $PM_{2.5}$), carbon dioxide (CO), nitrogen dioxides (expressed as NO_2), sulphur dioxides (SO_2), volatile organic compounds (VOC).
- Group 5 *Volatile Organic Compounds (VOC)*: includes 64 substances, including acetylene, benzene, ethylene, isopropyl alcohol, methanol, etc.

For each group of substances, a quantitative concentration criterion is established, upon reaching which, issuer enterprises are obliged to submit annual reports on emission inventories to the competent authority.

2.4.3. Types of environmental standards

2.4.3.1. Environmental Quality Standards

Canadian Ambient Air Quality Standards – CAAQS[94] is the driving force for the implementation of the *Air Quality Management System – AQMS*, in the country. Currently, values of quality standards for particulate matters ($PM_{2.5}$), ground-level ozone (O_3), sulphur dioxide (SO_2), and nitrogen dioxide (NO_2) (Table 8) have been developed.

Table 8. Canadian Ambient Air Quality Standards

Pollutant substance	Averaging Period	Value		
		2015	2020	2025
Particulate matters ($PM_{2.5}$)	24 h	28 mcg / m^3	27 mcg / m^3	-
	Year	10.0 mcg / m^3	8.8 mcg / m^3	-
Ozone (O_3)	8 h	63 ppb*	62 ppb	-
Sulphur Dioxide (SO_2)	1 h	-	70 ppb	65 ppb
	Year	-	5.0 ppb	4.0 ppb
Nitrogen Dioxide (NO_2)	1 h	-	60 ppb	42 ppb
	Year	-	17.0 ppb	12.0 ppb

** – parts per billion*

The values of ambient air quality standards are reviewed every 5 years, taking into account the latest scientific achievements and the opinions of all parties concerned, including government agencies, environmental organizations, the scientific community, representatives of the production sector, and the general public. The main principle of ensuring a high quality of ambient air in Canada is the requirement

[94] Canadian Ambient Air Quality Standards – CAAQS

for the design and operation of industrial plants in such a manner that the actual concentrations in the ambient air remain below the quality standard values.

At the provincial level, the competent authorities in the field of environmental protection can determine their own air quality standard values, as well as expand the list of regulated pollutants. For instance, the list of *Alberta Ambient Air Quality Objectives – AAAQO* is developed considering the impacts on various receptors (human health, components of the natural environment)[95]. In table 9 the values of substances for which, in the province of Alberta, the environmental standards have been set along with hygienic ones, are provided[96].

Table 9. Hygienic and environmental standards for the ambient air quality in the province of Alberta

Pollutant substance	**Averaging Period**	**Receptor**	**Allowable concentration, mg / m^3**	**Allowable concentration, ppbv***
Ethylene	1 hour	Harvesting Capacity	1,200	1,050
	3 days	Harvesting Capacity	45	40
	1 year	Conifers and perennial plants	30	26
Nitrogen Dioxide	1 hour	Respiratory organs	300	159
	1 year	Vegetation	45	24
Sulphur dioxide	1 hour	Respiratory organs	450	172
	24 hours	Human health in total	125	48
	30 days	Ecosystems	32	11
	1 year	Ecosystems	20	8

** – parts per billion by volume*

Water quality standards are presented in the *Canadian Environmental Quality Guidelines* [97]and developed for various water uses, such as domestic water supply, agricultural water supply, protection of freshwater flora and fauna, recreational functions, etc.

Drinking water quality standards regulate the microbiological, chemical, physical and radiological parameters of water that must be provided by treatment plants[98].

[95]Alberta Ambient Air Quality Objectives and Guidelines Summary
[96] Всего в провинции Альберта по состоянию на 2017 г. разработаны нормативы качества атмосферного воздуха для 49 ЗВ
[97] Canadian Environmental Quality Guidelines
[98] Guidelines for Canadian Drinking Water Quality —Summary Table

Quality standards for protecting freshwater flora and fauna regulate a number of organic and inorganic pollutants, as well as physical indicators such as temperature and total suspended solids in waters[99].

The standard values for all regulated parameters of water resources in Canada are provided in the database of the Canadian Council of Ministers of the Environment[100] on their official website.

2.4.3.2. Emission standards

Pollutant emission standards may be established by *technology based limits or by ambient environmental quality based limits*.

Technological emission standards are set on the basis of performance indicators achieved through implementation of the most efficient technologies for the prevention and control of emissions, expressed in the form of *Base-level industrial emission requirements (BLIERs)*[101]. BLIERs are quantitative or qualitative emission requirements applied to the new and existing sources of main industries and certain types of production equipment. BLIERs are regulated within the framework of practical guidelines and industry standards. To date, in Canada, the BLIERs have been developed for such industries as aluminum smelting, metal smelting, potash production, and the pulp and paper industry. In June 2016, emission requirements for large stationary combustion plants, boilers, and furnaces were approved[102]. The emissions of nitrogen dioxide (NO_x), sulphurdioxide (SO_2), volatile organic compounds (VOC), and particulate matters (PM) are regulated within the BLIER. Technological standards are expressed as performance indicators of a particular technology that minimizes emissions of a single substance per unit of energy consumed (g / GJ).

Technological standard values for emissions of nitrogen dioxides when burning gaseous fuel in boilers, depending on their heat rating, are provided in Table 10.

Table 10. Technological standards for NOx emissions for gas boilers

Type of fuel burned	Heat rating	Specific NOx emissions (g / GJ)
Natural gas	< 80%	16
Natural gas	≥ 80% and ≤ 90%	16 + (E - 80) / 5, where E is boiler heat rating
Natural gas	> 90%	18
Other types of gaseous fuel	< 80%	20.8
Other types of gaseous fuel	≥ 80% and ≤ 90%	20.8 + (E - 80) / 4.54, where E is boiler heat rating
Other types of gaseous fuel	> 90%	23

[99] Summary—Guidelines for Freshwater Aquatic Life, p. 87
[100] Canadian Council of Ministers of the Environment
[101] Summary of final and proposed instruments used to implement base-level industrial emission requirements (BLIERs)
[102] Multi-Sector Air Pollutants Regulations SOR/2016-151

Canadian provinces may develop their own technological emission standards, while taking into account the *Best available technology economically achievable – BATEA.*[103]

Technological standards for pollutant discharges in wastewaters are regulated at the federal level within the framework of the Regulation on Wastewater Discharges[104]. The Regulation sets minimum requirements for the quality of wastewater discharged into receiving water bodies after the secondary treatment plants. The discharge standards are set for the following substances[105]:

- Average concentration of BOD is 25 mg / l;
- Average concentration of suspended solids is 25 mg / l;
- Average concentration of residual chlorine is 0.02 mg / l;
- Maximum concentration of unionized ammonium, expressed through nitrogen at a temperature of 15 °C ± 1 °C is 1.25 mg / l.

The provinces may independently develop technological emission standards by adapting federal regulations or the world's best practices of implementing the most efficient technologies to prevent and control emissions of other countries. In the province of Alberta, when setting technological standards, the *sector-specific technology limits* are primarily used[106,107]. In the absence of sector-specific technologies, the *case-specific technology limits* may be developed for individual enterprises, based on the performance indicators of individual enterprises with a similar production process.

The amount of pollutants, the emission or discharge of which under normal utilization and the least favorable local conditions will not lead to exceeding the established environmental quality standards, is determined by calculation. The calculated standard values of pollutant emissions into the atmosphere are determined from the results of calculations of dissipation as pollutant concentrations in vent gases (ppm, mg / m^3) or gross emission values. The calculated values of emissions involved in the modeling of ground-level concentrations can be based on the actual data on enterprise emissions, specific emission factors, results of emission monitoring, or any other available emission assessment methods agreed with the competent authority[108].

The calculated standards for pollutants in wastewater discharges are determined based on the results of water flow modelling, so that the standards established for water quality in the receiving water body are not exceeded[109].

The technological and calculated standards are compared with each other, and the more stringent are taken as emission standards. If an enterprise is located in an area

[103] Emission guidelines for oxides of nitrogen
[104] Wastewater Systems Effluent Regulations
[105] Wastewater Systems Effluent Regulations (SOR/2012-139), 6(1)
[106] Summary of Alberta industrial wastewater limits and monitoring requirements
[107] Alberta air emissions standards for electricity generation
[108] Industrial release limits policy
[109] Water quality based effluent limits manual

with a high level of pollution, then preference is given to the calculated standards. In practice, an enterprise may face a situation in which the achievement of calculated emission standards that ensure compliance with the established environmental quality standards, is technologically impossible. In this case, depending on the scale and degree of the enterprise's impact on the environment, the competent authority may take the following decisions:

- the establishment of *temporary emission standards* (*interim limits*) which will ensure the gradual achievement of environmental quality standards within a fixed period;
- a prohibition of production activity until the requirements for compliance with environmental quality standards are met.

2.4.4. Regulation of emission reduction

In order to ensure a higher level of public health and environmental protection, in 2012, the comprehensive *Air Quality Management System – AQMS*, was launched in Canada. AQMS consists of the following 4 components[110]:

1. Canadian Ambient Air Quality Standards (*CAAQS*) used by local authorities when making decisions on the necessary actions to improve or maintain high quality of the ambient air at the local level;
2. Territorial air quality management through the organization of *air zones* and local *airsheds*. Air zones are established within the provinces and territories, while airsheds are larger areas that combine several provinces;
3. Base-Level Industrial Emissions Requirements (*BLIER*) for major industries;
4. Intergovernmental working group on improving cooperation to reduce emissions from mobile sources (automobile and freight transport).

CAAQS are supported by 4 management levels of the corresponding colors (red, orange, yellow, and green). Each management level is determined by the level of air pollution and provides recommended actions to control the air quality:

- *Red management level*—actions aimed at achieving standards for ambient air quality;
- *Orange management level*—actions aimed at preventing ambient air quality standards from exceedance;
- *Yellow management level*—actions aimed at preventing degradation of the existing ambient air quality;
- *Green management level*—actions aimed at maintaining the ambient air purity in unpolluted areas.

If the pollutant content in the air area increases, then management should take more stringent control measures. Such a differentiated approach ensures that CAAQS are

[110] Air Quality Management System – AQMS

not considered as allowable levels of pollution and that all necessary measures are taken to ensure that pure areas remain pure.

Quality objectives of the ambient air quality standards by management levels within AQMS are provided in Table 11.

Table 11.. Air quality objectives by management level, annual concentrations in ppb

Management level	**O_3**	**PM***	**SO_2**		**NO_2**	
	2020	**2020**	**2020**	**2025**	**2020**	**2025**
Red	> 62	> 8.8	> 5	> 4	> 17	> 12
Orange	> 56 and ≤ 62	> 6.4 and ≤ 8.8	> 3 and ≤ 5	> 3 and ≤ 4	> 7 and ≤ 17	> 7 and ≤ 12
Yellow	> 50 and ≤ 56	> 4.0 and ≤ 6.4	> 2 and ≤ 3		> 2 and ≤ 7	
Green	≤ 50	≤ 4.0	≤ 2		≤ 2	

** – in mcg / m^3*

In each province, depending on the existing level of pollution, the management level is determined by appropriate measures to ensure high quality of ambient air, and consequently target concentrations for individual pollutants are established. The provincial government controls the monitoring and preparation of annual reports on ambient air quality. Based on the results of the reporting data, an assessment of the achievement of the quality objectives and status of the management level set in the province for each of the controlled substances, is carried out. If an improvement or degradation of the ambient air quality is recorded, the appropriate measures are taken[111].

2.4.5. Regulation of pollutant emissions into the ambient air

Technological and calculated emission standards accepted as emission standards must be confirmed by the results of modeling of ground-level pollutant concentrations that guarantee compliance with the ambient air quality standards. Areas in which the compliance with quality standards must be checked, are not set at the legislative level. However, in practice, the territories accessible to public visits are accepted as such areas. As a rule, the concentration of pollutants in the ambient air is monitored at the *facility boundary* and beyond its limits in the *study area*, as well as at the control points set.

The study area covers the area of the object's impact on the environment. The study area should include all predicted ground-level concentrations that are at or above 10% of the ambient air quality standards or background concentrations (if they exceed the predicted ones). The production facility must be in the center of the study area. All existing neighboring sources within 5 km from the facility should be considered as a background concentration[112].

[111]Canadian Ambient Air Quality Standards Reporting
[112]Air Quality Model Guideline

The *control points* (or receptors) at which the surface concentrations of pollutants are assessed, must be set in the study area. When choosing the location of control points, it is necessary to determine the sensitive areas closest to the facility (for example, residential areas, schools, hospitals, agricultural areas, water bodies, etc.)

If the the results of modeling for the designed enterprise show an excess in any of the control zones, the following measures should be taken:

- revision of the design of processing plants, including the cleaning equipment used, in order to make the necessary changes and improvements to achieve compliance with the ambient air quality (for example, increasing the height of chimney stacks);
- if the design changes of an enterprise at the stage of approval of an application for environmental permit failed to ensure the achievement of quality standards, a management plan must be developed and implemented to decrease the probability of exceeding the quality standard;
- in exceptional cases, the competent authority may prescribe the requirements for reconstruction of an enterprise, if the results of field measurements confirm the risk of exceeding the quality standards identified as a result of emission modeling[113].

2.4.6. Regulation of discharge into surface water bodies

2.4.6.1. Discharges of treated wastewater into surface waters

The methodology for determining emission standards for pollutants discharged into surface water bodies in the province of Alberta is presented in the *Water Quality Based Effluent Limits Procedures Manual*[114]. The Manual establishes a three-level approach to the determination of standards for the pollutant discharge into natural water bodies:

1. *Technological standard* achieved by implementation of treatment technologies or other pollution prevention practices. These standards consider the minimum requirements for reducing pollutant releases and are established at the treated wastewater discharge point. The technological standard will be used as the pollutant standard only if, according to the results of a mathematical calculation, a *potential to exceed an instream guideline* has not been established[115,116]. These calculations are performed taking into account the existing background pollution of water bodies and on the basis of the most unfavorable impact scenario during the pollutant discharge.

[113] Using Ambient Air Quality Objectives in Industrial Dispersion Modelling and Individual Industrial Site Monitoring
[114] Water quality based effluent limits procedures manual
[115] Water quality based effluent limits procedures manual, see formula No. 6
[116] In the absence of approved quality standards for certain pollutants discharged, the business operators and competent authorities may use US MAC values (US EPA)

2. If, according to the results of the above calculations, the potential excess of the MAC in the receiving water body is determined, then the *wasteload allocation – WLA*[117] is necessary. The total allowable load of a water body by pollutants, at a degree that does not lead to exceeding the MAC values, is meant as a *wasteload*. According to the results of WLA calculations, two maximum concentrations (mg / l) of pollutants that can be discharged into a water body, are determined. Two types of WLA must be calculated considering the types of pollutant impact on aquatic fauna – *acute* and *chronic* ones. The basis for determining the standards for pollutant emissions is taken as the indicator with the smallest (strict) value of two.

3. According to the WLA results, the standards for pollutant emissions are calculated based on *quality standards (WQBEL)*. These standards are established at the *end-of-pipe limits* and can be presented as monthly average and maximum daily discharges.

In order to prevent the negative impact of pollutants discharged into water bodies and to monitor compliance with quality standards, the environmental permit should include determination of a *mixing zone* for pollutants discharged[118]. The mixing zone is a limited area around the wastewater discharge point, beyond which the quality standards are not allowed to be exceeded[119]. The methodology for determining the boundaries of the mixing zone is not established at the legislative level. In practice, there are the "*Rule of thumb*" rules to be implemented when determining the size of mixing zones. These rules include the following factors:

- zone size must be determined so that the marine life is not negatively impacted, which could lead to its mortality;
- zone should not include the spawning areas;
- the zone should not include the potable abstraction area and should not negatively impact the existing water consumption, etc.

2.4.6.2. Regulation of wastewater discharges into the lagoons

Treated wastewater discharges into the lagoons is not regulated by Canadian environmental legislation. However, according to the *Wastewater systems standards for performance and design* in the province of Alberta, the business operator must ensure that the technical requirements regarding the organization and utilization of lagoons are met, to obtain a permit for operating evaporation lagoons of treated wastewater[120].

[117] Water quality based effluent limits procedures manual, see formula No. 8
[118] Water quality based effluent limits procedures manual
[119] Atlantic Canada Wastewater Guidelines Manual
[120] Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems, see Section 3.4

2.4.6.3. Regulation of storm / rainwater discharges

The *industrial runoff* of the stormwater and its subsequent discharges into water bodies are activities regulated by an environmental permit[121]. Production facilities must be equipped with a system for stormwater runoff and discharge, and, if necessary, with systems for stormwater storage and treatment as well[122]. The stormwater should not be mixed with industrial runoff.

The following regulated parameters can be set when issuing an environmental permit for the stormwater discharge: pH, oils and fats, total suspended solids, chemical oxygen demand, ammonia, chloride, sulphates, etc[123]. The list of regulated parameters, as well as their qualitative and quantitative values are determined for each regulated facility separately, depending on the type of activity, assessment of potential pollution of the industrial surface runoff and water quality in the receiving water body[124].

Management of the stormwater runoff, storage, and discharge must be performed through the implementation of best available practices. The Stormwater Management Guidelines for municipalities provides various engineering and management solutions aimed at reducing the total accumulated and discharged stormwater runoff, as well as at improving the quality of the water discharged to surface water bodies[125]. Best practices presented in the Guidelines also apply to operators of production facilities. Examples are:

- exclusion of the primary pollution of stormwater by industrial substances (efficient storage of chemical products, prevention of leaks of chemicals, oils, etc.)
- implementation of the best technical and operational practices in the field of organization of treatment plants (filtration ponds, constructed wetlands, etc.)
- re-use of accumulated water in production, etc.[126]

2.4.6.4. Treated Wastewater Discharges to the land

Treated wastewater discharges to the land can be performed for *groundwater recharge* or water re-use in agriculture (*irrigation*). At the level of Canadian provinces, there are requirements for the organization of lands designated for the treated wastewater discharge. Thus, when considering an application for obtaining a permit for discharges, the following factors are assessed by the competent authority:

- the type and quality of soil in the territory where discharges are planned. Treated wastewater discharges to the land are possible if the receiving soil has the following characteristics:
    - PH level from 6.0 to 8.5;

[121] Guide to Content for Energy Project Applications
[122] Alberta Regulation 119/1993, Wastewater and Storm Drainage Regulation
[123] see example of environmental permit issued by the competent authority of Alberta
[124] Stormwater Management Guidelines for the Province of Alberta
[125] Stormwater Management Guidelines for the Province of Alberta
[126] Best Management Practices for Stormwater Management Facilities

    - organic matter in the soil is from 0.5 to 3%;
    - electrical conductivity is 2 deciminutes per meter
    - sodium adsorption factor is 10;
    - cation exchange capacity is 10 mEq / 100 g.
- infiltration rate of water into soil;
- hydrological and geological structure of the area;
- weather conditions of the area;
- type of economic use of neighboring lands, etc.

The parameters regulated by environmental permits are volumes (*application rate*) and frequency (*loading cycle*) of treated wastewater discharge. These parameters are determined by calculation[127]. The competent authority can also determine the requirements on seasonal water discharges into the land. Thus, in the winter months, the volumes of allowable discharges can be minimized, and the periods between discharges are increased.

The regulation of the discharged water quality is performed by determining the requirements for the production efficiency of treatment plants[128,129]. At the same time, when discharging treated wastewater into the terrain, the impact on the soil and groundwater should be monitored.

2.4.6.5. Offshore wastewater discharges

Discharge of produced, drilling and wastewater from offshore plants in Canada (Newfoundland and Labrador) is regulated by the Offshore Waste Treatment Guidelines[130]. The management determines the following requirements regarding the implementation of discharges from offshore installations:

1. Produced water

- a 30-day average oil-in-water concentration in discharged produced water should not exceed 30 mg/l;
- a 24-hour average oil-in-water concentration in discharged produced water should not exceed 44 mg/l.

Compliance with the above standards should be ensured at the point of discharge.

2. Drilling fluid

- spent and excess water-based drilling mud is allowed without prior purification;
- discharge of synthetic or petroleum based drilling muds is prohibited.

[127] Atlantic Canada Wastewater Guidelines Manual
[128] Wastewater and storm drainage regulation, Atlantic Canada Wastewater Guidelines Manual
[129] Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems
[130] Offshore Waste Treatment Guidelines

3. Drilling solids

- discharge of drill cuttings resulting from the use of water-based drilling mud is allowed without prior treatment;
- the discharge of drill cuttings formed as a result of using synthetic or petroleum based drilling mud should be carried out according to the best available technologies and practices. The 48-hour average of retained “synthetic-on-cuttings” or “enhanced mineral oil-on-cuttings” discharged to sea should not exceed 6.9 g/100 g oil in wet solids.

4. Storage displacement water; bilge water; ballast water

- the concentration of residual oil should not exceed 15 mg/l.

5. Well treatment fluids

- these fluids may be recovered and directed to the produced water treatment system and then treated as a component of produced water;
- if the above is not possible, the fluids should be treated such that the residual oil concentration does not exceed 30 mg/l.

Solutions containing aromatic hydrocarbons should, if possible, be recycled and reused on site; if use is not possible, they should be transferred to land.

6. Desalination brine

- The brine resulting from the desalination of seawater for drinking purposes may be discharged without prior treatment.

7. Sewage and food waste

- Sewage and food should be reduced through maceration to a particle size of 6mm or less.

3. ENVIRONMENTAL REGULATION IN THE OIL AND GAS SECTOR

3.1. Gas flaring regulation

In the countries investigated, different approaches are used to determine the allowable volumes of associated petroleum gas (APG) flaring. In Russia, the maximum allowable value of the flaring indicator is set by law in the amount of 5% of the total volume of APG produced in the reporting year. In Great Britain and Norway, the volumes of allowable gas are set in agreement with the competent authority. At the same time, when coordinating, the technical and economic feasibility of reducing APG flaring volumes are taken into account. In Brazil and the countries of North America, the cases have been identified in which APG flaring is allowed without prior approval from the competent authority. Examples of such cases are the gas flaring to the extent permitted by law and the flaring during the emergency cases.

From the analysis of the practice of environmental taxation in the oil and gas industry in the countries studied, it follows that the practices of higher rates of emission payments for APG flaring are not applicable. In Russia, however, when the allowable volumes of associated gas flaring are exceeded, the operators are obligated to pay the emission tax 25 times higher the base emission rate. At the same time, in countries such as Germany, UK, and Brazil, the pollutant emission rates are absent even for stationary sources.

3.1.1. Determination of allowable volumes of APG flaring

The only legislative document that regulates the reduction of pollutant emissions into the ambient air resulting from the flaring of associated petroleum gas (APG) in *Russia,* is the Decree on the Specifics of Calculating Payments for Negative Impact on the Environment in the Event of Pollutant Emissions Generated During Flaring and (Or) Dissipation of APG[131]. This Decree sets requirements that limit volumes of gas flaring at fields. Thus, the maximum allowable value of APG flaring and dissipation should not exceed 5% of the total APG produced during the reporting year. However, this restriction does not apply for developing fields with a percent of reserve depletion less or equal to 0.01, as well as within 3 years from the moment of exceeding this indicator, or until reaching a percent of reserve depletion equal to 0.05.

Gas flaring at onshore and offshore facilities in the *United Kingdom* is regulated by the UK Energy and Oil Acts (*Energy Act 1976 & Petroleum Act 1998*). The

[131] Decree dated November 8, 2012 No. 1148

allowable gas flaring volumes are approved by the competent authority (*Oil and Gas Authority*) under the reasonable request of subsoil users. When coordinating the requested volumes of APG flaring, the competent authority assesses the technological and economical feasibility of the implementation of APG utilization[132] and the implementation of best practices in the oil and gas industry.

UK competent oil and gas authority issues permits for gas flaring for up to 3 months during the *commissioning*. For existing oil production facilities, the flaring permits are issued for up to 1 year and can be updated on an annual basis[133]. Flaring without permit is subject to legal prosecution and in exceptional cases may lead to withdrawal of the right to subsoil use[134]. In order to avoid violations of the law, the competent authority may issue the short-term permits for additional volumes of gas flaring, if the operator justifies this need[135].

In *Norway*, there is legislation permitting the APG flaring and venting at onshore and offshore facilities in volumes that ensure the safety of production activities[136]. Norwegian Ministry of Petroleum and Energy[137] sets the allowable volumes of APG flaring by three different types of permits[138]:

- permits for new facilities during the commissioning period prior to their transition to the stable operational stage;
- permits for oil and gas production facilities in the stable operation stage;
- temporary permits provided for the implementation of gas flaring, associated with the temporary impossibility of APG recovery (inability to transfer gas or inject it into formation).

For violation of the provisions of permits, the Ministry of Oil and Energy may also suspend or terminate a license for subsoil use[139].

In *Brazil*, the types of flaring are set at the legislative level, as well as the limits of the allowed gas flaring volumes that do not require prior authorization by the competent authority (*Agencia Nacional de Petroleo*):

- gas flaring, which corresponds to 3% of the monthly production of associated gas;
- flaring during well testing;
- flaring to ensure the safety of facilities with a limit of up to 15,000 m^3 / month for pilot burners, 30,000 m^3 / month for closed flare systems, 60,000 m^3 / month for pilot burners at offshore installations;
- flaring in a field of activity that produces 150,000 m^3 or less of gas per month, or with a gas / oil ratio less than 20 (m^3 / m^3);

[132] Flaring and venting. OGA policy position
[133] OGA website, Flaring and venting
[134] Atmospheric Emission – Flaring
[135] Oil and gas regulation in the UK: overview
[136]Oil and gas regulation in Norway: overview. Thomson Reuters
[137] Ministry of Petroleum and Energy of Norway
[138] Oil and gas regulation in Norway
[139] Oil and gas regulation in Norway: overview

- flaring of gas vapors in above-ground tanks, with a limited factor of solubility of 15 m^3 / m^3 or less;
- flaring during emergency situations.

In the countries of *North America*, there is a similar practice of setting the time frame and limits for the allowable volumes of gas flaring without prior approval from the competent authority. In Texas, for instance, the gas flaring is permitted during drilling works. Operators are also allowed to flare gas up to 10 days during the well testing[140]. To perform APG flaring in other cases, it is necessary to obtain a gas flaring permit. According to the Rule No. 32 of the State of Texas, the gas flaring can be allowed for up to 180 days[141]. In exceptional cases (absence of infrastructure or high capital and operating costs for the implementation of gas utilization measures), the authorities can increase the timeframes for gas flaring. Permits issued by Texas RRC may also define limits for allowable gas flaring rates for each well (cubic feet per day). These limits are established by RRC based on the results of assessment of the documentation submitted by operators[142].

In Alberta, Canada, the gas flaring is regulated by the Directive 060 "Upstream Petroleum Industry Flaring, Incinerationg and Venting"[143]. According to the Directive, the operators are allowed to flare APG during unplanned events that include upset flaring (off-spec product, hydrates, loss of electrical power, process upset and operation error) and emergency flaring[144,145]. At the same time, the number of large unscheduled gas flaring events[146] (see the table below) should not exceed six times in six consecutive months (the "6-in-6" rule). Law enforcement measures are used by the competent authority only if the preventive measures implemented to avoid major flaring events were not sufficiently effective, and the "6-to-6" rule is violated twice within 24 months. In the province of Saskatchewan, Canada, the APG flaring is allowed within the limits set at the provincial level – 900 cubic meters per day for each well[147].

Table 12. Major flaring event definition

Approved plant inlet capacity (10^3 m^3/day)	**Major flaring event definition(10^3 m^3)**
More than 500	100 or more
150 - 500	20% of plant design daily inlet or more
Less than	30 or more

[140] RRC Flaring Regulation
[141] Statewide Rule 32: Flaring/Venting of Produced Gas. RRC
[142] See examples of permits issues
[143] Upstream Petroleum Industry Flaring, Incinerating, and Venting . AER Directive 060
[144] Includes technological failures and abnormal, emergency situations. Technological failures – "Upset flaring" that include flaring to prevent formation of gas condensate (hydrates); power outages; malfunctions and failures in production processes, etc.
[145] Non-routine flaring management. Government of Alberta
[146] The Directive determines the criteria according to which an unscheduled gas flaring event is classified as large. See it. 5.2 of the Directive
[147] The Oil and Gas Conservation Regulations, 2012 eliminates flaring to ensure the safety of the facility

In the province of *Newfoundland and Labrador, the Newfoundland and Labrador Atlantic Accord Implementation Act* regulates mining on the continental shelf. Within the framework of this law, the regulatory acts adjusting the treatment of APG [4] were brought into force:

- Regulation 20/97 – *Offshore Petroleum Installations* (2001)[148] obliges to complete the hydrocarbon extraction and transportation facilities with a *Gas Release System*
- Regulation 120/09 – *Offshore Petroleum Drilling and Production Guidelines* (2009)[149] prohibits APG flaring and venting with the exception of emergency and test flaring.

3.1.2. Emission regulation during APG flaring

There is no separate legislation in *Russia* regarding the regulation of pollutant emissions during the gas flaring. The standards are established in accordance with the Rules for Establishing Allowable Pollutant Emissions by Industrial Enterprises[150] and with the results of the developed projects on maximum allowable emissions of harmful (polluting) substances into the ambient air.

It is worth mentioning that starting fomr 2019, a list of certain technological standards is going to come into use. This indicates that enterprises that subject to IEP must comply with technological standards, including in APG processing / recovery. Thus, for methane, hydrogen sulphide, saturated hydrocarbons, and carbonic oxide, the values of emissions per kg / ton of oil equivalent of products (per year) are set[151].

Emissions from gas flaring in the oil and gas sector in *EU* are regulated by several BREFs, depending on the purpose of gas flaring. For processing plants of oil refinery facilities (gas turbines, catalytic cracking plants, etc.), there is a separate BREF (*REF*) that regulates and establishes the standards for maximum allowable concentrations of NO_x, SO_2 and CO[152]. According to REF BREF, prevention of the routine gas flaring at production facilities is considered as BAT. Gas flaring, on the other hand, is allowed for safety purpose. Thus, the regulation of emissions from gas flaring is performed through the BAT implementation. A separate BREF for the organic chemical industry (LVOC)[153] also provides for the BAT implementation to prevent routine gas flaring during the production of organic chemical products.

[148] Newfoundland and Labrador Regulation 20/97
[149] Newfoundland and Labrador Regulation 120/09
[150] Rules for determining the allowable pollutant emissions by industrial enterprises
[151] ITD 28-2017 Oil Production
[152] Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas
[153] Currently the directory is being finalized.

Since 2015, the European Commission has also been working on the development of a separate BREF for the oil sector (*upstream*), which will include information on BAT, the implementation of which should significantly reduce the negative impact of oil and gas production on the environment[154].

In *Norway*, an individual approach is applied for the determination of pollutant emission standards, which are established taking into account the requirements of national standards. According to the *Pollution Control Act*, environmental permits in the above events will regulate such parameters as noise, vibrations, light (for onshore gas flaring) and NO_x, VOC, CO, SO_2, PM emissions (for onshore and offshore facilities).

In *Germany*, emissions from gas flaring in the oil and gas sector (downstream) are regulated by the TA Luft Technical Manual for Atmospheric Air Quality Management (similar to the BREF), according to which the following conditions are set[155]:

- Flaring of exhaust gas from gas relief and blowdown systems

All gases exhausted from gas relief and blowdown systems (safety valves, shutoff and control valves) should be directed to the gas collection system and then used during the flaring in combustion plants. If it is technologically impossible, the gases should be flared.

- Waste gas flaring

Exhaust gases from combustion plants and exhaust gases produced during catalyst regeneration, as well as during the equipment inspection and cleaning operations, should be directed to the vent gas supplementary firing plant, or equivalent technology should be implemented to minimize pollutant emissions into the atmosphere.

- Gas flaring during commissioning and outages

The gases generated during commissioning or outage of the plant should, as far as possible, be re-used in the technological process through the gas collection system, or should be flared in combustion plants. If it is technologically impossible, the gases should be flared. At the same time, the flare units must comply with the requirements of gas flaring from gas relief and blowdown systems.

- Hydrogen sulphide gas flaring

Gases generated during desulphation or other processes in which the volume concentration of hydrogen sulphide is more than 0.4% and with a mass flow of hydrogen sulphide more than 2 mg / day, should be further processed. Gases that are not further processed should be directed to the supplementary firing plant.

[154] Hydrocarbons BREF
[155] Technical Instructions on Air Quality Control—TA Luft

Thus, the gas flaring is an extreme measure, applied only in events when other more environmentally friendly gas recovery technologies cannot be applied. At the same time, the TA Luft manual does not establish the emission standards values, but it is mandatory to determine the obligation to implement BAT, ensuring the minimum amount of gas flaring and, therefore, pollutant emissions into the atmosphere.

In the *United Kingdom*, the emissions from natural gas flaring at onshore sites are regulated by the Environmental Agencies of England, Wales, and Scotland with two different types of permits, depending on the total amount of gas flared at production facilities, and the purpose of gas flaring. If gas is flared during well testing and trial operation of the field, then these emissions are considered as *hazardous waste*[156]. Any flaring the purposes of which is not safety considered as *waste flaring*. Emission standards during *waste flaring* are regulated by the *mining waste permit*, if the gas flaring volume does not exceed 10 tons per day; and integrated environmental permits regulated by the Industrial Emissions Directive (*IED*), if the flaring volume exceeds 10 tons per day.

In the UK, the APG flaring at oil and gas production facilities, as well as hydrocarbon vapors and gas emissions at oil refineries, which includes *emergency* flaring, technologically unavoidable flaring during *scheduled and unscheduled maintenance* of process equipment, as well as *over-pressure flaring*, is classified as *gas flaring to ensure safety of the facility (safety flaring)*. Subsoil users must also obtain environmental permits in accordance with the requirements of the Industrial Emissions Directive or Mining Waste Dircetive. However, unlike *waste flaring*, the Environment Agency does not establish emission standards for flaring that are necessary to ensure safety as safety of personnel is paramount[157]. However, the gas flaring enterprises must report on flaring volumes; inform the authority on the scheduled gas flaring events and notify on unplanned flaring.

Despite the absence of a special BREF guide for the oil and gas industry, the environmental regulation of gas flaring is carried out through the use of BAT, as well as according to the precautionary principle. Thus, application of enclosed flares are considered as BAT in the UK. If the application of enclosed flares is not possible, the operator must provide documentation justifying the technological or economic infeasibility of integration of enclosed flare systems. Operators should also provide the information on the use of alternative BAT to ensure the equivalent environmental performance to enclosed flares. These are usually shrouded flares and elevated pipe flares (for sour gas and safety gas flaring only).

[156] Onshore Oil & Gas Sector Guidance
[157] Onshore Oil & Gas Sector Guidance

Due to the absence a special BREF that regulates gas flaring at onshore sites, emissions are regulated through the BAT. When implementing BAT, the natural resource users should consider the following criteria[158]:

- stack height;
- minimization of noise and vibrations;
- no visible fume;
- odour control, etc.

Emission limits are set according to the results of air emission modelling. In addition to the emission limits, permits may establish additional standards for the following parameters:

Parameters	**Monitoring conditions**
Polluting substances	By calculation on monthly basis
Flow rate (mln stand. feet/day)	Continuous monitoring
Temperature	Continuous monitoring
Flame length	By video recording during flaring event
Odour	Periodic monitoring
Noise	Periodic monitoring

Environment agencies may prescribe additional requirements in environmental permits if the use of alternative BAT does not ensure the environmental performance of enclosed flare systems. Examples of such requirements may be the determination of timeframes for gas flaring or limits for permitted gas flaring volumes.

In *Canada*, the regulation of pollutant emissions into the atmosphere is performed by reducing the allowable amount of gas flaring, as well as through the *good engineering practice* implementation. Thus, the operator must prove that the measures taken, such as the implementation of gas recovery processes or the modification of technological processes, will lead to a decrease in pollutant emissions to concentrations that allow to comply with the established *Ambient Air Quality Objectives* (concentrations) for 49 pollutants[159]. If the obtained concentrations of ground-level pollutants as a result of air dispersion modeling does not exceed the established standards for the ambient air quality, then these concentrations can be accepted as standards for the maximum allowable emissions of pollutants when APG is flared.

[158] Onshore Oil & Gas Sector Guidance
[159] Alberta Ambient Air Quality Objectives and Guidelines Summary

3.1.3. Emission payment for APG flaring

In *Russia*, if the flaring rate does not exceed the maximum allowable value or is equal to it, the amount of emission payment is calculated in accordance with the rules for calculating and charging for negative environmental impact[160]using standard emission rates[161].

If the maximum allowable value of the flaring and / or APG dissipation indicator is exceeded, the calculation of the emission payment amount is performed by applying a K factor of 25 to the rates of payment for negative environmental impact.

In the absence of measuring instruments and (or) technical systems and devices with measuring functions that meet the requirements set by the Ministry of Energy measuring the amount actually produced and flared at flare units and (or) dissipated APG, the calculation of the emission payment amount is performed regardless flaring indicator value with an additional K factor of 120 applied to the emission payment rates.

If the annual volume of associated petroleum gas produced by the subsoil user does not exceed 5 million cubic meters, or the volumetric content of non-hydrocarbon components in the associated petroleum gas produced in the subsoil area exceeds 50 percent, then an additional K factor is not applied to the emission payment rates, except if the operator does not have means of measuring the volume of APG actually produced and flared.[162]

In *Norway*, when calculating emission payments for gas flaring, the standard rates for SO_2 and NO_x emissions are applied. At the same time, for NO_x emissions, a separate increased rate is determined for offshore facilities[163].

A comparative table on the set payment rates for pollutant emissions into the ambient air is provided in Annex 2.

3.2. Sulphur management and regulation

The regulatory approach to elemental sulphur management in oil and gas industry differs in Russia and OECD countries. In Russia, the sulphur is classified as a waste of hazard class 4, for which the standards for the volume of generation and disposal are established. In OECD countries, conditions and criteria are defined under which substances generated in the process of industrial production cease to be waste and can be classified as a market or by- product, the disposal of which is not charged. In addition, the approach to regulating sulphur used in OECD countries is not based

[160] FZ On Environmental Protection
[161] Decree on the Rates of Payments for Negative Environmental Impact and Additional Factors
[162] RF Government Decree dated November 08, 2012 No. 1148 'On Specifics in Calculation of Payments for Negative Impact on the Environment During Pollutant Emissions into the Ambient Air, Generated from Burning in Flare Units and (or) Dissipation of Oil-Associated Gas'
[163] For more information on carbon taxes, see the Greenhouse Gas Regulation Section

on regulating the amount of sulphur disposed, but on assessing its possible negative impact on environmental components.

3.2.1. Russia

According to the Federal Classificatory Catalogue of Wastes (FCCW), block sulphur wastes generated during the treatment of petroleum gas in the refining industry are classified as hazardous waste of hazard class 4.

According to No. 89-FZ 'On Production and Consumption Waste'[164], legal entities, in the process of economic and (or) other activities that generate waste at facilities subject to federal state environmental supervision, develop Waste Generation Standards and Waste Disposal Limits (WGSWDL) in accordance with the methodical guidelines. The duration of the WGSWDL is 5 years, subject to annual confirmation of the stability of technological processes. Upon receipt by the enterprise of an integrated environmental permit, which will include the development of a WGSWDL, the validity period of the waste generation standard and the limits on their disposal will be equal to the validity period of the IEP and will be 7 years, subject to annual confirmation of the stability of technological processes. The validity period of the WGSWDL for facilities not receiving CEP, will not change.

3.2.2. European countries

The approach of other EU countries implies different environmental requirements for legal regulation of sulphur depending on its belonging to one or another category of production material.

According to the regulations on waste types[165], the result of desulphurization can be sulphur containing waste regulated by an environmental permit for non-hazardous waste. At the same time, according to the EU Hazardous Waste Directive[166], the waste management requirements may not apply to non-hazardous waste if it is disposed directly on the production site. At the same time, the nature resource users are obliged to ensure the safe disposal and storage of non-hazardous waste, to prevent environmental pollution and negative impact on human health.

According to the EU Waste Directive, a by-product is a material or substance generated during the production of other materials or substances. A by-product is not a waste[167] if it meets the following criteria[168]:

[164] Federal Law dated June 24, 1998 No. 89-FZ 'On Production and Consumption Waste'
[165] Guidance on classification of waste according to EWC-Stat categories
[166] Directive 2008/98/EC on waste and repealing certain Directives
[167] Disposal is not taxable, respectively
[168] EU Waste Framework Directive

- the product can be used, or there is a market demand for it, or there is an economical benefit from its sales;
- the product does not need additional processing prior to its use;
- its production is an integral part of the production process;
- its further use is legal, the product meets all environmental and safety requirements; its use will not lead to negative impacts on public health and the environment.

A diagram to determine whether the material produced during the process is a market product, waste, or by-product, is provided below:

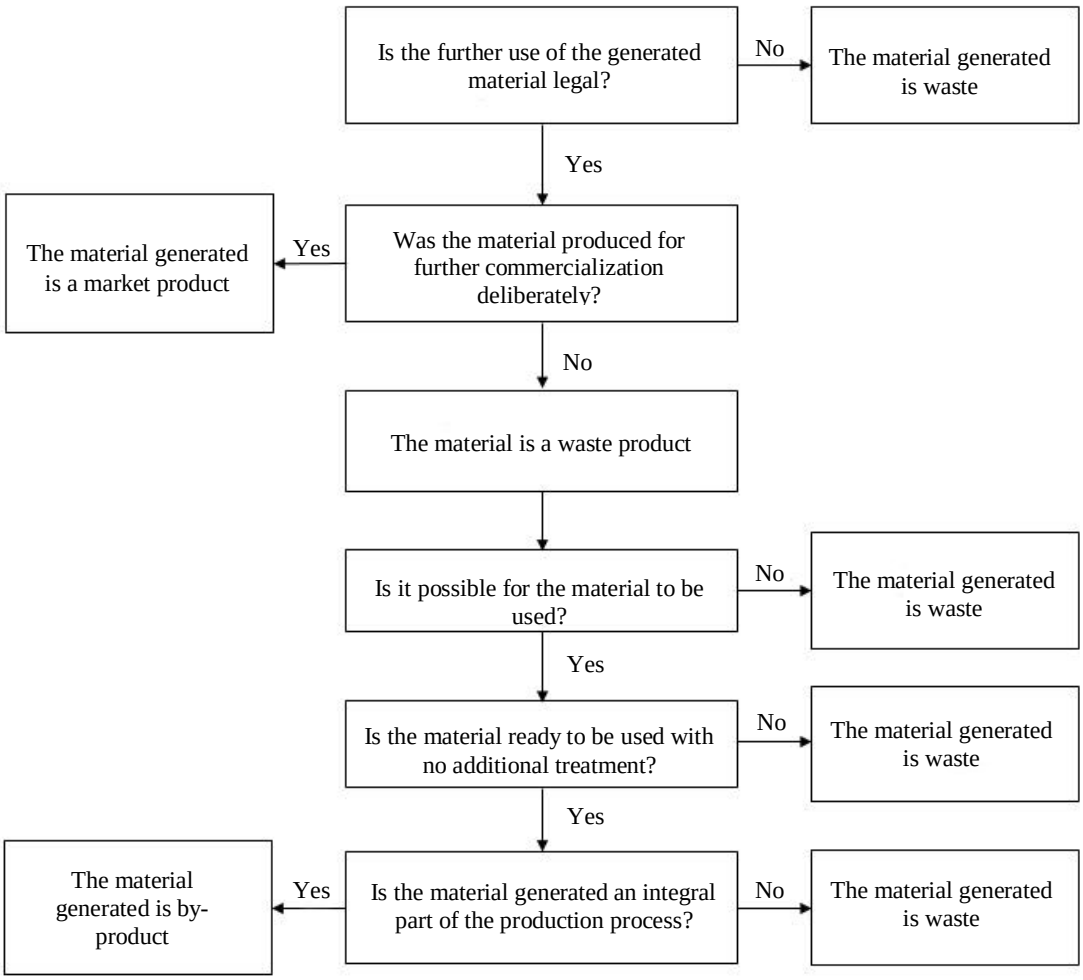

Figure 1. Determination of material produced as market product, by-product, or waste[169]

Thus, the elemental sulphur can be classified as a by-product or market product. Sulphur treatment processes (storage, reload, shipment) are not subject to environmental permits. Sulphur disposal can be regulated by the EU Directive on the safety of market products[170], EU legislation on the classification, labeling and

[169] Communication from the Commission to the Council and the European Parliament on the Interpretative Communication on waste and by-products
[170] Directive 2001/95/EC on general product safety

packaging of chemical substances[171], requirements for products of the agrochemical industry[172], and other EU requirements in the field of industrial safety and physical safety of workers at production facilities[173], etc.

3.2.3. Canada

The legal regulation of sulphur treatment issues has been most developed in Canada, in particular, in the province of Alberta.

As a result of oil processing (including oil from oil sands) and gas, the elemental sulphur and sulphur containing waste are generated.

The sulphur treatment and recycling industry includes[174]:

- sulphur recovery and processing facilities are facilities generating free sulphur in the amount of more than 1 ton per day;
- sulphur storage facilities are facilities with a total sulphur storage amount of more than 100 tons.

Elemental sulphur is classified as a byproduct of the oil and gas industry and is marketed in solid and molten forms (*solid sulphur and molten sulphur*).

Sulphur in solid form is disposed as *pastille storage*, *open stockpiles*, and in *silos*. Sulphur units are formed as a result of liquid sulphur loading into special forms and its subsequent cooling. Open stockpiles and silos are used to dispose granulated sulphur. Pits for temporary storage, and tanks for permanent storage of liquid sulphur are used.

Installations for storage, recovery and processing of sulphur are subject to environmental permit *approval* under the *Environmental Protection and Enhancement Act – EPEA*. The permit establishes requirements for the sulphur treatment, including such environmental aspects as impact on ambient air, surface and wastewaters, soil, etc[175].

At the discretion of the management of the competent environmental protection authority for various activities related to the sulphur treatment, an environmental impact assessment may be scheduled[176], the report on the results of which will be taken into account when issuing an environmental permit.

The negative impact of elemental sulphur is primarily due to emissions of sulphur dust into the ambient air and its subsequent migration to other natural environments. *Sulphur dust* is generated during operations on the mechanical separation of sulphur units, in sulphur granulation plants, in the process of unloading and loading, as well as a result of entrainment of sulphur particles from the storage sites. Sulphur dust

[171] Classification, packaging and labelling of chemicals and their mixtures
[172] Regulation (EC) No 2003/2003 relating to fertilisers
[173] EH40/2005 Workplace exposure limits
[174] Alberta Regulation 276/2003
[175] The Elemental Sulphur Management Framework, 2009
[176] Article 43 of Environmental Protection and Enhancement Act

causes diseases of the respiratory organs, its subsidence leads to acidification of soils, surface waters, and groundwaters.

The requirements set in the environmental permit depend on the specifics of the activity of the sulphur treatment facility and, as a rule, include the following regulated parameters:

- the concentration of elemental sulphur in the soil should not exceed *500 mg* per kg of soil on the previously set and agreed *sampling sites*.
- soil acidity is the pH value of the soil in the sampling sites that should not be reduced by 1 unit compared to the background values. The background condition of the soil (acidity, sulphur content) is set prior to the commissioning of the sulphur treatment facility, and relative to it, the monitoring and control of compliance with the conditions of the permit are performed.
- *emission limit values* of pollutant discharges into the ambient air. Liquid sulphur storage facilities (pits, tanks) are sources of emissions of hydrogen sulphide (H_2S) and sulphurous oxide (SO_2), for which, as a result of calculating the dispersion of ground-level concentrations, the standards are established for each emission source, provided that the criteria for non-exceedance of *Ambient Air Quality Objectives* set in the province of Alberta are met.
- implementation of the best available techniques to prevent the negative impact of sulphur on the environment and human health (for example, dust suppression systems to reduce generation of sulphur dust, purification systems for steam-and-gas mixture emitted from liquid sulphur storage tanks, wastewater leak detection systems, etc.)
- implementation of a system for monitoring and reporting pollutant emissions into the ambient air, soil conditions, surface and groundwater in the area of impact of the sulphur treatment facility.

By decision of the competent authority, an additional requirements may be determined in the environmental permit.

Water flowing from the sulphur storage sites (acidic wastewater) should be collected in specially equipped wastewater storage tanks to prevent its emissions into the environment. Discharge of acid wastewater without prior neutralization is prohibited. For wastewater discharge from sulphur storage facilities to surface water bodies, a separate permit must be obtained under the Alberta Water Act[177].

Sulfur Waste Regulation

Sulphur containing wastes (*S-wastes*) are generated as a result of processes for sulphur treatment and processing and also include sulphur containing soils. Sulphur waste disposal is regulated by the Waste Control Act[178] and Directive-58[179] of the

[177] Alberta Water Act
[178] Waste control regulation
[179] Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry

province of Alberta. Requirements for the disposal of sulphur containing waste are determined in *Guidelines for Landfill Disposal of Sulphur Waste and Remediation of Sulphur Containing Soils*[180] of the province of Alberta. At the same time, the main condition for a permit for disposal of sulphur containing waste on landfills is to ensure safe storage conditions that prevent leakage of sulphur compounds into the environment and acidification of neighboring soils and water bodies. The volume of placement of sulphur containing waste is set by the decision of the competent authorities, and the criterion for compliance with environmental requirements is not exceeding the maximum allowable concentration of sulphur in the soil (500 mg / kg).

3.3. Wastewater management regulation

3.3.1. Wastewater injection

3.3.1.1. Russia

Deep disposal of hazardous (polluting) substances, waste (including radioactive one), and wastewater is one of the types of subsoil use and, at the same time, environmental protection measure aimed at preventing pollution of the surface, open water bodies, and drinking groundwater. The use of subsoil also refers to the reinjection into the subsoil of drainage, produced, as well as mineral, thermal energy, industrial, and service waters.

The legislative basis for implementation of the disposal of wastewater into the subsoil is the Law of the Russian Federation 'On Subsoil' and 'Regulations on the Procedure for Licensing the Subsoil Use'[181], Section 14 of which sets out the subsoil use procedure for the disposal of hazardous substances, waste and wastewater.

When injecting wastewater and re-injecting of used mineral, thermal, industrial and drainage water into the subsoil, the following is regulated:

- the volume and physical-and-chemical parameters of water;
- pressure at the injection wellheads.

Wastewater disposal into deep horizons can be performed in presence of a reasonable technical,environmental and economical inpracticality of wastewater disposal on the surface, taking into account its compatibility with formation waters and the adjacent formations of reservoir beds (both specified conditions must be reflected in the conclusion of a specialized scientific research organization). A permit must be obtained for the injection of wastewater.

[180] Guidelines for landfill disposal of sulphur waste and remediation of sulphur containing soils
[181] Decree of the Armed Forces of the Russian Federation dated July 15, 1992 No. 3314-I 'On the Procedure for Implementation of the Regulation on the Procedure for Licensing the Subsoil Use' (as amended and supplemented)

Injection of wastewater, groundwater, and surface water to maintain formation pressure is governed by the Rules for the development of oil fields and gas and oil fields[182]. Thus, the injected water must be compatible with formation water, reservoir rock and not cause sludge generation in the formation and production equipment. Requirements for the quality of injected water are determined by design process documents for development, in which the allowable content of mechanical and chemical contaminants in water, iron in oxide form, oil products, oxygen and microorganisms is set depending on reservoir properties and lithologic characteristics of productive formations and swelling characteristics of clay particles.

Despite the basic requirements, the water quality for injection into the formation is usually regulated for each specific field according to the results of research by regional research institutes or laboratories licensed for this type of activity, upon receipt of an injection permit[183].

To carry out the injection of produced waters for maintenance of reservoir pressure at offshore oil and gas facilities, the following requirements must be met:

- the permissible content of oil and mechanical impurities in the produced water injected into the wells is established depending on the permeability and relative fracture of the reservoir in accordance with Table 13;

Table 13. Permissible content of mechanical impurities and oil

Permeability of a porous medium, μm2	Relative fracture factor of a collector	Permissible content in water, mg / l, not more than	
		mechanical impurities	oil
Up to 0.1 inclusive	-	3	5
Over 0.1	-	5	10
Over 0.35 inclusive	6,5-2	15	15
Over 0.35	Less than 2	30	30
Up to 0.6 inclusive	0,35-3,6	40	40
Over 0.6	Less than 3,6	50	50

- pH 4.5 to 8.5;
- when water is pumped into pore collectors with permeability above 0.1 μm2, 90% of particles of mechanical impurities should be no larger than 5 μm, and

[182]Rules for the Development of Oil and Gas Fields
[183] Industry Standard OST 39-225-88. Water for Oil Reservoir Flooding. Quality Requirements.

when water is pumped into porous reservoir with permeability up to 0.1 μm2, no larger than 1 μm;

- the content of dissolved oxygen should not exceed 0.5 mg / dm3;
- in water pumped into productive reservoirs, the produced water that do not contain hydrogen sulfide or contain iron ions, hydrogen sulfide should be absent;
- in case of corrosivity of water over 0.1 mm / year, it is necessary to take measures for corrosion protection of pipelines and equipment.

To implement the disposal of drilling waste by pumping into the absorbing horizons, operators of offshore oil and gas facilities must comply with the following requirements:

- the presence of well-permeable absorbing horizons (sand, sandstone, limestone);
- the presence of impermeable screens that provide isolation of the absorbing horizon above and below the productive horizons and bottom layers of sea water within the boundaries of the zone of excessive reservoir pressures (regressions) created by injection;
- absence of fresh and low-saline waters suitable for drinking purposes, as well as minerals in the reservoir within the fishing area;
- control of seismicity of the fishing area, etc.

3.3.1.2. European countries

The EU *Water Framework Directive* sets requirements to prohibit the wastewater injection into the subsoil. However, Article 11 it. 3 of the Directive determines the conditions under which the injection of water into the underground formations is possible[184]:

- injection of produced/formation water in the oil and gas production with the aim of final water disposal or its use for technical purposes, provided that the water does not contain chemicals other than natural, and those used in the above activities. The formation water injection is allowed only to underground formations from which it was produced or to geological formations determined by the competent authority as unsuitable for other purposes;
- injection of mine and quarry waters;
- injection of wastewater with a minimum concentration of pollutants, for research activities.

[184] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

Produced water injection is also subject to the requirements of the EU *Groundwater Directive*. Nature resource users are subject to regulation in the event of any discharges that can directly or indirectly pollute the groundwater. This activity is called *groundwater activity* and is regulated by permits.

According to the EU *Groundwater Daughter Directive*, EU member states must determine *groundwater quality standards*, *list of pollutants*, and their *threshold values for pollutants* at the monitoring points set. Compliance with the above conditions is the basis for allowing the injection of produced water into the subsoil.

If, due to natural features, the formation waters also contain radioactive substances exceeding the maximum allowable concentrations set by the requirements of *NORM*[185] (*naturally occurring radioactive materials*), the water injection is regulated by the permit to perform *radioactive substances activity*. Formation water injection with concentrations within the NORM does not require an environmental permit.

Table 14. Maximum allowable concentrations set by the requirements of NORM (naturally occurring radioactive materials). Example of the United Kingdom

Radioactive substance	**Liquid state (Bq / l)**	**Gaseous state (Bq / m3)**
Radium-226+	1	0.01
Lead-210+	0.1	0.01
Polonium-210	0.1	0.01
Actinium-227+	0.1	0.001
Thorium-232sec	0.1	0.001
Thorium-232	10	0.001
Radium-228+	0.1	0.01

**Becquerel is nuclide activity unit*

EU member states may also determine their requirements for the injection of produced water, provided that the permitted activity will not negatively impact on the groundwater and surface water state.

Injection of produced waters in the oil and gas sector in Germany is permitted, provided that the scheduled activity does not have any negative impact on the sources of drinking, agricultural and mineral waters. In Norway, the produced water at offshore facilities, before reinjection into the formation, must be treated to the state set by the competent authority.

Recycling of formation waters in the UK is regulated by the Environmental Agencies of England, Wales, and Scotland. Produced water can be disposed the following ways:

[185] Naturally-Occurring Radioactive Materials

- ***by injection into injection wells or in the systems for reservoir pressure maintenance***

To maintain the formation pressure, its waters can be injected back into the geological formations from which they were produced, but provided that the subsoil user has a permit for the *groundwater activity*.[186] To obtain such a permit, the subsoil users need to perform a hydrogeological risk assessment and make sure that the water injection back into the formation will not negatively impact on the groundwater.

Discharge standards in the event of produced water injection are not established. Snowmelts and urban runoffs can also be injected into the formation, provided that they are not polluted by industrial substances.

If the formation waters contain radioactive substances, the injection of these waters can be regulated by a permit for discharges of radioactive substances, depending on whether the discharge is *waste* or not:

- if the concentration of radioactive substances in the formation waters exceeds the maximum allowable concentrations set by NORM, and these waters are injected into the same formation from which they were produced, then this activity is not regulated by permit for *radioactive substances activity*;
- if the formation water is transferred to other facilities for injection into the formation, and the concentration of radioactive substances in the formation water exceeds the MAC set by NORM, then this water will be classified as waste and its use will be regulated by a resolution on *radioactive substances activity*.

- ***underground disposal***

Underground disposal of formation water is considered the most environmentally friendly method of disposal. Formation water may be disposed under the condition that all requirements for the groundwater activity set by the competent authority are complied with.

- ***by transfer to permitted waste facilities***

If the wastewater disposal by the above methods is impossible due to technical or environmental considerations, the formation water is transferred to the permitted waste facilities. According to European legislation, produced water as well as other fluids produced during the exploration, extraction, processing and storage of mineral resources is considered as an extractive waste, regulated under the 2006 Directive 2006/21 / EC (Mining Waste Directive). Discharges of such waste into special waste disposal facilities are regulated by an appropriate environmental permit. According to Directive 2006/21/EC, a waste facility is any facility that accumulates or disposes solid or liquid wastes for the periods defined in section 3 of the Directive.

[186] Guidance, Onshore oil and gas exploration and extraction: environmental permits

The permit will define technical requirements for the organization and operation of these facilities, the need for a waste management plan, and measures to prevent pollution of water bodies, soil and air. More information about Directive 2006/21 / EC is provided in the "Waste Management" section.

3.3.1.3. North American countries

The injection of liquid waste, wastewater, and formation water, as well as gases into the subsoil of the province of Alberta, Canada, is governed by a separate Directive 051 (*Injection and Disposal Wells-Well Classifications, Completions, Logging, and Testing Requirements*)[187]. It should be noted that Canadian practice does not provide for the establishment of standards for pollutant discharges when injecting liquid waste, wastewater, and formation water into the subsoil. The main requirements for obtaining environmental permits are:

- injection of liquids not included in the list of *prohibited for injection*;
- injection of liquids, waste, and gases that meet the criteria set (*general criteria*) for each class of wells (*injection wells*):
    - class 1a – liquid oilfield waste;
    - class 1b – produced water;
    - class 2 – produced water (*brine equivalent*);
    - class 3 – hydrocarbon, inert and sour gases;
    - class 4 – steam / potable water;
- ensuring the technical conditions of well operation, namely meeting the requirements for cementing and surface casing, hydraulic insulation, ensuring the necessary pressure during injection, etc.
- results of the analysis of the prevention of groundwater pollution;
- results of economical and technical assessment of the impossibility to dispose liquids by other means, etc.

The list of liquids prohibited for injection into the subsoil includes the following[188]:

- urban and production sewage;
- *surface runoff* meeting the criteria for allowable discharges to surface water bodies;
- lube oils and spent solvents;
- drilling fluids;
- liquids that can be disposed by other means than injecting.

The following types of waters are allowed to be injected into wells of *class 2*:

- produced water;
- brine reject or backwash from water softeners associated with enhanced recovery;
- waste fluids and pigging fluids

[187] Directive 051: Injection and Disposal Wells – Well Classifications, Completions, Logging, and Testing Requirements
[188] Directive 051: Injection and Disposal Wells – Well Classifications, Completions, Logging, and Testing Requirements

- water containing calcium chloride etc.

Waters that meet the following criteria are allowed to be injected into wells of *class 1b*:[189]

- PH level from 6.0 to 9.0;
- ignition temperature is higher than 61.5 ºC;
- metal content does not exceed the concentrations set:
  - arsenic, chromium, lead, nickel – 500 mg / kg;
  - selenium and thallium – 200 mg / kg;
  - beryllium, cadmium, uranium, silver – 100 mg / kg;
  - mercury – 20 mg / kg.
- total content of halogenated organic compounds is less than 100 mg / kg.

The following types of waters are allowed to be injected into wells of *class 1a*:

- acidic or caustic solutions;
- acidic solutions, the metal content of which exceeds the concentrations set:
  - arsenic, chromium, lead, nickel – 500 mg / kg;
  - selenium and thallium – 200 mg / kg;
  - beryllium, cadmium, uranium, silver – 100 mg / kg;
  - mercury – 20 mg / kg.
- wastewater generated from oil refinery;
- polluted surface industrial wastes that cannot be treated up to a level allowable for discharge into surface water bodies, etc.

In the United States, the formation water injection activities are regulated at the federal level by a legislative act (*The Safe Drinking Water Act*[190] *– SDWA*) that determines measures to prevent pollution of underground sources of drinking water. In particular, the law establishes a special wastewater injection control program (*SDWA's Underground Injection Control – UIC*).

The program establishes 6 types of wells, with the specific requirements and conditions for the wastewater and waste injection determined for each of them. The division of wells into types is performed according to various criteria, such as geological structure, depth, targeted use, horizon period of operation, etc:

Wells of type I[191] are used for disposal of hazardous and industrial non-hazardous waste, as well as municipal wastewater below the level of underground drinking water sources (usually to a depth of several hundred meters).

Wells of type II [192]are used for disposal of waste generated from the producing and processing of oil and gas. All wells of class II are regulated either by a government authority with regulatory powers for the program, or by *US EPA.*

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[189] examples of the type of waters allowed for injection are provided in Section 2.4 of the Directive
[190] The safe drinking water act. United States Congress. 1974
[191] Website. United States Environmental Protection Agency
[192] Website. United States Environmental Protection Agency.

There are 3 subtypes of wells of class II:

- waste disposal wells. After production of hydrocarbons, the solution used is separated from them and re-injected into the wells for disposal;
- enhanced recovery wells. Liquids that may contain salt brine, freshwater, steam, polymers, or carbon dioxide are injected into the oil-bearing formations with the aim of increasing the efficiency of the well.

Wells of type III[193] are used for liquid injection with the purpose of mining and are not regulated within the UIC program.

Wells of type IV[194] are shallow wells for hazardous or radioactive waste disposal, taking into account the characteristics of the geological formation to prevent pollution of the underground drinking water source. In 1984, the EPA prohibited the wells of type IV.

Wells of type V[195] are used for non-hazardous liquid injection. Most wells of class V are used for waste disposal, taking into account the characteristics of geological structure, including the rock permeability, to prevent pollution of the underground drinking water source.

Wells of type VI[196] are used to inject carbon dioxide (CO_2) into the deep rock formations to reduce CO_2 emissions into the atmosphere, and for mitigation of climate change.

When issuing permits, the regulatory authorities take into account the following parameters of liquids injected into the well:

- average and maximum daily rate and volume of the liquid injected;
- pressure and temperature of liquids injected;
- the source of the liquid generation, as well as the chemical composition, physical, radiological, biological characteristics, and properties of the liquids injected into the well.[197]

[193] Website. United States Environmental Protection Agency.
[194] Website. United States Environmental Protection Agency.
[195] Website. United States Environmental Protection Agency.
[196] Website. United States Environmental Protection Agency.
[197] Underground injection control program:criteria and standarts

3.3.2. Wastewater/produced water discharge into lagoons/evaporation ponds

3.3.2.1. Russia

In Russia, the requirements for the regulation of treated wastewater discharges into lagoons (storage ponds/evaporators) are not regulated by the current environmental legislation. However, in practice, discharges of wastewater into storage ponds (evaporators) in oil and gas facilities are regulated by technical standards and industrial safety requirements. Authorities issuing permits for the operation of storage ponds (evaporators), including wastewater discharge, is the Federal Service for Environmental, Technological and Atomic Supervision (Rostechnadzor)[198]. Under the provisions of the technical regulation, storage ponds/evaporators belong to hydraulic structures[199]. An operational permit is issued on the results of project documentation review for the construction and operation of hydraulic structures.

As part of the project documentation, the environmental impact assessment of the designed hydraulic structure (evaporation pond) should be implemented, and measures to ensure engineering and environmental safety of the territory adjacent to the hydraulic structure, including flood, soil and groundwater pollution protection should be developed. The order of development, coordination and approval of project documentation concerning environmental protection should be determined by the requirements of environmental legislation[200,201], as well as SP 47.13330[202] и SP 11-102[203].

According to GOST R 57955-2017, discharge of treated wastewater is allowed into evaporation ponds if all technical and operational requirements are met. For example, the liner of the evaporation pond must be made of a watertight material that eliminates any impact on the environment[204].

Following Article 9 of the Federal Law "On the Safety of Hydraulic Structures", the owner or operator of the hydraulic structure is obliged to ensure control over the indicators of hydraulic structure operational conditions. The basis of such monitoring is an observation of the hydraulic structures condition and the impact of these structures on the environment[205].

According to the Safety Regulations for Hydraulic Structures of Storage of Liquid Industrial Waste, the operator must annually develop a status report of hydraulic structures with detailed analysis of hydraulic structures condition, their maintenance

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[198] Resolution of the Government of the Russian Federation of July 30, 2004 N 401 On the Federal Service for Environmental, Technological and Nuclear Supervision

[199] SP 58.13330.2012 Hydrotechnical structures. The main provisions.

[200] Federal Law of the Russian Federation of January 10, 2002 No. 7-FZ "On Environmental Protection"

[201] Regulation on the assessment of the impact of the planned economic and other activities on the environment in the Russian Federation (approved by the Order of the State Committee on Ecology of the Russian Federation dated May 16, 2000 No. 372)

[202] SP 47.13330.2016 Engineering surveys for construction. The main provisions.

[203] SP 11-102-97 Engineering and environmental survey for construction

[204] GOST R 57955—2017 Buildings and facilities for gas and oil producing industries. Design standards.

[205] Instructions on the procedure for monitoring the safety of hydraulic structures of enterprises, organizations controlled by the bodies of the Gosgortekhnadzor of Russia (RD 03-259-98)

and safety level. The report, among others, may include a section on environmental protection. A copy of the status report should be sent to analytical centres monitoring the safety of hydraulic structures no later than the first quarter of the year following the reporting[206].

3.3.2.2. North America

Canadian environmental legislation does not have provisions on the establishment of effluent emission limits values for discharges of treated wastewater into lagoons. However, according to the *Wastewater systems standards for performance and design*, to obtain operating permit, the operator must ensure compliance with technical requirements regarding the organisation and operation of wastewater lagoons[207].

The practice of ensuring the environmental safety of evaporation ponds (lagoons) in the United States differs significantly from Kazakhstan's practice. In particular, in Texas and Wyoming, the legislation does not define clear requirements for the quality of discharged wastewater into evaporation ponds. At the same time, wastewater shall be treated in the receiving and pre-treatment facilities to remove hydrocarbons before discharging to the evaporation cells in order to protect birds and other wildlife. If a sheen develops on any part of the evaporation cell, it shall be removed immediately by skimming, use of sorptive materials and/or by the introduction to the evaporation cell(s) of biological cultures that digest hydrocarbons[208].

In Texas, USA, for discharging treated and untreated wastewater into evaporation ponds operators must obtain a general permit for discharges *(WQG100000)* [209] according to the Texas Administrative Code[210]. The permit establishes the following requirements for the quality of discharged water into evaporation ponds:

- the oil and grease concentration should not exceed 100 mg / l;
- pH from 5 to 10 or within the liner manufacturer's recommended pH range for synthetic liners;
- should not contain any radioactive substances, hazardous wastes, or medical wastes;
- should not contain constituents that will inhibit evaporation, or are incompatible with or would damage the evaporation pond liner;
- should not contain flammable and explosive substances, etc.

[206] PB 03-438-02b, p.5.11
[207] Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, see chapter 3.4
[208] GUIDELINES. COMMERCIAL OILFIELD WASTEWATER DISPOSAL FACILITIES
[209] Wastewater Evaporation Ponds
[210] Texas Administrative Code

Wastewater samples shall be collected and analysed quarterly for total suspended solids, pH, and oil and grease. The operator shall make a visual inspection of each evaporation pond weekly and document the following information:

- the wastewater level;
- the presence of scum, floating solids, or floating vegetation, etc.

4. WASTE MANAGEMENT

In OECD countries, the practice of waste disposal regulation is not the main tool for reducing the amount of waste generation and disposal on landfills. The waste management systems applied (prevent, reduce, reuse, recycle, recover, dispose), as well as the implementation of resource efficient BAT, allow minimizing the amount of waste generated. Thus, in the application for obtaining the IEP, the natural resource users must prove that the way of organizing the production guarantees prevention of waste generation, reusing, recycling, using for energy purposes and only at the end of the line, disposing on the landfill. At the same time, the environmental and public health protection is ensured by monitoring compliance with strict technical requirements for the organization and operation of landfills, as well as waste storage facilities.

4.1. Russia

4.1.1. General terminology

Production and consumption waste ("waste") is considered as substances or objects formed in the course of production, performance of works, provision of services, or during consumption, which are disposed, intended to be disposed, or must be disposed.[211]

The treatment of each type of production and consumption waste depends on its origin, state of aggregation, physical-and-chemical properties, the quantitative ratio of the components and the degree of hazard to public health and the human environment.

The processes of waste management (the waste lifecycle) include the following steps: generation, accumulation and temporary storage, primary processing (sorting, dehydration, deactivation, pressing, calibration, etc.), shipment, recycling (deactivation, modification, disposal, use as secondary raw materials), storage, burial, and incineration.

In the process of production activities, the enterprise can both accumulate waste[212]:

waste accumulation is waste storage for a period not exceeding eleven months, for the purpose of further processing, utilization, deactivation, disposal;

and dispose it:

disposal is the storage and disposal of waste generated during the production process.

[211] Federal Law dated June 24, 1998 No. 89-FZ On Production and Consumption Waste
[212] Waste management: new terminology and new concepts

The waste storage is the storage at specialized facilities for a period *exceeding eleven months* for utilization, deactivation, burial.

If possible, the waste is disposed by:

waste utilization is the waste use for the production of goods (products), the performance of works, the provision of services, including the re-use of waste, including the re-use for its intended purpose (recycling), return to the production cycle after an appropriate pre-treatment (regeneration), and extraction of useful components for the re-use (recuperation).

If utilization is impossible for some reason, or the waste is not subject to further utilization, the waste is disposed:

waste burial is the isolation of waste not subject to further disposal in special storage facilities for an unlimited period in order to prevent the ingress of pollutants into the environment.

For production and consumption waste, there is a process of waste transfer into the secondary raw materials, produced in accordance with the requirements determined by the legislation of the Russian Federation in the field of technical and sanitary and epidemiologic regulation (*the law On Technical Regulation*[213] *and the law On Sanitary and Epidemiologic Well-Being of the Population*[214]). The generated production and consumption waste can be re-used, provided that the nature resource user obtained a positive conclusion of Rostekhnadzor and Rospotrebnadzor (Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing). For this, it is necessary to perform certain laboratory tests for the relevant types of waste according to the test criteria, with the exception of radiological researches performed for all types of waste. Then, on the basis of the data obtained, the technical specifications (TS) are drawn up, which contain a conclusion on the compliance of secondary raw materials with the requirements of the existing GOST, as well as the information on the planned use as secondary raw materials.

To ensure that the product generated is no longer classified as waste and received the status of secondary raw materials, the nature resource user must send the following package of documents to Rospotrebnadzor (Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing) and Rosprirodnadzor (Federal Nature Management Supervision Service):

- technical specifications (TS);
- expert report of the Sanitary and Epidemiological Center of Rospotrebnadzor on the certification of raw materials as products; and expert report on the results of laboratory research.

Based on a positive conclusion of Rospotrebnadzor and Rosprirodnadzor, a certificate indicating that secondary raw materials comply with all legislative

[213] 184-FZ On Technical Regulation
[214] 52-FZ On Sanitary and Epidemiologic Well-Being of the Population

requirements for safety and quality, is issued. TS are attached to the draft Waste Generation Standards and Waste Disposal Limits (WGSWDL). When establishing waste disposal limits, the volumes of waste planned for converting to secondary raw materials are not taken into account. Also, the payment for negative impact on the environment is absent.

4.1.2. Waste classification

According to the Federal Law On Production and Consumption Waste, waste is divided into the following hazard classes[215]:

Table 15. Waste classification by hazard classes

Class of hazard	Examples
Hazard class I – extremely hazardous waste	Compounds of lead tetraethide, polychlorinated biphenyls, arsenic salt waste in solid form, asbestos waste.
Hazard class II – highly hazardous waste	Residues of petroleum product refining, lead salt waste and copper chloride in solid form, spent battery alkalies.
Hazard class III – moderately hazardous waste	Slime from cleaning pipelines and tanks from oil, diesel fuel with consumer properties lost, sand contaminated with oils or gasoline (pollutant content is 15% or more).
Hazard class IV – low hazardous waste	Construction waste, concrete dust, waste tires, bitumen and asphalt waste in solid form, etc.
Hazard class V – virtually non-hazardous waste	Wood and straw ash, cement waste in lump form, scrap and steel iron, waste polyethylene in solid form.

Requirements for determining the class of hazard are disclosed in the Order of the Ministry of Environment of Russia No. 536 dated December 04, 2014[216]. Thus, the criteria for assigning waste to the I-V classes of hazard according to the degree of negative impact on the environment are:

- degree of waste hazard for the environment;
- the multiplicity of aqueous extracting from the waste, in which there is no harmful impact on aquatic life.

To consolidate information on hazard of various waste, a Federal Classificatory Catalogue of Wastes (FCCW) was created[217]. FCCW is a list of all registered waste items to be used in the preparation of documentation for waste management.

[215] Federal Law dated June 24, 1998 No. 89-FZ On Production and Consumption Waste
[216] Order of the Ministry of Natural Resources and Environment of the Russian Federation dated December 04, 2014. No. 536

[217] Federal Classificatory Catalogue of Wastes

4.1.3. Waste management

Regulation of the generation and disposal of production and consumption waste is performed through the development and coordination of drafts Waste Generation Standards and Waste Disposal Limits (WGSWDL). Due to the lack of calculated technological indicators in the developed ITD BAT, the current practice of determining the WGSWDL will remain relevant in 2019 after the implementation of IEP and the Declarations on the negative impact.

Waste generation standard is the set volume of waste of a specific type generated during the production of a production unit. Waste generation standards are used to determine the amount of waste of specific types, taking into account the planned volume of production or provision of services. The proposed standards for generation of specific types of waste on average per year are indicated in tons per year.

Waste disposal limit is the maximum allowable amount of waste of a specific type allowed for disposal in a certain way for a specified period, on waste disposal facilities, taking into account the environmental situation in a given area.

Above-limit waste disposal volumes include the unusable waste generated above the waste limits set by the norms for consumption of raw materials and materials for production, the volume of generated substandard products not provided by technological regulations and standards, and the waste disposal volume with no permit issued in due order.

The waste generation standards and limits for their disposal are set in tons and calculated according to the Order of the Ministry of Natural Resources and Environment of the Russian Federation No. 349 'On Approval of Guidelines for Developing Draft Standards for Waste Generation and Limits on their Disposal'[218], using methods such as:

- the method of calculation for the material balance (using information on the amount of raw materials and other materials, the loss standards and the number of products);
- calculation method for specific industry standards for waste generation: industry directories and collections of indicators are used;
- calculation and analytical method: is selected in the presence of design and engineering documentation (process charts, recipes, regulations, engineering drawings);
- experimental method: the calculation of standards is performed on the basis of experimental measurements under production conditions, is used for technological processes that allow a certain range of changes in the raw

[218] Order of the Ministry of Natural Resources and Environment of the Russian Federation dated August 05, 2014. No. 349 'On Approval of Methodical Guidelines on the Development of Drafts Waste Generation Standards and Waste Disposal Limits'

material components. The method is used quite rarely, mainly in facilities that use new technologies which have no analogues;

- calculation method for actual waste generation (statistical method): is used to determine the standards for waste generation on the basis of statistical processing of information on waste management for the base (at least 3 years) period. Useful for calculating waste such as paper waste, packaging waste from raw materials and other waste, for which it is difficult to perform calculations using other methods.

Draft WGSWDL is not developed by enterprises that produce waste only in one case – if they are small and medium-sized businesses (SMEs).

4.1.3.1. Waste management and implementation of BAT

As part of IEP implementation on the basis of BAT in the field of waste management, the following documents are developed:

- ITD-17-2016 Disposal of Production and Consumer Waste
- ITD-9-2015 Thermal Treatment of Waste (Waste Incineration);
- ITD-15-2016 'Recycling and Deactivation of Waste (Except Thermal Treatment of Waste (Waste Incineration).'

These directories contain systematized data in the field of disposal, utilization, and deactivation of industrial and consumption waste, and are developed taking into account the techniques, equipment, resources available in the Russian Federation, as well as climatic, geomorphic, geological, economical, and social features.

The BAT use for the organization of waste management activities can be selected to receive government support in the form of benefits for:

- investment loan – compensation of interest rate on a loan against income tax;
- refusal to charge for negative impact after the BAT implementation – the use of a reduction factor equal to zero;
- accelerated depreciation of BAT equipment – the use of an additional factor "2" in the charging of depreciation considering the BAT equipment, in accordance with the approved list;
- adjustment of payments for negative impact – payments offset on account of investments up to 100%.

In addition, if an object of financial and economic activity has its own landfill, then, if such a landfill excludes a negative impact on the environment, the payment for disposal of production and consumption waste is not charged[219].

[219] RF Government Decree dated March 03, 2017 No. 255 On Calculation and Collection of Charges for Negative Impact on the Environment (as amended and supplemented)

4.1.3.2. Waste accumulation/storage

Waste accumulation generated as a result of financial and economic activity on the area of nature resource use is the waste storage for a period not exceeding eleven months, on a specially equipped sites. The payment for the negative impact on the environment in the event of accumulation is not charged[220].

Requirements for waste accumulation are described in SanPiN 2.1.7.1322-03 'Hygienic Requirements for the Disposal and Deactivation of Production and Consumption Waste[221].' Thus, for storing waste of hazard classes I-III, depending on their properties, it is necessary to use a closed or sealed container. Production and consumption waste of hazard classes IV and V can be disposed in an open container. Disposal in the open container of waste containing volatile harmful substances is not allowed. The temporary disposal of solid waste of classes IV and V, depending on its properties, is allowed without a container – in piles, in bulk, in the form of ridges, dumps, baled, rolls, briquettes, bundles, in piles and separately on pallets or pedestals.

4.1.3.3. Landfill activities management

Federal Law No. 89-FZ 'On Production and Consumption Waste' determines requirements for waste disposal facilities, waste disposal sites, their movement, waste management activities, waste disposal and deactivation[222]. Key requirements in the field of regulation of landfill activities:

- construction of waste disposal facilities is prohibited within the boundaries of populated areas, water protection areas, within the boundaries of mineral deposits in the event of a threat of mining;
- disposal of waste at facilities not listed in the state register of waste disposal facilities is strictly prohibited.

On the territory of waste disposal facilities and within their impact on the environment, the owners are obliged to monitor the environmental condition in the manner established by law.

Within the framework of the Order of the Ministry of Natural Resources of the Russian Federation No. 379 dated July 01, 2016, legal entities, individual entrepreneurs engaged in the collection, treatment, and disposal of waste of hazard classes I-IV are not entitled to perform activities without a license[223]. Licensing of activities in the field of waste management is performed by the Federal Nature

[220] Federal Law dated June 24, 1998 No. 89-FZ On Production and Consumption Waste
[221] SanPiN 2.1.7.1322
[222] Federal Law dated June 24, 1998 No. 89-FZ On Production and Consumption Waste
[223] Order of the Ministry of Natural Resources of the Russian Federation dated July 01, 2016 No. 379

Management Supervision Service. No license is required for the accumulation of waste of I-IV classes and management of waste of class V of hazard.

Waste management facilities must meet the following licensing requirements:

- the availability of premises, specially equipped facilities for waste disposal, signs on vehicles for waste disposal;
- availability of certificates in management of waste of classes I-IV, confirming professional training in this industry;
- production control of compliance with the waste management procedures set;
- sanitary-epidemiological conclusion certificates (issued by Rospotrebnadzor, Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing) on compliance with the rules of facilities and property that the licensee intends to use for activities related to waste;
- availability of waste certificates;
- State environmental seal of approval on the design documentation of the above facilities.

In addition to the licensing of waste management activities for SMW landfills, there is a set of rules, which describes the basic provisions of the design, operation and recultivation, which are mandatory[224]. Thus, it is determined where the landfill location is forbidden (recreational, sanitary zones, etc.), which properties are mandatory for the site on which the landfill is planned to be located (soil characteristics, groundwater features, compliance with the Sanitary-Epidemiological Conclusion Certificate, etc.), as well as rules of land use and recultivation.

4.1.3.4. FEC waste management

All materials generated as a result of economic or other activities that are not primary products, are classified as waste, regardless of their source of generation and possible future use. Regulation of the generation and disposal of waste of the fuel and energy complex (FEC) in the environment is performed according to the same rules as for any other types of waste, by developing a draft WGSWDL, then approving it and obtaining a permit from regulatory authorities. However, it should be noted that the legislation has controversial interpretation for some FEC wastes. Thus, the overburden grounds – unpolluted rocks of natural origin, extracted during rock formation, are waste on the one side (Law No. 89-FZ and FCCW), but in the meantime, Article 18 of the law No. 89-FZ indicates that when calculating the waste disposal limits, the overburden grounds used for the recultivation of mining works, are not included.

[224] Code of Rules SP 320.1325800.2017 'Landfills for Solid Municipal Waste Design, Operation and Recultivation' (approved by Order of the Ministry of Construction Industry, Housing and Utilities Sector of the Russian Federation dated November 17, 2017 No. 1555/pr)

Regarding the abandoned waste, in accordance with Article 226 of the Civil Code of the Russian Federation, the rules are set that regulate the appropriation of abandoned movable things, including various types of waste abandoned on the land plot, in relation to which the owner of the land plot has the right to perform activities considering their appropriation[225,226]. Non-compliance with these requirements is subject to administrative liability of the land plot owner. After the waste is turned into property, it becomes subject to the legislation of the Russian Federation in the field of waste management.

The Federal Law On Subsoil does not provide the term “technogenic deposits”[227], which makes it difficult to perform regulation on mining and smelting production waste. However, the concept of technogenic formation can be found in the regional laws of some subjects of the Russian Federation (Rostov Oblast, Tatarstan), in which the technogenic formation is determined as the accumulation of mineral substances on the surface or in mining works, generated as a result of their separation from the rock mass and storage in the form of the waste of mining, concentrating, metallurgical, and other productions, suitable in quantity and quality for industrial use[228].

The technogenic mineral and raw material potential remains practically unfulfilled by the industry due to the necessity to determine the rules for the use and treatment of waste, and the need for capital intensive modernization of the mining industry, including the reconstruction and construction of production plants implementing modern and advanced technologies for the technogenic raw material development. Currently, within the framework of updating the Subsoil Law, the Ministry of Natural Resources and Environment of the Russian Federation is taking steps to determine the legal status of technogenic deposits. The waste of primary processing of mineral raw materials is assumed to belong to the state fund of mineral resources. Approved amendments to the Law 'On Production and Consumption Waste' include removing the technogenic formation from the waste list and classifying it to a special category.

4.1.4. Waste accounting and registration

According to the Article 19 of the Law No. 89-FZ On Production and Consumption,individual entrepreneurs and legal entities, that perform activities in the field of waste management, are obliged to keep records of generated, recovered, deactivated, transferred to other persons or received from other persons, as well as disposed waste, in the prescribed manner. The accounting procedure[229] applicable to

[225] Civil Code of the Russian Federation (Part One)
[226] Land Code of the Russian Federation dated October 25, 2001
[227] equivalent to technogenic formation
[228] Subsoil Law of the Republic of Tatarstan
[229] Federal Law dated June 24, 1998 No. 89-FZ On Production and Consumption Waste

waste management is set by the federal executive authorities in the field of waste management in accordance with their competence. The procedure for statistical accounting in the field of waste management is determined by the federal executive authority performing the functions of forming official statistical information on social, economic, demographic, environmental and other public processes in Russia.

Based on the waste composition data, and on the assessment of the degree of its negative impact on the environment, a certificate of hazard classes I-IV is drawn up – a document certifying that the waste belongs to the waste of the corresponding type and hazard class, and containing information on its composition.

The procedure for waste certification is determined by RF Government Decree dated August 16, 2013, No. 712 'On the Procedure of Certifying the Wastes of I-IV Class of Hazard'.[230] The following should be indicated in the waste certificate:

- the waste name;
- its state of aggregation;
- class of hazard;
- technological process as a result of which it was generated;
- information on the legal entity that requests a certificate.

Certification requirements do not apply to the following types of waste:

- radioactive waste;
- biological waste;
- hospital waste;
- waste with ozone depleters (unless such substances are part of products that have lost their consumer properties).

The certificate as well as documents confirming the classification of the waste type to a particular class of hazard should be sent to the regional department of the Federal Nature Management Supervision Service. The document confirming an assignment of the waste type to a specific class of hazard is a copy of the letter of the territorial authority of Rosprirodnadzor (Federal Nature Management Supervision Service) regarding the compliance of this waste type with a similar type of waste included in the FCCW and its specific class of hazard[231]. The certificate has no expiration date, and introduction of amendments and supplements to it is prohibited without prior approval of the competent authority.

4.1.5. Extended responsibility principles

In accordance with Article 24 of the Law No. 89-FZ, producers and importers of goods are obliged to disposewaste from the use of produced goods in accordance

[230] RF Government Decree dated August 16, 2013 No. 712 'On the Procedure of Certifying the Wastes of I-IV Class of Hazard'
[231] Federal Classificatory Catalogue of Wastes

with the waste disposal standards, approved by the Government of the Russian Federation. Disposal standard is the amount of the released goods of a certain type, expressed as a percentage, subject to disposal, over the total number of goods released into circulation. Standards are established taking into account the economical and environmental conditions (safety for the environment and human health, technological disposal capabilities, etc.) In case of non-fulfillment of disposal standards for the category of goods, the producers and importers are obliged to pay an environmental payment.

In Russia, the officially extended producer liability does not apply to oil and gas companies (in accordance with the currently established list of goods, to which the requirements of Article 24 of the Law 89-FZ apply)[232].

4.1.6. Waste management system

From 2017 to 2019, in the subjects of the Russian Federation, a new waste management system is being implemented, based on the amendments to the current federal legislation on waste management (Federal Law No. 89 'On Production and Consumption Waste'). The main goal of implementation of the new system is to reduce the amount of burial of solid municipal waste.

The reform includes the following stages:

- preparation and coordination of territorial waste management models in each region of the country;
- the choice of regional operators (legal entity obliged to conclude an agreement on the provision of waste management services with the owner of SMW, generation and collection of which are located in the area of activity of the regional operator) who will be responsible for the entire waste management cycle;
- setting a uniform tariff for the waste management service in the region;
- creation of modern high-tech sets for waste disposal in the regions. Measures of the last stage will allow increasing the percentage of waste recycling and reducing the number of waste disposed.

It is also planned to implement a system for separate collection of solid municipal waste (SMW) in the constituent entities of the Russian Federation as well.

[232] RF Government Order dated December 28, 2017 No. 2971-r

4.2. European countries

4.2.1. General terminology[233]

A material is considered to be waste when the producer or holder discards it, intends to discard it, or is required to discard it. [234].

Waste management is collection, storage, shipment, recovery, and disposal of waste, including inspections of these processes.

Waste collection is any actions to collect waste, including sorting and temporary storage of waste before they are transferred for further waste treatment.

Temporary storage of waste is not part of the permit system, however, there are requirements for the type of waste that can be stored at the waste production sites, at the sites operated by the waste generator and at the sites where the waste is collected for further shipment[235].

Temporary storage at the place of production is a process of collecting and storing waste in the area of the waste generation facility. In this event, any types of waste can be stored for up to 12 months, provided that the waste generator ensures its safe storage[236].

Temporary storage of waste at a place controlled by the producer is the process of collecting and storing waste generated by enterprises in the course of activities outside their facilities (for example, waste generated by contracting organizations). In this case, any waste that does not contain asbestos, and which flash point is not lower than 21 °C can be stored. In addition, various types of waste should not be mixed, and their storage should not exceed 3 months.[237]

Temporary storage at the place where waste is collected for further transportation is the process of collecting, sorting and storing for further transfer of waste to processing plants. In this case, any waste that does not contain asbestos, and which flash point is not lower than 21 °C, and the volume of which does not exceed 30 cubic meters for electronic waste, 50 cubic meters of non-hazardous waste and 5 cubic meters of other types of waste, can be stored. Various types of waste should not be mixed, and their storage should not exceed 3 months.

[233] On the example of United Kingdom
[234] https://www.gov.uk/government/publications/legal-definition-of-waste-guidance/decide-if-a-material-is-waste-or-not
[235] Waste exemptions: storing waste
[236] Waste exemption: NWFD 2 temporary storage at the place of production
[237] Waste exemption: NWFD 3 temporary storage of waste at a place controlled by the producer

Waste treatment includes recovery and disposal actions.

> *Waste recovery* is any actions that result in the recycling of waste as a material or resource for performing of any activity; includes processes such as recycling and preparation for re-use.
>
> > *Recycling* is any actions with waste, as a result of which the waste is processed into products, materials and substances for further use; actions do not include processes for the preparation of waste for energy recovery.
> >
> > *Preparation for recycling* is testing, cleaning, and recovery of waste materials for their further preparation for recycling without the use of any mechanical and chemical treatment.

Waste disposal is any actions with waste that are not restoration activities. The most common examples could be disposal on landfills or waste burial[238].

The European legislation[239] provides for the practice of changing the classification of certain waste materials produced, whereby they lose their *end-of-waste* status and, accordingly, are not regulated by waste management legislation.[240] Article 6 of the Waste Management Directive determines requirements for events where waste subject to *recovery* processes is no longer classified as waste. These requirements include the following[241]:

- substances or materials may be used for specific purposes;
- there is a market demand for these substances or materials;
- these substances or materials comply with the technical requirements for use for certain purposes; they meet all legal requirements and quality standards;
- the use of substances or materials will not lead to a negative impact on the environment and human health.

If necessary, EU member states can set limit concentrations of pollutants in recycled waste as a criterion for confirming the "*waste*" status. EU countries can also set a list of wastes subject to the above requirements. The practice of terminating the "*waste*" status must at least be extended to such types of waste as paper, glass, metal, tires, and textile[242].

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[238] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

[239] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098

[240] https://www.gov.uk/guidance/turn-your-waste-into-a-new-non-waste-product-or-material#eu-reg

[241] http://ec.europa.eu/environment/waste/framework/end_of_waste.htm

[242] Turn your waste into a new non-waste product or material. Guidance

4.2.2. Waste classification

The waste classification in the EU is based on the European List of Waste – ELW and Annex 3 of Directive 2008/98/EC[243] (WFD). WFD Directive determines the concepts of hazardous and non-hazardous waste:

Hazardous waste is waste that has one or more hazardous properties. These properties are encoded and include the following[244]:

- HP1: *explosive*
- HP2: *oxidising*
- HP3: *flammable*
- HP4: *irritant – skin irritation and eye damage*
- HP5: *harmful*
- HP6: *toxic*
- HP7: *carcinogenic*
- HP8: *corrosive*
- HP9: *infectious*
- HP10: *toxic for reproduction*
- HP11: *mutagenic*
- HP12: *contributing to the release of an acute toxic gas*
- HP13: *sensitising*
- HP14: *ecotoxic*
- HP15: *waste capable of exhibiting a hazardous property listed above not directly displayed by the original waste; waste capable by any means after disposal of yielding another substance*

Non-hazardous waste is the remaining waste that is not hazardous.

ELW represents the coding of all types of waste, depending on the industry or specific industrial process, as well as the waste source. In total, the list includes 842 types of waste called "entries", among which 408 are classified as hazardous, and 434 are non-hazardous[245]. They are presented in view of industries (01-12; 17-20) or industrial processes (13-15):

01. waste from the extraction, physical or chemical processing of mineral resources;
02. waste generated in the agricultural, fishery, forest, and food industries;
03. waste from wood processing, furniture, paper production, etc.;
04. waste generated in the textile industry;
05. waste generated from the processing of oil, natural gas and pyrolytic coal treatment;
06. waste generated during inorganic chemical processes;

[243] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
[244] Directive 2008/98/EC
[245] Commission notice on technical guidance on the classification of waste (2018/C 124/01)

07. waste generated during organic chemical processes;
08. waste generated during the production of solvents, paints, adhesives, etc.;
09. photographic industry waste;
10. waste generated by heat treatment;
11. waste generated during the chemical processing and coating of metals and other materials;
12. waste generated during the mechanical or physical processing of metals and plastic;
13. oil and liquid fuel waste (except edible oils);
14. waste from organic solvents, coolers, etc.;
15. packing waste, absorbents, etc.;
16. other waste not listed;
17. waste generated during construction and demolition, including contaminated soil;
18. hospital waste;
19. waste generated in the process of waste management, wastewater treatment, and drinking water treatment;
20. household waste.

In addition to coding, the previously specified entries can also be divided into such types as "absolutely hazardous" (code – AH), "absolutely non- hazardous" (code – ANH) and "mirror" ones (codes – has MH (mirror hazardous) or MNH (mirror non-hazardous))[246]. Mirror waste consist of two or more *entries*, where one can be classified as hazardous and the other (s) as non-hazardous. The hazard (or safety) of this waste is determined based on the concentrations of hazardous substances or the degree of impact of hazardous properties on human health and the environment.

The coding should be used when issuing environmental permits, when transporting waste, or for keeping records of waste[247]. Subsequent waste management after its generation is also determined on the basis of coding. For instance, the conditions of storage, collection, and shipment will be determined depending on the industry or a specific process (code 01—20), on the source and on the *entry*[248].

To control the export and import of hazardous waste within EU countries and beyond their borders, in 2006, the legal requirements for the cross-border movement of waste were developed and implemented based on the provisions of the Basel Convention[249]. Waste is classified according to two indices[250]:

- green index – the waste list is taken from the OBSR decision, Annex 3;
- orange index – the waste list is taken from the OBSR decision, Annex 4;

[246] Commission notice on technical guidance on the classification of waste (2018/C 124/01)
[247] Waste Framework Directive
[248] Thus, the general code will consist of 6 figures: the first two to indicate the industry, the second two for the source, the third one is the entry code
[249] Waste shipments
[250] Regulation No. 1013/2006 on shipments of waste

4.2.3. Waste management

4.2.3.1. Waste management system

The waste management system is defined in Article 4 of the Waste Framework Directive as a *waste hierarchy*[251]. The main purpose of the hierarchy is the efficient resource use and prevention of waste generation. The hierarchy includes 5 components, where the first one is the most preferable:

- *prevention*;
- *preparing for re-use*;
- *recycling*, the purpose of which is to restore the source material for further use;
- *recovery* is any actions with waste, the purpose of which is the beneficial use by replacing primary materials that would otherwise be used as raw materials; examples are provided in Annex 2 of the Waste Framework Directive;
- *disposal* is any actions with waste that are not restoration activities. The most common examples could be disposal on landfills or waste burial[252].

Prevention means the initial use of the minimum amount of materials in the production and product development, the implementation of economical or other activities. The principle of prevention also includes minimizing the use of materials containing hazardous substances. The economic instruments promoting the efficient use of materials and recycling of waste may be implemented to meet the goals of prevention at the national level. Thus, EU member states must perform research on the use of new clean materials and the implementation of techniques.

Recovery actions[253] are already considered undesirable, since, when sending waste to incineration for energy purposes, the economy in general loses useful materials[254]. However, if the waste for any technical or economic reasons could not be recycled or reused, the waste generator must take measures to use his waste for energy purposes and prevent its disposal on the landfill. In this case, the requirement for recovery actions is the sorting and separate collection of waste with distinctive properties.

Waste disposal is the latest component of the hierarchy. Waste can be disposed on landfills, injected into the formation, flared, etc.[255], if this is the safest way of disposal for the environment and human health.[256]

The principle of waste management hierarchy must be used throughout the EU. Member states must develop national waste management plans and waste prevention programs, which should reflect target parameters on waste reduction, economical

[251] Waste Framework Directive
[252] Directive 2008/98/EC
[253] Examples are provided in Annex 2 of the WFD Directive.
[254] which were previously extracted, produced, processed, packed, shipped, etc.
[255] Examples of waste disposal processes are provided in Annex 1 of the WFD
[256] Kreislaufwirtschaftsgesetz – KrWG

mechanisms to address waste management problems, and public and business awareness programs.

When performing activities, operators must ensure that the waste generation is minimized. When issuing environmental permits, competent authorities must also ensure that operators of economical or other activities have taken all measures to prevent, recycle, or restore materials and waste. For instance, in the UK, if the competent authority has grounds for believing that the measures proposed by the operator are not sufficiently effective, and the scheduled volume of waste generation[257] can be reduced, they have the right to propose alternative measures to prevent waste generation, or reject the application for environmental permit. At the same time, the competent authorities must follow the general principles of the EU EP, according to which the decisions on the implementation of any measures should be based on sustainable development, technical feasibility, economic feasibility, environmental protection, and people's health.

4.2.3.2. Waste management and implementation of BAT

Activity related to the waste generation and handling is subject to a comprehensive permit within the framework of Directive 2010/75/EC on industrial emissions. According to Clause 5 of Annex 1, the following activities are subject to the requirements of Directive 2010/75/EC:

- (5.1) disposal or recovery of hazardous waste that exceeds 10 tons per day, by:
  - biological treatment;
  - physical-and-chemical trearment;
  - processing of inorganic materials, with the exception of metals;
  - recovery of materials used for *pollution abatement*, etc.
- (5.2) disposal or recovery of waste by incineration:
  - more than 3 tons / hour of non-hazardous waste;
  - more than 10 tons / day of hazardous waste;
- (5.3a) disposal of non-hazardous waste that exceeds 50 tons per day, by:
  - biological treatment;
  - physical-and-chemical trearment;
  - pre-treatment for incineration;
  - grinding metal waste, etc.;
- (5.3b) recovery or a combination of recovery and disposal of non-hazardous waste that exceeds 75 tons per day, by:
  - biological treatment;
  - pre-treatment to waste incineration, etc.;
- (5.4) waste disposal on landfills that daily arrange more than 10 tons of waste, or with total capacity over 25,000 tons[258];

[257] of regulated waste
[258] except landfills for storage and disposal of inert waste

- (5.5) temporary storage of hazardous waste not regulated by the item above, for the purpose of further disposal or recovery, the volume of which exceeds 50 tons[259];
- (5.6) underground storage of hazardous waste, the volume of which exceeds 50 tons.

To ensure efficient and safe waste management, the BREF on [260]*Waste Management* has been developed, the requirements of which apply to the above activities regulated by the Industrial Emissions Directive: 5.1, 5.3, 5.5. This directory does not apply to the regulation of waste disposal on landfills, in particular, waste disposal by placing on underground landfills or long-term storage (more than 1 year before disposal or more than 3 years before recovery). This activity is governed by the Landfill Directive 1999/31/EC, described below.

BAT described in the BREF waste management directory are divided into two categories: general BAT and specific to a particular waste disposal or recovery process. General BAT include such practices as the implementation of environmental management systems, the development and implementation of the waste receiving / transfer systems, inventory and tracking of waste shipment, waste storage requirements, determining the location of waste storage, reducing emissions into the environment, performing emission monitoring, reducing physical impacts, energy efficiency, etc.[261] Specific practices for a particular process for the waste disposal or recovery include the use of certain materials and the implementation of technological processes when performing mechanical, biological, and other types of waste treatment or recycling. This directory also determines pollutant emission and discharge limits for each technique used for waste disposal or recovery.

When issuing a permit, the competent authority will evaluate the proposed measures to reduce waste generation, and the allowable waste generation standards will be the minimum available waste volumes provided by the BAT implementation.

The process of issuing environmental permits in the absence of BAT directories for an activity performed, can be considered using the example of the United Kingdom, where the best practices of waste disposal are determined based on the results of a risk assessment. In accordance with the *Guidance "Select a waste recovery or disposal method for your environmental permit"*, the waste generators must conduct a comparative analysis of several waste management scenarios and determine the impact scores of a particular method to obtain an environmental permit.[262][263] At the same time, the waste generator must take all measures within the principles of the waste management system (waste hierarchy) and make sure that the measures proposed are the most preferable.

The risk assessment consists of 4 stages:

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[259] except waste storage at the production facility prior to its collection for further shipment.
[260] Commission Implementing Decision (EU) 2018/1147
[261] please refer to Conclusions to the BREF Directory for review of all types of BAT
[262] Select a waste recovery or disposal method for your environmental permit
[263] bespoke permit

- determination of waste disposal methods;
- development of at least 3 scenarios – combinations of waste disposal methods for each type of waste generated as a result of economic or other activities;
- a comparative analysis of various scenarios;
- selection of the scenario planned to be implemented when obtaining environmental permits.

In the risk assessment report, the waste generator must provide the following information for each selected scenario:

1. ***Classification of the waste generated: hazardous and non-hazardous waste.***

2. ***The hazard level of the waste is as follows:***
   - hazardous waste – 10 points;
   - permanent hazardous waste – 8 points;
   - biodegradable non-hazardous waste – 4 points;
   - other non-hazardous waste – 2 points;
   - inert waste – 1 point.

3. ***Disposal or recovery method for each type of waste.***

   The waste generator must take an assessment of all possible waste management methods for use. When considering certain disposal methods, the waste generator must provide the competent authority with a justification on the reason why certain methods were / weren't considered. Where the method implementation is impossible due to the reasons of cost efficiency, the waste generator must provide an economic assessment of the method implementation (the cost of disposal of a ton of waste).

4. ***R and D points[264] and the corresponding environmental impact points of each waste disposal method[265].***

   Each waste disposal or recovery method presented in the Waste Management Directive has its own impact score. With that, the highest score is assigned to the method with the highest level of negative impact:

   - wood, metal, glass, or plastic recycling – 3 points;
   - chemical recovery – 4 points;
   - use of waste as fuel – 6 points;
   - waste incineration for power generation – 10 points;
   - biological or physical-and-chemical impact – 12 points;
   - waste incineration – 20 points;
   - disposal on landfills – 30 points, etc.

[264] Codes presented in the WFD Directive
[265] Waste disposal methods presented in WFD Annexes 1 and 2

5. ***The planned volume of waste generation per year in the event of each method of waste disposal implementation.***

As a result of the risk assessment performed, the waste generator must calculate the total exposure score for each scenario, using the following formula:

$$sum(IS \times HR \times WG), where$$

$$IS - (impact\ score),$$

$$HR - (hazard\ rating)$$

$$WG - (waste\ generation)$$

$$sum\ of\ all\ scores$$

The competent authority will issue a permit to use the scenario with the lowest environmental impact score.

4.2.3.3. Landfill management

According to the principles of the EU waste management system, the waste can be sent to landfills only if that is impossible or economically unreasonable to re-use, recycle, recover it, or if the waste disposal on the landfill is the safest method of disposal. Currently, at the European level, there is no BREF directory for landfills. However, the general requirements of the Industrial Emissions Directive must be observed during the landfill operation. To regulate the waste disposal on the landfill, as well as to regulate the landfills themselves, the Landfill Directive 1999/31/EC was developed at the EU level, the goal of which is to determine the operational and technical requirements for the landfill organization and waste disposal on them to prevent pollution of water bodies, soil, air, and other natural components.

The landfills are facilities for open or closed (underground) waste disposal, including private facilities organized by waste generators themselves and other facilities organized for temporary waste storage. Facilities waste is temporarily discharged to, before being shipped for recovery, recycling, or elimination; facilities waste for recovery or recycling is disposed at, up to 3 years; facilities for storage of waste less than 1 year for the following elimination are not considered landfills[266].

Landfills are divided into three types[267]:

- landfills for storage and disposal of hazardous waste.
- landfills for storage and disposal of non-hazardous waste.
- landfills for storage and disposal of inert waste.

Waste must be placed strictly on landfills of the corresponding classification. Moreover, before disposal on landfills, all waste, except inert ones, must be pre-treated. At the same time, it is prohibited to dispose of liquid, explosive, flammable,

[266] Regulation of these facilities can be determined by the EU countries themselves
[267] classification may differ

oxidizable waste, medical or veterinary waste which may be infectious; disposal of tires and other wastes that are not included in Annex 2 of the Landfill Directive.

The landfill directive does not regulate the following disposal of unpolluted soil or non-hazardous inert waste, which was formed as a result of geological exploration, mining, processing and storage of mineral resources, as well as waste generated during coal mining.

In addition to the above requirements, European legislation defines strict requirements for the location of landfills, the introduction of technologies and other practices to protect soil, water and prevent leakage of fluids into soil, and to prevent such negative physical impacts as noise, dust and odors[268]. Additional requirements for landfill operators may also be implemented at country levels. In Germany, for example, availability of specially trained operational personnel is mandatory[269].

Landfill operators are subject to regulation and must obtain permits for operation of landfills. To obtain the permit, operators must provide the following documents to the authorized body[270]:

- information about the legal entity, a complete description of the object;
- a complete description of waste and the planned volume of waste disposal at the landfill;
- information on the maximum amount that the landfill can accept;
- action plan to prevent environmental pollution;
- plan for operation, monitoring and control of the site;
- plan for completing the landfill operation and measures for subsequent monitoring;
- information on the financial capabilities of the operator to meet the requirements for the landfill operation;
- if necessary, the results of the EIA.

An issued permit should include the following information:

- landfill type;
- the list of waste that will be disposed of at the landfill, as well as the permitted disposal volumes;
- requirements for landfill operation, as well as monitoring and control procedures;
- requirements for providing the authorized body with at least annual reports on the types and volumes of disposed waste, as well as the results of the monitoring program.

It is important to note that the Landfill Directive does not regulate the mechanisms for regulating the generation or disposal of waste. The requirements of the European

[268] Please refer to Annex 1 Landfill Directives
[269] Verordnung über Deponien und Langzeitlager
[270] The information provided is the minimum of requirements for operators when submitting a questionnaire for obtaining the permit. EU countries may lay down additional requirements

waste management system described above ensure minimum waste disposal at landfills. Waste treatment before disposal, implementation of BAT for waste management, separation of landfills by type, as well as strict technical requirements for the installation and operation of landfills and subsequent control and monitoring are implemented in order to minimize the negative impact of activities on the environment and human health.

Waste generation and disposal mechanisms, however, can be implemented at the national level through the development of *waste acceptance criteria*, the general requirements for which are defined for all EU countries in Regulation 2003/33 / EC[271].

4.2.3.4. Extractive waste management

Directive 2006/21/EC[272] has been implemented to control extractive waste at the EU level. The main objective of this Directive is to establish the requirements for reducing environmental risks in the production, transportation, processing, stockpiling and disposal of extractive waste. This goal should be achieved through the development of a waste management plan, which includes:

- the use of certain methods of mineral resources mining and processing, ensuring the minimization of waste generation;
- the possibility of extractive waste underground burial in the formed geological voids;
- the possibility of using minimal amounts of hazardous substances in the processing of mineral resources;
- plan for recycling or recovery of extractive waste;
- plan for prevention of environmental components contamination;
- plan for monitoring and controlling the compliance with legislative requirements;
- plan to prevent pollution of water resources in accordance with the requirements of the EU Water Directive. For this purpose, the operators must develop the following documentation:
    - assessment of the planned *leachate* formation volumes at the mining waste disposal facility;
    - measures to prevent the formation of leachate;
    - measures to collect leachate and polluted water;
    - measures to clean leachate and polluted water for further discharge.

As with other types of waste, restriction of extractive waste volume generation is not the main mechanism of waste regulation. However, hierarchy principles are also applicable to extractive waste. So, to obtain the environmental permit, the industry needs to prove that all necessary measures to reduce waste generation at production facilities will be implemented.

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[271] 2003/33/EC: Council Decision of 19 December 2002
[272] Directive 2006/21/EC

Extractive waste includes waste generated from the exploration, mining, processing[273] and storage of mineral resources. The requirements of the Directive do not extend to waste generated at offshore oil and gas facilities and to the process of pumping water into subterranean formations. According to Art. 2 p. 4, the requirements of the Directive on landfills also do not apply to extractive waste. Technical and administrative requirements for the management of extractive waste including the requirements [274]for waste disposal at specialized sites (*mining waste facility*) and obtaining environmental permits, are presented in the relevant Directive and the EU Commission Regulation of April 20, 2009[275].

According to the EU waste list[276], tailings and bottom ash of FEC (Fuel and Energy Complex) are classified as hazardous and non-hazardous waste, respectively. FEC tailings control at the European level is based on the BREF [277] '*Management of Tailings and Waste-Rock in Mining Activates'*. The management of FEC tailings is not regulated within the framework of integrated environmental permits and requires obtaining a permit under the Mining Waste Directive.

The above BREF establishes the following technical, environmental and management requirements to control of FEC waste:

- General requirements: developing a management system, risk assessment strategies and procedures for efficient and safe waste management;
- engineering requirements: the use of the best available techniques during the design, operation and closure of facilities for the accumulation and disposal of FEC waste presented in the directory;
- environmental requirements: introduction of measures to prevent air, soil and water pollution; Examples include the use of dust suppression techniques by irrigating the surfaces of tailings storage areas, the reuse of industrial water, as well as groundwater conditions monitoring, and emergency response plans development;
- environmental footprint reduction requirements: determining the ways of FEC waste beneficial usage to reduce the volume of their disposal.

4.2.4. Waste accounting and registration

The Waste Management Directive [278]defines separate requirements for registration and accounting of waste management to authorized bodies and waste owners. The authorized body must maintain the registration of all persons collecting and

[273] mechanical, physical, biological, heat, and chemical treatment
[274] industrial safety requirements
[275] Commission Decision of 20 April 2009
[276] Commission Decision of 3 May 2000
[277] Reference Document on Best Available Techniques for Management of Tailings and Waste-Rock in Mining Activities
[278] Directive 2008/98/EC

transporting waste, account of waste brokers and dealers, as well as the registration of all persons who are not subjects to obtain environmental permits.

Waste owners should keep records of the following information:

- the volume of production, hand over, transportation, and sale of waste;
- type and source of waste;
- in the case of waste transfer to other entities, the owners of the waste must keep records of where and to whom the waste was transferred; and what treatment (disposal or recovery) methods will be applied to the waste;
- waste transporting persons should keep records of the frequency of waste collection from the production site, as well as the type of transport used.

The above information should be kept for three years for all persons, with the exception of waste transporters, who must keep their records for 12 months. All information can be accessed for inspection by an authorized body or previous owner of the waste.

In the UK, when handing over hazardous waste, a *consignment note* [279]must be kept which must be completed by the manufacturer/owner, transporter and recipient of the waste[280]. The waste producer/owner provides the following information:

- contact information of legal entities disposing and receiving waste;
- complete waste information, namely:
    - waste code according to the European classification ELW;
    - sources of hazardous waste;
    - chemical and biological composition of waste, concentration of hazardous substances;
    - information on the waste aggregate state;
    - waste hazard code.

The waste transporter re-checks the completed information and fills in his contact details, as well as provides the information on the forms of waste transport. With incorrectly filled information, the final recipient of waste has the right not to accept waste at its facility[281].

When handing over non-hazardous waste the producer/owner and the waste recipient should fill in another form of the *waste transfer note*, which can be completed online or in hard copy form. The note should contain the following information[282]:

[279]An example of the invoice form can be found at the link.
[280] Hazardous waste: consignment note guidance
[281] Hazardous waste: consignment note guidance
[282]An example of the invoice form can be found at the link.

- information about legal entities;
- the types and amounts of waste disposed, as well as any additional information that is necessary for the safe transportation, storage and disposal of waste;
- with an environmental permit, the number of this document; information on the authorized body that issued the permit.

It is important to note that regulated facilities can keep records of data according to their invoice forms, provided that these forms contain similar information.

4.2.5. Extended responsibility principles

According to Article 15 of the[283] *Waste Framework Directive (WFD)* 2008/98 / EC, member states should take all necessary measures to implement waste management requirements for waste producers or owners[284] at the national level. Paragraph 1 of Article 15 of the Directive establishes a mandatory requirement for producers and owners of waste on the implementation of measures for waste management in the territory of facilities or for handing them over to other entities. As a rule, when handing over waste to third parties for *preliminary treatment*, the producer or owner of the waste is responsible for the implementation of the *recovery* or *disposal*.

EU countries can define liability conditions for producers and owners of waste during the entire waste management cycle, from production and storage to recovery or disposal[285]. For example, a participating country can assign full responsibility to the producer or owner of the waste, or establish the requirement that the responsibility for waste management can be divided among all participants of the process (producers, dealers, brokers, carriers, landfill operators or treatment facilities and others). Art. 8 of the Directive also defines the principles of *extended producer responsibility*, according to which producers of products and materials, after using which waste is generated, can also be subjected to responsibility for arranging waste management.

An example of the introduction of responsibility in terms of waste management can be the British rule of practice on *Duty of Care*, which is legally enshrined in the *Environmental Protection Act*[286]. According to Art. 34 of this Act, Duty of Care applies to any entity[287] that imports, produces, moves, stores, treats or disposes the "controlled"[288] waste. Examples of such entities include[289]:

- waste producers are any natural and legal entities, as a result of whose activities controlled waste is generated; may include industrial, commercial

[283] Directive 2008/98/EC
[284] waste owner is the waste producer or the natural or legal entity owning the waste
[285] If this does not contradict the requirements of the EU legislation on the transboundary shipment of waste
[286] Environmental Protection Act 1990
[287] Including dealers and brokers
[288] industrial and commercial waste; household waste. Does not include radioactive waste, wastewater and other types of waste presented in Art. 2 WFD.
[289] Waste Duty of Care Code of Practice

and government facilities. It is important to note that waste producers are even those natural and legal entities whose activities are not regulated by environmental permits (*exempt facilities*);

- waste transporting entities are any entities who *collect*, *carry* or *transport* waste as part of their activities or for the purpose of gaining income, including those who produce and transport their waste themselves;
- dealers are those that buy waste for the purpose of resale; responsibility may be extended even in cases when the waste is physically located on the territory of another entity;
- brokers are those that organize the transportation and management of waste on behalf of another organization or government body;
- waste managers are any entities involved in the process of collecting, transporting, recovering or disposing the controlled wastes, including supervisors of specified operations, waste disposal facilities, etc.

The above-mentioned entities should apply all necessary measures to prevent violations of the requirements of the Waste Management Act[290], such as unauthorized waste dumping or disposal; violation of the conditions of permits, as well as the avoidance of waste *escape* from an organized facility for storage, dumping or disposal. One of the key principles of Duty of Care is liability when handing over waste to other entities. So, when handing over the controlled wastes, the waste producer or owner must ensure that[291]:

- a license or an environmental permit to carry out the activity ia available with the receiving party or the entity transporting the waste;
- the receiving party has all the necessary information on the composition, volume, and type of waste for the implementation of safe and effective waste management.

The entity handing over its waste must also ensure that the waste has been disposed or recovered according to the requirements of Duty of Care. For example, the waste producer can request any documentation proving that the waste was actually delivered and registered at the controled facility. The receiving party must also ensure that the waste producer or owner fulfills the requirements of Duty of Care. Documentation collected, namely copies of environmental permits, business licenses, notification of waste hand over, inspection reports that the waste was transferred and delivered without violation of legal requirements, can serve as proof that a party has fulfilled its obligations in respect of Duty of Care[292].

Similar principles[293] are applied to the producers of waste in mining sector (*extractive waste*)[294], with the exception of liability in transferring waste to third parties.

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[290] Environmental Protection Act 1990, art. 33
[291] Environmental Protection Act 1990
[292] Waste Duty of Care Code of Practice
[293] Paragraph 1A, Article 34 of the EPA
[294] Wastes resulting from exploration, mining, processing and storage of mineral resources; generated in coal mines

Failure to comply with the principles of exclusive responsibility may lead to criminal liability in the form of an unlimited fine for legal entities and imprisonment for individuals.

In Norway, the Environmental Protection Agency uses the "levere med befriende virkning" principle according to which entities that form hazardous waste are relieved from the liability upon handing over their waste to a registered landfill operator or a processing facility operator[295]. The waste producer must also complete a mandatory waste declaration containing information on the composition, characteristics and source of the waste. The waste declaration and documentation confirming the the waste hand over must be available for inspecting by an authorized body.

4.3. Brazil

4.3.1. General terminology

In accordance with the Federal Law of Brazil 12.305, *"waste"* is defined as solid waste materials, which, after various processing and recovery processes, have no other purpose than environmentally acceptable disposal[296]. The legislation also defines the term "*industrial waste"*, which includes all waste generated as a result of industrial activity in solid, semi-solid, gaseous state, prohibited for discharge into public sewer systems or water bodies, and those that require treatment and recovery[297].

Solid Waste Management: package of measures directly or indirectly carried out at the stages of collection, transportation, hand over, processing and environmentally acceptable end use and environmentally acceptable waste disposal in accordance with the Solid Waste Management Plans required in accordance with Federal Law 12.305.

The terms "*by-product*" and "*secondary raw materials*" are not defined in the legislation governing waste management.

4.3.2. Waste classification

Waste classification in Brazil is based on the degree of the waste hazard and includes four classes[298]:

Class I - *hazardous waste:* waste with the following properties:

- flammable;

[295] Waste recycling and treatment regulations (Waste Regulations)
[296] FZ 12.305
[297] CONAMA Resolution 313/2002, p 683
[298] CONAMA Resolution 23/1996, p 626

- prone to accidental fire;
- oxidizable;
- containing organic peroxides;
- poisonous;
- infecting;
- corrosive;
- contributing to the release of toxic gases;
- toxic;
- ecotoxic.

Class II - *non-inert waste:* those that are not classified as hazardous waste, inert waste or other waste;

Class III - *inert waste:* waste that, upon contact with distilled or deionized water at room temperature, does not change the water quality;

Other waste: household waste or incineration of household waste.

In Brazil, import of class I waste is prohibited; for class II waste, import is possible only for reuse and recycling purposes after issuing a permit by the Brazilian Institute of Environment and Renewable Natural Resources (*IBAMA*). For class III waste there are no restrictions other than transportation, while for *other waste* import is also prohibited.

4.3.3. Waste management

4.3.3.1. Waste management system

Waste management is governed by Federal Law 12.305 (*The Brazilian Solid Waste Management Policy*)[299], which establishes requirements for efficient waste management through the implementation of the principles of an environmentally acceptable end-use of waste.

The environmentally acceptable end-use of waste includes *non-generation* production, *reduction of waste generation*, *reuse*, *recycling*, *waste-to-energy* recovery and environmentally acceptable waste *refuse*. The law also determines the *order of priority* in the waste management system:

1. waste-free (non-generation) production.
2. waste reduction, according to which enterprises should apply all possible measures to minimize waste production as a result of their activities.
3. reuse is the process of using waste without a biological, physical, or physical and chemical transformation.

[299] Federal Law 12.305

4. recycling is a process of waste transformation, which includes changing the physical, physical and chemical, or biological properties in order to convert waste into secondary raw material.
5. recovery for energy production is possible proving technical feasibility and environmental friendliness.
6. Environmentally acceptable disposal, which includes the disposal of waste in landfills and underground disposal of waste, is possible on condition of compliance with specific operational standards in order to avoid harm to health and safety of the population, as well as adverse environmental impacts.

Wastes that are legally regulated include:

- household waste;
- waste of commercial enterprises and service providers;
- waste of public sanitation services;
- industrial waste;
- medical waste;
- construction waste;
- agricultural waste;
- resources industry waste.

According to the waste management system in Brazil, if the waste can be used for further processing, it is mandatory to use it. However, one method of waste disposal or another, or a measure to reduce waste generation should be applied taking into account the technological and economic feasibility of the operator's activities, which result in waste generation.

Law 12.305[300] establishes provisions for the development of the *National Solid Waste Plan*, the State Waste Management Plan, the Municipal Waste Management Plan and the Inter-Municipal Plan, which have been in force for 20 years and are updated every 4 years to take into account the following provisions:

- diagnosis of the current situation, taking into account the assessment of the socio-economic and environmental impacts of the waste management system;
- waste reduction and reuse goals;
- targets for the energy use of gases generated in solid waste disposal installations;
- landfill and dumps arrangement measures;
- mechanisms to encourage and promote regional solid waste management programs;
- operational procedures and minimum technical requirements to be adopted in public municipal and solid waste collection services, including environmentally acceptable waste disposal;

[300] FZ 12.305

- transportation rules and other stages of solid waste management;
- environmental education programs and activities that contribute to the reduction, reuse and recovery of solid waste.

4.3.3.2. Waste accumulation/storage

Temporary storage of waste means waste accumulation for the purpose of further processing, recovery, treatment or disposal. According to the laws of São Paulo state, depending on the nature of the environmental risk, the period of waste temporary storage cannot exceed: 150 days for class I waste and 180 days for class II waste[301]. The exact periods of temporary storage, as well as the periods of temporary storage for other classes of waste are regulated by the authorized body issuing environmental permits. Operational requirements for the temporary storage of hazardous waste are defined in NBR[302] 12.235 and NBR 11.174 national standards. The standards provide for monitoring the impact of waste accumulation and disposal, determine the criteria for the location of landfills, taking into account zoning of the territory, the availability of road infrastructure for transporting waste, taking into account potential hazards under certain environmental conditions (high rainfall, winds, landslides, erosion)[303], etc.

Standards for storing inert and non-inert waste contain technical provisions for controlling air pollution, soil and water, including consideration of minimizing the effects of winds, if necessary, possible closure of the surface of storage facilities, providing waterproofing and dust suppression systems[304].

4.3.3.3. Landfill management and waste disposal regulation

The key mechanisms for regulating the activities of landfills and waste disposal are regulation of emissions generated during the operation of landfills, as well as monitoring the impact of the activity on the environmental components. Herewith standards (limits) for waste disposal are not established. However, to obtain an environmental permit, activity operators must provide information on the planned waste disposal volumes.

The activities of landfills provides for analysis of waste, monitoring of soil and groundwater, including the determination of controlled pollutants concentrations contained in waste[305] [306].

The main legislative acts establish technical requirements for the organization and operation of landfills in order to prevent pollution of the environment and minimize negative impacts on public health. For example, the National Technical Standards Association (*ANBT*) establishes NBR 10.157 and NBR 13.896 Standards, which

[301] Minas Gerais State Law
[302] NBR - Norma Brasileira Regulamentadora
[303] NBR 12.235
[304] NBR 11.174
[305] NBR 10.157
[306] NBR 13.896

define the criteria for the construction and operation of landfills for hazardous and non-hazardous waste, respectively. So, waste of different classes should be dumped at appropriate landfills. Landfills should be located at least 500 m from settlements, at a minimum distance of 200 m from water bodies, the location of landfills should also take into account the slope of the terrain. The term of use should not exceed 10 years.

4.3.3.4. Waste accounting and registration

Resolution CONAMA No.313[307] establishes provisions for the accounting of solid industrial waste (*National Inventory of Solid Industrial Waste*). The categories of activities defined by the Resolution should provide the information on the production, properties, storage, transportation and disposal of waste, updated every 24 months or less: [308]

- preparation of leather and manufacture of leather goods;
- coke production, refining, nuclear fuel preparation and ethanol production;
- chemical production;
- metallurgy;
- manufacture of metal products;
- manufacture of machinery and equipment;
- production of office and computer equipment;
- production and assembly of cars, trailers and car bodies;
- production of other transport equipment.

However, government agencies may include other types of regulated activities, depending on the state, when obtaining a permission from IBAMA.

To account for waste, operators must develop a solid waste management plan. The management plan contains the following information: [309]

- description of the enterprise or activity;
- waste identification, classification, quantification and form of sorting;
- packaging, collection, transportation, storage and pre-processing;
- if necessary, transportation procedures;
- reuse and recycling procedures;
- location and removal procedures;
- emergency response program;
- identification of persons responsible for each stage of solid waste management.

There is also a form MTR[310] (Waste Transportation Manifesto), completed to comply with the national policy on solid waste. The MTR contains a description of

[307] CONAMA Resolution 313/2002, p 675
[308] The term is determined by the authorized body.
[309] Sao Paulo state decree 54.645
[310] MTR - Waste Transport Manifesto

the waste to be transported (type of waste and quantity), as well as the information about the entity responsible for its production, the carrier responsible for its transportation, and the entity responsible for handling and disposal. MTR is mandatory for hazardous waste.

In the state of São Paulo, waste management operators must also request a CADRI (*Industrial Waste Treatment Approval Certificate*) from a state authorized body. CADRI is a tool that allows the shipment of waste for recycling, storage, treatment or disposal. This permission is used to confirm proper waste management, information on which is reflected in the Solid Waste Management Plan. This certification is mandatory for hazardous and non-inert classes of waste.[311]

4.3.4. Extended responsibility principles

Brazilian solid waste legislation[312] considers extended producer responsibility. There is overall responsibility for the product entire life cycle, including the responsibility of producers, importers, distributors and traders, owners of solid waste.

Overall responsibility for the product life cycle is aimed at:

- facilitating the reuse of solid waste in the production chain or for other economic purposes;
- reducing the production of solid waste;
- encouraging the use of less hazardous resources and materials that have a negative impact on the environment;
- stimulating the development of the market, production and consumption of products derived from recycled and recyclable materials;
- promoting best practices in social and environmental responsibility.

4.4. Canada

4.4.1. General terminology

According to the Alberta Provincial Legislation (*Activities Design Regulation 2003*), waste refers to any liquid or solid materials or products intended for treatment or disposal, with the exception of *recyclables*[313].

Waste disposal[314] is a type of waste disposal where waste is dumped on or under the ground and this placement is the final method of waste management[315].

[311] Sao Paulo state decree 54.645
[312] FZ 12.305
[313] Alberta Regulation 276/2003
[314] Definitions of other terms are not provided in Canadian law.
[315] Alberta Regulation 276/2003

The processes and types of disposal of waste generated in the oil and gas industry include the following[316]:

- waste treatment before their final disposal (*waste processing*);
- injection into wells for waste disposal (*disposal wells*);
- disposal on organized *landfills*;
- *biodegradation*;
- waste incineration (*thermal treatment*);
- waste treatment (*recycling*);
- burial at the production site, etc.

Storage of materials and waste includes the accumulation of waste until subsequent transport, treatment or disposal.

4.4.2. Waste classification

The Law on Environmental Protection approves the regulation on waste management, which regulates transportation, accounting, and an authorization system for the storage, processing and disposal of hazardous waste[317]. In accordance with this Rule, in Canada, waste is categorized by its physical, chemical, and toxicological properties and is classified by the class of hazard:

Hazardous waste has the following properties:

- ignition temperature of at least 60,5ºC;
- flammable;
- toxic;
- pH value less than 2.0 or more than 12.5;
- contain polychlorinated biphenyls in a concentration equal to or greater than 50 mg/kg;
- presents toxic leaching agents in dispersible form and contain any of the following substances: hexachlorobibenzo-p-dioxins, pentachlor-dibenzo-p-dioxins, tetrachloro-dibenzo-p-dioxins, hexachlorocyclopentadiene, dibenzofurans, pentachloride-dibenzofurans, tetrachloro-dibenzofurans at concentrations higher than 0.001 mg/l.

Non-hazardous waste is all waste that does not have the characteristics of hazardous waste. *Non-hazardous waste* includes:

- household or municipal waste;
- agricultural waste;
- domestic wastewater;
- waste resulting from accidental spills;
- biomedical waste;

[316] Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry
[317] Waste control regulation, Environmental protection and enhancement Act

- the waste described in Annex 1, with the exception of the listed substances in Part B of the "Guidelines for Waste Managers"[318], in quantities of less than 5 kg per month in solid form or 5 liters per month in liquid form, etc.

Non-hazardous waste types are listed in Section 1A of the "Guidelines for Waste Managers". It should be noted that *ash and slag tailings from the coal industry* are non-hazardous waste in accordance with Section 1A-22 of this Guide[319] and can be used as secondary raw materials as building materials or for other purposes.

Directive 058 on waste management in the oil sector of Alberta Province (*Oilfield Waste Management*)[320] also establishes requirements for the classification of waste generated by the activities of oil production facilities. So, waste can be classified as *dangerous and non-dangerous oilfield waste*. The classification is based on physical, chemical and toxicological properties of the waste, which are also closely related to the hazard classification of substances presented in Annex 3 of Directive 058.

Oil hazardous waste is classified as dangerous if it has the following properties: flammable, non-absorbent, oxidizing, toxic, corrosive, containing polychlorinated biphenyl and releasing toxic filtrate. It is important to note that hazardous waste generated on one production facility in quantities less than 5 kg or in volumes of less than 5 liters per month is not classified as dangerous oilfield waste.

4.4.3. Waste management

4.4.3.1. Waste management system

The waste management system in Canada is similar to the European "waste hierarchy"[321] system. In contrast to the European hierarchy, measures to prevent waste generation, reuse or recycle are encouraged by the authorized body, but are not mandatory for execution[322], unless the waste is dumped into the sea.

The widespread application of the principles of waste management systems is noted at the municipal level in relation to manufacturers of packaging materials, paper, plastic, electronic equipment, tires, etc[323]. Directive 058 also defines the requirements to Oilfield Waste Management System, according to which subsoil users are encouraged to apply the principles of "4Rs" (*reduce, reuse, recycle, recover*)[324]:

- minimization of waste generation (*reduce*), which may include measures to prevent oil leaks and spills, respectively, and the formation of contaminated

[318] Alberta User Guide for Waste Managers
[319] Alberta User Guide for Waste Managers
[320] Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry
[321] State of Waste Management in Canada
[322] According to Directive 058, one of the obligations of subsoil users is to minimize waste generation, only if it is possible.
[323] State of Waste Management in Canada
[324] Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry

land; the use of less hazardous substances in production to reduce the generation of hazardous waste; improvement of technological processes;
- *reuse* of lubricants; use reusable filters;
- *recycle* includes measures to process lubricants, antifreeze, solvents and other chemicals; paper, plastic and glass;
- *recovery* measures may include the recovery of nutrients from sludge or industrial water.

The application of measures in accordance with the principles of "*4Rs*" should be based on the results of the analysis of economic benefits, technological feasibility of implementation and environmental safety. Annex 7 of Directive 058 provides the available and acceptable forms of oilfield waste handling and disposal developed based on the practices used in the Canadian oil and gas industry.

Section 3 of the Canadian Environmental Protection Act establishes the requirements for the protection of the marine environment from pollution and negative human-induced impact[325]. According to paragraph 5 of Annex 6 of the Act for obtaining a permit to discharge waste into the sea, the owner of the waste must prove that all possible measures for applying the waste management hierarchy were considered:

- reuse;
- off-site treatment
- deactivation or destruction of hazardous constituents;
- hazardous waste treatment to reduce or remove the hazardous constituents;
- waste disposal on land, into the air and in water.

An application for a permit to waste dumping at sea may be rejected if the authorized body considers that the implementation of measures for the reuse, recycling and disposal of hazardous waste is economically feasible and technically possible[326].

4.4.3.2. Waste management and implementation of BAT

Mandatory implementation BAT practices for waste generation and disposal control are not applicable in Canada.

4.4.3.3. Waste accumulation and storage management[327]

The accumulation and temporary storage of oilfield waste at production facilities is governed by the requirements of Directive 055 (*Storage requirements for the upstream petroleum industry*). Temporary storage means storage of materials produced, formed or used for three months. According to paragraph 3.3, temporary restrictions on the storage of oilfield waste are set for a period not exceeding one

[325] Canadian Environmental Protection Act, 1999
[326] Canadian Environmental Protection Act, 1999
[327] The information in this section is presented on the example of legislative practice in Alberta province

year. Within one year, the waste must be handed over for treatment, processing or disposal.

Temporary storage of oilfield waste is not subject to environmental permits[328][329]. However, the Directive establishes strict requirements in the field of organizing the facilities for waste accumulation and storage, as well as in terms of monitoring the environmental impact. Thus, the requirements of the Directive cover the following aspects:

- *primary containment devices & secondary containment systems*: location and forms of waste storage; materials used to organize storage facilities; size and volume of storage facilities, etc .;
- *leak detection* systems;
- *weather protection* systems;
- *production inspection programs & record retention requirements*.

4.4.3.4. Landfill activities management[330]

Landfills means facilities of waste disposal by surface or underground dumping[331]. Facilities organized for the temporary storage of non-hazardous waste, its sorting, crushing and processing before transporting it to a *waste management facility* do not refer to landfills.

Landfills are divided into three types[332]:

- landfills for hazardous waste (*Class I Landfills*);
- landfills for non-hazardous waste (*Class II Landfills*);
- landfills for inert waste (*Class III Landfills*);

Waste after treatment processes should be disposed on landfills of the appropriate classification. Herewith, strict requirements are defined for hazardous waste disposal at class 1 landfills[333]:

- solid waste should not contain halogenated organic compounds in concentrations exceeding 1000 mg/kg, and polychlorinated befinyls in concentrations exceeding 50 mg/kg;
- solid hazardous waste containing one or more of the following compounds with a total concentration not exceeding 1000 mg/kg: acetone; benzene; n-butyl alcohol; carbon disulfide; cresol and cresic acid; cyclohexanone; ethyl acetate; ethylbenzene; ethyl ether; isobutanol; methanol; methyl ethyl ketone; nitrobenzene; 2-nitropropane; pyridine; toluene; xylene.
- The pH of solid waste should exceed 12.5;

[328] if the storage period exceeds one year, the nature user must apply for an environmental permit
[329] Directive 055: Storage Requirements for the Upstream Petroleum Industry
[330] The information in this section is presented on the example of legislative practice in Alberta province
[331] Waste control regulation
[332] Waste control regulation
[333] Waste control regulation

- Concentrations of substances in the formed filtrate should not exceed the following values:
    - 500 mg/l for arsenic, chromium, lead, nickel
    - 200 mg/l for selenium and thallium
    - 100 mg/l for beryllium, cadmium and silver
    - 20 mg/l for mercury.

Directive 058[334] specifies oil and gas sector-specific requirements for waste disposal at landfills[335], namely technological requirements to organization and operation of landfills, location requirements in relation to surface and groundwater, settlements, roads, industrial safety requirements, etc. Landfills for *oilfield waste* disposal are divided into 4 classes (1a, 1b, 2 and 3):

- landfill class 1a and 1b—for solid hazardous and non-hazardous oilfield waste;
- class 2 landfill—for non-hazardous solid waste;
- class 3 landfill—for non-hazardous, inert and filtrate-proof waste.

Disposal of liquid petroleum waste at landfills is prohibited. It is worth noting that the Directive does not regulate the methods of calculating limits for waste generation and disposal. The main mechanism of environmental regulation during waste disposal at landfills is to prevent pollution of the environment components and the occurrence of risks to the health of the population and workers at production facilities. Thus, waste placed on landfills of classes 1a, 1b and 2 should be covered with a layer of soil (at least 15 cm) to prevent the occurrence of fires and suppress odors and dust. Herewith, soil should be distributed over the surface of the landfills with the following frequency:

- 48 hours after the last distribution of soil at a landfill accepting from 5,000 to 10,000 tons of waste per year;
- 7 days after the last distribution of soil at a landfill accepting from 3,000 to 5,000 tons of waste per year;
- 15 hours after the last distribution of soil at a landfill accepting from 1,000 to 3,000 tons of waste per year;
- 30 days after the last distribution of soil at a landfill accepting less than 1,000 tons of waste per year.

To prevent contamination of soil, groundwater and surface water, landfill operators should not allow the permeation of leachate formed at landfills into the soil and monitor the state of groundwater quality in accordance with the established requirements for exposure monitoring, as reflected in paragraph 15.6 of the Directive. Landfill operators also should not allow *fugitive emissions* of pollutants, which will exceed the standards for air quality.

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[334] Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry

[335] According to Directive 058, a landfill is an organized facility for the disposal of waste generated during oilfield activities.

It is important to note that the handling of oilfield wastes formed directly at the operated facility and located at its own landfill is not an activity regulated by the environmental permit[336]. Waste producers should on the annual basis provide the information on the volumes and characteristics of the waste, transfer information to other entities and on the forms of treatment/disposal to the authorized body. The transportation of hazardous waste and hazardous recyclable materials throughout Canada, however, is subject to authorization under Section 8 of the Environmental Protection Act[337].

Thus, environmental regulation in the field of waste management is not focused on setting the standards for waste generation and disposal. Mechanisms for encouraging a reduction in waste disposal are associated with the strict technical and operational requirements for landfills, requirements for processing and disposing of waste, monitoring the impact the on environmental components, as well as high pricing in the market for the provision of services for waste transportation, processing, treatment and disposal.

4.4.4. Waste accounting

Directive 058 defines the requirements for record keeping and reporting of oilfield waste management within the framework of the *waste tracking*[338] system. Waste producers should keep records of wastes and completed annual report forms with the information on the actual volumes of hazardous and non-hazardous wastes generated, detailed information on the composition of the waste, the types of treatment that were applied to the waste prior to final disposal, and the waste disposal types and location. In this case, the tracking form as it is can be developed at the discretion of the waste producer. The data in the tracking system should be stored for two years and be available for inspection by the authorized body.

One of the forms of reporting tracking system is an electronic report on the disposal of oilfield waste (*Oildfield Waste Disposition Report*). This report should contain the following information:

- types and volumes of generated waste;
- types and volumes of disposed wastes;
- source of waste;
- the place of collection or accumulation of waste before its final disposal;
- the used method of processing and disposal.

Information on waste generated as a result of the activities of contracting organizations should be included in the report.

The frequency of reporting is regulated by the authorized body. Waste producers/owners provide reports on oilfield wastes dumping/disposal only if they

[336] However, it is subject to obtaining an operating license for performing the activity
[337] Canadian Environmental Protection Act, 1999
[338] Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry

were included in the annual list of operators for whom reporting for the previous reporting year is obligatory. This list is developed by the authorized body each year before January 15. Producers of waste within 43 days (before February 28) must submit a report to the authorized body.

According to p. 1, p. 9.2 of Directive 058, the authorized body has the right to request the report or its part from any regulated waste producer/owner at any time after February 28.

When transporting and handing over waste to other entities, the Declaration of Oilfield Waste must be filled in to control the proper handling of hazardous waste. This declaration is structured in such a way that each participant involved in the waste management process fills in a specific section (for producers, for transporters, for operators of waste treatment and disposal plants) and forwards it to the next participant in the process and to the waste producer. As a result, the authorized body should receive a completed Declaration from the waste producer within 60 days from the date of the waste hand over to third parties. It is not required to fill the Declaration in the following cases:

- the volume of hazardous waste transported does not exceed 5 kg or 5 l;
- transported waste is non-hazardous;
- waste is treated and disposed of in the same area in which it was generated, etc.

Additional requirements for record keeping and reporting for the operators of storage facilities are defined in Directives 055[339] and 058. These operators must tag and log waste accumulations on a monthly basis and keep inventory reports for two years from the time they are compiled. Reports must be available for sending at any time upon request of the authorized body. Monthly reports should contain the following information:

- balance of waste accumulation/storage at the beginning of each reporting month;
- volumes of waste received, information on the types and forms of waste, the date of waste receipt;
- the balance of accumulation/storage of waste at the end of the reporting month, the volume of waste sent for treatment or disposal, information about the facility for waste treatment or disposal.

According to paragraph 15.10 of Directive 058, other additional requirements for the provision of annual reports are defined for landfill operators. The reports should contain the following information:

- type, form and volume of waste disposed at landfills;
- groundwater monitoring results;
- current landfill operation plans;
- internal inspection reports;

[339] Directive 055: Storage Requirements for the Upstream Petroleum Industry

- training reports for responsible persons;
- the volume of the formed filtrate and methods for its subsequent treatment;
- copies of any documentation sent to the authorized body during the reporting period;
- monitoring of gas emissions, etc[340].

[340] Reporting forms are also defined for operators engaged in other forms of treatment, dumping/disposal of waste. See sections 15-17 of Directive 058

5. ENVIRONMENTAL PERMITS

In OECD countries studied, integrated environmental permits act as the main tool of the integrated system for the prevention and control of environmental pollution.

A distinctive feature of IEP is an integrated approach to assessing the impact of a production facility on various environmental components (air, water, soil) at all stages of its life cycle (from design to decommissioning). In addition to regulating emission standards, IEP sets requirements for organising an effective waste management system, improving energy efficiency, conducting emission monitoring and reporting, as well as ensuring industrial safety. In Russia, the EU and Canada, the obligation to use BAT is a mandatory requirement for IEP. In the countries studied, the public plays an important role in the procedure for reviewing and approving the applications for IEP. Comments and suggestions from the public representatives are taken into account when deciding on the issuance of IEP. However, in some countries, for example, the United Kingdom and Canada, public participation is limited to stakeholders "directly exposed" to negative impacts.

5.1. Russia

5.1.1. Environmental permits issuing system, types of permits

Currently, the following types of environmental permits for emissions into the environment are provided in the Russian Federation[341]:

- permit for pollutant emissions into the ambient air;
- permit for pollutants discharge into water bodies;
- waste generation permit and disposal limit.

Within the framework of the current course on environmental legislation reform, the Integrated *Environmental Permit (IEP)* is introduced (for facilities of category I) and the *Declaration on environmental impact* (for facilities of category II). In addition, legal entities and individual entrepreneurs engaged in business and (or) other activities at facilities of category II, if they have relevant industry information and technical reference books on BAT, are entitled to receive IEP. Objects assigned to category III (with the exception of objects with emissions of radioactive, highly toxic substances and substances with carcinogenic, mutagenic properties (substances of hazard class I, II) and category IV will receive only permission to generate waste and a limit for waste disposal. IEP is a document issued by an authorized federal

[341] Federal Law dated January 10, 2002 N 7-FZ

executive body to a legal entity or an individual entrepreneur performing economic and (or) other activities at a facility that has a negative impact on the environment, and contains mandatory environmental protection requirements.

The *Declaration on Environmental Impact* is a new kind of environmental reporting that comes into effect on January 1, 2019. It will be submitted instead of calculating the fee for negative environmental impact (NEI). This calculation is currently required to be done every quarter, and the declaration will be formalized once in 7 years.

IEPs are issued by the federal level control authorities, the rest of the permits are issued by the regional level control bodies.

5.1.2. List of documents required to obtain an environmental permit

To obtain a IEP, the following documentation must be provided[342]:

- the name, legal form of organization and address (location) of the legal entity or the last name, first name, patronymic (if any), place of residence of the individual entrepreneur;
- code of the facility, having a negative impact on the environment (NEI);
- type of main activity, types and volume of products (goods);
- information on the use of raw materials, water, electrical and thermal energy;
- information about accidents and incidents that entailed NEI and occurred over the previous 7 years;
- information on the implementation of the environmental efficiency improvement program, which is developed by enterprises of category I facilities in case it is impossible to comply with the standards for permissible emissions/discharges, technological standards for the period of gradual attainment of standards. The program of improving environmental efficiency includes a list of measures for the reconstruction, technical re-equipment of objects that have a negative impact on the environment, the time-frame for their implementation, the amount and sources of funding, a list of officials responsible for their implementation.
- calculations of technological standards;
- calculations of emission limit values (ELV), discharge limits (DL) of radioactive, highly toxic substances, substances with carcinogenic, mutagenic properties (substances of I, II hazard class), if such substances are present in emissions, discharges of pollutants;
- justification of waste generation norms and waste disposal limits;
- draft program of industrial environmental control (IEC);

[342] Federal Law dated July 21, 2014 N 219-FZ

- information on the presence of a positive conclusion of the State Environmental Expert Review (SEER) in case such expertise is needed in accordance with the legislation on environmental impact assessment;
- other information that the applicant considers necessary to submit.

The application is filed no later than 2 months prior to the commissioning of the NEI facility, or 4 months before the expiration of the IEP validity term. The IEP validity period is 7 years (unless changes are made to the production processes).

5.1.3. List of issues regulated by environmental permit

Contents of IEP[343]:

- technical standards;
- DL and ELV of highly toxic substances, substances with carcinogenic, mutagenic properties (substances of I, II hazard class), if there are such substances in emissions and discharges of pollutants;
- norms of acceptable physical impacts;
- waste generation norms and waste disposal limits;
- requirements to production waste treatment and consumption;
- agreed IEM program;
- validity period of IEP.

If it is impossible to comply with the standards for permissible emissions/discharges and technological standards with the current stationary source and (or) a set of stationary sources located at the facility that has a negative impact on the environment, temporarily allowed emissions/discharges are established[344]:

temporarily allowed emissions (interim emissions) means the volume or mass of chemicals or a mixture of chemicals, microorganisms, other substances allowed for release into the air and established for existing stationary sources in order to achieve the standards for permissible emissions for the period of the environmental protection plan implementation or to achieve technological standards for the period of implementating the environmental efficiency improvement program.

temporarily allowed discharges (interim discharges) means the volume or mass of chemicals or a mixture of chemicals, microorganisms, other substances in wastewater that is allowed to be discharged into water bodies for the period of the environmental protection plan implementation or to achieve technological standards for the period of implementating the environmental efficiency improvement program.

[343] Federal Law dated July 21, 2014 N 219-FZ
[344] Federal Law dated January 10, 2002 N 7-FZ

The establishment of temporarily allowed emissions/discharges is allowed only if there is an environmental protection plan or an environmental efficiency improvement program. Temporarily permitted emissions/discharges are established for the period of environmental protection plan or environmental efficiency improvement program implementation in accordance with the schedule for achieving the established standards for permissible emissions and discharges, as well as technical standards.

Temporarily permitted emissions/discharges are established on the basis of actual indicators of the volume or mass of pollutant emissions and discharges. During the period of implementing the measures to reduce emissions/discharges of pollutants, the level is set in accordance with the planned indicators for reducing the volume or mass of the relevant emissions/discharges of pollutants, provided for in the plan of measures for environmental protection or the program for environmental efficiency improvement[345].

5.1.4. BAT Incentive Mechanisms

According to paragraph 3 of Article 17 of the Federal Law No. 7-FL, state support for the implementation of BAT can be achieved through:[346]

- granting tax incentives in accordance with the legislation on taxes and fees;
- the provision of exemptions in relation to fees for NEI in accordance with environmental legislation;

the allocation of funds from the federal budget and the budgets of subjects of the Russian Federation in accordance with budget legislation. In this regard, paragraph 5 of Part 1 of Article 259.3 of the Tax Code of the Russian Federation (as amended up to 01.01.2019; hereinafter the Tax Code of the Russian Federation) it was found that for fixed assets related to the main process equipment used with application of BAT, accelerated depreciation can be applied with a special step-up factor.[347] Tax benefits include the possibility of providing an investment tax credit when introducing BAT. In addition, according to Article 16.3 of the Federal Law No. 7-FL from 01/01/2020 with emissions (discharges) of pollutants within the technical standards after the introduction of BAT, the NEI fee will actually be canceled.

The introduction of BAT, initially enshrined in environmental legislation, is considered as an important tool of industrial policy. According to Article 10 of the Federal Law of 31.12.2014 No. 488-FL “On the Industrial Policy in the Russian Federation” (hereinafter Federal Law No. 488-FL) it is possible to provide subsidies for financing the creation or modernization of industrial infrastructure, including application of BAT, and by virtue of Article 12 of the Federal Law No. 488-FL—

[345] Federal Law dated January 10, 2002 N 7-FZ
[346] Federal Law dated January 10, 2002 No. 7-FZ 'On Environmental Protection'
[347] Tax Code of the Russian Federation

provision of financial support to organizations engaged in innovative activities in the provision of engineering services, in the implementation of projects to improve the environmental safety of industrial plants, including through the use of BAT.[348]

The transition to BAT is closely related to Federal Law No. 261-FL dated November 23, 2009 "On Saving Energy and Increasing Energy Efficiency…" regulating relations in the efficient use of energy resources.[349] At the same time, tax exemptions are established for facilities and technologies with high energy efficiency, including an investment tax credit (Article 67 of the Tax Code of the Russian Federation) and the use of special step-up factors to the depreciation rate for the corresponding fixed assets (Article 259.3 of the Tax Code of the Russian Federation), similar to those established for the introduction of BAT.

5.1.5. Permit revocation

An integrated environmental permit may be revoked by a court decision, by a decision of the environmental monitoring body of Russia or its territorial body in the event of an applicant's violation for six or more months in a row mandatory requirements established by IEP, when performing activities at the facility without revising the IEP, and in the case of withdrawing the facility from state account, having negative impact on the environment.

Legal entities and individual entrepreneurs are obliged to fulfill the conditions stipulated by the integrated environmental permit, and are responsible for their non-compliance or the implementation of activities without an integrated environmental permit in accordance with the legislation of the Russian Federation.

5.1.6. Public participation in the environmental permitting procedure

To date, participation of the public in the procedure of issuing environmental permits is not regulated in Russian legislation.

5.2. European countries

The basic principles of the Industrial Emissions Directive to be taken into account in the process of issuing environmental permits are as follows:

- environmental protection should be considered comprehensively, and permits should regulate emissions, discharges, waste generation, physical impacts, use of raw materials, energy efficiency, industrial safety and recovery of environmental quality;
- when performing industrial activities, operators should apply BAT;

[348] Federal Law dated December 31, 2014 N 488-FZ "On Industrial Policy in the Russian Federation"
[349] Federal law dated November 23, 2009 N 261-FZ "On Energy Saving and Energy Efficiency Improvement and on Amendments to Certain Legislative Acts of the Russian Federation"

- permit conditions must be flexible;
- conditions of the permit should include the information about the conditions of state control.

The conditions of the permit should provide for the interests of the public through its involvement in decision-making.

5.2.1. Environmental permit issue system, types of permits

In Germany, the Emission Control Act establishes a comprehensive regime of obtaining permits for emissions into the environment. The *integrated environmental permit* has a so-called "cumulative" effect, i.e. it combines all the aspects necessary for the implementation of production activities that require coordination with government bodies. So, for the construction and operation of production facilities, implementation of emissions into the environment and provision of industrial safety only one permit needs to be obtained. The list of activities subjected to obtaining a IEP is approved by the 4th Rule to the Law on Emission Control[350].

However, there are a number of activities that are not covered by a complex permit and require a *separate permit*[351]:

- special water use and wastewater discharge in accordance with the Law on Water Resources;
- waste disposal at landfills, collection, transportation, sale of hazardous waste in accordance with the Law on the closed cycle;
- planning activities (as a rule, large infrastructure projects, such as the construction of power lines);
- activities related to the use of radioactive substances in accordance with the Atomic Energy Act;
- mining activities in accordance with the Law on Subsoil.

The subjects obtaining IEP are enterprises that carry out the following:

- construction and operation of new facilities, the activities of which may have a negative impact on the environment;
- making fundamental changes to the existing technological process (equipment modification, expansion of production, etc.), the environmental effect from the introduction of which is also subject to preliminary assessment.

In Germany, the system for issuing environmental permits is not centralized and the authority for issuing permits is distributed among various government agencies, depending on the type of activity of the enterprise and its location (affiliation to one or another federal state). As a rule, at the level of individual lands, for the issuance

[350] Verordnung über genehmigungsbedürftige Anlagen— 4. BImSchV
[351] Environmental Law in Germany, Clifford Chance

of environmental permits, middle level administrative bodies, called *Landratsamt* or *Regierungspräsidium*, are responsible.

Integrated environmental permits are usually indefinite, while certain types of permits (for example, permits for water use) have certain time limits established by legislation (in certain cases, permits may be issued for more than 30 years[352]).

The law on emission control provides for special cases of issuing permits—partial permits[353] and permits for early commencement of work[354].

Partial permit may be issued on the basis of the enterprise application for the construction and/or operation of an installation or its part in cases where:

- there is a legitimate interest in issuing a partial permit;
- the entity of obtaining a partial permit satisfies all permit requirements;
- preliminary assessment showed the absence of any fundamental and insurmountable obstacles to the construction and operation of the production facility, of which the object of receipt is a part.

If the application for obtaining a permit for the construction of an installation is in the process of approval, an enterprise may obtain a *permit for early commencement of work* before obtaining a basic permit if the following conditions are met:

- a positive conclusion of the state expertise in obtaining a permit is expected;
- earlier commencement of work is necessary in the interests of the public or the legal interests of the applicant;
- the applicant undertakes to repair any damage to the environment that may arise as a result of construction work before obtaining a basic permit and, if the permit is not received, recover the original state of the environment.

The competence of the authorized bodies in relation to the permit for early commencement of work includes both the right to impose additional requirements on applicants and the right to withdraw such a permit at any time at their discretion.

5.2.2. Environmental Permits and BAT

Environmental legislation in Germany in terms of emissions control through a permit system generally reflects a common approach for EU countries based on the mandatory requirement for the application of BAT. A synonym for BAT widely used in regulatory acts is "*Stand der Technik*" (*state of the art*), which means "the level of processes development, technologies or methods of industrial production based on the practical feasibility of the technology used to limit emissions to atmospheric air, water bodies and soil, which guarantees industrial safety and prevents or reduces any negative environmental impact, while ensuring the achievement of a high level

[352] Wasserhaushaltsgesetz, § 14
[353] Sec.8 Federal Emission Control Act
[354] Sec.8a Federal Emission Control Act

of environmental protection in general."[355] Before choosing a different technology, several BAT proposed for implementation as in practice of specific enterprises with similar production processes should be evaluated so as to compare them with regard to the effectiveness of emission reduction. The criteria for choosing BAT are defined in the Annex to the Law on the Control of Emissions and are generally identical to the criteria established by EU Directive 2010/75 / EU.

The Federal Government of Germany, in consultation with the Federal Council (*Bundesrat*), approves the Regulations to the Law on the Control of Emissions, which are analogous to the European BREF. The Regulations are developed for individual regulated industries and contain requirements for BAT usage and emission limit values. The emission limit values specified in the Regulations are set in permits as minimum emission standards expressed as concentrations of pollutants to be achieved at each emission (in mg/m^3) and discharge (in mg/l) source. For enterprises emissions volumes of which do not meet the requirements of quality targets, based on the information in the submitted application, which includes the results of dispersion calculations[356],the authorized body may establish more stringent environmental standards.

5.2.3. List of documents required to obtain an environmental permit

To obtain an environmental permit, an enterprise must submit an application to the state authorized body in written or electronic form.

Application for an environmental permit must include[357]:

- name, legal and business address of an applicant;
- type of permit obtained: permit (for a new plant or due to alterations implemented), partial permit or permit for early start of works;
- actual (or intended) plant location;
- description of utilized technological solutions and equipment;
- time for a planned start-up of a plant.

Type of permit obtaining procedure (standard or simplified) shall be specified in the application. List of companies obtaining permits under the simplified procedure is given in Annex 1[358] of the 4th Regulation to the Law on Emission Control.

The application must come with a package of documents confirming that the planned activity is in compliance with submitted permissive requirements; and shall include the following information[359]:

[355] Sec.3 subsec. (5a) Federal Emission Control Act
[356] Environmental Requirements for Industrial Permitting, OECD iLibrary
[357] Verordnung über das Genehmigungsverfahren - 9. BImSchV, § 3
[358] Verordnung über genehmigungsbedürftige Anlagen— 4. BImSchV, Anhang 1
[359] Verordnung über das Genehmigungsverfahren - 9. BImSchV, § 4

- detailed description of a process regulation (equipment operating mode, operating procedure of the process, type and amount of materials and raw materials being used, output products, and etc.);
- physical, chemical, toxicological, and etc. properties of substances used in the process;
- amount of consumed and generated power;
- emission of pollutants, which can occur in the result of the process failure;
- kinds and volumes of emissions, which will develop in the result of the production operations (for each of the equipment operating mode), characteristics of each source of emission (mass concentration and mass flow of PS in smoke fumes, level of a source, temperature of exhaust gases, and etc.), spatial and meteorological factors considered in calculations of pollutant dispersion;
- assessment of emissions according to the degree of their impact on human health and separate components of the environment (water bodies, soils, flora and fauna), their comparison with environmental quality indices - so called *immision values*;
- environmental action plan designed to protect the environment from adverse effects and their prevention, and to reduce emission volumes, in particular; action plan regarding occupational safety, action plan on emission monitoring;
- action plan to prevent production waste generation and treatment, including a description of treatment technologies and measures aimed at reduction/prevention of waste generation and implementation of their relevant and safe treatment, recovery, and disposal (both in normal operation and in process failures); and explanation, in case if it is impossible or inexpedient to further prevent/treat some wastes;
- action plan on energy efficiency, including measures aimed at more efficient energy utilization and reduction in energy losses.

Companies that are obliged to develop a project of environmental impact assessment (EIA) shall include in the package of documents EIA project report, which should be developed in accordance with the requirements in §4e and Annex of the 9th Regulation to the Law on Emission Control[360].

Companies, for which EIA procedure development is not required, shall submit to the body issuing permit a brief description of production and probable impact on the environment and residents living in the immediate proximity to the production site.

[360] Verordnung über das Genehmigungsverfahren - 9. BImSchV, Anlage (zu § 4e)

5.2.4. List of issues regulated by an environmental permit

To obtain an environmental permit, a company shall guarantee compliance with the emission/discharge limit values (specified in the Regulations and other regulatory documents), apply BAT and comply with energy efficiency requirements for production processes and emission monitoring.

According to assessment results of the documents submitted for review and considering opinions of all interested parties, an authorised body makes a decision on whether to approve or reject the application. Approval procedure takes 7 months (and 3 months for the simplified procedure) from the date of application receipt, and by the decision of an authorised body it can be prolonged for up to 3 months depending on the complexity of the process and volume of the documentation submitted[361].

In case of a positive decision on the application, an authorised body issues a notification about permit specifying the following information[362]:

- name, legal and business address of an applicant;
- type of permit obtained: permit (for a new plant or due to alterations implemented), partial permit or permit for early start of works;
- precise name of the facility for which permit is obtained, including its location;
- values of emission limits, including justification of less strict limits according to § 7 (1b) (1) (2), § 12 (1b), or § 48 (1b) (1) (2) of the Federal Law on Emission Control;
- legal justification of the decision made and confirmation that the permit issued is consistent with the requirements of other legislative acts;
- information about general public participating in the application procedure review;
- legal guarantees (the right of an applicant to protect its interests in the court, including to appeal the decision made).

Decision on permit issuance can contain additional information depending on a company category:

1. Companies with obligation to develop EIA:
    - description of required measures for production monitoring;
    - brief summary of EIA project;
    - validated assessment of the EIA project by an authorised body, including the results of public hearings on the project, and approval of other governmental agencies involved in the application review process (if such approval applied);

[361] Sec.10 subsec. (6a) Federal Emission Control Act
[362] Verordnung über das Genehmigungsverfahren - 9. BImSchV, § 21

2. Companies subject to EU Directive – Industrial Emissions Directive:
    - measures on soil and ground water protection and measures on the processing and treatment of wastes generated in the production process;
    - control measures on emission compliance with specified standards, for example, obligation to carry out emission monitoring (automated monitoring or individual measurements), including requirements to measurement methods, interval of measurements, emission monitoring procedure evaluation.
    - requirements for regular maintenance and repair of the equipment;
    - requirements to control measures directed to monitoring and prevention of soil and ground water contamination with hazardous substances, determination of monitoring intervals (at least once every 5 years for ground waters and every 10 years for soils, unless this monitoring is based on systematic risk assessment of pollution);
    - measures taken in case of other operations, such as start-up of equipment, process failures, temporary or full shutdown of the equipment, in order to prevent/reduce negative impact on the environment;
    - possible measures taken to minimize long-term or transfrontier pollution of the environment.

5.2.5. Permit revocation

- The authorised body on issuing permits can fully or partially revoke the permission in the following cases[363]: if the permit was issued for a limited period and with a provision of potential revocation according to paragraph 2 of Article 12 of the Law on Emission Control;
- if the conditions of permit issuing were violated or were not fulfilled within the specified time;
- due to discovered and previously unknown facts, that threaten the interests of the public;
- if legislative requirements have been altered, provided that the company has not started its activities as per the permission obtained;
- if it is a necessary measure to ensure public welfare.

An authorised body may revoke the permission in case if it has discovered facts contradicting conditions on permit issue, but only within 1 year from the date those facts have been established.

If revocation of permit occurred due to the reasons beyond control of an entity obtaining that permit, then the authorised body shall compensate for financial losses that interested parties may have suffered as a result of such a decision.

[363] Sec.21 Federal Emission Control Act

The revoked permit is considered invalid from the moment the decision to revoke comes into force, unless a later date has been determined by the authorized body. The conditions for granting compensation are established by the authorized body. Any disputes arising in connection with the payment of compensation shall be settled in court.

The Emission Control Law envisages cases when permit validity can be terminated[364]:

- if the construction and operation of a plant has not been started within the period established by the authorised body, and
- if the production activity for which a permit was obtained has not been carried out within three years.

In the case of the reconstruction of the facility, where the modification made will have a confirmed negative environmental impact, then the existing permit will be subject to review and update of the established environmental standards and requirements (including obligations conduct emission monitoring).

5.2.6. Public participation in environmental permitting procedure

The process of issuing environmental permits includes a procedure of public discussions. Public participation in the application review process for permit obtaining is provided for all companies excluding companies undergoing the simplified procedure for obtaining a permit.

From the date of the application receipt for approval, the authorised body shall publish a notification about technical design review in mass media or Internet resources. A notification is an official document informing the general public, that they can comment on the application, and it contains information on the date and place of public discussions. The application and enclosed package of documents (without confidential data) are available for the public expertise during 1 month from the date of publication of that notification. Any objections and comments on the application are accepted in written form within 2 weeks after the end of the public expertise.

The results of the public expertise and the comments provided are reviewed by the authorised body in the course of the state expertise and can influence the decision to issue an environmental permit.

Upon completion of the state expertise, the authorised body shall notify in written form the representatives of the general public, who took part in the review and discussion of the project documentation, about a decision made on the application. The notification process can be replaced with public announcement of notification. In this case, a copy of the official decision on the application and its grounding shall

[364] Sec.18 Federal Emission Control Act

be provided for general public review the next day after the notification has been published, and shall be available for the public expertise within 2 weeks. During this period of time, any representative of the general public, who provided comments in the expertise of the project documentation to obtain a permit, can request from an authorised body both copy and grounds for a decision made on the application.

5.3. Brazil

5.3.1. Environmental permits issuing system, types of permits

National environmental policy of Brazil[365] includes mandatory requirements to obtain environmental permits for regulated activities[366] involved in the exploitation of natural resources and environmental pollution.

The system of environmental licensing in Brazil includes two types of permits: *integrated* and *single* permits.

5.3.1.1. Integrated permits

An integrated permit is issued for a major activity of regulated production facilities[367].

Integrated permit obtaining process includes 3 stages:

1. *Preliminary licence* is provided at the preliminary stage when a company is planning its activities. At this stage, location of the plant and design philosophy are validated. Licence is issued after the impact of planned activities on the environmental conditions has been assessed. Moreover, the requirements mandatory for fulfillment at subsequent stages of project implementation are specified in the licence.
2. *Installation licence* authorises to use technology and equipment in accordance with specification introduced in the validated project documentation, where environmental control measures are considered as a crucial factor, when making a decision on licence issuing. When submitting an application, a package of documents shall include confirmation that all preliminary licence conditions have been fulfilled.
3. *Operation licence* authorises a company to operate a plant or activities in general, on condition that the requirements of preliminary licence and the licence for a plant have been observed.

[365] "National Environmental Policy" (1981)
[366] The list of regulated activities is given in the section 1.1.1
[367] CONAMA 237/1997 p. 775

5.3.1.2. Single permits

Single permits are issued in addition to integrated environmental permits to carry out activities chosen as secondary for a natural resources user. For example, for companies in oil and gas sector, such activities can include deforestation and transportation of industrial waste.

5.3.1.3. Permit validity

Resolution CONAMA 237/1997[368] defines the following validity period for environmental permits:

- *preliminary licence* is issued with regard to production plan of a company, but not more than for 5 years;
- *installation licence* is issued at least for the period validated in production plan and not more than for 6 years;
- *operation licence* is issued with account of environmental control plans for the period 4 to 10 years.

The validity period for preliminary licence and installation licence can be prolonged by agreement with the authorised body, subject to compliance with the established emission standards.

The authorised body can set certain validity periods for operation licence, if termination or modification of a plant is planned in the near future.

The legislation also stipulates the procedure on prolongation of current operating licence. When prolonging a licence the authorized body, based on the results of the assessment of the environmental characteristics of production for the previous period, may either reduce or increase the regulatory period of validity of thelicence. A request to prolong a licence can be submitted not later than 120 days before a current operation licence expire.

5.3.1.4. Bodies authorised to issue licences

- At the state level, the body authorised to issue environmental permits is IBAMA – Brazilian Institute of Environment and Renewable Natural Resources. IBAMA issues licences for the following activities: Commercial or other activities negatively impacting the environment on the intergovernmental and trans-border level, including trans-border waters and continental shelf zone, as well as on the territory of indigenous people and specially protected natural areas;
- Activities performed in the territory of two or more states of Brazil;
- Activities negatively impacting territories and population of several states of Brazil;
- Activities involving handling of radioactive substances and materials.

[368] CONAMA 237/1997 p. 775

IBAMA delegates environmental licencing functions to local Environmental Protection Agencies on the state level to regulate the following activities: [369]

- Activities performed in the territory of two or more municipalities;
- Activities negatively impacting territories and population of several municipalities;
- Activities performed in a forest zone.

5.3.2. List of documents required to obtain an environmental permit

The list of documents required to obtain an integrated environmental licence in Brazil is determined depending on a type of a plant operation. However, a procedure to obtain licences for different production activities can have its specific aspects and additional requirements. Thus, for integrated environmental licences for oil and gas companies, specificities of works on oil and gas exploration and production are considered in the process, and it includes such steps as:[370]

- Preliminary licence for drilling operations;
- Production licence for economic feasibility and environmental assessment of oil and gas deposit operation;
- Installation licence;
- Operation licence.

Structure and content of a package of documents to obtain environmental permit depends on the type of licence aspired and includes the following documents[371]:

- Preliminary licence for drilling operations*:*
    - an application to obtain a licence;
    - Environmental Control Report (*RCA*) with description of activities on drilling, hazard and environmental impact identification, action plan on mitigation of negative impact on the environment;
    - licence for deforestation, if applicable;
    - a copy of the application published in mass media.
- Production licence for economic feasibility and environmental assessment of oil and gas deposit operation:
    - an application to obtain a licence;
    - Environmental Feasibility Study (*EVA*) describing production plans, environmental assessment, and control measures;
    - licence for deforestation, if applicable;
    - a copy of the application published in mass media.
- Installation licence:

[369] CONAMA 237
[370] CONAMA 23\1994 p. 803
[371] CONAMA 23\1994 p. 803

- an application to obtain a licence;
- Environmental assessment report (*RRA*) describing environmental diagnostics of the region where activities are carried out, a description of new production development or expansion, environmental impact assessment, and planned measures on the mitigation of negative impact on the environment;
- other appropriate environmental studies, if any;
- licence for deforestation, if applicable;
- a copy of the application published in mass media.

- Operation licence:
  - an application to obtain a licence;
  - Environmental control project (*PCA*) including documents submitted in the previous steps in the process to obtain environmental licences;
  - a copy of the application published in mass media.

In case if an authorised body requests additional documents, information, or clarifications, natural resources users shall execute the request within 60 days from the date that notification has been received. [372]

In issuing environmental licences the requirements of BAT application are not established. BAT application serves as guidelines with the purpose to reduce emission volumes to the environment.

5.3.3. Permit revocation

The authorised body can alter conditions to issue a licence, as well as to suspend or revoke a licence in the following cases:[373]

- identification of violations or inconsistencies to the established legal norms;
- the absence or provision of knowingly false information, on the basis of which the environmental permit was issued;
- occurrence of serious risks related to the environment and public health.

5.3.4. Public participation in the environmental permitting procedure

Legislation of Brazil[374] establishes regulations for holding public hearings as part of the application approval process to obtain an environmental permit. The purpose of public hearings is to engage all concerned parties to study the project documentation of planned activities and to collect comments and critical remarks from public representatives.

[372] Minas Gerais Decreto 47137, de 24/01/2017
[373] CONAMA 237, p.777
[374] CONAMA 9\1987 p.774

Public hearings on one project can be held more than once due to the complicity of project documentation submitted for review.

An authorised body notifies the general public via mass media about the date when the public hearing period will start, which must continue at least 45 days. Upon the end of the period set, the authorised body must publish the results of public hearings in mass media. The opinion of the general public is taken into account by the authorised body, when making a decision about an environmental permit.

5.4. Canada

5.4.1. Environmental permit issue system, types of permits

The majority of environmental permits in Canada is issued at the level of provinces, and each of them establishes its own requirements to the process of environmental licencing. In some provinces *separate licences* for emission to the air, water, and soil are issued within the requirements of appropriate legislative standards, while in other provinces *integrated policy* on issuing environmental permits exists. Although, there is a principle of "one window" in provinces where separate licences for emissions are issued, which allows to submit an application to one competent body to obtain several environmental permits[375].

Environmental permits are issued by the authorised bodies on environmental protection of the provinces. However, in some provinces the authorities to issue environmental permits for particular activities are exercised by other competent governmental bodies. For instance, in Alberta province, environmental permits for oil and gas extraction operations are issued by the energy regulatory authority, *Alberta Energy Regulator*[376], and the activities in oil and gas processing are regulated by the authorised environmental protection regulatory body - *Alberta Environment and Parks*[377].

5.4.2. List of documents required to obtain an environmental permit[378]

An application for an environmental permit must include the following information[379]:

- name and address of an applicant;
- location, capacity and scale of production activities;
- characteristics of technological process, description of the modifications or expansions/reductions made in the production (if applicable);

[375] Tomson Reuters. Practical Law in Canada
[376] Alberta Energy Regulator
[377] Alberta Environment and Parks (AEP)
[378] Information henceforth is given on the example of Alberta province
[379] Approvals and registrations procedure regulation

- approvals/permits for activities issued by other competent governmental bodies (if applicable);
- information about necessity to assess impact on the environment. List of activities requiring mandatory Environmental Impact Assessment Report is specified in the Provision about EIA[380];
- copies of current environmental permits (for existing companies);
- anticipated or actual dates on start of construction, completion of construction, and start of operation;
- list of PS, sources and volumes of PS emissions generated in result of production activities, description of methods on how PS release/discharge to the environment are arranged, and measures planned to reduce them;
- brief information about data on environmental monitoring and factors of PS emission control systems for the period regulated by current environmental permit (for existing companies);
- measures which are to be taken to minimize volumes of waste generation, including a list and volumes of waste generated, as well as methods on their final disposal;
- response plan in case of emergencies which could result in incidental PS emissions to the environment;
- recultivation plan;
- information about public consultations;

If the authorised body requires, requests to provide additional information may be submitted in the course of an application approval. Only applications with full package of necessary documents only are accepted for review and approval.

The validity periods of environmental permits are different in every province: if in Alberta a permit is issued for the period not longer than 10 years, then in British Columbia and in Ontario a certain period is not established, and a permit is valid until modifications to the process have been made, and that can require additional approval by the authorised body.

5.4.3. List of issues regulated by an environmental permit

Content of environmental permit is not regulated by the legislation of Canada. In practice environmental permits contain, at least, the following information[381]:

- name of an entity obtaining a permit;
- permit validity period;
- list of contaminant sources specifying emission limits. However, emissions could be specified in different units of measurements, both in concentrations (mg/m^3, mg/l, ppm) and in gross values (kg/h, t/year and others);

[380] Environmental assessment (mandatory and exempted activities) regulation
[381] Example of AER environmental permit

- requirements for monitoring and reporting, containing data on controlled sources and parameters, sampling intervals, measurement methods, and others;
- special conditions on permit issuing established by the authorised body;
- decommissioning and land restoration plans.

5.4.4. Permit revocation

The permit can be suspended or revoked by the decision of the authorised body on environment protection, by the initiative the licensee or upon a decision of law enforcement authorities. When revoking or suspending a permit, an authorised body on environmental protection shall publish an appropriate notification in one or more print media[382]. The grounds to reconsider and suspend the conditions of environmental permit are[383]:

- the risk or fact of adverse impact on the environment which was not taken into account at the stage of application approval;
- considerations of issues related to the fulfillment of monitoring and reporting requirements;
- temporary suspension of activities or transfer of property rights to another legal entity.

Moreover, if a licensee has a debt before the Government, then there is an official ground to revoke or suspend a permit[384]. The authorised body is entitled to revoke a permit with identificaition of legal grounds being in the relevant decision.

5.4.5. Public participation in the environmental permitting procedure

Procedure of public consultations is a key component in the environmental permitting process. Upon receipt of an application for an environmental permit, the authorised body shall notify the general public by publishing an official notification in mass media (*public notice of application*)[385], with a brief description of activities planned. The notice contains information about the possibility of filing *statements of concern*[386], where all concerned parties directly exposed to production activities being projected can express their remarks and proposals in written form[387]. Statements of concern shall be submitted within 30 days from the date when a notice of an application for environmental permit has been published. And that statement shall include grounds of how and in which manner a public representative will be exposed to activities planned. As a rule, residents living or possessing property in

[382] Chapter E-12 Environmental protection and enhancement act
[383] Item 70 (3) of Environmental protection and enhancement act
[384] Item 70 (4) of Environmental protection and enhancement act
[385] Public notice of application
[386] Statement of Concern About an Energy Resource Project
[387] Item 71 (3) of Environmental protection and enhancement act

geographical proximity to the production facility are recognized as directly exposed population[388].

Statements of concern are reviewed by an authorised body in the course of an application process and they can influence the decision about the issue of the environmental permit. Upon completion of the review procedure, the authorised body shall notify all concerned parties in written form about a decision made on application[389].

Public representatives submitted statements of concern have the right to appeal a decision of the authorised body on the issue of the environmental permit to the *Environmental Appeals Board - EAB*[390].

[388] Environmental Approvals and Licences
[389] Item 74 (3) of Environmental protection and enhancement act
[390] EAB Regulation

6. STATE ENVIRONMENTAL EXPERTISE

Approaches to State Environmental Expertise (SEE) differ in countries studied. In Russia, SEE facilities on federal and regional leves are determined, and they include project documentation of activities, with data on environmental impact assessment being mandatory. In Brazil, SEE is conducted when issuing environmental permits, and does not have any established procedure. In USA and Canada, review procedure is determined by Environmental assessment conducted by authorised environmental agencies or by an appointed review panel (in Canada).

If SEE procedure has been infringed, projectors can be administratively, legally, and civilly liable within regulations established by legislations of countries. Distribution of liability for quality of performed work and submitted documentation to an authorised body can also be regulated by provision of a contract signed by a customer and projectors.

Participation of the general public in SEE includes public environmental expertise (in Russia) and public hearings. In Canada, the general public has an opportunity to take part in environmental assessment procedure in various steps until the final decision is made.

6.1. Russia

As the RF Federal Law "On Environmental Protection" (2002)[391] implies, the aim of environmental expertise is to establish compliance of documents and (or) documentation demonstrating feasibility of planned commercial or other activities with environmental protection requirements.

Procedures for environmental expertise are established by RF Federal Law "On Environmental Expertise" (1995)[392].

There are the following types of environmental expertise in RF: state environmental expertise and public environmental expertise.

Certain items (documentation and materials) specified by Federal Law "On Environmental Expertise" are subject to the state environmental expertise.

[391] Federal Law dated 10.01.2002 No. 7-FZ "On Environmental Protection", art. 33
[392] FZ dd. 23.11.1995 N 174-FZ (rev. dd. 03.08.2018) "On Ecological Expertise"

6.1.1. Items under state environmental expertise on federal level

Items under the state environmental expertise on the federal level are:

1) drafts of regulatory-technical and instructional and methodological documents related to the protection of environment;
2) drafts of federal target programs covering construction and operation of facilities of commercial activities impacting the environment, particularly location of such facilities considering security of natural objects;
3) drafts of product sharing agreements;
4) drafts of technical documentation for new equipment and technology, which may impact the environment in the process of operation, as well as drafts of technical documentation for new substances, which may end up in the natural environment;
5) materials of complex environmental study of ground areas, validating a legal status for those areas as the environmental disaster area or the environmental emergency zone;
6) facilities under the state environmental expertise specified in FL dd. November 30, 1995 "On the Russian Continental Shelf"[393], FL dd. December 17, 1998 "On Exclusive Economic Zone of the Russian Federation"[394], FL dd. July 31, 1998 "On Inland Sea Waters, Territorial Sea and Contiguous Zone of the Russian Federation"[395];

6.1) design documentation of facilities, construction and reconstruction of which are intended within specifically protected natural areas of federal importance, as well as design documentation of particularly hazardous, technically complex and unique facilities, defense and security facilities, construction and reconstruction of which are intended within specifically protected natural areas of regional and local importance;

6.2) design documentation of facilities for disposal and (or) neutralization of waste of classes I - V, including design documentation for construction and reconstruction of facilities for neutralization and (or) disposal of waste of classes I - V, as well as projects on decommissioning of specified facilities, projects on land recultivation, which have been disturbed with disposal of waste of classes I - V, and land exploited but not designed to disposal of waste of classes I - V;

6.3) design documentation of artificial land areas, which are projected on water facilities belonging to RF;

6.4) project on disposal of mining works with utilisation of waste of ferrous metal production of IV and V hazard classes;

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[393] FZ "On Continental Shelf of RF"
[394] FZ "On Exclusive Economic Zone of RF"
[395] FZ "On Inland Sea Waters, Territorial Sea and Contiguous Zone of RF

6.5) design documentation of capital construction facilities related to I category facilities according to the environmental protection legislature, excluding cases if such design documentation is part of supporting materials for licences in accordance with subsection 4;

6.6) supporting materials for complex environmental permits, which are developed in accordance with environmental protection legislature, in case if the specified materials do not contain information about positive conclusion of the state environmental expertise conducted in relation to facilities specified in subsection 6.5;

7) the aforementioned item of the state environmental expertise, which has earlier received a positive conclusion of the state environmental expertise, in the following case:

- improvement of such item based on the remarks of the earlier conducted state environmental expertise;
- implementation of such item with deviations from the documentation, which has obtained a positive conclusion of the state environmental expertise, and (or) in case of alterations in the specified documentation;
- expiration of the validity period of a positive conclusion of the state environmental expertise;
- alterations in the documentation, which has obtained a positive conclusion of the state environmental expertise

6.1.2. Items under the state environmental expertise on the regional level

The state environmental expertise of items under the regional level is conducted by governmental authorities of territorial entities of the Russian Federation in the order established by Federal Law "On Environmental Expertise", as well as other laws and regulations of the Russian Federation. Items under the state environmental expertise on the regional level are:

1) drafts of regulatory-technical and instructional and methodological documents in the field of environmental protection, which are confirmed by the government authorities of territorial entities of the Russian Federation;
2) drafts of target programs of the RF territorial entities covering building and operation of facilities of commercial activities, which influence the environment, particularly the location of such facilities considering security of natural objects;
3) draft documentation of facilities, construction and reconstruction of which is intended to be conducted within borders of specifically protected natural areas of regional and local significance, excluding draft documentation of facilities specified in the subsection 6.1 in the list of SER on the federal level, in

accordance with the RF legislature and the legislature of the RF territorial entities;

4) the aforementioned item of the state environmental expertise on the regional level which has earlier received a positive conclusion of the state environmental expertise in the following case:
    - improvement of such items based on the remarks of the state environmental expertise conducted earlier;
    - implementation of such items with deviations from the documentation that has obtained a positive conclusion of the state environmental expertise, and (or) in case of alterations in the specified documentation;
    - expiration of the validity period of a positive conclusion of the state environmental expertise;
    - alterations in the documentation for which a positive conclusion of the state environmental expertise has been obtained.

6.1.3. State environmental expertise

Mandatory condition to accept materials for the state environmental expertise is available (in the sections of an item under the review or as appendices) data on impact assessment on the natural environment of projected commercial and other activities, and data on environmental feasibility for permissibility of its implementation.

Lead time for the state environmental expertise shall not exceed three months and can be prolonged for one month as requested by the customer, unless otherwise is stated by the federal law.

The state environmental expertise is conducted by a review panel formed by the federal executive body on the environmental expertise or by the state power bodies of territorial entities of the Russian Federation to conduct the environmental expertise of a certain item.

The result of the state environmental expertise is a conclusion of the state environmental expertise, which is in compliance with the requirements of the article 18 of Federal Law "On Environmental Expertise". The conclusion prepared by the review panel of the state environmental expertise includes specific substantiated opinions of experts who do not agree with the conclusion made by this review panel. A positive conclusion of the state environmental expertise is legally effective for the period established by the federal executive authority on the environmental expertise or by the state power bodies of the RF territorial entities conducting a certain state environmental expertise.

Another state environmental expertise is conducted pursuant to a decision of the court or the court of arbitration.

6.1.4. Requirements to prepare an item for review

According to the article 27 of Federal Law "On Environmental Review", customers of documentation subject to the environmental review shall:

- pay for the state environmental expertise;
- provide authorised bodies with necessary materials, information, calculations, additional development regarding items of the environmental review;
- fulfill scheduled commercial and other activities in accordance with the documentation received a positive conclusion of the state environmental expertise;
- convey data on the results of a conclusion of the state environmental expertise to credit institutions to start funding the implementation of an item of the state environmental expertise.

6.1.5. Responsibility of consultants and documentation developers

According to the article 30 of Federal Law "On Environmental Review" [396], violations of the RF legislature on environmental review *the responsibilities of the regulated entity* are the following:

1) failure to submit documentation for the environmental review;
2) falsification of materials, information and data submitted for the environmental review, as well as information about its results;
3) coercion of an expert of the environmental review to arrange a deliberately false conclusion of the environmental review;
4) obstructing an organisation and fulfillment of the environmental review;
5) avoiding to provide federal executive authority on environmental review, state power bodies of territorial entities of the Russian Federation and non-governmental organisations (unions) arranging and carrying out environmental review with appropriate materials, information and data;
6) implementation of an item under the environmental expertise without a positive conclusion of the state environmental expertise;
7) carrying out commercial and other activities contradicting the documentation supported by a positive conclusion of the state environmental expertise.

According to Federal Law "On Environmental Expertise"[397], individuals guilty of a violation of the legislature of the Russian Federation on the environmental expertise or of a violation resulted in severe direct or indirect environmental or other consequences are *criminally liable* in accordance with Criminal Code of the Russian Federation.

[396] FZ "On Ecological Expertise"
[397] FZ "On Ecological Expertise"

Individuals guilty of above mentioned violations, if those violations do not involve criminal responsibility, are liable to *administrative responsibility* in accordance with the Administrative Offence Code of the Russian Federation.

Officials, experts of the environmental expertise, consultants and other employees whose illegal or improper actions resulted in financial loss by the authotiry or the regulated entity are responsible for financial compensation to the costs incurred.

Federal Law "On Environmental Expertise" determines also *civil legal responsibility.* Citizens and legal entities, whose rights have been violated by bodies of the environmental expertise, requesters of documentation subject to environmental expertise and by other interested parties as a result of not fulfilment of the legislation of the Russian Federation concerning environmental expertise, can claim compensation of losses under the procedure outlined in Civil Law of the Russian Federation. Emotional distress caused to a citizen as a result of illegal actions in environmental expertise is eligible for compensation by the wrongdoer, as set forth in Civil Law of the Russian Federation.

6.1.6. Participation of general public in environmental expertise

Participation of general public in environmental expertise includes public hearings and public environmental review.

An authorised body of environmental expertise notifies about the start of *public hearings* concerning an item of the state environmental expertise in the form of enquiry, discussions, referendum, and etc. [398]

Legislation on *Public Environmental Expertise* is determined by the Chapter IV of Federal Law "On Environmental Expertise"[399]. Public environmental expertise is arranged and conducted upon an initiative of citizens and non-governmental organisations (unions), and upon an initiative of local government bodies, by non-governmental organisations (unions) whose core business according to their charters is environment protection, including arrangement and carrying out an environmental expertise, and who are registered as per procedure outlined in the legislature of the Russian Federation.

Public environmental expertise can be carried out concerning the aforementioned items of the State environmental expertise, excluding items of environmental expertise representing nationally and commercially confidential information.

Public environmental expertise is carried out before the state environmental expertise or at the same time with that. Public environmental expertise can be carried out independently from the state environmental expertise.

[398] Official website of the Environmental Monitoring Body of Russia
[399] FZ "On Ecological Expertise"

Non-governmental organisations (unions) carrying out public environmental expertise are entitled to:

- obtain documentation subject to environmental expertise from a requester;
- familiarise with regulatory-technical documentation establishing requirements to conduct the state environmental expertise;
- take part as observers through their representatives at the meetings of review panels of the state environmental expertise and to take part in discussion of conclusions of the public environmental expertise of those boards.

A conclusion of the public environmental expertise becomes effective after its validation by the federal executive body on environmental expertise or the state power body of a territorial entity of the Russian Federation.

6.2. Brazil

The state environmental expertise in Brazil is included in the process of environmental permits (licences) application. In the process of studying documentation submitted at each stage of complex licencing, an authorised body arrange an expert review of the documents submitted. Thus, the legislature of Brazil does not establish a separate process of the state expertise.

6.2.1. Responsibility of consultants and documentation developers

Consultnats must follow a strict subsequence in obtaining environmental permits. Start of works by projectors before providing Licence for a plant can lead to measures on termination of activities implemented by an authorised body. Absence of a permits for every phase of a project is deemed as a serious crime and can lead to the following consequences for consultnats:[400]

- imprisonment for a period from one to six months or penalty and / or prohibition of activities, repair, expansion, or deployment of operations on the territory of the country;
- imprisonment for a period from one to three years or penalty in cases, when a projector does not fulfill conditions and measures stated in licences;
- prison term from three to six years and penalties for those who, in licencing process, in particular, in reports submitted to an expert review, provide completely or partially false information, including omission of information.

[400] Environmental Licensing in Brazil

6.3. Canada

According to *Canadian Environmental Assessment Act - CEAA 2012,*[401]there are two types of environmental assessment: *environmental assessment by a responsible authority* and *environmental assessment by a review panel*

Environmental assessment by a responsible authority is conducted by *Canadian Environmental Assessment Agency*, *National Energy Board*, or by *Canadian Nuclear Safety Commission*.

Environmental assessment by a review panel is carried out by a group of individuals appointed by the Minister of Environment and supported by Environmental Assessment Agency; and they shall not represent a conflict of interests in relation to a project under assessment.

Both types of assessment are carried out by the federal government only or in cooperation with authorised bodies of provinces.

In the course of the federal environmental assessment, the following factors are considered:

- impact on the environment;
- relevance of data on environmental impact;
- comments of general public;
- measures to recover consequences;
- purpose of a project under assessment;
- alternative ways to implement an anounced project;
- results of any regional study on the project under assessment.

Professional responsibility of projectors is established based on an agreement approved by an authorised body and a subcontractor. In general, a subcontractor is responsible for information provided, however, it depends on which circumstances were determined in a contract between a customer and an executor.

6.3.1. Goals of the state environmental assessment

In Alberta province, [402]goals of environmental assessment determined by *Environmental Protection and Enhancement Act* are the following:

- support of goals on environment protection and sustainable development;
- integration of nature-oriented and economical solutions on the earliest stages of activity planning;
- prediction of environmental, social, economical and cultural consequences of activity planned and assessment of plans on restoration of any adverse effects caused by the planned activity.

[401] Canadian Environmental Assessment Act, 2012
[402] Environmental Protection and Enhancement Act

- allowing the general public, supporters, governmental institutions to take part in environmental assessment.

6.3.2. Facilities of the state environmental assessment

According to CEAA, projects, including activities carried out on the territory of Canada or on federal lands, are subject to environmental assessment.[403]

Minister of Environment at his discretion can determine activities, for which environmental assessment is mandatory, if, from his perspective, such activities can cause adverse effects on the environment and discontent of the general public.[404]

Federal government of Canada require environmental assessment before a final decision has been made, if there is any of the following conditions/situations:[405]

- an intended project is initiated by an agency/department being a part and/or being controlled by the federal government, involves financial commitment of the federal government of Canada;
- an intended project shall be arranged on land, including shelf, being under regulation of Canadian government;
- an intended project will probably cause environmental effects;
- any projects requiring federal decision, permission/licence before their implementation.

Legislature of provinces establishes a list of items for environmental assessment. In Alberta province, Environmental Assessment Act[406] determines activities subject to mandatory environmental assessment, as well as activities which do not require environmental assessment.

6.3.3. Participation of general public

According to CEAA, a responsible body shall provide an opportunity for general public to take part in environmental assessment of a project intended. [407]

An responsible body shall provide a public notice (via website) at the pre-project state of environmental assessment. A notice shall include: [408]

- a copy of a report or to indicate how that copy can be obtained;

[403] Canadian Environmental Assessment Act
[404] Canadian Environmental Assessment Act п. 14(2)
[405] Overview of the Canadian Experience in Enviromental impact assessment
[406] Mandatory and exempted Activities
[407] Canadian Environmental Assessment Act п. 28
[408] Canadian Environmental Assessment Act sec. 25

- a notice, which proposes the general public to provide comments to a report of project during a specified period, and provides an address to submit comments.

Then, the general public has an opportunity to take part at different stages of environmental assessment until a decision made by the Minister of the Environment.

If, in order to fulfill project, a certificate is required as per section 54 of National Energy Board,[409] a responsible body shall ensure, that any interested party could have an opportunity to take part in environmental assessment of a project intended.[410]

After taking into account all public comments, a responsible body shall finish preparation of a report on environmental assessment of a project and submit it to Minister of the Environment. The Minister can approve a project, only if the following conditions are observed:

- significance of environmental effects, measures to eliminate them, and goals of a project have been taken into account;
- the general public has been allowed to take part in the assessment;
- the general public will have an access to records of the assessment, in order to ensure their significant participation;
- any other conditions established by the minister are fulfilled or will be fulfilled.

6.3.4. Environmental assessment procedure in Alberta province

Copies of paper applications and electronic copies (EIA report with attached documents) shall be submitted to AER (*Alberta Energy Regulator*) for application on the facilities of environmental assessment. Guidelines to application content for energy project includes instructions for new projects and updates of applications for existing projects.[411]

Environmental assessment procedure includes:[412]

- publication of notice at several stages of environmental assessment to support participation of general public;
- when EIA report is required, an applicant shall develop and submit it to an authorised body;
- after comments from general public, indigenous communities, and experts have been studied, a final decision is developed;

[409] National Energy Board Act
[410] Canadian Environmental Assessment Act sec. 28
[411] Guide to Content for Energy Project Applications
[412] EIA, Project application

- any individual who considers that a project can directly affect his rights, can apply *Statement of Concern*;
- an integrated report of a project is forwarded to internal and external parties for a technical review. External parties can include provincial governmental departments and federal government;
- as soon as the report is considered completed, it is then used to determine whether the project is publicly accessible. Such determination can require hearings, after which a report about decision made will be published.

7. BASELINE ENVIRONMENTAL STUDIES

7.1. BES on land

In *EU* countries baseline environmental studies (BES) may be one of the conditions to obtain IEP. BES are mandatory for all on-shore companies, activities that apply, produce, or release hazardous substances[413] into the environment, and have a risk of underground water and soil contamination. BES are conducted by plant operators one time prior to production activities[414].

BES results shall be set out in *Baseline report* and submitted to an authorised body as a part of package of documents to obtain IEP. Baseline report shall contain information allowing to compare initial state of soil and underground water with the state after a facility has been decommissioned, in order to establish the degree of the negative impact.

Baseline report shall include the following information as a minimum[415]:

- existing and preceding to the study (if applicable) operating conditions of production facility;
- information about existing (at the time of *Baseline report* preparation) conditions of the environment covering hazardous substances concentration in soil and underground water.

Upon completion of production activities an operator of the plant shall fulfill secondary study of soil and underground water in order to determine concentration of relevant hazardous substances. If upon the results of comparison with baseline report data a significant negative impact on the environmental components under the study will be determined, then the operator of the plant shall carry out remedial measures.

Baseline environmental researches in other researched OECD countries are carried out, as a rule, as part of an impact assessment of the projected activities on the environment. In *Canada,* for example, EIA project shall include description of "basic scenario" (*baseline case*) determining environmental conditions before a project implementation. Assessment of baseline condition of the environment is conducted at the preliminary stage of project development by operators of projected activities (or by contracting organizations). Assessment of baseline condition of the environment shall be based on reliable data obtained as a result of field studies, or on existing databases allowing to obtain clear description of current conditions of the environment in an area directly or indirectly to be exposed by projected

[413] Hazardous substances according to REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures
[414] IED Directive. Art.22
[415] European Commission Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on industrial emissions

activities[416]. Assessment of baseline conditions of the environment within EIA project includes the following sections[417]:

- air quality, climate and noise (kinds and occurrence rate of unfavourable meteorological conditions, as well as quality parameters of ambient air);
- hydrogeology (detailed description of geological and hydrogeological structure of territory, background concentrations of ions, metals and hydrocarbons in aquifers, etc.);
- hydrogeology (description of hydrological regime of surface-stream flows, including seasonal water level fluctuations);
- surface water quality (determining relevant quality parameters of surface water);
- aquatic life (description of species composition, distribution, fish population size and other aquatic organisms);
- flora (description of species composition, distribution, diversity of vegetation);
- fauna (description of species composition, distribution, diversity of animal life);
- biodiversity (determining biotic and abiotic factors of biological diversity);
- landscapes and soil (types and condition of landscapes and soil);
- land utilization and management (characteristics of existing kinds of land utilization, allocation of specifically protected areas, etc.)[418].

In Brazil, baseline environmental studies are part of environmental studies conducted during the environmental permitting procedure. Baseline environmental studies are carried out by all enterprises that have a negative impact on the environment (i.e. subjects of obtaining environmental permits). The competent authority for each operator determines the scope and content of environmental studies (including baseline studies) during the environmental permitting procedure[419].

In Russia, at the pre-project stage (before construction), a preliminary survey should be conducted to identify components of the environment, indicators and characteristics that need to be monitored and to establish regional baseline indicators. In order to assess the regional baseline level of pollution and identify the main polluting components, a sampling of soils and groundwater is carried out. Controlled indicators include arsenic, heavy metals, oil and oil products, pesticides, ammonium nitrogen, sulfur, nitrates, nitrites, cyanides, aromatic hydrocarbons, benzo (a) pyrene, polychlorobiphenyls and volatile chlorinated hydrocarbons.[420]

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[416] Guide to Preparing Environmental Impact Assessment Reports in Alberta Updated March 2013
[417] Industrial Plant Project Terms of Reference EIA Report
[418] *Sections with assessment of natural environment conditions only are provided*
[419] CONAMA RESOLUTION 237, December 19, 1997
[420] SP 11-102-97

Soil samples are collected to obtain data on regional baseline levels of soil contamination outside the local anthropogenic impact area. Baseline samples should be taken at a sufficient distance from the residential area (on the windward side), not less than 500 m from the roads, on lands (meadows, wastelands) without application of pesticides and herbicides.

7.2. BES at sea

In *UK* baseline environmental studies on offshore facilities is a part of environmental impact assessment[421]. Additionally, requirements to conduct studies are determined in several legislative acts of Europe and UK[422]. Parameters needed for studies within BES are not established in legislature, so project organizations may determine them in accordance with preliminary assessment results of negative impact on water *receptors*, as well as in accordance with recommendations of OSPAR. Thus, a list of parameters studied can include benthos, phyto- and zooplanktons, aquatic vegetation and fauna, as well as large mammals. Baseline environmental studies are conducted by an operator himself once before projected commercial activities.

In Norway, baseline studies are a part of *benthic habitat* monitoring, and conducted prior to exploring drilling operations, and oil and gas extracting at sea. BES at sea are conducted both at regional stations and production stations. Regional stations are part of state monitoring network and their goal is to obtain information about *background levels* of an area studied; and they have a function as a reference stations reflecting normal (natural) condition of the environment. Regional monitoring stations shall be located in zones out of exposure of projected activities, whereas production stations evaluate condition of the environment in the immediate proximity to production facilities. Baseline monitoring shall be conducted at least at 3 stations. According to art. 53 of Rules of conducting oil and gas activities, BES is an obligation of the plant operators[423]. Table 17 provides main parameters subject to study in the course of BES.

Table 17. Parameters of baseline studies of bed deposits

Parameter	Sampling depth	Quantity of samples
General content of organic matter	0–1 cm	1 (compound sample to determine particle-size distribution)
Particle-size distribution	0–5 cm	Compound sample from 3 samples
Hydrocarbons: • total content of hydrocarbons;	0–1 cm 1–3 cm	3 samples 1 sample

[421] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/644775/OPRED_EIA_Guidance_-_130917.pdf
[422] Oil and gas: offshore environmental legislation
[423] Activities Regulations for the oil and gas industry, sec.53

Parameter	Sampling depth	Quantity of samples
• synthetic drilling mud; • nitrogen phosphorous detector and polycyclic aromatic hydrocarbons	3–6 cm	1 sample
Metals: Ba, Cd, Cr, Cu, Pb, Zn, Hg)	0–1 cm 1–3 cm 3–6 cm	3 samples 1 sample 1 sample
Macrofauna[424]	-	5 samples

BES results are effective during 6 years, unless other period has been established by an authorised body regarding the environment. BES stations after commissioning of a facility become stations of production for impact monitoring, which shall be conducted once in 3 years[425].

In Canada, description of the background conditions of the environment at sea is also conducted at the stage of EIA project development. Information about baseline conditions of a region where activities are projected shall include description of[426]:

- ambient air quality (concentration of suspended particles, $PM_{2,5}$, PM_{10}, CO, SO_x, NO_x, VOC, H_2S, and other potentially hazardous PS);
- marine environment (quality of sea water, including temperature, salinity, pH, and others; characteristics of seabed, currents, depths and other; ice conditions; marine flora characteristics (algae, phytoplankton, and others); acoustic conditions (existing noise levels of natural and human origine);
- fish and their habitat (characteristics, population size, species composition, and other);
- birds and their habitat (characteristics, population size, species composition, migration routs, gathering areas, and other);
- marine mammals, sea turtles and endangered species (characteristics, population size, species composition, migration routes, gathering areas, and other).

It should be noted that legislation does not establish obligations of operators to conduct BES. Guidelines to conduct EIA specify recommendations to obtain information necessary to describe baseline conditions of the environment, as well as official national databases and specialized state bodies[427].

In Russia, the initiator of the planned activity carries out baseline environmental studies before the commissioning according to a program of environmental studies

[424] Marine organisms of more than 1 mm in size
[425] Guidelines for offshore environmental monitoring: The petroleum sector on the Norwegian Continental Shelf
[426] Guidelines for the preparation of an environmental impact statement, pursuant to the Canadian Environmental Assessment Act, 2012, Husky Energy Exploration Drilling Project Husky Oil Operations Ltd.,October 28, 2016
[427] Guidelines for the preparation of an environmental impact statement, pursuant to the Canadian Environmental Assessment Act, 2012, Husky Energy Exploration Drilling Project Husky Oil Operations Ltd.,October 28, 2016, sec. 6.1

agreed with the competent authority. The research program is generally similar to the Program of operational environmental monitoring and includes monitoring the overall hydrochemical indicators, the characteristics and level of pollution of the aquatic environment, taking into account the distribution and dynamics of the pollutants content in water, sediment, hydrobionts etc.[428].

[428] See chapter "Operational environmental monitoring" in Russia

8. ENVIRONMENTAL CONTROL SYSTEM

"Unexpected" inspections are a form of the state control, ensuring inspection of onshore facilities during their normal operating conditions. The frequency of any inspections, including the unexpected, is based on risk assessment conducted by an authorised body to identify operators with a high probability of non-compliance with legal requirements. At the same time, a goal of the state control in OECD countries is not to impose punitive measures, but to assist users of natural resources with compliance of environmental legislation requirements.

The practice of enforcement actions is closely connected with goals of state control. Thus, with the purpose to educate natural resource users, as well as in the presence of insignificant non-compliance, the state inspector can give recommendations to prevent occurrence of more serious violations. In OECD countries, when determining enforcement measures, state inspectors try to apply less strict and non-disruptive actions. In the majority of the countries studied, a hierarchy of enforcement actions is used to determine the appropriate level of enforcement. Moreover, severity of law enforcement actions will depend on many factors, such as a character of the violation, occurrence of previous non-compliance, financial gain from violation, and the behavior of a violator himself.

Another key aspect is the participation of the general public in inspections. It should be pointed out, that practice of the general public participation in inspections has not been discovered in any of the studied countries In Russia, the functions of public inspectors are limited by violation detection, filing complaints, and participation in environmental education campaigns. In OECD countries, participation of residents and NGOs in the control process of regulated facilities is also limited by informing about violations of environmental legislation and filing complaints in order to initiate unscheduled inspections.

In all countries studied, the requirements to conduct industrial control (IC) are mandatory in issuance of IEP. Moreover, IEP can specify requirements to arrange continuous monitoring of emissions (release and discharge of PS to the environment).

In OECD countries, criteria are established for cases when automated monitoring system (AMS) is mandatory.

In EU countries' requirements for the implementation of AMS are established for large combustion plants with nominal thermal power more than 100 MW and waste incinerator units. Furthermore, it should be noted that only a limited amount of PS is continuously measured.

In Germany, continuous measurements shall be measured only at sources, a portion of which in total mass flow of a unit per hour is more than 20%. Sources with emission volume less than 10 % of annual PS emissions of a unit or annual working time reserve less than 500 hours a year are not subject to continuous measurements.

In Great Britain, the decision about the necessity to make continuous measurements of sources is made according to assessment results of emission limit exceedance risk.

In OECD countries, in addition to the concentration of certain pollutant substances in fume gases in the process of automated monitoring, such process parameters as temperature, pressure, oxygen and steam vapor content in exhaust gases are also subject to control.

In Russia, starting from 2019, the implementation of AMS will be mandatory for companies of the first category only (subjects of obtaining IEP). Moreover, a transition time is allowed for the period of 4 years from the date of receipt or revision of the IEP. It is important to note that, in Russia, only general requirements have been approved for the implementation of AMS. Acts with the detailed requirements to the programs of automated monitoring, to stationary sources and substances subject to automated control, as well as tools to record and transfer information are under development.

In the EU, in order to confirm the quality and reliability of IC results, plant operators are obliged to ensure that measuring tools are in compliance with EC technical standards (EN standards), including requirements for certification, calibration, and functional test of apparatus for continuous measurements by specialized certified organizations.

In some OECD countries (for example, in Germany and the Great Britain), the results of continuous measurements are forwarded online, however, measured PS concentrations here are processed, averaged, and verified before to be sent to a regulatory body for comparison with established emission standards.

8.1. Russia

8.1.1. State environmental supervision (control)

Government environmental supervision is regarded as activities of authorised bodies directed to prevent, detect and restrain violations by bodies of the state power, local government bodies, and by legal entities and their managers and other officials, entrepreneurs, their authorised representatives and citizens, of requirements established as per international agreements of the Russian Federation, federal legislation, laws and other normative legal acts of territorial entities of the Russian Federation in environmental protection, by means of arrangement and carrying out inspections, measures on prevention and (or) elimination of consequences of detected violations; and activities of authorised bodies of the state power on systematic surveillance over fulfilment of mandatory requirements, analysis, and prognosis of compliance with mandatory requirements[429].

[429] Federal Law dated January 10, 2002 N 7-FZ "On Environmental protection" (amended and updated)

8.1.1.1. Forms of state environmental control

State environmental supervision is carried out through the arrangement and conduct of planned and unscheduled, documentary and field audits in accordance with articles 9 - 13 and 14 of Federal Law “On Protection of the Rights of Legal Entities and Entrepreneurs in the process of state control (supervision) and municipal control” [430].

Scheduled audits

The frequency of scheduled audits is determined based on the risk category of the regulated facility [431] [432]. Scheduled audits of facilities of state federal and regional supervision depending on their risk category is carried out in the following intervals:

- categories of extremely high risk - once a year;
- categories of high risk - every 2 years;
- categories of considerable risk - every 3 years;
- category of average risk - not often than once in 4 years;
- categories of moderate risk - not often than once in 5 years.

Facilities of state supervision with low risk category are not subject to audits.

Audits should be conducted in no more than 20 working days from the date it has been started. In exceptional cases, when complex studies, tests, special expertise and examinations are needed, scheduled audit period can be extended, but not more than for 20 working days.

A legal entity or an individual entrepreneur shall be notified about a scheduled audit by the Environmental Monitoring Body of Russia no later than 3 working days before its start by means of a copy of an order from Manager of Environmental Monitoring Body of Russia[433]. Scheduled audits can be conducted as a *documentary* or *field* audit.

Legal entities carrying out commercial and (or) other activities at the facilities of IV category (facilities with minimal negative impact on the environment) are not subject to scheduled audits[434].

In case of non-compliance and (or) contradictions in submitted documents are detected in the course of documentary audit, the legal entity receives this information requiring to provide necessary clarifications in written within ten working days. If

[430] Federal law dated December 26, 2008. N 294-FZ "On protection of rights of legal entities and entrepreneurs in the process of state control (supervision) and municipal control" (amended and updated)
[431] RF Government Order dated August 17, 2016. N 806 "On risk-oriented approach in the process of arrangement of certain types of state control (supervision) and introduction of amendments to certain acts of Government of the Russian Federation"
[432] RF Government Order dated May 8, 2014 N 426 "On Federal State Environmental supervision"
[433] Order of Ministry of Natural Resources of Russia dated June 29, 2012. N 191 "On adoption of Administrative regulation of execution of state function of federal state environmental supervision by Federal Supervisory Natural Resources Management Service"
[434] alterations related to facilities of IV category are effective starting from January 1, 2019

after review of submitted clarifications and documents, or if clarifications have not been provided, signs of violation of mandatory requirements are detected, officials from the Environmental Monitoring Body of Russia have a full right to conduct field audits.

In the course of scheduled audit, an official from the Environmental Monitoring Body of Russia or its local agency is not authorised to:

- check whether mandatory requirements are observed, if such requirements are beyond the power of the Environmental Monitoring Body of Russia or its local agency;
- carry out a field audit in case if the manager, other official individual, or an authorised representative of a legal entity is absent, except if such audit is carried out as a result of infliction of life harm, injury to individuals, animals, flora, environment, security of the state, as well as in natural and human emergencies;
- to request documents, information, if they are not items for audit or not subject to audit; and to confiscate such original documents;
- take samples of the facilities of the environment studied in order to study them, to test, to make measurements without creating reports on specified samples taken, samples according to the established form and in quantity exceeding norms stated in national standards;
- distribute information obtained in the result of audit and information representing the state, commercial, professional, and other secret protected by law;
- exceed the period determined for an audit.

In case if a violation of mandatory requirement has been detected in the course of a scheduled action on supervision, officials execute the following powers:

- register facts of detecting violation in an inspection report;
- issue an improvement notice to the legal entity to eliminate violations detected, indicating dates to do that;
- file a lawsuit about administrative violations in case if signs of administrative violations are detected; establish and invoke administrative enforcement measure for committing an administrative violation in order to prevent new violations both by a violator himself and by other individuals.

In case of failure to comply with a legal order of an authorised body, and (or) impeding from the part of legal entities to carry out an audit, as well as restricting access of state inspectors to the audited territory, an official is obliged to register this fact in an act drafted in arbitrary form and send it to a prosecutor’s office.

Unscheduled audits

Grounds for unscheduled audits are:

- time to execute an earlier issued improvement notice about the elimination of a violation detected is expired;
- letters and claims from residents, as well as information obtained from the mass media about the following facts:
    - risk of harm to life, health of residents, harm to animals, flora, the environment, objects of cultural heritage, security of the state, as well as risk of natural and human emergencies;
    - infliction of harm to life, health of residents, harm to animals, flora, the environment, objects of cultural heritage, security of the state, as well as occurrence of natural and human emergencies;

- an order of the manager of an authorised body issued in compliance with an assignment of President of the Russian Federation, Government of the Russian Federation and on the basis of a requirement from a prosecutor for unscheduled audit within the supervision of execution of laws according to materials and letters provided to a prosecutor's office.

A legal entity is informed about an unscheduled audit by an authorised body *not less than twenty four hours* before that audit by any available means. If as a result of the activities of a legal entity harm to life, health of residents, to the environment, and security of the state has been caused or being caused, as well as natural and human emergencies have occurred or can occur, then preliminary notification of legal entities about the start of an unscheduled field audit is not allowed.

Unscheduled audits are conducted as a *documentary* or *field* audit. The procedures for conducting of unscheduled documentary or field audits are similar to those of scheduled audits.

8.1.1.2. Functions, rights and obligations of the state inspectors

State environmental supervision is fulfilled by the Federal Supervisory Natural Resources Management Service (Rosprirodnadzor) and its territorial agencies in accordance with their competence[435]. Rights of officials from Rosprirodnadzor as state inspectors in the environmental protection are set forth in art. 66 of FZ “On Environmental Protection”. Officials from Rosprirodnadzor have the following obligations:

- timely execution of powers on prevention, detection and restraint of violation of mandatory requirements;

[435] Federal Law dated October 6, 1999 N 184-FL "On general principles of establishment of legislative (representative) and executive bodies of the state power of territorial entities of the Russian Federation"

- compliance with the legislation in terms of rights and legal interests of audited facilities;
- carrying out an inspection only during the performance of official duties, on-site inspection only upon presentation of official certificates, a copy of the document on the approval of the inspection;
- do not prevent the manager or other official a regulated afcility to be present during an audit and provide explanations on issues related to a subject of that audit;
- to inform the manager, other official or an authorised representative of a regulated facility about the results of that audit;
- when determining measures adopted upon the facts of detected violations, to consider that specified measures are appropriate to severity of the violations, their potential danger for life, health of people, for animals, flora, the environment, security of the state, for the occurrence of natural and human emergencies, as well as not to allow ungrounded restriction of rights and legal interests of legal entities;
- to prove the validity of their actions when they are appealed by legal entities;
- to comply with the time frames of an audit[436];
- do not require documents and other information from a legal entity, which submission the legislature of the Russian Federation does not stipulate;
- prior to a field audit at the request of the manager, an official or an authorised representative of a legal entity, his authorised representative, to provide for their attention provisions of an administrative regulation based on which an audit is held;
- to register an audit carried out in the record book of a regulated facility, if available;
- to request documents and (or) information, including in electronic form, which are enclosed in the List[437], from other state bodies, local authorities, or organisations or local authorities possessing those documents and (or) information;
- to provide documents and (or) information acquired within the interdepartmental exchange of information for the attention of the manager, other official or an authorised representative of a regulated facility.

[436] Established by Federal Law dated December 26, 2008 N 294-FZ " On protection of rights of legal entities and entrepreneurs in the process of the state control (supervision) and municipal control"

[437] RF Government Order dated April 19, 2016 N 724-p On list of documents and (or) information requested and received by agencies of the state control (supervision) within interdepartmental exchange of information, when arranging and conducting audits, from other state bodies, local authorities or organisations possessing those documents and (or) information

8.1.1.3. Enforcement actions

If violations of mandatory requirements have been detected in the course of an audit, officials from Rosprirodnadzor shall:

- issue an improvement notice to the legal entity to eliminate violations detected, indicating deadlines;
- ensure the elimination of violations detected, as well as measures to bring to responsibility individuals who allowed violations to occur;
- if signs of administrative violations have been detected, initiate proceedings on administrative offences and ensure their consideration;
- if in the course of an audit, it has been discovered that the activities of a legal entity, its branch, representative office, structural subdivision present direct threat for life, health of residents, threat to species, the environment, security of the state, risk of natural and human emergencies, or if such harm has been caused, then an official from Rosprirodnadzor must immediately take measures to prevent harm or terminate it, up to imposing a temporary suspension of operations;
- if signs of crime have been detected, then materials indicating that are forwarded to law enforcement authorities to take measures on initiation of acriminal case[438].

Improvement notice on elimination of violations in the course of an audit is issued separately for each violation. Execution (non-executive) of an improvement notice is confirmed upon results of unscheduled audits initiated by an official no later than 15 working days after the expiration of improvement notice deadline.

If a legal improvement notice of an official from Rosprirodnadzor has not been executed within the prescribed period, a new order with an audit report is issued and an administrative violation report is drawn up for the violation stipulated in part 1 of article 19.5 of Administrative Offences Code of the Russian Federation (AOC RF), and, as a part of an administrative case, is forwarded for further proceedings to the court (justice of peace) within three days from the date it has been drawn up.

8.1.2. Public environmental control

The aim of public control in the environmental protection is to exercise the right of every citizen for favourable environment and to prevent of violation of legislation on the environmental protection; it is conducted by non-governmental unions and

[438] Order of Ministry of Natural Resources of Russia dated June 29, 2012. N 191 "On adoption of Administrative regulation of execution of state function of federal state environmental supervision by Federal Supervisory Natural Resources Management Service"

other NGOs according to their internal policies, as well as by residents in accordance with legislation[439].

The results of public environmental control are provided to the state agencies and local authorities and are subject to mandatory review.

Residents willing to assist state inspectors in environmental activities can become public inspectors and carry out public environmental inspections. When carrying out specified activities, public inspectors on the environmental protection assist public councils of state bodies on forest and environment supervision[440].

Public inspectors on the environmental protection are entitled:

- to register, including via video recording, the violation in the environmental protection and natural resources exploitation, and to forward appropriate materials with information indicating signs of administrative violations to state supervisory bodies;
- to take measures to preserve material evidences at locations where violations have been committed;
- to verbally inform individuals about violation committed by an individual;
- to assist implementation of state programs for protection of species and ecosystems;
- to take part in the environmental educational campaigns, and etc.

8.1.3. Industrial environmental control

8.1.3.1. Types and procedure of industrial environmental control

According to art. 67 of FZ No. 7 “On Environmental Protection”, the aim of industrial control in the environmental protection (IC) is to ensure measures on the environmental control, rational utilization and restoration of natural resources in the course of commercial activities, as well as to observe legislative requirements in the environmental protection[441]. The main document regulating IC content is Order of Ministry of Natural Resources and Environment of RF dd. February 28, 2018 “On validation of requirements of the content of a program of production environmental control, procedures and dates to provide a report on arrangement and results of the production environmental control”[442].

Legal entities engaging in commerce and (or) other activities at facilities of I, II and III categories shall develop and validate a program of IC, fulfill IC meeting the

[439] Federal Law dated January 10, 2002 No. 7-FZ 'On Environmental Protection'
[440] Order of Ministry of Natural Resources of Russia dated July 12, 2017 N 403 "On establishing an order to arrange activities of public inspector on the environmental protection" (Registered in Ministry of Justice of Russia 22.02.2018 N 50111)
[441] Federal Law dated January 10, 2002 No. 7-FZ 'On Environmental Protection'
[442] Order of the Ministry of Natural Resources and Environment of the Russian Federation of February 28, 2018 N 74 "On validation of requirements to the content of a program on production environmental control, procedures and dates to present a report on arrangement and results of industrial environmental control"

requirements established, record information and store data obtained in the result of IC.

Program of production environmental control includes the following information:

- inventory of PS releases to the ambient air and their sources;
- inventory of PS discharge to the environment and their sources;
- inventory of production and consumption wastes and location of their facilities;
- owned and (or) outsourced testing laboratories (centers) certified in accordance with legislation of the RF about certification in the national system of certification;
- intervals and conducting methods for production environmental control, sampling points and measurement techniques (methods).

Documentation with information about the results of IC includes documented information[443]:

- about technological processes, technologies, equipment for product (goods) production, fulfilled works, services provided, about fuel, raw materials, and materials utilized, about the waste generated from production and consumption;
- about actual volume or mass of PS release and discharge, about the level of physical impact and measurement techniques (methods);
- about handling with production and consumption wastes;
- about the condition of the environment, sampling points, measurement techniques (methods).

Industrial environmental control at sea is conducted in order to verify the effectiveness of measures and the implementation of established requirements for the protection of waters. Activities for the production of environmental control include[444]:

- organisational and technical support of industrial environmental monitoring;
- program of industrial environmental control.

Organisational and technical support of industrial environmental monitoring includes:

- periodic inspection of environmental equipment and materials (sorbents, sorbents, biological agents, booms, skimmers, wastewater filtration equipment, etc.) and the compliance of production processes with the design process and operational documentation;
- operation of sensors, detectors, instruments, equipment and communications, providing for the collection, processing and analysis of information on impacts on water bodies;

[443] Federal Law dated January 10, 2002 No. 7-FZ 'On Environmental Protection'

[444] GOST R 53241-2008 "Marine exploration. Requirements for the protection of the marine environment in the exploration and development of oil and gas fields of the continental shelf, territorial sea and coastal zone"

- equipment for sampling, laboratory and analytical work;
- data management capabilities;
- regulations of metrological control and calibration of sensors, instruments and equipment.

The program of industrial environmental control includes:

- accounting, monitoring and reporting on the characteristics and amount of wastewater generated and disposed of;
- lists of controlled indicators;
- regulations, location and frequency of observations, measurements and sampling;
- critical parameters of environmental control, requiring changes in equipment operating modes, including its manual and automatic shutdown;
- interaction with the system of state monitoring of water bodies.

General requirements for analytical and toxicological control of wastewater discharge and waste disposal under the program of industrial environmental control at sea are given in table 18.

Table 18. General requirements for analytical and toxicological control of disposal of wastewater and waste

Type of disposal, operation mode	**Controlled indicator**	**Frequency of control**	**Control method**
Disposal of waste drilling mud during the drilling exploration and production wells	Oil content (during drilling operations)	Daily during the disposal period	Established analytical control methods*
	LC_{50} acute toxicity indicator (for 96 hours)	Once a month during the drilling period	Established biological testing methods *
Sludge disposal during drilling of exploration and production wells	Oil content (during drilling operations)	Daily during the removal period with a maximum deviation for two consecutive periods of control	Established analytical control methods*
Produced water discharge during the fishing procedure	Oil content	Once every three days during the disposal period	Established analytical control methods*
	LC_{50} acute toxicity indicator (for 96 hours)	Once every three months during the disposal period	Established biological testing methods **
	Extended set of indicators based on complete chemical analysis ***	Once every three months during the discharge period with simultaneous biological testing	Established analytical control methods*
Discharge of oily ballast, process, stormwater, bilge and other waters	Oil content	Operatively depending on the mode of operation and the technological	Established analytical control

Type of disposal, operation mode	Controlled indicator	Frequency of control	Control method
		situation	methods *

** Analytical determination of the total content of petroleum hydrocarbons is carried out according to the methodology approved in the prescribed manner in the Russian Federation.*

*** The assessment of acute toxicity concerning LC50 (for 96 hours) is carried out by biological testing of samples on standard test organisms (crustaceans - Artemia salina, Misidopsis Bahia mysids at early stages of development) according to established procedures and methods. Before testing, the samples are mixed with seawater at an appropriate salinity in the ratio of 1: 9, settled for 1 hour and separated from the settled solid phase without filtration.*

**** The composition of the indicators to be determined includes indicators of total mineralisation, pH, BOD_5, total suspended matter, organic matter, the content of oil and its main components, heavy metals, phenols and hydrogen sulfide (by agreement) both on a set of monitored indicators and sampling points agreed with competent authorities.*

8.1.3.2. Operational environmental monitoring

Organisations that have a negative impact on the environment are obliged to monitor the environmental conditions in the framework of the state environmental monitoring system operation.[445] Environmental monitoring is a part of the Industrial environmental control program and includes the development of[446]:

- Schedule of observations of atmospheric air pollution with the indication of measured pollutants, frequency, locations and methods of sampling, used methods and measurement techniques;
- The program of conducting regular observations of the water body and its water protection zone, providing the observation of the quality of surface water in the background and control stations regarding the discharge of wastewater into the water body;
- Programs for monitoring the state and pollution of the environment in the areas of waste disposal facilities and within their impact on the environment.

Operational environmental monitoring (OEM) is carried out within the framework of industrial environmental control. OEM is a long-term observation of the environmental conditions, its pollution and natural phenomena occurring in it, as well as assessment and forecast of environmental conditions, its pollution in the territories of economic and other entities and within their environmental impact[447].

The main objectives of the OEM:

- regular monitoring of the state and changes in the environment in the area of the location of objects that have a negative impact on the environment;
- forecast of environmental change in the area of objects location;

[445] Resolution of the Government of the Russian Federation of 06.06.2013 N 477 (as amended on 10.07.2014) "On the implementation of state monitoring of the state and pollution of the environment

[446] Order of the Ministry of Natural Resources and Environment of the Russian Federation of February 28, 2018 N 74 "On approval of requirements for the content of the program of industrial environmental monitoring, the procedure and deadlines for submitting a report on the organization and the results of industrial environmental monitoring"

[447] GOST R 56059-2014 Operational environmental monitoring. General provisions

- development of proposals for the reduction and prevention of adverse environmental impacts.

The choice of the object of monitoring and places of observation (sampling points, observation posts) is carried out taking into account:

- background pollution information (if such studies have been carried out);
- the location of sources of adverse environmental impact;
- natural and climatic features of the areas where objects are located.

The OEM program is a part of the IC documentation, developing for a specific period, usually a multiple of one calendar year[448].

The definition of the list of controlled parameters (chemical, physical and biological indicators) is determined depending on the negative impact on the environment.

The structure of OEM, as a rule, includes:

- monitoring of air condition and pollution;
- monitoring of the state and pollution of surface and groundwater;
- monitoring the state and contamination of land and soil;
- monitoring of the state and pollution of the subsoil;
- monitoring the state and pollution of flora and fauna (including biological resources and their habitat).

8.1.3.3. OEM of offshore oil and gas enterprises

Today, the procedure for conducting OEM in the implementation of operations for the extraction of oil and gas at sea is not regulated in Russian legislation. However, there are some industry regulatory and methodological documents containing recommendations for conducting OEM during the production of oil and gas at sea, which are widely used by oil and gas companies in practice in developing monitoring programs. According to RD 153-39-031-98 "Rules for the protection of waters from pollution during drilling in offshore oil and gas fields"[449] an organization that received a license for regional geological study of the continental shelf, searching, exploring and developing mineral resources, organizes environmental monitoring of the marine environment in the area of the proposed drilling program agreed with the territorial environmental authorities. GOST R 53241-2008 “Marine exploration. Requirements for the protection of the marine environment in the exploration and development of oil and gas fields of the continental shelf, territorial sea and coastal zone" defines the requirements for the participation of organizations performing exploration and development of marine hydrocarbon deposits in the local state monitoring of water areas allocated for water use in order to timely detect negative

[448] GOST R 56063-2014 Operational environmental monitoring. Requirements for operational environmental monitoring programs
[449] RD 153-39-031-98 "Rules for the protection of water from pollution during drilling in offshore oil and gas fields"

impacts on water quality and condition of water bodies. Local monitoring includes measurements and sampling outside the offshore installations[450].

Observations of seawater quality should be carried out at observation points, which are divided into three categories[451]:

- *category I control points* are designed to control the quality of marine waters in coastal areas of national economic importance. The points should be located in the areas of water use of the population; in places of spawning, feeding and seasonal accumulations of fish and other marine organisms; in ports and port areas; places of urban, industrial and agricultural wastewater discharge; exploration, mining, development, transportation of minerals; at the mouth of the large rivers.
- *category II control points* are designed to monitor the quality of marine waters in coastal areas and in open sea areas, to study the seasonal and annual variability of pollution of marine waters. Points should be located in areas where the flow of pollutants occurs due to migration processes.
- *category III control points* are designed to monitor the quality of marine waters in the open sea, to study the annual variability of pollution of marine waters and to calculate the balance of chemicals. Items should be located in areas where concentrations of pollutants are usually the lowest.

The choice of a particular category depends on the location and capability of pollution sources, the composition, concentration and forms of pollutants, its physical-geographical and regional characteristics.

At monitoring points, observations are carried out according to the complete and reduced programs, the details of which are given in Table 19.

Table 19. Marine Pollution Observation Programs[452]

Indicators	Program	Controlled parameters
Hydrochemical	Reduced	Petroleum hydrocarbons, mg / dm^3 (mg/l); dissolved oxygen, mg/dm^3 (mg/l) and saturation (%); pH, units pH; visual observations of the state of the surface of the sea water body
	Complete	Reduced Program + chlorinated hydrocarbons, including pesticides, µg/dm^3 (µg/l); heavy metals (mercury, lead, cadmium, copper), µg/dm3 (µg l); phenols, µg/dm3 (µg/ l); synthetic surface-active substances (synthetic surfactants), µg/dm^3 (µg/l); additional ingredients specific to the area; nitrite nitrogen, µg/dm^3 (µg/l); silicon, µg/dm^3 (µg/l)
Hydrobiological	Reduced	Phytoplankton: total cell number, cells/ dm^3 (cell / l) species composition, number and list of species; zooplankton: a total abundance of organisms, number/m^3, species composition, number and list of species; phytoplankton chlorophyll concentration, µg/dm^3 (µg/l)
	Complete	Reduced program + zooplankton: total biomass, mg/m^3; number of significant groups and species, number/m^3; biomass of significant groups and species, mg/m^3; Phytoplankton: total

[450] GOST R 53241-2008 "Marine exploration. Requirements for the protection of the marine environment in the exploration and development of oil and gas fields of the continental shelf, territorial sea and coastal zone"

[451] GOST 17.1.3.08-82 Environmental Protection. Hydrosphere. Sea Water Quality Regulations

[452] GOST 17.1.3.08-82 Environmental Protection. Hydrosphere. Sea Water Quality Regulations

Indicators	Program	Controlled parameters
		biomass, g/m^3; the number of major systematic groups; phytoplankton photosynthesis intensity (primary production), mg C/m^3 * day (MGS /l*day)
Microbiologic	Reduced	The total number of microorganisms, cells/cm^3 (cells/ml); the number of saprophytic bacteria, cells/cm3 cells / ml)
	Complete	Abbreviated program + total biomass of bacteria, mg/dm^3 (mg/l); the number of indicator groups of marine microflora (sapphitic, oil-oxidizing, xylene-oxidizing, phenol-oxidizing, lipolytic bacteria), cells/cm^3 (cells/ml)

The frequency of the observation programs is given in table 20.

Table 20. Frequencies and monitoring programs for pollution of sea waters [453]

Control frequency	Control program for categories		
	I	II	III
Twice a month (I and II decade)	Reduced program	Not applicable	
Once a month (II decade)	Complete program	Not applicable	
5-6 times a year depending on hydrometeorological conditions	Not applicable	Complete program	Not applicable
2-4 times a year depending on hydrometeorological conditions	Not applicable		Complete program

For a correct assessment of the pollution of sea water, it is necessary to take into account the hydrometeorological conditions of the studied area. The program of hydrometeorological observations at sea includes observations of water temperature, its transparency, salinity, waves, currents, air temperature and humidity, atmospheric pressure, wind direction and speed, visibility, precipitation, etc.[454].
The program of studies during the OEM at sea may also include measures for the study of bottom sediments for the content of heavy metals, synthetic surface-active substances (synthetic surfactants), petroleum hydrocarbons and phenols[455].
One of the critical points of the marine environment studies is the observation of marine biota. Research is carried out in order to identify the structure and state of species of living organisms, trends in the number of populations, the characteristics of their distribution and the paths of seasonal migrations, as well as the nature of their use of the territory (water areas). When conducting surveys in the waters of water bodies and inland waterways and within the internal sea waters, the territorial sea and the shelf of the Russian Federation, the characteristics of phytoplankton, zooplankton, microphytobenthos, macrozoobenthos and bacterial plankton are additionally investigated[456].

[453] GOST 17.1.3.08-82 Environmental Protection. Hydrosphere. Sea Water Quality Regulations
[454] SP 11-114-2004 Engineering surveys on the continental shelf for the construction of offshore oil and gas facilities, paragraph 7.4
[455] RD 52.10.556-95 “Guidelines. Determination of pollutants in samples of marine bottom sediments and suspensions"
[456] SP 47.13330.2012 Engineering surveys for construction. The main provisions.

8.1.3.4. Innovations in IC implemented within change for IEP and BAT

Within the implementation of IEP in RF and change for BAT practise, a set of alterations is planned in the existing practise of IC[457]. Starting from 2019, IC program in category I facilities should contain the program on systems of automated control of PS release and discharge[458] or information about available system of automated control implemented in accordance with the legislative requirements[459]. Also, a requirement is implemented concerning equipment with the technical tools to register and transfer information about factors of PS release and discharge negatively impacting the environment to the national registry of objects (hereinafter referred to as the Registry). This Registry represents a state information system collecting and storing information about stationary sources, levels, volumes, or mass of PS releases and discharges, about the disposal of production and consumption wastes[460]. Information in Registry is open to review, except data representing the state or commercial secret.

According to art. 67 of FL No.7 “On Environmental Protection”, time period to implement a system of automated control can not exceed four years from the date of receipt or revision of the IEP. If the program of environmental efficiency increase specifies actions related to reconstruction of stationary sources subject to automated means of measurement and record of PS release and discharge factors, as well as the technical tools to register and transfer of information about the PS release and discharge factors to the Registry, time periods of equipment of such stationary sources are determined considering dates to implement actions of a program on environmental efficiency increase[461].

It is important to note, that presently only general requirement to implement systems of automated monitoring on the facilities of I category are confirmed in RF. But subordinate acts with the requirements to the very programs of automated monitoring, to stationary sources subject to automated control, to automated measurement and record tools, as well as the technical tools to register and transfer information are not confirmed on the legislative level.

For example, *Draft* Order of Government of the Russian Federation "On requirements for automated measurement and record tools of pollutant substances release factors, discharge of pollutant substances, technical tools to register and transfer information about PS release factors, PS discharge negatively impacting the

[457] FZ "On alterations in Federal Law on environmental protection and some legislative acts of the Russian Federation" dd. 21.07.2014 N 219-FZ
[458] FZ dd. July 29, 2018 N 252-FZ "On alterations in Federal law "On Environment Protection" and articles 1 and 5 of Federal Law "On alterations in Federal Law "On Environment Protection" and some legislative acts of the Russian Federation" concerning systems for automated control of pollutant substancies releases, pollutant substancies discharges"
[459] Federal Law dated January 10, 2002 N 7-FZ "On Environment Protection"article 67
[460] Federal Law dated January 10, 2002 N 7-FZ "On Environment Protection"see art. 69 for complete list of information
[461] FZ No. 7 "On Environmental Protection"

environment to the State registry of objects"[462] was submitted on September 6, 2018, and presently is in the process of modification.

According to this draft, *automated measurement and record tools of PS release factors* shall ensure measurement and record the following factors related to the standard conditions of:

- pollutant substance concentration, mg/dm^3;
- exhaust gases factors necessary to calculate mass and (or) volume of PS releases, including:
    - flow rate of exhaust gases, m/s;
    - pressure of exhaust gases in measured plane, kPa;
    - temperature of exhaust gases, ºC;
    - oxygen content in the exhaust gases, % (if the techniques of release mass and (or) volume calculation require that);
    - humidity of exhaust gases, % (if the techniques of release mass and (or) volume calculation requires that).

Automated tools of measurement and record of PS factors shall provide measurement and record of the following factors:

- concentration of pollutant substances, mg/dm^3, including chemical and (or) biological consumption of oxygen;
- factors characterising volume and quality of effluents, including:
    - volumetric flow rate, m^3/h;
    - temperature of discharged effluents, ºC;
    - pH factor of discharged effluents.

Technical tools to register and transfer information about the PS release and discharge factors to the Registry shall ensure:

- acceptance of information from automated measurement and record tools of PS release and discharge factors;
- transfer information about PS release and discharge factors to Registry as an average for 20–30 minutes;
- preservation of the transferred information about the PS release and discharge factors indicating the time and date of the stop and resumption of operation of automated measurement and record tools of PS release and discharge factors, in case of shutdown of specified automated tools;
- identification and authorization of production facilities and every certain source of release and discharge in Registry.

[462] Draft Order of Government of the Russian Federation "On requirements to automated measurement and record tools of pollutant substances release factors, discharge of pollutant substances, technical tools to register and transfer information about PS release factors, PS discharge negatively impacting the environment to the State registry of objects" (prepared by Ministry of Industry and Trade of Russia on 06.09.2018, and is not a normative legal act)

8.1.3.5. Directory ITD BAT Directory for IC

In order to apply the best practices, approaches and methods in IC fulfillment at companies of I categories, an interindustrial “horizontal” ITD BAT "General principles of production environmental control and its meteorological support" was developed in 2016[463]. This ITD BAT was developed on the basis of European directory on monitoring of PS release and discharge from sources governed by the Directive on industrial emissions[464] and includes the following key BATs:

- exercising of risk-oriented approach where control of parameters which could highly probably go beyond the limits of set values and/or lead to severe consequences are in the prime focus;
- IC program development based on assessment results on feasibility to take direct or indirect measurement, such as:
    - material balance completion;
    - calculation method application;
    - emission ratio using (specific release and discharge of PS);
- meeting the requirements for automated measurement and record tools for volume and mass of PS emissions, as well as the technical tools to transfer information to state system of environmental monitoring and others.

It is important to note, that ITD BAT legal status is not validated and currently the above BAT serve as guidelines. The developed recommendations can be applied in the development of BAT industrial guidelines or in the formation of normative requirements in IC arrangement and execution.

Fields to apply recommendations from BAT directory are limited by standard operating conditions of companies. Actions in emergency cases should be regulated by documents in the field of industrial safety and executed by representatives of the Ministry of Emergency Situations of the Russian Federation.

8.1.3.6. Quality assurance and integrity of IC results

The report on the arrangement and results of production environmental controls is provided to legal entities and entrepreneurs, who carry out commercial and (or) other activities at facilities of I, II and III categories, annually until March 25 of the year following the reporting year.

Responsibility for concealing, deliberate distortion or untimely provision of full and reliable information about conditions of the environment and natural resources, about sources of environment pollution or other hazard sources for the environment or natural resources, radiation situation of data obtained in the process of production environmental control as per art. 8.5, AOC RF results in recovery of an

[463] General principles of production environmental control and its metrological support
[464] JRC Reference Report on Monitoring of Emissions to Air and Water from IED Installations

administrative fine in the amount from 500 to 1000 rubles (10–17 US dollars) for individuals; from 3000 to 6000 roubles (51–100 US dollars) for officials; from 20,000 to 80,000 rubles (345–1370 US dollars)[465].

8.2. European countries

8.2.1. State environmental control (SEC)

Minimum requirements for state environmental control in EU countries are determined in Recommendations of European Parliament 2001/331/EC (*Recommendation provides for minimum criteria for environmental inspections in the Member States*)[466]. The purpose of these recommendations is to ensure a unified approach in organizing, conducting and issuing final reports of environmental audits, as well as distribution of necessary information for state bodies and the general public[467]. The main goal of the SEC is inspection of regulated facilities for their compliance with the requirements of European environmental legislation.

The minimum criteria for the above recommendations apply only to those companies, whose PS releases and discharges, as well as waste management, are regulated by environmental permits[468].

8.2.1.1. Forms of state environmental control

The SEC can be completed in the form of planned or unscheduled inspections, including direct visits to facilities. In the process of implementing SEC, the following can be checked:

- audit reports, in particular, of audits carried out in the framework of the unified System of eco-management and audit (EMAS);
- IC reports;
- the territory and production facilities, as well as the quality of the environmental management system at the facility;
- other necessary documentation of plant operators.

Scheduled audits are carried out according to the inspection programs:

- to check compliance with the requirements of European legislation;
- to increase awareness and understanding of environmental requirements and practices among regulated operators;
- to assess the risks of negative impact on the environment, as well as define whether conditions and requirements of permits require modifications.

[465] "Administrative Offences Code of the Russian Federation"
[466] Recommendation of European Parliament and Council of 4 April 2001
[467] The document serves as guidelines
[468] If other national requirements are not established by EU member country

Unscheduled audits are arranged in the following situations[469]:

- public claims;
- environmental accidents, incidents and serious violations of environmental legislation;
- if necessary, during the review of project documentation submitted for issuing an environmental permit or after permit has been issued, but before the production activities begin;
- if necessary, unscheduled audits can take place before the procedure for updating or modifying the conditions of environmental permits.

The Industrial Emissions Directive also defines similar conditions and requirements for conducting state inspections at regulated facilities[470]. Art. 23, sec.4 specifies the requirements for the intervals of state inspections which are based on the results of environmental risk assessment. Thus, facilities with a potentially high risk of pollution should be inspected at least once a year, while facilities with minimum risk – once every 3 years. In UK and Germany (Hessen region) inspection intervals depends on the level of compliance with environmental requirements. Frequenycy of inspection can be increased if a operator violates the requirements of environmental legislation on a regular basis[471]. If competent body detected violation of environmental permit conditions, then within 6 months after such violation has been detected an additional inspection of the facility should be carried out.

In addition to the Industrial Emissions Directive, other european legislative acts set requirements on SEC arrangement[472]. The Landfill Directive, for example, notes that a form of state control is regular visits to waste accumulation or storage facilities in accordance with an approved inspection plan. These plans are developed by authorised bodies considering assessment results of risks of potential pollution, the results of previous inspections, the presence of environmental violations, as well as comments and proposals from NGOs and interested general public[473]. State inspection must also be held before the start of a landfill operation[474] and up to its shutdown[475]. Unscheduled inspections can be held in case of complaints about the activities of landfill operators [476].

It should be noted that European legislation does not determine requirements for the "unexpected" visits of facilities. In Norway, for example, the authorised body must inform the management of the regulated company about the inspection, even if it is unscheduled. In Great Britain, there is an inspections which can be conducted at the discretion of Agency on environmental protection regulating activities of onshore

469 Recommendation of European Parliament and Council of 4 April 2001
470 The Industrial Emissions Directive
471 http://ec.europa.eu/environment/waste/framework/pdf/Guidance%20on%20permitting%20and%20inspection.pdf
472 Council Directive 1999/31/EC
473 GUIDANCE on permitting and inspection of waste management operations
474 Article 8 of Council Directive 1999/31/EC
475 Article 11 of Council Directive 1999/31/EC
476 GUIDANCE on permitting and inspection of waste management operations

production facilities. Thus, inspections can be carried out "without warning" (unannounced)[477] during which the inspector can visit the regulated facility, hold an interview with personnel and request the documentation required for the inspection.

8.2.1.2. Functions, rights and obligations of the state bodies

The recommendations of European Parliament 2001/331/EC define the obligations of the authorised bodies to carry out inspections in case of environmental accidents, incidents and serious violations of the legislation requirements. After information about such accidents and incidents has been received, inspectors:

- to investigate causes of accidents and incidents, to determine responsible individuals and probable environmental consequences of those accidents and incidents; to submit their conclusions to the authorised body[478];
- to prevent or minimize negative impacts of the consequences of accidents or incidents; to define the list of measures required for implementation;
- to establish measures necessary for execution in order to prevent subsequent accidents and incidents;
- to establish measures on enforcement of the law, if necessary;
- to follow up that measures are executed.

According to Directive 2003/4/EC, the authorities must to publish the results of all inspections with information about compliance / non-compliance of activities of operators[479].

8.2.1.3. Enforcement actions

The enforcement actions depend on the severity of violation of the legislation and a facility where such violation has occurred. For example, if non-compliance is due to a violation of legislation in waste management, then enforcement actions can be[480]:

- administrative notice including measures to clean up land, improve technological processes, means of transportation, and etc.;
- modification of conditions of environmental permit including the determination of stricter requirements;
- revocation of environmental permit;
- penalties;
- procedural measures.

The order of enforcement actions assumes priority of less strict administrative measures, then criminal punishment measures.

477 Environmental protection inspection
478 if the same state body does not employ such functions,
479 Directive 2003/4/EC
480 GUIDANCE on permitting and inspection of waste management operations

8.2.1.4. Participation of general public

Direct participation of the general public in environmental inspections and in other actions on environmental control is not stipulated in EU legislation. Public or self-regulating organisations, however, have the right to request information about status of execution of environmental legislation requirements, as well as put in question decisions and improvement notices of state bodies responsible for environmental control. In UK, for example, citizens have the right to file a lawsuit through practice of *judicial review*, if they consider, that the decision of an authorised body was illegal, or the punishment imposed on violators was not severe enough[481].

Individuals and non-governmental organisations also have the right to inform state bodies about violation of environmental legislation and to require inspections by authorised bodies[482].

8.2.2. Industrial environmental control

8.2.2.1. Types and organisation procedure of Industrial Environmental Control

Directive 2010/75/EU on industrial emissions is a legal basis for IC, which specify requirements on the arrangement of emissions monitoring on regulated production facilities. Thus, all companies – IEP obtaining parties shall conduct IC and provide competent authorities with information about the methodology used, measurement intervals and procedures[483].

Emission monitoring

The monitoring of emissions to air and water in the EU represents an important element in preventing and reducing pollution from industrial installations and in ensuring a high level of protection of the environment taken as a whole.. Emission monitoring is a systematic surveillance of the variations of a certain chemical or physical characteristic of an emission.. Monitoring is based on repeated with definite interval measurements and observations in accordance with approved procedures to obtain the necessary information about emissions. Emission monitoring can be carried out both by a direct method (instrument measurements) and by indirect method (calculation techniques).

Emission monitoring with direct method includes 3 types of measurements:

- *continuous measurements* – fulfilled using integrated, automated measuring systems (*AMS*), which collect data on a continuing basis;
- *periodic measurements* – assume separate instrument measurements at certain intervals;

[481] Grounds for Judicial Review
[482] Environmental Law in the UK, Clifford Chance
[483] Article 14 Directive 2010/75/EU

- *campaign measurements*– applied if additional parameters and characteristics of emissions unavailable in regular measurements are needed.

Table 21 provides an overview of important characteristics of continuous and periodic measurements, including advantages and disadvantages.

Table 21. Comparison of continuous and periodic measurements[484]

Characteristic	Continuous measurement	Periodic measurement
Sampling period	Measurement covers all or most of the time during which substances are emitted	Snapshots of the long-term emission pattern
Speed	Almost always real-time results	Real-time results if instrumental analysers are used; delayed results if a manual method with a laboratory endmethod is used
Averaging of results	Results continuously gathered and can be averaged over a given period, e.g. 30 minutes, 1 hour or 24 hours	Results over the sampling period, typically 30 minutes to several hours
Calibration and traceability	Automated measuring systems (AMS) require calibration according to SRM[485] (*standard reference method*) and adjustment with certified reference materials in the maintenance interval	Standard reference methods can be used for periodic measurements; these can be manual or automated methods
Accreditation	AMS calibration and maintenance quality must be confirmed according to EN 14181:2014, EN ISO/IEC 17025:2017	Confirmation of periodic measurement quality according to EN ISO/IEC 17025:2017
Equipment certification	Equipment certification is available	Certification of portable equipment is available
Installation and maintenance costs	Normally higher than the costs of periodic measurements,	Normally lower than the costs of AMS

When selecting a particular measurement type, factors such as local conditions (background pollution, risks of exceedance of emission limit values and quality standards of the environment), pan-European and national legislation requirements, technological availability, economic feasibility, qualified personnel for correct interpretation of the results obtained, and etc. must be considered.

The Industrial Emissions Directive specifies the mandatory requirements on arrangement of automated monitoring of sulfur oxides, nitrogen oxides and dust in releases from large incinerators with nominal thermal power higher than 100 MW[486]. For large waste incinerators, in addition to the above-mentioned pollutant

[484] JRC Reference Report on Monitoring
[485] An alternative method (AM) can be used for calibration where the equivalence has been demonstrated in accordance with EN 14793:2017
[486] EID, Annex V, Part 3

substances, continuous measurements are taken for carbon oxide, total content of organic carbon, hydrogen chloride and hydrogen fluoride[487]. In addition to the concentration of certain pollutant substances in the flue gases during theautomated monitoring process, technological parameters such as temperature, pressure, oxygen and steam vapor content in exhaust gases are also subject to control. At the same time, Directive specifies the conditions under which automated monitoring can be replaced by instrumental periodic measurements[488].

In some EU countries, special criteria are established according to which continuous IC becomes mandatory. For example, in Germany, automated monitoring of pollutant substance releases to the atmosphere becomes mandatory, if threshold value of mass flow in all sources of a plant is exceeded. Continuous measurements shall be measured only at sources, which emissions constitute over 20 per cent of the entire mass flow of the installation. The requirement of continuous monitoring of a source shall be waived if it emits for less than 500 hours in any one year or is less than 10 % of the annual emission of the installation.[489]

Table 22. Limit values of mass flow[490] for continuous IC

Pollutant substance	**Limit value, kg/h of mass flow**
Dust (a device for qualitative parameters)	From 1 to 3
Dust (a device for quantitative parameters*)	More than 3
Sulphur dioxide	30
Nitrogen oxide and nitrogen dioxide (per nitrogen dioxide)	30
Carbon monoxide as a factor of burning process efficiency	5
Carbon monoxide in all other cases	100
Fluorine and gaseous inorganic fuorine compounds (acc. to HP)	0.3
Gaseous inorganic chloride compounds (acc. to HC1)	1.5
Chlorides	0.3
Hydrogen sulphide	0.3
Total carbon content: - organic compounds** of class I	1.0
- other organic compounds	2.5
Mercury and its compounds***	0.0025

Notes:
** Other mass flow are defined for certain dust-like matters (TA-luft, sections 5.3.3.2, 5.2.2, 5.2.5, class I and 5.2.7)*
***According to section 5.2.5 TA-luft*
**** Measurement can be abandoned, if reliable proof that mass concentration taking less than 20 % of limit value is used can be provided.*

In coordination with the competent authority, continuous IC can be abandoned when compliance with emission standards can be confirmed by measurement of other parameters that demonstrate the effeciency of exhaust gases purification (for

[487] EID, Annex VI, Part 6
[488] EID, Annex V, Part 3, p.2
[489] Technical Instructions on Air Quality Control – TA Luft, 5.3.3.1
[490] Limit value of mass flow concerns the whole plant; a criterium of 20 % of total mass flow is valid for a separate source.

example, temperature control in the combustion chamber of a plant for thermal burning instead of measuring pollutant concentrations in exhaust gases).

In UK, the decision on necessity for continuous measurements at sources is made based on assessment results of exceedance risk of emission limit values. In assessment such risks, the following factors are considered[491]:

- size and type of a plant;
- quantity of sources which provide maximum contribution to the total emission volume of a plant;
- complicity of process which can increase the number of potential faults;
- output of purification equipment;
- proximity of the source to sensitive receptors of the environment, and etc.

As European practice shows, sources which must be equipped with automated measurement tools of continuous operation and which parameters must be measured are determined within a conclusion on IEP issuance by a competent authority.

In EU, the method of continuous measurements together with the assessment of pollutants release to the ambient air is also widely applied to determine the concentrations of pollutants in discharges of *industrial companies*. Measurements are carried out directly in the *effluent flow*. The main parameter that is almost always established in the course of continuous measurements is the volumetric flow rate of effluents. Additionally, in the process of automated monitoring, the following parameters can be established in effluent flows[492]:

- pH, dissolved oxygen and electric conductivity;
- ammonia nitrates and compounds;
- metals;
- phosphates, total phosphorus and iron;
- total oxygen consumption;
- opacity.

Selection of continuous monitoring of discharges depends on[493]:

- necessity to control highly variable and/or extreme discharge of effluents;
- parameter instability during sampling process, transportation and storage (for example, volatile compounds);
- the expected environmental impact of effluent discharge, local conditions into account;
- the need to monitor and control the performance of the waste water treatment plant and, possibly, to promptly react according to the generated data; ;

[491] IMPEL, Best practice in compliance monitoring
[492] JRC Reference Report on Monitoring, 5.3.4
[493] JRC Reference Report on Monitoring, 5.3.3

- the availability and reliability of measurement equipment, depending on the industrial sector and on the waste water discharge;
- the specific requirements of industrial sector and/or a plant;
- costs for continuous measurements (economic feasibility).

According to art. 14 (f) of the Industrial Emissions Directive, one of the conditions for issuing an environmental permit is measures, undertaken to ensure a safe level of impact on the environment and residents in different operating conditions. Therefore, in the process of IC, a plant operator, in addition to monitoring emissions during normal operation, must control emissions, which can occur in abnormal situations (leakages, faults, shutdown of equipment, accidents)[494]. All measurements taken in these abnormal situations should not be considered in average results of monitoring.

In Germany, 12th Ordinance "On Emergency Situations" [495]to the ederal Immission Control Act regulates the obligations of companies to equip plants with reliable measuring tools, as measures to prevent probable incidents and accidents. Monitoring of emissions in case of possible emergencies is carried out by plant operators within the framework of the industrial safety management system and in accordance with the Safety Plan. In addition to operation parameters, safety plan includes a list and description of characteristics of hazardous substances, which can release to the environment in accidents and incidents, an assessment of the risks of emergency situations, as well as planned measures on prevention and mitigation of negative consequences[496].

In case of emergency situations, the plant operators should immediately inform the competent authority and within 2 weeks and according to the validated form provide detailed information about an event, substances released to the environment, assessment of the damage caused, measures taken to contain negative impact on the environment, and etc..[497]

Impact monitoring

Plant operators are required to monitor the conditions of environmental media that are exposed as a result of production activities.

Monitoring of the ambient air includes the determination of both background concentrations (*existing load*) and concentrations reflecting the contribution of the company to total pollution (*additional load*). Amount of existing and additional loads represents total value of impact of a pollutant substance on a component of the environment (*total load*). Value of "impact" concentration - *immission value* is determined at *assessment points* for each relevant pollutant and is compared with

[494] EID, Article 14 (f)
[495]Störfall-Verordnung - 12. BImSchV
[496] Störfall-Verordnung - 12. BImSchV, Anhang 2
[497] Störfall-Verordnung - 12. BImSchV, Anhang 6

the specified value of the environmental quality standard as a confirmation of compliance with permit conditions. Assessment points are agreed by the competent authority in the process of application review for environmental permit.

All measurements during the impact monitoring should be taken in accordance with the approved monitoring plan, defining all monitoring points, goals, monitoring period, methods used, frequency and duration of measurements, considering local meteorological factors.

As a rule, immissions shall be measured at a height of 1.5 to 4 metres above ground and at a lateral distance of 1.5 metres from buildings.. Usually, measurement periods shall stretch over 1 yearA measurement period may be reduced up to a total duration of 6 months if this is to cover the season with the most immissions to be expected. Though, continuous measurement method is preferred as it ensures more accurate results. [498]

Values of *existing load* of pollutants in the ambient air are calculated on the basis of hourly average values of measurements obtained as a result of continuous or periodic monitoring.

The operator with the consent of competent authority may not conduct measurements of background concentrations if state environmental monitoring data is available..

Impact monitoring of oil and gas productions on sea

In Norway, operators of offshore oil and gas extraction plants are required to conduct *monitoring of the water column* and *benthic habitat*[499].

Water column monitoring includes *condition monitoring* and *impact monitoring.*

The goal of condition monitoring is to determine degree of fish exposure to pollution caused by oil and gas activities at sea. Measurements must be taken every 3 years. The scontrolled parameters are the content of hydrocarbons and certain biomarkers in fish.[500] Water column monitoring must be conducted in autumn (preferably in October) and should not cover the period of spawning of fish.[501]

The objects of study in the course of monitoring exposure are fishes and mollusca. Impact monitoring assumes assessment of effluent impact on certain marine organisms (as a rule, blue mollusca *Mytilus edulis*), which are placed in special cages installed in the direction of effluents. The location of such points of study is based on the modelling of effluent dispersion. And in order to obtain more reliable data about dispersion (dilution) pattern of effluents in sea waters it is reasonable to place

[498] Technical Instructions on Air Quality Control – TA Luft, 4.6.2.7
[499] Activities Regulations for the oil and gas industry, sec.52
[500] Miljøovervåking av petroleumsvirksomheten til havs
[501] Miljøovervåking av petroleumsvirksomheten til havs, 3.1

monitoring stations in all directions from the discharge point. Impact monitoring should be carried out at least once for each region. It should be noted that necessity to conduct baseline studies in monitoring the water column is not regulated in the Norway legislation.

Benthic habitat monitoring includes: [502]

- *baseline surveys* carried out prior to exploring,drilling works and oil and gas extraction on the sea;
- production and regional monitoring programs, which surveillance is started after production facilities have been put into operation. And production monitoring (*field-specific*) carried out by plant operators is done together with state (regional) monitoring.

Studies of initial state are carried out at least on 3 monitoring stations, which, after the field exploitation has been started, will become a part of regional monitoring network . Survey results of initial state are valid during the 6 years from the time they have been conducted.[503]

Aim of regional monitoring stations is to obtain information about *background levels* of the investigated area for controlled parameters of a zone studied, and they serve as reference stations showing normal (natural) condition of the environment. While production stations assess condition of the environment in the immediate proximity to production facilities in every region. The parameters studied are hydrocarbons (THC, NPS, PAHs), metals (Ba, Cd, Cr, Cu, Pb, Zn, Hg), radioactive elements of natural origin (Ra-226, Ra-228, Th-228) and the composition of marine fauna. Benthic habitat monitoring, in addition to assessment of spacial impact of oil and gas activities on marine ecosystems, must include sampling of seabed deposits. Production monitoring stations should be located in such a way that the obtained data made it possible to determine the extent of impact of discharges from oil and gas activities on representatives of benthic marine habitat. The stations, as a rule, are located on the cross-line of circles at increasing distances from point of effluent discharge, and they comprise 250 m, 500 m, 1000 m, 2000 m, and etc. correspondingly. Production monitoring must be conducted every 3 years. When field exploitation is completed, 2 additional studies are required during the following 3 year periods.[504]

8.2.2.2. Handling transparency items and access to industrial environmental control results

Results of emission monitoring are calculated and indicated as half-hour average value. For the average half-hour values which are used in calculation of daily average values being instrumental from the point of view of control. In case of

[502] Miljøovervåking av petroleumsvirksomheten til havs, 1.5.2
[503] Miljøovervåking av petroleumsvirksomheten til havs, 4.2.1
[504] Miljøovervåking av petroleumsvirksomheten til havs, 4.3.1

exceeding the established emission limits, the operator must immediately inform a competent authority .

Operators must inform the competent authority about the IC results, which must be available for audits and must be maintained for 5 years. The monitoring results are provided in the form of *emission declaration.*[505] The declaration must include the information on the type, volume, methods of emission assessment, characteristics of sources, and etc. The declaration on emissions is forwarded to the competent authority every 4 years.[506]

In some parts of Germany, the measurement results of mass flow concentrations and operational parameters of installations are provided to the administration of a district by remote emission monitoring system. If the operator has implemented a remote emission monitoring system, the submission of the emission declaration is not required.. Thus, in North Rhine Westfalia, the remote transmission of emission monitoring datais employed from 1990 within additional Regulation on remote release monitoring (*RDM - EFÜ*).[507] Remote transmission system for data monitoring allows continuous measurements of pollutant concentrations in fume gases and transfer them online to a competent authority. In this case, the measured concentrations of pollutants in the process of continuous emission monitoring are processed, averaged and verified before transmission to the competent authority for comparison with established emission limit values.s[508].

There are three ways to transfer data[509]:

1) periodic data transmission, when information is provided on a daily basis (for preceding day);
2) automatically if threshold values have been exceeded (with comments, if necessary);
3) upon request from a controlling body.

As European monitoring practice shows, the main advantages of RDM are the following:

- prompt transfer of information to controlling bodies and immediate detection of discharge pattern in significant industrial facilities;
- fast assessment of measurement results and immediate implementation of correcting actions;
- simplified annual assessment of emissions by a plant operator.

[505] Federal Immission Control Act - BImSchG, sec. 27
[506] 11th BImSchV
[507] EFÜ
[508] Bundeseinheitliche Praxis bei der Überwachung der Emissionen
[509] EFÜ

8.2.2.3. Quality assurance and integrity of industrial environmental control results

In order to confirm quality and accuracy of IC results, plant operators shall ensure that measuring tools used meet EU technical standards (EN standards), including requirements for certification, calibration, and functional test of continuous measurements equipment by specialized certified organizations. Obligations to conduct emission monitoring in accordance with EN standards are validated in the IED and BREF conclusions. Moreover, each EU member country shall adopt EN standards with the national standartization system.

There are three level of quality in EU countries, which include conformance assessment and certification of an automated measuring device (QAL1), inspection of that device after installation (QAL2) and control in the process of operation on the production equipment (QAL3). Time period for annual operational test is established (AST).[510]

For continuous emission control in Europe, only inspected and certified devices of pattern discharge measurements for compliance with EN 15267[511] are allowed to use.

To ensure reliability and comparability of measurement results, certain requirements must be followed. EN 15259 Standard[512] establishes minimum requirements to points and areas of measurements with automated monitoring devices. After measuring equipment has been installed, calibration must be completed and data about instability (QAL2) must be obtained in accordance with EN 14181.[513] After successful functional inspection with independent standard reference method (SRM), minimum 15 comparative measurements are taken, which take about 30 min, and they must be distributed evenly during three days. Calibration is done every 5 years, as a rule, and after significant modification of the process equipment or its operation.[514]

Certification (QAL1), calibration (QAL2) and functional inspection (AST) must be conduct by a certified organisation in compliance with ISO 17025. National centers on certification control activities of such organisations and examine employee competences and instrumentation.

Standards applied in EU to ensure quality of continuous measurements of pollutant releases and discharges to the environment are listed in Appendix 3.

In Great Britain, a monitoring assessment system OMA (*Operator Monitoring Assessment*) system has been set up to test the quality and reliability of the IC

[510] JRC Reference Report on Monitoring, 4.3.2.2
[511] Air quality—Certification of automated measuring systems
[512] Air quality - Measurement of stationary source emissions
[513] Stationary source emissions - Quality assurance of automated measuring systems
[514] JRC Reference Report on Monitoring, 4.3.2.2.2

conducted at facilities subject to environmental permits.[515]. The equirements of this assessment system apply to the production monitoring systems of emissions anddischarges of pollutants in the environment. Furthermore, the procedures and results of the IC are checked, carried out not only by the operator of the regulated activity, but also by the involved contracting organizations. In addition to the IC quality assessment, the recommendations to improve the IC process can be developed and the environmental permit conditions for monitoring should be revised.

OMA procedure includes 4 key aspects[516]:

- *management of monitoring system inspection* studying documentation of the management system, reports, organisation structure and duty instructions of individuals responsible for IC, monitoring plan, knowledge of environmental permission requirements and methods of monitoring, and etc.;
- *periodic monitoring system (periodic monitoring and test laboratories) inspection* including assessment of sampling methods used, equipment inspection, sample storage and transportation procedure and etc.;
- *automated monitoring system (continuous monitoring) inspection* including assessment of online representation of monitoring results, calibration methods for equipment, equipment reliability inspection, and etc.;
- *quality audit (quality assurance)* including available special certificates to conduct and analyse IC results, internal quality control, personnel competency, and etc.

In the process of OMA, the competent authority applies a confirmed system of scores (*scoring card*), based on which a level of "*development*" of the every above aspect is determined. The overall result will affect the frequency of inspections within the OMA[517]. The low quality level of the IC and obvious violations of the environmental permit requirements can also lead to a decrease in the compliance scores (*compliance band*) according to the *Compliance Classification Scheme*[518]. As a result, [519]high administrative charges for the environmental permits[520] can be applied to violators in addition to measures within the environmental permit legislation.

[515] Guidance on undertaking an Operator Monitoring Assessment
[516] Guidance on undertaking an Operator Monitoring Assessment, Discharges to water; Guidance on undertaking an Operator Monitoring Assessment, Emissions to air
[517] It is carried out once in 4 years, however, frequency of inspections can be increased
[518] Compliance rating guidance: environmental permits; Guidance on undertaking an Operator Monitoring Assessment, Emissions to air
[519] The Environmental Permitting (England and Wales) Regulations 2016, Chapter 4
520 Tables of Charges The Environment Agency (Environmental Permitting) (England) Charging Scheme 2018

8.3. Brazil

8.3.1. State environmental control

State environmental control (*Environmental inspection*) represents natural resources regulation required by the federal legislation of Brazil in order to control activities of facilities using natural resources and being potential polluters of the environment[521].

Authorised bodies in the environmental control are federal, state and municipal bodies on the environmental protection.

State environmental control has following types[522]:

- environmental control of pollution including development of actions related to air, water, and soil pollution, as well as to emission of solid wastes;
- environmental control of commercial or other activities requiring environmental permits. The purpose of this environmental control is to check compliance of the carried out activities with conditions of the environmental permits;
- environmental control with the aim of monitoring of the environment, local flora and fauna.

State environmental control has the following forms:

- automated control including installation of monitoring stations at a control site or mobile stations used for temporary studies;
- inspections, which include sampling for studying in central laboratories of states.

Necessity for inspections is established in the course of activity of licencing. In case if inspections are necessary, authorised bodies determine dates and send a notification to a facility. Also, *unscheduled* inspections can be conducted in case of public claims.

Legislation of Brazil does not establish mandatory requirements on control and monitoring automation. Automated monitoring is only recommended for production environmental control, baseline environmental studies on the ambient air and water.

8.3.1.1. Enforcement measures to violators

State environmental control is carried out to prevent environmental damage, punish violators and prevent further environmental violations by means of penalties, embargo and bans for activities.[523]

[521] FZ 6938
[522] Official website of IBAMA
[523] Law 9605

According to the law regulating criminal and administrative environmental violations in Brazil[524], a violator receives a warning, after which he take measures within time prescribed by an authorised body. If a violator does not take measures within the prescribed time, he pays administrative penalty established by a competent body.

In case of creating obstacles for the state inspectors to perform their duties, law envisages measures of enforcement as a penalty or imprisonment up to three years.

8.3.1.2. Participation of general public in the environmental control

Non-governmental organisations performing environmental protection activities may take part in the environmental control on the territories of environmental reserves, state or private environmental protection zones, territories corresponding to environmental interests, and on other units of protected regions[525][526].

Furthermore, every citizen may provide information to authorised state bodies about violations in the form of claim and require measures to be taken in relation to a source of environmental damage.

Non-governmental organisations have a right to take part in environmental control of specifically protected natural areas (SPNA). In order to take part in such control of SPNA, non-governmental organisations are required to establish Environmental association. Association shall comprise at least three individuals certified by an authorised body. Members of the association must be trained in technical, legal, and administrative aspects regarding environmental control. In the course of inspections as a part of public inspectional group, in order to ensure security, at least one state representative of law enforcement bodies shall be present, otherwise, minimum number of members shall be increased to five people. If violations of the legislation on environmental resources protection have been discovered, the association records a violation and informs authorised bodies on the federal and local levels[527].

8.3.2. Production environmental control and monitoring

Requirements for mandatory production environmental control on the territory of Brazil apply to all kinds of activities resulting in emission into the environment. In particular, for each component of the environment, parameters controlled in the production environmental control are defined by authorised bodies in the environmental protection based on categories of facilities subject to regulation[528].

Production environmental control includes:

- monitoring of PS releases to the environment;

[524] Law 9605
[525] see report on Stage 1, sec. 3.5
[526] CONAMA Resolution 3\1988, p 80
[527] CONAMA 3\1988 (p. 80)
[528] see section Rationing

- monitoring of PS discharges;
- monitoring of soil and underground waters.

8.3.2.1. Monitoring of emissions into the ambient air

State and private companies carrying out activities representing potential sources of air pollution must conduct production environmental control with mechanisms which allow to prevent, minimize and control emissions.

Monitoring of emissions into the ambient air can be conducted using continuous or periodic measurements in accordance with requirements established by authorised body on the environmental protection and observing the following criteria: [529]

- *periodic monitoring* of atmospheric emissions must be conducted under certain operating conditions for each source of pollution.

In periodic monitoring:

  - air samples must be representative and correspond to normal working rates of the plants (samples are taken in chimneys);
  - emission limits are met, if arithmetic average of results of three continuous measurements taken in one period corresponds to standards, and one result can be discarded if it falls out of a standard.

- *continuous monitoring* implies available automated monitoring system at points of pollutant release.

Continuous monitoring is used to check whether limit release values are met, and if they are fulfilled in accordance with the following conditions:

  - monitoring is considered continuous if a source of pollution is controlled at least during 67% of its operating time during one year;
  - daily average norm will be accepted as actual, if monitoring was done at least during 75% of a working day;
  - data collected in such situations as shutdowns and starts, chimney cleaning, tests of new burning and main resources, will not be accepted for assessment, on condition that they do not exceed 2% of the time controlled during a full day (24 hours). Higher percents (than 2 %) may be accepted for special processes requiring prolonged shutdown and start periods, on condition that they have been approved by a licencing body.

In considering constant monitoring, the following aspects are taken into account:

- significance of source releases for air quality in a region;
- changeability of source releases;
- available equipment for monitoring with reliable technologies available at the market for pollutant analysis.

Measurement results obtained in continuous and periodic methods shall be represented in a report with intervals determined by an authorised licencing body,

[529] CONAMA Resolution 382\2006 p 398

and must specify all results of measurements, sampling and analysis methods, identification of release source and typical operating conditions during a period analysed (raw material supply, production, nominal thermal power, fuel type, consumed energy, temperature and pressure), results and conclusions. [530]

Pollutant sampling must represent structure and/or direct determination of pollutant substances in air channels and chimneys in accordance with standardized methodologies accepted by an authorised licencing body, under conditions of normal operation.

Legislation does not establish rules regarding obligations for companies on air quality monitoring around/beyond their territory. However, obligation to install stations for air quality monitoring around territory of a company is regulated by an authorised body of environmental licencing.

Period of monitoring averaging point beyond the territory of a company for any pollutant shall be based on type of pollutant, location of polluting source, proximity to residential area and air quality in a region.[531]

8.3.2.2. Water monitoring

Monitoring of surface waters on land

Production environmental control of effluent release is conducted with periodic measurements:

- rational selection of sampling points, sampling time and storage, deadline to send them to laboratories, observance of validity period for checking every parameter;
- confirmation that sampling schedule has been provided to relevant laboratories.

CETESB Directory on water sampling[532] specifies guidelines on sample selection, which includes representativeness of sampling, sample preparation, etc. However, precise designation of sampling points is established by a company itself followed by an approval of a competent body.

A competent environmental body determines criteria and procedures to conduct and inspect IC related to discharge analysis and for water quality assessment of accepting water body. Sources with low polluting potential may be relieved from IC as decided by a competent environmental body.

Facility responsible for water source pollution shall annually provide *Pollution Charge Statement* to a relevant competent environmental body until March 31, and must include data for preceding year. Statement shall contain quantitative and

[530] CONAMA Resolution 436\2011 p.424
[531] CETESB Technical decision № 10-P-2010
[532] CETESB. National Guide of Sampling Collection and Preservation/2012

qualitative characteristics of effluents based on representative samples. Competent environmental body may determine additional criteria and information, which must be included in the Statement, and can relieve a facility from its presentation if that facility has low level of pollution. Reports, assessments, and studies on based on which the Statement on pollution has been drawn up must be archived by a company and be available for bodies of environmental inspection. [533]

Water monitoring on offshore facilities

Operators of offshore production facilities must conduct monitoring of production waters every six months. Parameters used for measurements include:[534]

- inorganic compounds: arsenic, barium, cadmium, chrome, copper, iron, mercury, manganese, nickel, lead, vanadium, zink;
- radium isotopes: radium-226 and radium-228;
- organic compounds: polycyclic aromatic hydrocarbons, benzene, toluene, ethylbenzene and acids, phenols and estimation of general petroleum hydrocarbons;
- toxicity of production water determined using eco-toxicological standartized methods engaging marine organisms;
- total quantity of organic carbon, pH, salinity, temperature and total ammonia nitrogen.

Until March 31 every year, all companies present a report to state authorised bodies about monitoring results over the past year and about monitoring methodology applied.

Companies shall provide to National Board on Environment a statement about monitoring of hydrocarbons, also involving goals to reduce hydrocarbons in production waters. If amount of monthly rate (29 mg/l) is exceeded, a licencing environmental body must be informed immediately after such exceedance has been discovered, and this must be drawn in a report within 30 days, indicating specifications about inconsistency with limit requirements. Every time when maximum daily rate (42 mg/l) is exceeded, a company must immediately inform an authorised body.[535]

8.3.2.3. Monitoring of soil and underground waters[536]

With the aim of soil and underground water quality control, a company carrying out activities with potential of soil and underground water pollution shall:

- integrate a programme of soil and underground water quality monitoring on the territory of a company and in a region with direct impact on surface waters, if necessary;

[533] CONAMA Resolution 430, p. 345
[534] CONAMA Resolution 393, p. 324
[535] CONAMA Resolution 393, p. 324
[536] CONAMA Resolution 420, p. 750

- provide a technical report on soil and underground water quality every time when applying for licence prolongation.

After monitoring has been conducted, soil must be classified for further procedures of quality control:

- class 1: does not require actions;
- class 2: an assessment by an environmental agency may be required, including a study for natural formation of a substance or available polluting source, with preventative actions eliminating pollution;
- class 3: requires identification of a potential pollution source, assessment of natural formation of a substance, pollution source control, and soil and ground water quality monitoring;
- class 4: requires actions to restore polluted soil.[537]

8.3.2.4. Responsibility of accuracy and quality of IC

According to the law[538] regulating criminal and administrative environmental violations in Brazil, criminal and administrative responsibilities are imposed on the natural resources user for false, inaccurate information, as well as suppression of information, and enforcement measure is applied as a penalty, and deprivation of freedom for responsible individuals from 1 to 3 years.

8.4. Canada

8.4.1. State environmental control

8.4.1.1. Forms of state environmental control

State control for the environmental protection in Canada is conducted according to requirements *Compliance and Enforcement Policy*[539]. According to the general policy, goals of state environmental control are[540]:

- *education*: increase awareness about state strategies, goals and policies in the environmental protection, increase awareness and understanding of legislative requirements, as well as consequences in case if those requirements are disregarded;
- *prevention*: implementation of measures promoting compliance with legislation; inspections in order to discover potential risks resulting in environmental damage;
- *enforcement*: enforcement of measures in order to punish for non-compliance of legislative requirements and to prevent a re-occurrence of non-compliance.

[537] CONAMA Resolution 420, p. 751
[538] Law 9605
[539] Canadian Environmental Protection Act: compliance and enforcement policy: chapter 1
[540] Canadian Environmental Protection Act: compliance and enforcement policy: chapter 5

Local policies and rules of state control based on the above goals are developed on the level of provinces[541,542].

On the national level, state environmental control is manifested through *inspections* and *investigations*. The goal of an inspection is to determine that activities conducted are in compliance with Act on the environmental protection of Canada. Inspections can be carried out through a request and remote inspection of necessary documentation, without visits to facilities.

Inspections can be both scheduled and unscheduled. When scheduling inspections, an authorised body applies an approach based on *priority rating* and considers the following factors[543]:

- probability of negative impact in the process of activities;
- history of compliance / noncompliance with legislative requirements;
- environmental performance;
- time period elapsed from the last state inspection.

Unscheduled inspections are carried out in case of claims from the general public or a notification from representatives of state bodies about a violation on a regulated facility[544]. In American practice such inspections are called *civil investigations* and may be carried out up to one month, as opposed to scheduled inspections that are conducted in one or two days[545].

Legislation in provinces of Canada envisages *unannounced* inspections ensuring control of regulated facilities in their normal operating conditions[546,547]. However, in some cases advanced notice is required. This applies to instances when facilities are in a remote location, administrative records require advance preparation, inspectors require certain employees to be present or inspectors themselves must undergo site specific safety training prior to entering the work site.

In British Columbia province, there is a strict division between types of inspections conducted by authorised bodies:

- inspections with the purpose to review new technical processes, equipment or activities;
- inspections with the purpose to check compliance with conditions and requirements of environmental permits;
- inspections with the purpose to check general requirements of environmental legislation of Canada and a province;
- inspections with the purpose to check compliance with requirements of earlier issued compliance notices.

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[541] Compliance Assurance Program
[542] Compliance Assurance Management Framework (CAMF)
[543] Compliance Inspection Program
[544] Compliance Inspection Report, British Columbia
[545] EPA, Compliance
[546] Compliance Inspection Program
[547] Compliance Inspection Report, British Columbia

Besides inspections, another form of state control for oil and gas facilities in Alberta province is environmental audit with the purpose to[548]:

- check methods of periodic and continuous monitoring of emissions;
- check condition of abandoned wells;
- check response plans in case of emergency;
- check APG flaring systems for compliance with requirements of technological permits,etc.

Additional form of state environmental control is investigations in case when an authorised body suspects environmental offence[549]. In the course of investigation, an inspector collects necessary evidence, in order to determine whether a violation took place or not. Moreover, an investigation may be conducted only if authorised by the court and with a *search warrant*. In case of emergency, or risks of environmental pollution and negative impact on health of the residents, state inspectors are entitled to investigate without a warrant.

8.4.1.2. Functions, rights and obligations of the state bodies

For inspections in Canada, there is a complicated system of distribution of obligations between representatives of an authorised body. Thus, on the state level, obligations of the following officials are established[550]:

- *enforcement officers* who directly carry out inspections on regulated facilities, including inspection of means of transportation; conduct investigations in case of non-compliance with legislative requirements; develop corrective measures in case of health hazard for residents and the environment, prohibited releases or discharges of PS;
- *analysts* (employees in laboratories, toxicologists, engineers, IT specialists), who have a right to enter any regulated facilities; responsible for sampling, analysis and tests; have a right to request necessary documentation and make copies;
- *review officers* of *environmental protection compliance orders*[551], issued by state inspectors.

In the course of inspections, state inspectors are entitled [552]:

- to inspect any facility and equipment;
- to inspect any computer and information systems in order to assess the stored data;
- to prepare a report based on stored data and request such report;
- to copy necessary documents;
- to take necessary materials for further expertise;

[548] Compliance and Enforcement Program, Alberta Energy Regulator
[549] Canadian Environmental Protection Act: compliance and enforcement policy: chapter 6
[550] Canadian Environmental Protection Act: compliance and enforcement policy, chapter 4
[551] Canadian Environmental Protection Act: environmental protection compliance orders
[552] Compliance and Enforcement Policy for the Canadian Environmental Assessment Act, 2012

- to collect information using photo, video, and voice records;
- to hold interviews with employees of facilities;
- to request a start or shutdown of equipment operation;
- to control access to a facility being inspected, etc.

In addition to above mentioned items the national governors of British Columbia are entitled to:

- issue notices and instructions;
- forward recommendations to the Ministry of OOS about application of orders or administrative fines;
- inform well-trained officers with the competences of making investigations (*conservation officers*), about presence of major infractions[553].

8.4.1.3. Enforcement actions

According to the Policy, state bodies may apply the following enforcement actions in case of violations of the law[554,555]:

- *tickets* are issued if there are no serious environmental violations. Administrative violations that ensure tickets include failures to provide reports according to the Environmental Management Act or failures to provide requested information on time;
- *warnings* are applied in case of violations with minimal negative impact on the environment and public health; warnings may be in written or oral form. If the warnings issued by national governors are ignored, more stringent measures may be enforced;
- *directions* are issued for operators the activity of which leads or can potentially lead to unauthorised emissions or discharges;
- *orders* are issued by national governors (*compliance orders*) and the Minister of OOS (*minestrial orders*) in the following cases:
    - non-compliance with the requirements tickets, measures, warnings or directions earlier issued by the national governors;
    - non-compliance with the requirements of environmental permits and legal requirements. For example, failure to conduct continuous automatic monitoring of emissions, etc.;

  If order is issued, the governor should inform the operator about the grounds of the order and measures that should be taken to tackle and avoid violation. Operator has an opportunity to object the conditions of the order or provide recommendations on how the conditions shoud be amended[556]. If operator does not agree with conclusions and conditions of the order, a complaint is

[553] the credentials and rights of the officers are presented in the Act of Environmental management (Environmental Management Act)
[554] Canadian Environmental Protection Act: compliance and enforcement policy: chapter 7
[555] the influence austerities may differ depending on Canada province
[556] The Canadian Environmental Protection Act, 1999 and Environmental Protection Compliance Orders

submitted for the consideration of *review officers*. Based on the results of order assessment, *review officers* have the right to revoke the order or confirm its legality without involving the court.

- *administrative penalty*[557] are the penalties that may be determined by authorised agency in cases when operators ignore requirements of the orders, and environmental permits, etc.

The following enforcement measures are issued through legal proceedings:

- *injunctions* for production operations, processes or any other activities that lead to violation of environmental legislation and the subsequent contamination of the environment. Injunctions may also include enforcement notices to avoid infliction of harm and damage to the environment and population. Injunctions are administrative measures, however they do not include application of punishment in the form of monetary penalties.
- *prosecution* is applied to individuals in the following cases[558]:
    - operator purposely gave false information or disguised it;
    - operator interfered with the inspection;
    - operator did not follow the orders from Ministry of Environmental Protection or national governors, etc.
- *penalties and court orders upon conviction*

The sequence of enforcement measures depends on the province and authorised agency. Thus, authorised agency of Environmental Protection in Alberta (*Alberta Environment and Parks*), issues *Letter of non compliance*[559] in case of serious violation. In response to this letter violators must give written explanation about how the non-compliance was tackled or will be tackled. If previously found discrepancies were not fixed by the time of the next inspection, an authorised agency applies more stringent measures, such as administrative fines, suspension of operations, etc.

Nationwide the national governors may issue orders instead of more stringent measures if operators cooperate with authorised agency and demonstarte willingness to eliminate the violation[560].

The authorised agency of British Columbia province uses the enforcement matrix for non-complainces. Thus, the severity of measures will depend on the level of negative impact as a result of environmental legislation violation [561] and the possibility of compliance/non-compliance with legislation [562](see figure below). If national governors have not found any violations, they issue *notice of compliance*.

[557] Compliance Inspections Report, British Columbia
[558] non exhaustive list, applicable only for inspections and investigations
[559] Compliance Inspection Program
[560] The Canadian Environmental Protection Act, 1999 and Environmental Protection Compliance Orders
[561] including potential violations that may occur as a result of actual economic activities or other activities.
[562]Compliance Inspections Report, British Columbia

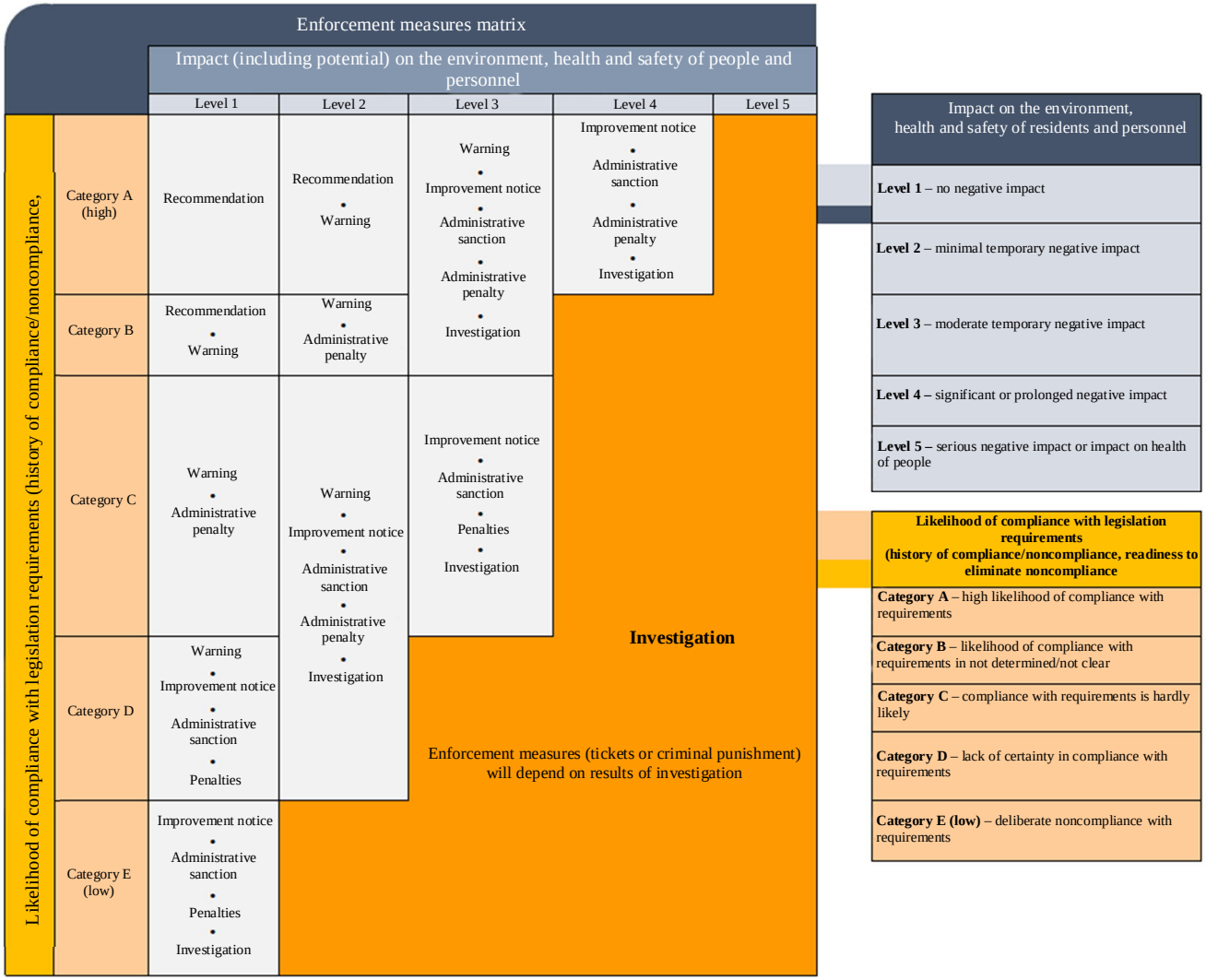

Figure2. Action matrix for law violation

8.4.2. Industrial environmental control

8.4.2.1. Types and organisation procedure of industrial environmental (Environmental Monitoring Programme)

Emission monitoring

One of the conditions for issuing environmental permits in Canada is the obligation to conduct industrial emission monitoring. Requirements vary depending on the substance monitored and the size and nature of the industrial facility. Source emission monitoring serves a number of purposes including:

- ensuring pollution control technologies are operating effectively;
- characterizing complex emissions;
- providing information for provincial and national emission inventories; and
- providing data for tracking trends.

Monitoring can be either *in-stack emission monitorin*g (continuous or intermittently) or fugitive emission monitoring[563].

In-stack emission monitoring In-stack emission monitoring includes manual stack surveys and continuous emission monitoring. Manual stack surveys are short duration sampling of pollutant concentration of flue gases in the pipe conducted by specially trained personnel. In addition, facilities that emit large quantities of substances must conduct monitoring with continuous emission monitoring systems (CEMS), which are instruments permanently installed on a stack. Measurements of the concentration and flow rate allow the mass emission rate to be determined on an ongoing, year round basis.

Fugitive emission monitoring

Fugitive emissions are typically volatile organic compounds (VOCs) but can be other compounds, may be emitted from leaking valves, flanges, sampling connections, pumps, pipes and compressors If the leakage volumes are small and cannot be estimated by instrumental measurements, the mass balance method can be used in combination with separate measurements of pollutant concentrations.

The content and quantity of demands for monitoring of industrial emissions depends on the type of controlled branch and the character of emissions that come into the environment. In general, the bigger the source of contamination and, accordingly, the higher the negative impact on the environment, the more stringent requirements for monitoring will be applied.

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[563] Using ambient air quality objectives in industrial dispersion modelling and individual site monitoring, p.5

Specific requirements for emission monitoring are set in the environmental permits and are also present in Code of Practice, and determine[564]:

- the location of sampling point;
- frequency of measurements;
- method of sampling;
- measuring parameters;
- methodology for handling and analysis of monitoring results;
- the order of data logging, record keeping and report delivery.

For example, for monitoring emissions from stationary combustion of solid fuels, the requirements for the substances to be monitored and the methods for conducting measurements are determined depending on the power of the equipment used [565].

Table 23. Demands on emission monitoring for steam boilers on solid fuel

Boiler rating (GJ/h)	Control parameters	Requirements for monitoring
<105	NOx, SO_2, SO_3, PM, PM_{10}, $PM_{2.5}$, VOC, CO_2, PAH, heavy metals	Initial stack survey to be conducted at the time the boiler or heater is commissioned
105-264	NOx, SO_2, SO_3, PM, PM_{10}, $PM_{2.5}$, VOC, CO_2, PAH, heavy metals	Initial stack survey to be conducted at the time the boiler or heater is commissioned
	NOx, SO_2, PM, PM_{10}, $PM_{2.5}$, VOC, CO_2, heavy metals	Semi-annual stack surveys unless fuel composition changes significantly, in which case monthly stack will be done until stack survey data is constant for 3 months
>264	NOx, SO_2, SO_3, PM, PM_{10}, $PM_{2.5}$, VOC, CO_2, PAH, heavy metals	Initial stack survey to be conducted at the time the boiler or heater is commissioned
	NOx, SO_2, CO_2, PM, PM_{10}, $PM_{2.5}$, heavy metals	Semi-annual stack surveys
	NOx, SO_2, SO_3, PM, PM_{10}, $PM_{2.5}$, VOC, CO_2, PAH, heavy metals	Continious emission monitoring system

Monitoring of discharges is carried out according to the Wastewater Systems Effluent Regulations that contains monitoring requirements of such parameters as volume, wastewater consumption, carbonaceous biochemical oxygen demand, suspended solids and unionised ammonium[566]. The Regulation also describes minimum frequency of measurements depending on design of wastewater treatment facility and volume of wastewater discharge. All measurements should be carried

[564] Compulsory Industry Monitoring
[565] Guidance on air emissions and monitoring requirements during combustion of non-gaseous fuels
[566] Wastewater Systems Effluent Regulations

out by accredited laboratories according to ISO/IEC 17025:2005. At the provincial level, more advanced requirements for monitoring wastewater discharges can be defined. Thus, Alberta province has controlled parameters, frequency and method of sampling for different types of industrial activities - from piper and pulp industry objects to converters of oil, gas and electricity production[567].

In addition to sampling industrial effluents, operator should (if this stipulated in the environmental permit) perform *industrial runoff monitoring*[568].

The requirements for industrial runoff monitoring parameters and sampling frequency are presented in the table below.

Table 24. Control parameters of land drainage disposal

Control parameter	Ceiling or characteristic	Frequency of sampling
Volume of disposal	-	Daily
pH	6-9.5	Daily
Oils and fats	Absence of oil film	Daily
Total suspended particulates	25 mg/l	Weekly
Chemical oxygen demand (COD)	50 mg/l	Weekly
Ammonia nitrogen	5 mg/l	Weekly
Chlorides	500 mg/l	Weekly

Impact monitoring

Impact monitoring s may be performed both as part of the environmental permitting requirements and as part of the Canadian air quality management system.

Ambient monitoring can take various forms[569]:

- continuous monitoring in a station located permanently or for a specified time period at or near the point of predicted maximum ground level concentration, maximum frequency of exposure direction, or for other considerations;
- passive or active integrated sampling that collects or absorbs gaseous pollutants over a specified time period and sampling schedule; or innovative ambient monitoring programs using techniques such as remote sensing.

Regulated operators should develop a Monitoring Plan that includes at least the following information[570]:

[567] Summary of Alberta industrial wastewater limits and monitoring requirements
[568] Code of Practice for Compressor and Pumping Stations and Sweet Gas Processing Plants
[569] Using ambient air quality objectives in industrial dispersion modelling and individual site monitoring, p.5
[570] Air Monitoring Directive, Chapter 2: Ambient Air Monitoring Program Planning

- description of the ambient air quality;
- responsible authorities for monitoring plan;
- documentation of monitoring objective(s);
- geographical area for the monitoring program, including the ecosystem and/or population within that area;
- number and location of monitoring stations;
- the list of controlled substances;
- monitoring method(s), duration, frequency and instrumentation;
- duration of monitoring program (continuous, periodical, seasonal or short-term);
- the list of emission sources;
- the list of receptors that may be affected by the emissions;
- data management;
- implementation timelines;
- contingency plans;
- date of the last monitoring plan review and its results.

Monitoring plan should be reviewed and updated every five years.

Minimum requirements for ambient air monitoring (technical specifications for measuring equipment, selection criteria for location of monitoring stations, etc.) are described in the Ambient air monitoring directive[571]. The Directive also includes sampling requirements for seasonal variabilityand weather conditions. The sampling points should be sheltered to prevent measuring devices from exposure of atmospheric precipitation and to ensure the accuracy of obtained data[572].

Depending on the nature and scale of operating activities, environmental permits may include requirements for groundwater and soil monitoring.

The environmental permit holders are obliged to provide an annual groundwater monitoring Report (until the end of March of the year following the reporting year, unless another date is determined by the competent authority) that should contain the following information[573]:

- the legal description of the facility and a map illustrating the facility boundaries;
- a topographic map of the facility;
- a description of the industrial activity and processes at the facility;

[571] AMD Directive Ch.4
[572] AMD Directive Ch.4
[573] Code of Practice for Compressor and Pumping Stations and Sweet Gas Processing Plants

- a general hydrogeological characterization of the region within a 5 kilometre radius of the facility ;
- an interpretation of groundwater flow patterns ;
- a map of groundwater monitoring well locations and a description of any existing groundwater monitoring program for the facility, a summary of any changes to the groundwater monitoring program made since the last annual groundwater monitoring report ;
- a summary of groundwater level within groundwater monitoring wells ;
- explanation of analytics including description of contamination sources and their location, concentration of pollutants;
- proposals for remediation of groundwater resources;
- a sampling schedule for the following year, etc.

Soil monitoring should be conducted in accordance with the Soil Monitoring Directive [574] which provides guidance on the development of a monitoring program, sampling, recording and reporting.. Before commissioning, background studies of soil condition should be carried out, including obtaining data on the following parameters:

- soil acidity pH;
- electric conductivity;
- cation exchange capacity;
- organic carbon content;
- texture (content of sand, salt and clay);
- pH;
- sodium absorption ratio;

Information about background concentrations is necessary for evaluating the degree of deterioration of the soil quality as a result of impact of production activities, and for planning remedial measures.

Soil monitoring during operation should include measurements of specific pollutants as well as determination of pH level and conductivity. All soil samples should be collected in a close proximity to the pollution source and at different depths (from 0 to 100 cm).

Impact monitoring of oil and gas productions on sea

Operators of offshore oil and gas platforms are obliged to develop annual Environmental Effects Monitoring *(EEM*) Program. The purpose of impact monitoring for offshore oil and gas activities is to identify and quantify any possible

[574] Soil Monitoring Directive

adverse effects on marine ecosystems, as well as develop measures to reduce or prevent environmental impacts.[575]. The content of the monitoring program, including monitored parameters, analytical methods, a frequency of measurements, etc., is not regulated by law. As a rule, the monitoring program is usually developed on a case-by-case basis, considering the specifics of production and local conditions as agreed with the competent authority.[576].

In practice offhore impact monitoring includes the evaluation of the following parameters[577,578]:

- sea water quality: analysis of chemical composition and toxicity level of treated water discharged into the sea;
- ambient air quality (NO_x, SO_2, $PM_{2.5}$, H_2S, O_3);
- condition of bottom sediments including concentration of metals, hydrocarbons and toxicity level;
- concentration of metals and hydrocarbons in tissues of seashells;
- number and condition of seabirds in the area adjacent to production facilities;
- noise exposure to marine mammals (sea lions, seals, dolphins), etc.

To determine the location of sampling points (monitoring stations) and the frequency of measurements, the EIA data and the results of dispersion modelling in ambient air and water are used. The monitoring program should be reviewed and updated each year, taking into account the results of previous monitoring studies..

Regulation of transparency and access to IC resultsThe regulated operators in Canada are obliged to provide reports on the results of the Environmental Monitoring Programme to the competent authority. Reports may be in the form of:

- emission monitoring and impact monitoring reports;
- reports on monitoring data quality indicators;
- reports on exceeding emission limits;
- emission inventory reports, etc.;

Emission monitoring and impact monitoring reports are submitted every month or quarter (depending on the environmental permit conditions) and every year. Monthly reports must be submitted to the competent authority before the end of the month following the reporting, and annual reports by the end of March of the current year for the previous reporting year..

[575] Environmental Effects Monitoring
[576] Environmental Effects Monitoring Coordination Framework
[577] Offshore environmental effects monitoring program
[578] Offshore environmental effects monitoring program

It should be noted that, reports about Environmental Monitoring Programme in Canada are submitted in digital form, while there's no possibility to transfer monitoring data online.

According to the *Release Reporting Regulation*[579] regulated operators are obliged to report to the competent authority on any cases of violation of environmental permit conditions, including excessive and unauthorized emissions, violation of monitoring and control requirements.. . Information on emissions released to the environment as a result of incidents and accidents should also be immediately transmitted to the competent authority. Thus, for oil and gas enterprises, the requirements for monitoring the concentration of hydrogen sulfide in the atmospheric air as a result of accidental emissions of acid gas are defined. Data of such monitoring is used to develop emergency response plans, measures to reduce the negative consequences of accidents, identify safe areas for evacuation of personnel and the public.[580].

Documented Environmental Monitoring Programme Reports should be kept at the enterprise and be available on request of the competent authority to verify the compliance with requirements of environmental permits. Raw monitoring data should be kept for 3 years, and consolidated reports - for 10 years[581].

All emission monitoring data should be available on public request according to the Freedom of Information Act[582]. This requirement does not apply to confidential information.

8.4.2.2. Quality assurance and integrity of IC results

Requirements about installation, operation, maintenance and certification of automated monitoring systems are set in the Continuous Emission Monitoring System *(CEMS) Code*. Compliance with the requirements of the CEMS Code provides effective measurement, registration and reporting of controlled emissions and their parameters. The Code contains guidelines for ensuring and controlling the quality of data obtained during emission monitoring.[583].

Operators performing continuous emission monitoring are required to develop a Quality Assurance Plan which should contain a detailed and step-by-step description of the procedures for ensuring the quality of measurements.. Quality Assurance Plan should contain the following information[584]:

- *Quality Assurance Activities*, that include description of continuous monitoring systems, calibration activities and performance tests, control

[579] Release Reporting Regulation
[580] Emergency Preparedness and Response Requirements for the Petroleum Industry
[581] Air Monitoring Directive, Chapter 5: Quality System
[582] Access to Information Act
[583] CEMS Code
[584] CEMS Code, sec.5.1

processes, liability distribution, requirements for personnel qualification, data and report collecting system;

- *Quality Control Activities*, that include standard working activities necessary for functioning and evaluation of measuring equipment performance, detailed description of activities in the estimation of precision and bias measurements.

Execution of quality assurance plan guarantees data integrity and accuracy received during automated monitoring of emissions. Evaluation of the Plan's performance and its accuracy should be performed annually within the context of independent audit.

The operator is responsible for the quality of given Environmental Monitoring Programme data according to the Environmental protection and enhancement act. According to the Act, providing incorrect data about emission monitoring is considered as violation of environmental permit that presupposes fine of USD 100,000 ,or imprisonment for the period of up to 2 years for individuals, and a fine of up to USD 1,000,000 for companies[585].

[585] Environmental protection and enhancement act, art.228

9. LIABILITIES OF NATURAL RESOURCE USERS

9.1. Types of liabilities

Several types of environmental liabilities for environmental violations have been established in the countries studied:

Administrative liability incurs for the commission of an administrative environmental violation both by individuals and legal entities that caused harm to a person, owner of facilities, natural resource users, the environment as a whole, or created a real threat of causing such harm [586,587]. *Criminal* liability is applied to individuals for committing environmental violations that entail serious consequences for the environment and society. *Civil liability* regulates relationships between individuals and legal entities and occurs when the action or inaction of a violator has caused environmental degradation of any type. Civil liability entails compensation to affected party for moral, reputational or property damage caused as a result of environmental violation.

There isalso *disciplinary liability*[588,589] in Russia, that arises when public officials and corporate employees fail to comply with or improperly implement the provisions, regulations, by-law and other regulatory documents in regards to the environmental protection.

OECD countries have *corporate responsibility* when managers of enterprises are responsible for environmental violation that caused harm or damage for environment. According to corporate regulations, executive members are responsible for the performance of the company and also for the impact that company has on the environment and society[590].

9.1.1. Definition of enforcement measures for environmental violations

Key principles that define enforcement measures in OECD countries are transparency, proportionality to violation, consistency, rationality and purposiveness[591]. Therefore, most of the OECD countries develop nationwide *enforcement policies* that contain available measures of punishment for different

[586] https://www.oecd.org/env/outreach/42356640.pdf
[587] EEA fine regime https://www.canada.ca/en/environment-climate-change/services/environmental-enforcement/acts-regulations/about-act/fine-regime.html
[588] Federal law dated 10.01.2002 No. 7-F3 "On Protection of Environment"
[589] Federal law dated 27.02.2004 No.79-F3 "On State Civil Service of the Russian Federation"
[590] Environmental Law in the UK, Clifford Chance
[591] https://www.oecd.org/env/outreach/42356640.pdf

types of environmental violations[592]. For example, Great Britain has developed the document that reveals information about possible measures of influence for over 900 types of environmental violations[593]. These policies were developed to apply a uniform approach that define enforcement measures for similar violations and avoid the misuse of power by authorised or judicial agencies.

Besides the above mentioned policies, authorised agency also takes into account the following factors that allow to stiffen or alleviate applied measures for each individual case:

- *intention* - the degree of intent and / or negligence;
- *foreseeability* - the ability to foreseen violation and taking proactive measures to protect the environment;
- *impact on society and environment* – materiality of harm, damage on population and environment;
- *nature of violation* – presence / absence of obstructive actions on the part of violator to fulfill the duties of regulatory authorities;
- *financial implications for violator* - financial gain of violator taken from their illegal actions;
- *"intimidation" effect* - the effectiveness of the proposed punishment measures to prevent subsequent violations;
- *history of previous environmental violations* - record of previous recommendations and penalties*;*
- *violator's behavior/attitude*– violator's willingness to cooperate with the authorities and willingness to mitigate the damages and prevent the re-occurrence of environmental violations.

It is important to note that OECD countries have defined significant number of enforcement measures for the legal entities that include not only different types of monetary penalties but also the following measures: notifications, instructions, official warnings, prescriptions, etc. In cases of unauthorized or above-limit emissions/discharges, the authorities, as a rule, apply enforcement measures "gradually" (from less to more strict) and the imposition of an administrative fine can be applied in cases of repeated violations.

[592] https://www.oecd.org/env/outreach/42356640.pdf

[593] See example of Great Britain https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/705525/Enforcement-and-Sanctions-Offence-Response-Options.pdf

9.1.2. Determining the size of administrative fines

The following principles are applied to determining the size of fines in OECD countries[594]:

- prevention of subsequent law violations;
- exclusion of financial gain resulted from environmental violation;
- proportionality to the type of violation and caused harm;
- setting the appropriate approach to determining the fine for each violator.

Exclusion of financial gains is one of the two key components of the formula for definition of penalty size. Thus, penalty should significantly exceed the sum of received gain to avoid situations when it is more beneficial for natural resource users to violate environmental legislation than to pay out the administrative fines. The second key component is *the "gravity" component of violation* that should consider the seriousness of violation (actual or possible harm for environment and the importance of compliance with the legislative requirement).

It is worth noting that in the OECD countries, the minimum and maximum rates of administrative fines per violation or per day of the violation are established on the legislative level[595]. Thus, when imposing and determining the amount of administrative fines, authorities are governed by enforcement policies and minimum-maximum rates, unless otherwise determined by the court decision.

The process of establishing the penalty should be transparent and systematic, taking into account the history of previous violations, willingness of violator to cooperate, financial possibility to pay penalty, the duration of violation, volume and toxicity level of emissions, etc.[596] The lack of financial capacity of the violator to pay does not exempt them from administrative liability. So, an authorized agency may extend the deadline for penalty payment, order alternative measures of compensation by enforcing environmental protection measures or reduce the amount of penalty.

Case study of *presumption of good faith* in the USA [597]

In the USA the companies that behaved faithfully and informed authorised agencies about an incident that caused harm to the environment, made prompt elimination of the violation and took actions to prevent possible future non-compliance, are

[594] https://www.oecd.org/env/outreach/42356640.pdf

[595] See the examples of the UK https://www.sentencingcouncil.org.uk/offences/magistrates-court/item/organisations-illegal-discharges-to-air-land-and-water-unauthorised-or-harmful-deposit-treatment-or-disposal-etc-of-waste/ , Germany https://efface.eu/sites/default/files/EFFACE_Fighting%20Environmental%20Crime%20in%20Germany_0.pdf & the USA https://www.epa.gov/sites/production/files/2018-01/documents/amendmentstotheepascivilpenaltypoliciestoaccountforinflation011518.pdf

[596] https://www.oecd.org/env/outreach/42356640.pdf

[597] *The use of presumption of good faith in other countries that are under investigation was not determined*

provided with special conditions[598]. American practice name such behaviour as "*in a good faith*" or actions "with good intentions". Exemption form liability measures may include:

- reduction of the amount of penalty or its cancellation depending on the level of violation, if nine conditions of Audit policy are met[599]. The purpose of the document is to encourage companies to voluntarily detect, disclose, correct and prevent violations indicated in the National Environmental Protection Act (*NEPA*). Organizations that follow the conditions of this document may claim to reduce the size of penalty, and also exemption from criminal liability;
- reduction of penalty amount by 75% if the subject meets all conditions of *Audit policy*, except detection of non-compliances during a systematic audit[600].

The document of Environmental Protection Agency (*EPA*) *Audit Policy* lists the range of conditions the fulfillment of which mitigate punishment for environmental violation:

- regular information release about violations through the system of environmental audit or integration of control system to comply with requirements;
- voluntary disclosure that was not revealed during mandatory procedure of monitoring, sampling or audit;
- notification about violation to EPA within 21 days from the moment of detection or in shorter period;
- correction of violations within 60 calendar days from the date of finding out the non-compliance;
- information release regardless of request or petition;
- prevention of non-compliance re-occurrance;
- if specific (or closely related) violations took place at the same unit within the last 3 years; or those that took place at several units that belong or controlled by the same operator within the last 5 years and which have similar characteristics and if the unit was re-acquired, the presence of violation prior to the acquisition does not entail repeated responsibility;
- simultaneous presence of other violations;
- cooperation with authorised agencies.

It is worth noting that there are situations where the amount of penalty can be reduced. An entity may claim an additional reduction in the amount of penalty, provided thatthe activities undertaken in the field of environmental protection or the

[598] Report. EPA Announces Renewed Emphasis on Self-Disclosed Violation Policies
[599] Notice. Incentives for Self-Policing: Discovery, Disclosure, Correction and Prevention of Violations (Audit Policy)
[600] Notice. Incentives for Self-Policing: Discovery, Disclosure, Correction and Prevention of Violations (Audit Policy)

measures taken exceed the established requirements of EPA. So, for example, when an entity wants to carry out additional environmental project which corresponds to formal criteria of the Policy *SEP EPA*, they may claim for additional reduction of penalty size[601].

9.2. The responsibility for non-compliance or partial fulfillment of environmental protection measures

In countries studied, except for Russia, the concept ***"environmental measures"*** is not enshrined in legislative acts. In Russia there's administrative liability for non-fulfillment or untimely implementation of environmental protection measures according to the Clause 8 of the Code of the Russian Federation on Administrative Offenses "Administrative offences concerning environmental protection and wildlife management" [602]. Depending on the severity of the consequences for non-fulfillment of environmental protection measures, a warning or a fine can be issued. Failure to comply with the requirement of EPMP project development (Environmental Protective Measures Plan) for obtaining a permit for construction, reconstruction or liquidation of an object entails the suspension of the placement, construction, reconstruction, commissioning, operation, conservation and liquidation of buildings, structures, constructions and other objects [603,604].

In EU countries environmental measures include measures developed for EIA project [605,606], and also measures adopted in environmental permits[607]. In this case there are no clear legislative measures of responsibility for non-fulfillment of measures in the range of permission documentation.

Environmental measures in Canada are developed as a part of restoration of the environment in cases of damages non-fulfillment / partial fulfillment of which presuposes penalties depending on the level of significance and violator's behaviour.

[601] https://www.epa.gov/sites/production/files/documents/audpolintepgui-mem.pdf

[602] Russian Federation Administrative Offence Code dated December 30, 2001. No. 195-F3
[603] F3 No.7 "On Protection of Environment", art.34
[604] Russian Federation order "On Composition of Design Documentation Sections and Requirements to their Contents"
[605] The Town and Country Planning (Environmental Impact Assessment) Regulations 2017
[606] Evaluation of environmental intervention and its compensation. Russian-german guidance manual, 2013
[607] Environmental Permitting Guidance

9.3. Liabilty for environmental damage

This section contains information on regulatory regimes regarding liability of legal entities on environmental pollution and environmental damage in Russia, Brazil and OECD countries. The section presents information on such notions as harm/damage, categories of environmental losses, its assessment and types of compensation for environmental damage.

In Russia the law defines environmental damage as an adverse change in the environment that triggers degradation of environmental systems and depletion or change of natural resources. Violation of emission standards/exceedance of emission limits is a damage by default. Therefore, the legislation envisages both direct and indirect methods of economic damage assessment.

The practice of EU countries obliges to determine a fact of damaging, namely the evidence of cause-and-effect relationship between pollution and significant negative influence on the environment. With this, under the EU Environmental Liability Directive , air pollution is not considered as environmental damage as it is not possible to return the air quality to the pre-damaged condition.

The main form of environmental compensation in the EU is a compensation "in kind" which aim is to return the natural conditions existed prior the damage. Environmental Liability Directive (ELD) aims to restore or remediate the damaged natural resources and the remedy is not punitive - it does not consist of a cash compensation in the form of administrative fine. ELD, however, requires liable parties to reimburse all expenses in cases when the authorities implement remedial or compensatory measures themselves.

Liable parties may also compensate administrative expenses and procedural costs incurred by the authorities in the process of assessing the damage and monitoring compliance with regulations.

The responsibility for environmental damage in the form of administrative penalties occurs only in case of non-fulfillment of enforcement or remediation notices.

9.3.1. Russia

Russian Federal law No.7 (FL) "On Environmental Protection" [608] defines the meaning of environmental *harm* as an adverse change in the environment as a result of its pollution which caused degradation of environmental systems and depletion of natural resources. The notion of *damage* in the law is similar to that of environmental harm.

[608] Federal law dated 10.01.2002 No. 7-FL (rev. dated 19.07.2018) "On Environmental Protection "

Both legal entities and citizens may inflict environmental damage by polluting, depleting, damaging, destroying it, by irrational use of natural resources, destruction of natural ecosystems and other environmental crimes. Damage is regarded as direct damages in combination with the loss of profits.

Article 7 of the Act No.49 of the Plenum of Supreme Court of Russia dated 30 October, 2017, provides violation of admissible environmental impact by legal entities, individual entrepreneurs results in causing damage. Operator is responsible for proving that adverse impact was occurred due to other factors and (or) its appearance irrespective of the committed violation.

Monetary compensation is obligatory regardless the range and type of the environmental damage under the article 77 No.7 FL "On Environmental Protection":

- legal entities and natural persons which have caused a damage to the environment by polluting, depleting, damaging, destroying it, by irrational use of natural resources, degrading and destroying natural environmental systems, natural complexes and natural landscapes and another violation of the environmental protection legislation shall compensate it in full under the law.
- damage to the environment inflicted by a person pursuing an economic or another activity, in particular an activity covered by a positive state environmental expert examination statement, including in particular, the activity of withdrawing components from the environment, shall be compensated by the customer and/or the person pursuing the economic or the other activity.
- damage inflicted to the environment by an economic or another agent shall be compensated in compliance with the rates and environmental damage calculation methods approved in the established manner, or in the absence thereof, on the basis of actual expenses incurred for restoration of deteriorated condition of the environment, with due regard to losses incurred, in particular profit missed.

9.3.1.1. Environmental impact assessment

There are several approaches to assess environmental damage in Russia.

Table 25. Main methods to assess environmental damage

Name of the method	Description of the method	Normative acts
Expert rating	Used in case of non-sufficient regulatory-procedural guidelines for environmental impact assessment.	Procedural guidelines to assess and compensate for the environmental

Name of the method	Description of the method	Normative acts
		damage as a result of environmental crimes, M., 1999.[609] Interim procedure for assessmentand compensation of environmental damage in case of emergency.
Indirect assessment	Damage calculation by means of defining mathematical relations between the level of pollution and the size of economic loss	Guidelines for calculating harm to aquatic biological resources adopted by the order of the Federal Agency for Fishery No.1166 dated November 25, 2011;[610] Interim guidelines to determine prevented environmental damage.
Market-based valuation	Natural objects and resources may be referred to movables which gives the possibility (according to the Civil Code of Russia) to apply practices of financial analysis and calculations in the system of market relations, namely: • *cost method* – accounting for all costs necessary to restore natural environment • *sales comparison approach* - calculation of object's damage costs in comparison with market pries • *income method* - calculation of damage by calculating lost income	Civil Code of Russia, article 130.

Guidelines to determine prevented environmental damage may be used to assess the environmental damage caused by emission of pollutants to the atmosphere[611]. The guidelines are based on specific assessment of environmental damage estimated for main pollutants. Its application is suggested for all main areas (soil, atmosphere, water objects). Prevented damage is calculated as a product of specific damage, caused by emissions of pollutants and the volume of substances from emitter to the environment. Specific damage is calculated by economic assessment of the damage caused by one tonne of pollutants and adjusted taking inflation into account.

Currently there are public hearings on the Methods of calculating the extent of damage caused to air, which (as opposed to the Guideline to determine prevented damage) is mainly focused at one environmental component. The calculation of the damage is done by the similar formula, but accounting for clean-up activities for

[609] Procedural guidelines to assess and compensate the environmental damage in the result of environmental crimes
[610] Guidelines for calculating harm to aquatic biological resources
[611] Guidelines to determine prevented environmental damage

emissions (there's a specific rate that indicates the presence of cleaning technologies of different types).

9.3.1.2. Types of compensation for environmental damage

According to Article 79, a harm inflicted to citizens' health and property by a negative effect on the environment resulting from the economic and other activities of legal entities and individuals shall be subject to full compensation. According to Article 1085 of Russian Civil Code[612] the cases of harming an individual or of any other injury to his health the lost income and additional expenses (treatment, nursing, preparing for another job, etc.) should be compensated.

The evidences of caused damage are:[613]

- wrongdoing by defendant who violated environmental legislation;
- damage caused to environment as a result of environmental violation;
- damage to health and property of the citizens;
- cause-and-effect relationship between adverse influence on environment and caused damage.

The last item is the most defficult one in judicial practice because of legislation peculiarities as it is hard to prove the connection between environmental pollution as a result of violation and causing harm to human health.

Determination of the volume and scope of damage as a result of violation of environmental laws is done in line with the legislation.

According to clause 1082 of Russian Civil Code[614], while making a decision on damage compensation, the court makes the individual responsible to compensate the caused damage basically or cover caused losses (item 2 of Clause 15 of the Russian Civil Code).

Therefore, damage compensation can be made in two forms - in a form of natural compensatory measures or in a form of financial compensation. However, compensation in nonmonetary way is not possible for some types of environmental damage. In such cases the damage caused to the environment is compensated financially only. The damage for such cases is calculated based on the size of lost advantage (shortcoming in revenue, income which a person may get if his rights and activity conditions were not disturbed; differences between profits before and after environmental damage), or using method of expert assessment. In all other cases the compensation method for caused damage through the court is made by the applicant.

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[612] Civil Code of the Russian Federation, Part 2
[613] Anisimov P.A., Kayushnikova Yu.E. The compensation of damage caused to human health by environmental crime
[614] Civil Code of the Russian Federation, Part 2

The procedure for compensation of the damage is determined in the Article.78 of the Federal law "On Environmental Protection":

1. *commencement of hearings for compensation for damages caused to the* environment as a result of violation of the environmental legislation (time limitation - 20 years);
2. *judicial consideration* by therelevant authority for the purpose of infringing act of environmental legislation and caused damage for environment by these actions;
3. *based on court decision the defendant may be obliged to compensate damage* by means of restoring the damage to the environment according to the plan of renovation works or by means of compensation of restoring works, taking into account incurred losses and also lost profits.

9.3.2. European countries

According to ELD, environmental damage means:

- "damage to protected species and natural habitats, which is any damage that has significant adverse effects on reaching or maintaining the favourable conservation status of such habitats or species";
- " 'water damage', which is any damage that significantly adversely affects: the ecological, chemical or quantitative status or the ecological potential, as defined in Directive 2000/60/EC; the environmental status of the marine waters concerned, as defined in Directive 2008/56/EC…"
- land damage, which is any land contamination that creates a significant risk of human health being adversely affected as a result of the direct or indirect introduction, in, on or under land, of substances, preparations, organisms or micro-organisms".

In Germany, according to the Law on Environmental damage, "damage" is a measured direct or indirect adverse change of natural resource or measured degradation of natural resource functions (ecosystem services)[615].

Establishing the fact of environmental damage as a result of environmental pollution and in accordance with the "damage" criteria defined in the EU legislation is a key requirement of ELD. Whether or not an emission is unauthorized or above-limit is not a factor under the ELD for establishing liability for environmental damages. Damages liability under the ELD is established through physical evidence of actual harm to the environment. Thus, environmental damage liability would arise only if the fact of causing damage is established, i.e. based on the definition of 'damage',

[615] Environmental Damage Act -USchadG

there is an adverse effect to one or several natural resources and the negative change can be measured.

According to the requirements of the ELD, adverse impact of direct emissions of pollutants on the air quality is not regarded as environmental damage as it is impossible to return air quality to pre-damaged conditions. However, if emissions of pollution agents caused significant pollution of water, soil or other natural constituents, natural resource user will be responsible for the damage caused[616]. Such pollution will be classified as diffuse pollution, in other words the pollution of any natural component through other natural component. Diffuse pollution is regarded as damage only in the case when it is possible to determine cause-and-effect relationship between consequences of pollution and its source. In this case, there is no direct damage from emissions of pollution agents into the atmosphere.

9.3.2.1. Environmental damage assessment[617]

As a rule, environmental damage in other EU countries is assessed based on demand in restoration of natural resources or ecosystem services. In other words, the assessment of environmental damage in most cases is based on identification of quantitative and qualitative changes of ecosystems as a result of damage and possibility to restore natural resources to baseline conditions or possibility to compensate ecosystem services.

According to Annex 2 ofELD[618] it is determined, that assessment methods *of lost natural resources* is much preferred than monetary valuation (economic damage assessment)[619]. The economic damage assessment is not carried out to determine the size of administrative fines since ELD aims to protect and restore the environment and not to punish those responsible for the damage. This kind of monetary assessment is carried out in cases where the full restoration of the natural resources is impossible and the liable parties need to take additional measures (for example, restoration of environment on other polluted area, purchase or creation of similar natural resources instead of damaged, etc.), the costs of which should be proportional to the estimated monetary value of the lost natural resources or services.

9.3.2.2. Types of compensation for environmental damage

If authorized agency established that the activity of natural resource user caused environmental damage, then natural resource user is obliged, firstly, to take measures to restrict the causes of damage and secondly, to take the necessary measures to restore the damaged resources. The liable parties must develop the

[616] EFFACE, 2015
[617] The information from the item can be applied to all EU countries
[618] Directive 2004/35/CE on environmental liability with regard to the prevention and remedying of environmental damage
[619] Liability for environmental damage in EECCA, OECD 2012

restoration plan and review it with the component authority that, in turn, should approve it taking into consideration the interests of all stakeholders

In a case when public authority or third parties took remediation actions themselves, they may demand full compensation of their expenses from the company that caused damage. Herewith the principle of full damage recovery is valid: environmental components should be in conditions similar to those before damage took place and if it is impossible, then additional measures should be applied (for example, restoration of environment on other polluted area, purchase or creation of similar natural resources instead of damaged, etc.).

Annex 2 of the ELD defines the following forms of natural compensation for damage to natural water bodies, specially protected species of flora and fauna and natural habitats:

1) 'Primary' remediation is any remedial measure which returns the damaged natural resources and/or impaired services to, or towards, baseline condition;
2) 'Complementary' remediation is any remedial measure taken in relation to natural resources and/or services to compensate for the fact that primary remediation does not result in fully restoring the damaged natural resources and/or services;
3) 'Compensatory' remediation is any action taken to compensate for interim losses of natural resources and/or services that occur from the date of damage occurring until primary remediation has achieved its full effect;

Land remediation is a natural form of compensation for land/soil damage. The purpose of land restoration is to clean it from pollution to provide safety for human health and to prevent further pollution of water resources. Natural land restoration can also be treated as restoration as agreed with authorities.

The list of measures is developed individually by natural resource users and, carried in line with the best accessible methods, taking into account the following aspects:

- the cost for event execution;
- the possibility to avoid further pollutions;
- the efficiency of simultaneous cleaning of several natural objects using measures;
- quick goal achievement, etc.[620]

[620] Environmental Damage (Prevention and Remediaiton) Regulations 2015

The performance of these remediation measures is obligatory. In case of violation and non-fulfillment of conditions agreed with the authorities, liable parties bear responsibility for actual damage in the form of deprivation orof administrative penalty established by the court[621]. In these cases the restoration of environment is conducted by the state and costs are covered by liable parties[622].

It is important to note that the compensation of environmental damage or the absence of damage due to above-limit or unauthorized emissions/discharges does not exempt liable parties from administrative and/or criminal liability in accordance with other directives of EU or national regulations of EU members.

9.3.3. Brazil

There is no concept of *environmental damage* in Brazilian legislation. However, there is a definition of *environmental harm* that means a significant deterioration (degradation) of quality of environmental components due to pollution.

Degradation of quality of environmental components includes adverse change of environmental characteristic that directly or indirectly negatively impact public health, social security, economical and social activities, ecosystem processes, as well as aesthetic or sanitary environmental conditions. [623]

9.3.3.1. The evaluation of environmental damage

In Brazil, the valuation of damage is made by a court or experts appointed by authorized bodies. In most cases, the experts make economic valuation of damage that defines the monetary compensation for the damage caused. Calculation of compensation should consider the full amount of expenses required for restoration of environmental quality and eliminate the effects of pollution. If the amount of monetary compensation cannot be established due to the lack of scientific or technical bases, then responsibility for determining the amount of compensation is transferred to judicial authorities, which, in turn, act in accordance with the principles of case law.

It is worth noting that damage valuation remains one of the key open issues of environmental regulation in Brazil.

9.3.3.2. Types of compensation for environmental damage

According to the 'objective guilt' concept, a polluter is obliged to compensate and/or restore harm caused to environment and injured third parties through the court. According to Brazil legislation, environmental damage must be eliminated regardless when it happened. The restoration of environment to its original state is

[621] Environmental Damage (Prevention and Remediaiton) Regulations 2015
[622] Environmental Law in the UK, Clifford Chance
[623] "The Ecological damages recovery under the Brazilian law", Paulo de Bessa Antunes, 2017

a priority repayment method. When the harm cannot be eliminated, for example in case of pollution of the atmospheric air, the court may request monetary compensation.

9.3.4. The USA

In the USA environmental damage is defined as the cost of measures to eliminate the damage caused[624].

The Comprehensive Environmental Response, Compensation and Liability Act (*CERCLA*) aimed to regulate the cleaning of contaminated areas of Superfond, defines the damage occurred due to injury, destruction or loss of natural resources, including reasonable costs of determining the extent of such injury, destruction or loss[625].

Oil Pollution Act implies six categories of damage and covers the cost of damage assessment[626]. Depending on the category of damage there are:

- "Natural resource" category: injury, destruction, loss while using natural resources including reasonable costs for assessment of damage valuation;
- "Real or personal property" category: injury or economical losses due to breaking down of property;
- "Subsistence use" category: losses due inability to use natural resources as means of subsistence;
- "Revenues" category: financial losses caused by injury, destruction of real and personal property, natural resources;
- "Profits and earning capacity" category: losses caused by injury, destruction of real and personal property, natural resources;
- "Public services" category: the cost of providing public services during or after operations to remove the consequences of damage, including protection from fire, health hazards caused by oil spills.

According to CERCLA[627], as well as Oil Pollution Act[628], the definition of 'natural resources' includes land, wildlife, animal life, fish, atmospheric air, drinking water sources, surface and groundwater, and other resources under the control of the United States.

[624] Responsibility for environmental damage in EECCA countries. OECD, 2012
[625] The Act on Comprehensive Environmental Response, Compensation and Liability (CERCLA), chapter 107(a)(4)(C).
[626] OIL POLLUTION ACT OF 1990
[627] COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (SUPERFUND)
[628] OIL POLLUTION ACT OF 1990

9.3.4.1. The evaluation of environmental damage

General approach to valuation of damage implies identification of qualitative differences between provided "ecosystem services" before and after the environmental damage[629].

Methodologies of the Department of Interior (*DOI*) or the National Oceanic and Atmospheric Administration (*NOAA*) are used to evaluate the damage. The DOI methodology is used to evaluate damage under CERCLA, the NOAA methodology is applicable to damage in the framework of Oil Pollution Act. An integral part of valuation is the development of a work plan for restoration of natural resources.

The DOI methodology provides the basis and standards for assessment of natural resource damage in coastal and marine environments (A-type) and other environments (B-type)[630]. A-type assessment process is a simplified procedure requiring minor field observations. A-type assessment processes involve the use of a computer-based model to assess damage caused by chemical or oil splits in coastal and marine environments. B-type process is designed for situations that require an individual approach[631]. B-type assessment processes are used when more extensive field observations and investigations to determine the extent of damage caused to natural resources are required.

A-type and B-type processes for s involve four successive steps to evaluate damage[632]:

- ***Stage 1: Preliminary assessment*** – identifies the fact of damage and existence of a significant negative impact.
- ***Stage 2: Assessment plan*** - involves development of assessment plan taking into account criteria and requirements of the methodology.
- ***Stage 3: Assessment*** - involves gathering of data required to quantify a damage and determine a harm. This stage includes laboratory and field investigations as part of B-type assessment plans.
- ***Stage 4: Post assessment.*** The trustees prepare Assessment report detailing the results of Stage 3. The report proposes reasonable number of alternatives to restore the natural resources including natural restoration. Preferred alternative is selected in the report based on several factors such as technical capability, cost-benefit ratio, and coordination of response actions.

[629] Natural Resource Damages, EPA website
[630] Natural Resource Damages, EPA website
[631] Natural Resource Damages: Liability Implications for the Mining and Energy Industries
[632] 43 C.F.R. 11

NOAA method gives the base for assessment of natural resource damage including three stages[633]:

- ***Stage 1: preliminary assessment.*** The trustees first define whether there are grounds for carrying out restoration within the framework of Oil Pollution Act, then they define whether restoration planning should be made.
- ***Stage 2: Restoration planning.*** This stage includes two main procedures: assessment of damage and selection of restoration works. Assessment of damage determines whether the spill/leakage caused an adverse change in natural resources and/or 'services. At the stage of selection of the restoration plan, the trust determines the need and scale of restoration actions. The trustees (trust) should develop a draft restoration plan that identifies the **primary restoration actions** (*resource-to-resource* approach) to return the damaged resources to their original condition and **compensatory restoration actions** (*valuation scaling approach*) to compensate the community for the temporary loss of services up to return to original condition. It is important to mention that compensatory mitigation actions implemented by the authorized agency are also the measures to compensate the environmental damage[634].
- ***Stage 3: Restoration works.*** Restoration works plan is presented by potentially responsible parties to carry out or finance the restoration works by trustees (trust)[635].

9.3.4.2. Types of compensation for environmental damage

The compensation for environmental damage can be carried out administratively when measures to prevent and eliminate damage are ordered by relevant state authority without a preliminary court decision, or civil law when a state agency files a lawsuit in court to determine the person responsible for the caused damage and the level of his responsibility[636].

In the United States, there is a mixed system that includes civil responsibility and administrative powers that allow the United States Environmental Protection Agency to issue mandatory pollution abatement regulations, supported by the threat of large fines for non-compliance[637].

Above CERCLA and Oil Pollution Act provide several mechanisms for compensating damages. The trustees (trust) responsible for assessment of environmental damage and restoration of natural resources may either:

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[633] 15 CFR 990
[634] Natural Resource Damages: Liability Implications for the Mining and Energy Industries
[635] Natural Resource Damages. EPA website
[636] Responsibility for environmental damage in EECCA countries. OECD, 2012
[637] Responsibility for environmental damage in EECCA countries. OECD, 2012

- Apply to the court for compensation (which must be in the form of restoration, not monetary compensation) from potentially responsible parties for the damage caused to natural resources and reimbursement of costs for assessment and planning of restoration works;
- Carry out assessment or restoration works based on standards defined by the federal government, and file a claim for cost recovery from the Trust Fund established in accordance with the Oil Pollution Act;
- Participate in negotiations with potentially responsible parties to get financing or directly carry out the assessment and restoration of the damage caused by the responsible parties to natural resources[638].

It is important to mention that results of assessment carried by trustees (trust) under DOI and NOAA methodologies are subject to a rule of disputable presumption in the court. That means that potentially responsible party may dispose the conclusions of the assessment in the court.

Apart from that, Oil Pollution Act (OPA, 1990) foresee absolute liability for a wide range of damages caused by oil spill in waters by boats and stable objects. The responsible party should take all expenses for elimination of pollution incurred by state agencies of any level, private individuals or companies.

9.3.5. Canada

Canadian environmental legislation provides no strict definition of *harm or injury* and *damage* concepts, which are widely used both in relation to pollution of environmental components and in the context of negative impact to human health, property loss and market reputation of a company.

9.3.5.1. The evaluation of environmental damage

The assessment of environmental damage in law enforcement practice come down to definition of consumer value of ecosystem services which nowadays has not been duly reflected in Canadian legislation. The recognition of the fact of damage and the determination of responsible persons is in the competence of the courts and is carried out according to the principles of case law.

The violation of provisions of a number of regulatory acts of environmental protection and natural resources may be regarded as actions that cause environmental harm and subject to administrative taxes. The amount of imposed penalty depends on the type of environmental offense and the category of the offender as defined according to Rules for Establishing Fines for Environmental

[638] Natural Resource Damages: A Primer. EPA website

Offenses[639]. Following criteria confirm the fact of environmental damage and its assessment:

- change, destruction or degradation of ecosystem biological diversity and habitation of living organisms;
- elimination, violence, vicious treatment of wild life species;
- removal, damage, injury of any material patrimony objects;
- any negative impact on environment, including pollution or degradation of its components in a result of emissions of solid, liquid or gaseous polluting agents, smells and also thermal pollution, influence of physical factors (noise, vibration, radiation).

It is worth noting that the violation of the conditions of environmental permits, i.e. unauthorized and above-limit emissions, as a result of which negative environmental changes were recorded, is also recognized as environmental harm and entails the application of additional payment rates to the base amount of the administrative penalty for environmental offenses.

9.3.5.2. Types of compensation for environmental damage

According to the Regulation 34 of CEPA, if there's an evidence of environmental damage, a court orders to negotiate a plan to correct the harm to the environment. The plan may include the following:[640]

- the prevention, reduction or elimination of the harm ;
- the restoration of the environment, including the restoration of cultural and aesthetic values of natural objects;
- monetary compensation to execute above mentioned measures;
- measures to track the performance of actions in line with the adopted plan.

Authorized agency or other individualsthat revealed the fact of environmental damage (*plaintiff*), or the object the actions of which lead to environmental damage (*defendant*) is responsible for the preparation of the plan. The court may appoint an independent individual to prepare a draft plan if authorised agencies and individuals that caused environmental damage can not come to a consensus.

The plan is prepared in line with approved deadlines and must be done according to *reasonable,practicable* and *environmentally sound*[641] principles. If the bodies that caused environmental damage took all necessary actions to restore the environmental conditions before judicial process, the court does not set up a claim for preparation of the plan.

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[639] Environmental Violations Administrative Monetary Penalties Regulations
[640] The Canadian Environmental Protection Act
[641] The Canadian Environmental Protection Act

It should be noted that the performance of measures envisaged in the plan for environmental restoration does not exempt violators from payment of administrative penalties for environmental crimes. Penalty payments are transferred to the *Environmental Damage Fund* the purpose of which is to finance priority environmental projects.

9.4. Legacy contamination

Legacy contamination means accumulated environmental damage that occured as a result of extensive use of lands and reservoirs for industries, positioning/processing/storage of waste and any other commercial activities. Dumps of solid municipal wastes, sites of dumped and unusable pesticides, oil sludge pits or former military training areas are examples of legacy contamination.

The main principle of regulatory agencies in all countries is to impose responsibility on initial polluter or current/former owner or territory lessee. This includes companies that are the source of pollutants; companies that initiated activities which lead to pollution; companies with the source of pollution on their territory. When it is impossible to determine initial polluter or the owner of the territory, the government takes responsibility for elimination of pollution. The elimination of caused damage is done based on the results of risk assessment that reveal risk of pollutantion to the environment.

It worth noting that in such countries as Canada, Great Britain, the USA, Norway and Brazil purchase and sale deals are concluded based on "caveat emptor" or " purchase at buyers own risk" principle: buyer of the land takes responsibility for previously caused damage even in cases he was not aware of pollution. However, in Russia, Germany and the USA if there is sufficient evidential base it is possible to bring former owners of the territory to responsibility retrospectively.

9.4.1. Russia

The legislative acts of Russia defines "legacy contamination" as accumulated environmental damage. According to the Article 3 of the Federal Law No.254[642], accumulated environmental damage is a damage that occured as a result of previous economical or any other activity and was not eliminated in full. The object stands for water area where accumulated environmental damage was revealed and also capital facilities, waste disposal sites that present the source of accumulated environmental damage. Disposal sites of municipal solid waste, sites of dumped and unusable pesticides, oil sludge pits, technological barns, etc.[643] can be referred to objects of accumulated damage.

[642] Federal Law No.254 "On Introduction of amendments to certain legislative acts of the Russian Federation" dated 03.07.2016
[643] Site of Ministry of Natural Resources and Environmental Protection of the Russian Federation

Federal Law dated 10.January.2002[644] establishes legal framework and mechanisms for elimination of such damage. Under the Law, revealing of polluted objects is performed during the inventory and examination of territories and water areas which were used for economical activities but currently there are unownedcapital construction projects with waste disposals. The Federal Service for Supervision of Natural Resources keeps public register of such lands. This includes processing of applications from governmental authorities or local government, classification of objects and updating of information.

Under the order of the Ministry of Natural Resources dated 04.08.2017[645] the classification is done within 30 working days from the day of inclusion of objects to the public register. Thereby the following criteria are considered:

- the volume of polluting substances;
- the volume of disposed production waste materials and consumtion by different danger classes;
- land area (water area) under adverse impact;
- level and volume of adverse impact on environment;
- the presence of dangerous substances in objects specified in the international contracts, signed and ratified by Russia;
- number of people living at the territory that is under adverse environmental influence of the object or there is a thread such influence;
- overall influence of the contaminated area on environmental safety that is defined as a sum of values got from the criteria above.

Contaminated sites are being included into priority project program in line with the results of the categorization and funds from the federal budget are being allocated for the elimination of accumulated damage. Under the approved mechanism the organization of elimination measures is an exclusive right of the state bodies and self-government authorities.

Under the legislation, legal and natural persons causing environmental damage are obliged to compensate it. According to Paragraph 3 of the Article 78 of the Law on Environmental protection [646] an action relating to compensation of a harm inflicted to the environment by a breach of the environmental protection legislation may be brought within 20 years. Therefore, judicial settlement may be held during the period to assign responsibility for compensating caused damage on defendant .

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[645] Order of the Ministry of Natural Resources and Environment of the Russian Federation dated August 4, 2017. No.435 on adoption of criteria and terms of object classification with accumulated environmental damage which are the subject toelimination with priority

[646] Federal law "On Environmental Protection " dated 10.01.2002 No. 7-FL

9.4.2. UK

Legacy contamination is a common issue in the UK. Such pollution is a result of active use of land and water areas for industrial purposes and also uncontrolled disposal of waste since the times of the industrial revolution[647].

The matter of legacy contamination in the UK is not regulated by any separate legislative act. Part 2A of the Environmental Protection Act 1990 sets requirements on management and regulation of polluted lands, regardless of whether they are legacy or not[648]. It should be noted that elimination measures of legacy contamination are applied only after conducting a risk assessment, which determines the hazard of pollutants to the components of environment. Risk assessment allows to reveal the effect of pollution (*contaminant*) on the recipient (*receptor*) through the migration path of pollution (*pathway*).

- *contaminant* is a substance or material on the surface or underground, which may have negative impact on human health or condition of environment.
- *receptor* is any subject that my be adversely influenced by the pollution including human and bio-objects, surface and ground water objects.
- *pathway* is the route that connects pollution and subject of influence.

The remediation measures are carried out only upon the availability of such connection (three connected components: *contaminant-pathway-receptor*) and determination of substantional risk or damage of pollution to human health, the state of water and other natural resources. According to chapter 2A of the Act the following persons or entities may be responsible for elimination of pollution:

A Class

Persons or entities activities of whom caused pollution of lands; or persons or entities who knowingly permitted land pollution.

B Class

If it is impossible to determine A Class persons, then the owners and / or tenants of land are responsible for the elimination of pollution (including legacy contamination), regardless of whether the pollution is a result of their activities. Purchase and sale of real estate and lands in the UK are based on the principle "caveat emptor", which means that the buyer of the land takes responsibility for the previously caused environmental damage even if he did not know about the pollution. If regulation authority cannot identify Class A or Class B persons, the polluted lands should be classified as "orphan"[649] and the government takes the responsibility for elimination of pollution via budget funds.

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[647] DEFRA, 2012. Contaminated land statutory guidance
[648] Land affected by contamination
[649] DEFRA, 2012. Contaminated land statutory guidance

It is important to mention that the personcarrying out the elimination of legacy contamination takes the responsibility for project documentation approval on restoration work and and obtaining environmental permits. In addition, responsible persons also pay all environmental payments. However, if cleaning or land reclamation is done for any social-economical purposes, those responsible for elimination of legacy contamination may receive government support in the form of grants or loans.

9.4.3. Norway

At the end of 2017, 5000 objects with legacy contamination were registered in Norway[650]. The most popular types of pollutions are industrial pollutions including those made by chemical or oil wastes. Contamination Act defines requirement that any environmental pollution should be paid by polluter (polluter pays principle). By "polluter" the regulatory base of Norway means the following legal entities:a company the activity of which caused pollution;

- a company that began activity which caused pollution;
- a company the territory of which has the source of pollution or legacy contamination[651].

The presence of the latter category of pollutants in the legislation allows state authorities to prosecute the present object owners or tenant farmers regardless of whether they were acknowledged about pollution before land purchase or sign of rental agreement. Norwegian legislation allows regulatory bodies to reveal “polluter” or several “polluters” from above mentioned categories by themselves. The main criterion while revealing responsible body is financial and technical ability of the “polluter” to remedy and restoreof the lands. In most cases, regulators firstly prosecute direct polluters and in case there is no one or it is impossible to detect them, land owners.

If it is impossible to define the source of pollution and, accordingly, determine a responsible person, the government takes responsibility to conduct all necessary measures for cleaning and restoration of polluted lands by means of budgetary financing[652]. Yearly the Ministry of Climate and Environment of Norway allocates up to 17 bln. USD to finance projects for remediation of legacy contamination and to provide financial support for companies that cannot eliminate land pollution at their own expense.

9.4.4. Germany

In Germany, one of the most industrially developed countries of Europe, the solutions of problems for polluted lands are of high priority for environmental

[650] Contaminated soil, the Norwegian Environment Agency
[651] Ecological risk assessment of contaminated sites
[652]Conditioning with all concerned. Oslo Fjord Clean Up

policy. Legacy contamination (*Altlasten*) include territories of former military sites, industrial facilities, sites that were used for processing, storing or dumping wastes as well as the territories where substances with high level of hazard to the environment were used (including radioactive). The regions with legacy contamination are industrial centers on the river Rhine and the Ruhr area, territories on the borders with Poland and Czech Republic, which inherited pollutions made by factories of heavy industry enterprises in the zone of so-called “black triangle”.

Current legislation is presented by the Federal Law on Soil Protection (*Bundesbodenschutzgesetz*)[653] as of 1998 and the Federal Soil Protection and Contaminated Sites Ordinance (*Bundesbodenschutzverordnung*)[654] as of 1999. According to clause 5 of Article 2 of the Federal Law on Soil Protection, former disposals and former industrial objects are treated as historically polluted areas, which, as expected, have negative soil changes or other hazards to individuals or the general public.Bodies that may be held responsible for legacy contamination are:

- a company the activity of which caused pollution (*Handlungsstorer*);
- a cessionary of polluter (in case of reorganization of legal entity);
- the current owner of the territory, tenant farmer or person who has permission (licence) for activities on the object acts as *Zustandsstorer* (person responsible for the current state of the object);
- former owner of the territory if he sold its property after March 1, 1999 and herewith was acknowledged about the pollution of the territory.

To establish the fact of pollution and appoint a person responsible for pollution, the appointing authority may conduct an inquiry taking into account all conditions. State agencies cover initial expenses for investigation of territories with signs of pollution. "Polluter" pays the costs of restoration only in case of proven pollution.

The Federal Soil Protection and Contaminated Sites Ordinance establishes requirements on making investigations and planning of measures for remediation of possibly polluted territories. The ordinance also regulates marginal (trigger) values of pollution agents that require appropriate response measures depending on the way of influence (pollution-human, pollution-flora and pollution-ground waters). If in a result of carried investigation the increase of maximal permissible concentration of pollution agencies was found out, then the territory, that is under investigation, is declared to be polluted and a "polluter" is obliged to provide works on land reclamation and cleaning of polluted area including surface watercourse and underground waters. The order settles a request that obliges responsible body to provide environmentally friendly way for pollution elimination, taking all preventive measures to avoid repeated release of polluting agents to the environment

[653] Bundes-Bodenschutzgesetz - BBodSchG
[654] Bundes-Bodenschutz- und Altlastenverordnung

during works for pollution settlement. Herewith extracted polluted soil will be treated as "waste" and will be a subject to the law on waste management.

If a property item was transfered to a new owner after March 1, 1999, then the former owner is obliged to perform works on restoration at their own expense if only they could not prove that they didn't know and could not get to know about the pollution and possible negative consequences for soil.

If there is a change of the land owner, then a new owner takes responsibility for any hazard from the territory even if such hazard was caused by other individuals. The owner takes full and unlimited responsibility for payment of all expenses connected with works for cleaning of polluted territory, if necessary. Limitation of liability to the amount of the value of the land is applicable only in cases when a new owner can show facts that prove he did not know about pollution prior the the land purchase. In those cases when a new owner did not know about pollution at the moment of purchase, but explored it later, then he (the current owner) will be obliged to pay expenses for cleaning of polluted territory and its restoration.

The executive authorities decide on the identification of the individual responsible for the pollution based on the available facts for each individual case. The authorities are not obliged to search for an individual who was the owner of pollution in the period when the pollution occured, if it is no longer possible to find him. The responsibility transfers to the current owner or operator. These individuals have the right to go to the court with the requirement to recover costs from the direct polluter. When contamination is effected by several persons at once, then the principle of equal and fair distribution of the cost among these persons (joint and several liability) applies. If the responsible person does not take appropriate measures for the recultivation of the land within the established time limits, the state authorities may allocate the funds necessary for carrying out the remediation work, and then to recover costs from the responsible person in court. If at the same time the market value of the object increased, and the owner did not pay the costs in full, then he would need to pay extra to the current value of the object in the amount set by the relevant competent authority[655].

9.4.5. Brazil

Dynamic development of industrial production, trade and building in Brazil that took place in the 90th. of 20th century along with insufficiently developed legislative framework in the field of environmental protection, led to large-scale pollution of soil and ground waters.

The owner of the land takes responsibility for legacy contamination and he is obliged to compensate all expenses for restoration works, even though he is not guilty of

[655] The experience of European Union countries and the countries of central and east Europe in decision making for former ecological damage - Debatable report for the World bank.

causing environmental damage. The legislation provides for the possibility of sharing responsibility, if it is proved that the pollution was caused by several persons. When transferring ownership, the new owner of the land assumes full responsibility for the pollution that exists on the land, except for the cases when the exclusion of such responsibility was specified in the terms of the sale contract[656]. The current owner of the land has the right to file a lawsuit against the former owner if he can provide evidence that the pollution occurred before he acquired the land.

In those cases, if it is impossible to determine the owner of the land, then the responsibility for the elimination of pollution passes to the state. Environmental protection authorities and other related parties (Office of Public Advocates, non-governmental organizations, individuals) may require responsible parties to carry out land restoration by requesting an appropriate assessment of contaminated land and a plan for their restoration.[657]

9.4.6. The USA

The main elements of american system that work on legacy contamination are Comprehensive Environmental Response, Compensation and Liability Act (1980) (*CERCLA*) and Superfund Amendments and Reauthorisation Act (1986) (*SARA*) which together with the range of other normative legal documents have mutual name "Superfund". Superfund is a regulatory structure to valuate and determine the priority of territory cleaning and also set responsibility for expenses on ellimination of pollution caused by any economic activities. The area of application for Superfund is spread on so called "inactive objects[658]" when pollution caused in a result of usage of working objects under normative acts that regulate current activity of environmental protection, in particular, Resource Conservation and Recovery Act (*RCRA*).

It is possible to emphasize the following peculiarities of approach that defines responsibility for legacy contamination:

- “necessity” (*strict*) - responsibility regardless of severity of offence;
- “collectivity” (*joint and several*) - can be applied for several bodies at once;
- “roll-back” (*retroactivity*) - has unlimited application even for pollutions that took place before Superfund in 1980.

Responsible bodies, that may bear responsibility for cleaning measures of polluted areas or compensate expenses, if such works are covered by the government, may be any bodies that were ever a part of initiation of pollution. As a rule, such category of bodies may include companies that are the source of polluting agents, operators

[656] Directoria Nº 038/2017/C Sao Paulo
[657] Environmental law and practice in Brazil: overview
[658] The objects that finished financial and economic activity

of training areas for processing and elimination of waste, companies that transport them and owners (current and former) of territories that become polluted[659].

EPA as well as the state government agencies are endowed with powers to open evaluation of any territory with evidences of potentional pollution and based on formal rating system of hazard levels, to list such territory in the National Priorities list (*NPL, Superfund sites*), which automatically means the obligatory carrying of its remedial actions. By the results of complex valuation, natural resource users may emerge from pollution responsibility in cases when the range of adverse influence is treated as unessential or when natural resource user is recognised impaired. The responsibility for legacy contamination does not cover lands that belong to private individuals or local authorities.

During the assignment of the property for land and industrial objects the seller cannot put off responsibility for territory pollution, but the buyer may take at least part of mentioned responsibility during dealing. As a result there is a base to conduct elaborative inspections of current environmental conditions of the purchase-sale objects and previous economical activities of the seller as part of obligatory procedures for making deals on assignment of property (due diligence).

The main principle of many other countries and regulatory authorities of the USA requires to set responsibility on the polluter even if there is a wide range of that sort. There are exceptions in that cases when the government takes responsibility for conditions of abandoned contamination, for example, when it is impossible to find guilty person and if responsible body is one of the government frames. Besides, the government has the right to initiate works for cleaning of polluted territories without any guilty body and after that to collect expenses from responsible bodies.

9.4.7. Canada

The experience of Canada for carrying works on accumulation of environmental damage is substantially similar to the American practice. The main responsibility is imposed on the current land owner. However, the principle of separated responsibility may be applied. The example is in the *Environmental Management Act* of British Columbia. According to it, the responsibility for restoration of polluted lands is taken by the current owner, the previous owner and may also be placed on the former owner of the company/site/object on the territory of which the pollution took place and caused environmental damage. In addition, a subject may be held accountable for transporting hazardous substances, as a result of the actions of which pollution has occurred.

The responsibility results in obligatory compensation of expenses for restoration (*costs of remediation*) which include the costs for preparation of the territory for restoration procedures, development of restoration plan, penalties and other

[659] Superfund Liability

payments imposed by authorised agencies and also the cost of restoration activities by itself. A person is held accountable on the basis of a decision of the commission, convened either by the Minister of the Environment, or by the director of the Environment Department, who, in addition to determining the guilt, can assess the value of restoration costs.

The principle of separated responsibilities was supported by judicial decisions in trials connected with the Canadian Environmental Protection Act (*CEPA*). Further development of federal and local laws together with juridical decisions that broadened the range of responsible bodies, entailed a significant strengthening of the role and importance of expertise in environmental and economic activities carried out in concluding property transfer transactions, even if the basic principle of transferring substantive responsibility. As a result, the development of the practice of Due Diligence allows to determine legacy contamination and estimate costs, and ultimately affect the value of the transaction.

9.5. The responsibilities of natural resource users on public notice about the consequences of their activities

The legislation of *Russia* does not establish obligations for subsoil users to inform population about environmental consequences of implemented activity. According to clause 24 of Russian law on Subsoill resources[660], in the event of an immediate threat to the life and health of population in the zone of influence of work related to the use of subsoil, the managers of corresponding companies are obliged to inform the relevant state and local authorities.

According to the Law 116-FL “On Industrial Safety of Hazardous Production Facilities”,[661]the organisation operating the hazardous production facility is obliged to promptly inform in the prescribes manner by the Federal Executive authority in the field of industrial safety, its local agencies and other government bodies, local authorities and the population about emergency at the hazardous production facility.

According to clause 13, 14 and 32 of the Act of environmental damage of the UK[662], natural resource users are obliged to inform appropriate public authorities about the consequences of their activities, in particular to give information about accidents, emergencies and other cases that lead to pollution of environment and/or make harm to health of population and workers[663]. They, in their turn, embark all necessary actions to provide security for community and take decisions about necessary information of population about the consequences of pollution.

[660] The Law of the Russian Federation dated February 21, 1992. N 2395-I "On Subsurface Resources"
[661] About safety at hazardous production facilities
[662] The Environmental Damage (Prevention and Remediation) (England) Regulations 2015
[663] Environmental Law in the UK, Clifford Chance

The Law of *Norway* has no direct responsibility for natural resource users to inform community about the consequences of its activities. However according to the *Pollution Control Act*[664], the body that carries out business which may cause significant pollution of environment, should immediately inform the nearest police agency in case of significant pollution or danger of critical pollution. The obligation to give notice remains with the body responsible for pollution. Other bodies are also obliged to provide notice untill it is determined that this is clearly not necessary.

The law of *Germany* has no direct responsibility for natural resource users to inform community about the consequences of its activities. Natural resource users are obliged to reveal information about capacity of emissions in the form of reports and declarations to authorised agency which must provide accessibility of information for wider public by means of its publishing it in official databases on the Internet.

In case of environmental damage, natural resource user is obliged to inform the authorised agency immediately. If the fact of environmental damage was confirmed, natural resource user is obliged to give information about his activities on request of injured party to define claims about damage compensation. Injured party may request only the information related to the activity which caused environmental damage, including information about types and concentrations of polluting substances released to the environment and other negative effects as well as information about unit operational covenant. In this case natural resource user consolidates the right to keep information in secret which in virtue of legal requirements, commercial interest or third party interest is confidential.

All legal bodies and private individuals of *Brazil* have an obligation to inform both environmental authorities and population about environmental incidents. Especially when there is possible infliction of injury for public health and significant damage of environment.

Such kinds of activities as mining and downstreaming and also transportation of dangerous products presupposes specific procedures to open information about accidents and emergencies. The responsible party should immediately inform proper authorities about emergencies that may pose risk to population.

The law of Brazil settles that [665] all state organisations should provide public access to any information about the environment, in particular, to information related to quality of environment, environmental policy, plans and programms, accidents, risks, emergencies, air emissions, discharge of wastewater and production of waste, dangerous and toxic substances. The exception is the confidential information. Private individuals have the right to request information related to potential effect

[664] Pollution Control Act

[665] The law of Brazil No.10.650 (Provides public access to data and information in the organs and entities that are members of Sisnama)

on environment. Legal authorities should provide availability of environmental information for population by publishing it in official sources.

To make control for negative impact on environment in *the USA*, American environmental authorities collect statistic and other data in the range of company reports about impact on environment and received permissions for emissions/discharge. This environmental information is accumulated on local level by authorised state agencies and Environmental Protection Agency (EPA) at the federal level and is available to the public in different data bases. [666]

The *Emergency Planning and Community Right-to-Know Act* (*EPCRA*)[667] in the USA (, specifies requirements for operators to give information to federal, state and local authorities about storage, usage and emission of dangerous substances.

National Pollutant Release Inventory (*NPRI*)[668] in Canada, maintains records of information about emissions in the air, water and soil, recycling on the objects and transfer to other places for disposal.

NPRI reports are obligatory according to the Environmental protection Act of Canada (CEPA 1999). The owners or operators of the objects with emissions of pollution agents[669], should give information for NPRI.

9.6. Classification of emergency events

In *Russia*, the classification of industry incidents that pose a danger to the environment is regulated by norms in the field of industrial safety. The "*Methodological Recommendations for the Classification of Accidents and Incidents at Hazardous Industrial Facilities of the Chemical, Petrochemical, and Oil Refining Industries*" [670] presents the criteria based on which events are divided into accidents and incidents according to the definitions of these terms adopted in the Federal Law "*On Industrial Safety of Hazardous Industrial Facilitie*s"[671]. According to the Safety guide "*Guidelines for the classification of technogenic Events in the Field of Industrial Safety at Hazardous Industrial Facilities of the Oil and Gas Complex*" [672], technogenic events at oil and gas facilities are classified into 4 hazard levels, respectively, into accidents, incidents, prerequisites for the incident and violations in the industrial safety management/production control system and (or) dangerous deviations of technical parameters. It is recommended to classify

[666] EPA databases for environmental information
[667] The Emergency Planning and Community Right-to-Know Act
[668] NPRI
[669] The list of contamination agents
[670] Methodological Recommendations for the Classification of Accidents and Incidents at Hazardous Industrial Facilities of the Chemical, Petrochemical, and Oil Refining Industries
[671] Federal Law "On Industrial Safety of Hazardous Industrial Facilities"
[672] Safety guide "Guidelines for the classification of technogenic Events in the Field of Industrial Safety at Hazardous Industrial Facilities of the Oil and Gas Complex"

technogenic events by hazard levels through identifying danger features of a technogenic event with a comparison of the possible consequences of events, as well as taking into account threshold quantities of hazardous substances entering the environment. Both competent authorities and operators themselves use the above criteria in the implementation of classification of technogenic events.

In *Germany*, operators can independently classify emergencies following the criteria approved in Annex 6 of the 12th Ordinance to the Federal Emission Control Act (*Störfall-Verordnung*) [673]. The classification of events is carried out according to five following criteria: the release of hazardous substance in the amount at least 5% of the threshold values[674], damage to health, life and property of individuals, environmental damage, damage to property of legal entities and transboundary damage. After receiving the notification, the competent authority organises an on-site visit to check the adequacy of the response measures taken to mitigate adverse effects, as well as the correctness of the incident assessment made by the operator[675].

In *Norway*, the law provides a clear definition of events classified as dangerous and emergencies arising at onshore and offshore oil and gas enterprises[676]. In the event of emergencies identified by law[677], operators shall immediately send a notice to the Petroleum Safety Authority Norway in the prescribed form indicating the intended consequences[678]. The Petroleum Safety Authority Norway forwards the written confirmation of the notification to the Norwegian Coastal Administration, the Norwegian Environment Agency and other relevant authorities[679].

In the *UK*, competent officers of the Environmental Agency hold the responsibility for the qualification of incidents. The classification of incidents is carried out according to the Common Incident Classification Scheme[680]. The Common Incident Classification Scheme (CICS) is a two-tier system. The first tier measures our physical response and impact on Environment Agency business in dealing with the incident. The second tier describes the actual impact the incident has on the environment (people, property and the natural environment).

In *Canada*[681], the authority has developed an assessment matrix for classifying incidents. According to the matrix, all incidents are classified as the alert or level-1, -2, or -3 emergency. Incidents that can be handled on-site through standard operating procedures are very low risk and are typically defined as an alert. Those with low to high risk require a more difficult or complex resolution and are defined as

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673 Störfall-Verordnung - 12. BImSchV, Anhang 6
674 The threshold values are given in Appendix 1 of the 12th Ordinance to the Federal Emission Control Act
675 § 16 Störfall-Verordnung - 12. BImSchV
676 Guidelines regarding the management regulations
677 Guidelines regarding the management regulations
678 The form to confirm notification/report of hazards and accidents in the petroleum industry
679 Regulations relating to management and the duty to provide information in the petroleum activities and at certain onshore facilities (the Management regulations)
680 Incidents and their classification: the Common Incident Classification Scheme (CICS)
681 На примере провинции Альберта

emergencies. The licensee determines the initial level of emergency in order to immediately communicate and activate internal response resources. The licensee must contact the AER immediately after it has communicated and activated internal response resources to confirm the level of emergency and convey the specifics of the incident[682].

In the *USA*, clear criteria for qualifying emergencies are not regulated by law. In the case of such conditions, operators are required to prepare facility-specific response plans and immediately notify the competent authorities[683]. The competent authorities of the National Response System conduct the response, management and assessment of emergencies and incidents[684].

In *Brazil*, operators are also required to submit a detailed Emergency Plan[685]. The Monitoring and evaluation group, consisting of representatives of the Brazilian Institute of Environment and Renewable Natural Resources (*IBAMA*), the Navy of Brazil and the National Agency of Petroleum, Natural Gas and Biofuels (*ANP*), carries out the assessment and classification of emergency cases of oil spills at sea[686].

[682] Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry (February 2017). The assessment matrix is given in Appendix 4 of the Directive
[683] Title 40: Protection of Environment Appendix F to Part 112—Facility-Specific Response Plan
[684] National Response System
[685] Conama Resolution 398, p.726
[686] Decree 8.127, 2013

10. ENVIRONMENTAL PAYMENTS

Based on results of the study, environmental payments can be categorized by the following:

- *taxes for negative impact on the environment/release and dischargess of the polluting substances to the environment;*
- *natural resources fee (for example, water consumption);*
- *administrative charges for state services (provided by competent bodies in the environmental protection, with the purpose of environmental regulation, inspection of companies, etc.).*

Fixed charge rates for pollutants released into the atmosphere are set in Russia only (list of 159 substances); in Norway, two pollutant substances (NO_x, SO_2) are charged for emissions; in Canada and USA, these charges are paid when obtaining a permission for releases and discharges of a limited amount of substances. In UK and Brazil, taxation for pollutant releases and discharges is not practised. It should be noted, that the practice of higher tax rates for emissions from gas flaring is applied in Russia only.

In all countries studied, taxation rates on waste management are individually considered. In Russia, charge rates for waste disposal are categorized by class of hazard; two fixing rates are applied to waste landfillinf of any hazard class in the UK. Taxation for hazardous waste disposal is commonly practiced in USA. In EU, commonly charges are applied in case of waste landfilling. While in Russia, both storage and landfilling of wastes are charged.

The main application of state tax payments in OECD countries and Brazil is to execute environmental measures: project financing for efficient exploitation of natural resources (Norway); scientific research and development, financing water quality improvement projects, (Germany); projects and educational programs on river basin management, and investments for technologies and disposal of effluents (Brazil).

10.1. Russia

Depending on activities of natural resources user, there are the following types of payments in Russia:

Table 26. Types of environmental payments in Russia[687]

Name	Legal form	Type of payment	Description
Water tax	Tax	Natural resources fee	Regulated by chapter 25.2 of Revenue Code of the Russian Federation. Exploitation of water bodies in Russia are subject to charges. Exploitation of water bodies are taxed and this money is allocated for their restoration and protection.

[687] Revenue code of the Russian Federation
Land, Water, Forestry Codes of the Russian Federation
Yalbulganov A.A Legal regulation of natural resource payments
http://схемо.рф/schema?source=190

Name	Legal form	Type of payment	Description
Hunting tax	Tax	Natural resources fee	Species are those included in the list provided in the chapter 25.1 of Revenue Code of RF
Mineral Extraction Tax	Tax	Natural resources fee	Mineral Extraction Tax defined by chapter 26 of Revenue Code of the Russian Federation.
Water abstraction fee	Fee	Natural resources fee	Payment for exploitation of water bodies.
Penalty fees	Fees		Charged for undue or incomplete advanced payments and payments for negative impact on the environment, based on the results of a reporting year.
State duties	Fees		Payment for licences, projects, etc.

Environmental payments are mandatory for legal entities and entrepreneurs who carry out commercial or other activities negatively impacting the environment on the territory, continental shelf and in exclusive economic zones of Russia, except for legal entities and entrepreneurs who carry out commercial or other activities exclusively on facilities of IV category with minimum negative impact on the environment[688].

In addition to payment for natural resources and state duties, payments for negative impact on the environment (releases into the atmosphere, discharges into water bodies, waste disposal) are introduced.

Currently, there is a practice when costs for measures on reduction of negative impact on the environment are deducted from the amount of payment for negative impact on the environment[689].

Additionally, state support in integration of the best available technologies (BAT) and other measures aimed to reduce negative impact on the environment is provided[690].

[688] item 1 of clause 16.1 of the Law No.7-F3
[689] Federal Law dated January 10, 2002 N 7-FZ "On Protection of Environment" Article 16.3 item 11
[690] Federal Law dated January 10, 2002 No.7-F3 "On Protection of Environment" Article 17

State support includes[691]:

- tax incentives in accordance with the Russian legislation on taxes and fees;
- tax incentives regarding payments for negative impact on the environment;
- allocation of funds from the federal budget and the budgets of subjects of the Russian Federation in accordance with budget legislation of Russia.

State bodies can provide tax incentives to companies for design, construction, and reconstruction periods of the following facilities:

- circulating water supply systems and zero-discharge water systems;
- centralized water sewage systems (sewage facilities), sewage networks, local (for certain facilities of commercial and (or) other activities) structures and equipment for treatment of effluents, including drainage waters, waters for treatment of liquid household wastes and sediments of effluents;
- structures and plants designed to capture and dispose released pollutants, for thermal treatment and treatment of gases before they are released into the ambient air, for useful application of oil-associated gas.

10.1.1. Payment for Pollution of Environment

Impact of commercial or other activities resulting in negative changes in the quality of the environment is subject to environmental charges[692]. Order of RF Government[693] establishes three types of charges for pollution of the environment:

- in amounts not exceeding maximum allowable rates of releases and discharges of pollutants, or volumes of waste disposal established for natural resources user;
- for approved temporary allowable (interim) limits;
- for above-limit emissions and discharges.

According to the current RF legislation, [694] operators which emissions and discharges are regulated under temporary allowable limits regime subject to pay base emission/discharge tax rate multiplied by factor “5”.

For above-limit emissions/discharges (incl. accidental releases of polluting substances), operators are obliged to pay base tax rates multiplied by factor “25”. If regulated facility carries out its operations in special protected areas, base rates for negative impact on the environment are multiplied by factor “2”.

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[691] Federal Law dated January 10, 2002 No.7-F3 "On Protection of Environment" Article 17
[692] Comparative tables on payment rates for emissions (PS release and discharge) are given in Appendix 2.
[693] RF Government Decree dated March 03, 2017 N 255 "On calculation and collection of charges for negative impact on the environment"
[694] Order of RF Government dated March 3, 2017 N 255 "On calculation and collection of charges for negative impact on the environment"

Charges for negative impact on the environment are added to the budget of the budget system of Russia, according to the budget legislation[695]. From 2001, charges lost their target status[696]. Thus, funds from charges for negative impact on the environment, as well as charges for exploitation of natural resources transferred to the budget are not currently marked and can be used not only for evnrionmental protection measures and measures on environmental quality increase, but for other purposes.

Rates of charges for waste disposal are given in the Table 27.

Table 27. Charge rates for waste disposal.

Hazard classes	**Russian rubles**	**US dollar**[697]
Wastes, class I (extremely hazardous)	4,643.70	79.63
Wastes, class II (highly hazardous)	1,990.20	34.13
Wastes, class III (moderately hazardous)	1,327.00	22.75
Wastes, class IV (low hazard) (except for solid household wastes, class IV (low hazard)	663.20	11.37
Wastes, class V (non-hazardous practically):		
in mining industry	1.10	0.02
in processing industry	40.10	0.69
others	17.30	0.30

With purpose to encourage legal entities and entrepreneurs to take measures for reduction of negative impact on the environment, and to integrate BAT, factors given below are applied to base rates for disposal of hazardous wastes[698].

Table 28. Reduction factors in case of hazardous wastes disposal

Factor	**Condition**
0	In case of disposal of class V wastes in mining industries by laying artificial cavities in rocks in the process of land and soil cover recultivation (following the section "List of environmental protection measures" of design documentation and (or) technical project for development of mineral deposits)
0.3	In case of disposal of production and consumption wastes generated during in-house production within limits for their disposal in special facilities owned by a legal entity or entrepreneur as a right of property or on other legal basis, and which are equipped in accordance with established requirements
0.5	In case of disposal of classes IV and V wastes generated in the process of utilization of earlier disposed wastes from processing and mining industries
0.67	In disposal of class III wastes generated in the process of neutralization of class II wastes

[695] Federal Law dated January 10, 2002 No.7-F3 "On Protection of Environment" Article 16.3
[696] Environmental payments. Article
[697] Rate is given based on average exchange rate for 2017, National Bank of Kazakhstan https://www.nationalbank.kz/cont/2017%20%D1%80%D1%83%D1%8111.pdf

Factor	Condition
0.49	In disposal of class IV wastes generated in the process of neutralization of class III wastes
0.33	In disposal of class IV wastes generated in the process of neutralization of class II wastes

At present there is a practice in which the costs for the implementation of measures to reduce the negative impact on the environment are deducted from the amount of emission/discharge taxes.

Starting from January 1, 2020, with purpose to encourage legal entities and entrepreneurs to take measures on reduction of negative impact on the environment and integrate BAT, additional factors given below are applied to charge rates for negative impact on the environment.

Table 29. Additional factors to charges for negative impact on the environment, starting from 2020

Factor	Condition
0	For volume or mass of PS releases and PS discharges within process norms after integration of the BAT in a facility negatively impacting the environment
0	For volume or mass of production and consumption wastes subject to accumulation and actually used in the course of their generation in in-house production in accordance with process regulation or transferred for usage within time specified by Russian legislation on waste handling
1	For volume or mass of PS releases and PS discharges within standard limits for allowable releases, limits for allowable discharges
1	For volume or mass of production and consumption wastes disposed within specific limits, as well as in accordance with reporting on generation, utilization, neutralization, and on disposal of production and consumption wastes, which is provided in accordance with Russian legislation on waste management
25	For volume or mass of PS releases, PS discharges within temporary allowed limits for releases, temporary allowed limits for discharges
25	For volume or mass of production and consumption wastes disposed beyond established limits for their disposal, or stated in declaration on environmental impact, as well as in reporting on generation, utilization, neutralization, and on disposal of production and consumption wastes, which is provided in accordance with Russian legislation on waste management
100	For volume or mass of PS releases, PS discharges exceeding those established for facilities of category I (significant negative impact on the environment), as well as exceeding those indicated in declaration on environmental impact for facilities of category II (moderate negative impact on the environment)

10.1.1.1. Payment regime for oil and gas sector

There is a special tax rate calculation methodology for air emissions caused by gas flaring on oil and gas facilities[699].

Table 30. Factors applied to charge rates for releases from gas burning

Numerical value	Description
25 (100 starting from 2020)	Factor applied to a base rate of charges for releases in part of volume or mass exceeding those established by permits for PS release into the ambient air
from 1.01.2018 to 31.12.2019 and from January 1, 2031 -**1**; from 1.01.2020 to 31.12.2030 - **0.25**;	For new marine raw hydrocarbon deposits totally located within Barents sea, Kara sea, Pechora sea, the sea of Chukotsk, East Siberian sea, White sea and Laptev sea, percent of their field depletion is more than 0.01, as on January 1, 2017
2	Additional factor to base rates of charges for releases regarding territories and facilities under special protection in accordance with federal laws
25 **120**	In case if maximum allowable value of APG flaring has been exceeded If measurement tools and (or) technical systems and devices with functions measuring volume of APG flaring are not available

10.1.2. Natural resources fee

Fees for exploitation of natural resources are levied in compliance with Revenue Code of Russia and some legislative and standard acts of Russia. Payers for exploitation of water bodies are organizations and entrepreneurs who directly exploit water bodies using constructions, technical tools and devices subject to licencing.

Exploitation of water bodies using constructions, technical tools or devices with the following purpose is subject to payment: water abstraction from water bodies, supplying water for hydropower engineering needs, exploitation of surface area of water bodies[700].

[699] RF Government Order dated November 8, 2012 N 1148 "On specifics in calculation of charges for negative impact on the environment in case of PS releases to the ambient air, which generated from burning in flare units and (or) dissipation of oil-associated gases"

[700] Order of RF Government dd. 30.12.2006 N 876 (rev. dd. 29.12.2017) "On charge rates for exploitation of water bodies of federal property"

Fee rates for abstraction of water bodies of federal property, of property of territorial entities of RF, municipalities, are calculated and levied according to Government of Russia, state power bodies of entities of Russia, and local authorities respectively. Payment is charged for a unit of water abstracted (1 cubic km) and varies depending on category of water body (river, lake, sea). Rates of payments for water abstraction for hydropower production are separately charged.

10.1.3. Charges for subsoil use

According to the law "On Subsurface Resources", the following types of charges exist:[701]

- single payments for subsoil usage utilization – established upon results of a competition or an auction and registered in a licence for subsoil usage. Minimum (start) value shall not be less than 10 % of amount of tax for mining.
- regular payments for usage utilization of subsoils are charged per area of subsoil zone provided to a user on rates for exploration and assessment of reserves, for exploration of minerals.
- fee for participation in a competition (auction) for field development – is paid by all participants of an auction and is one of the conditions of application review. Its value is calculated based on administrative costs for preparation, holding, and finalising a competition (auction), etc.

10.2. UK

Unlike many international practices, there is no tax regime for release/discharges of polluting substances in the UK. Hence, the information on emission/discharge tax rates is not available.

10.2.1. Landfill tax in England and North Ireland

This tax is directed to encourage companies to use alternative forms of waste management (processing, recycle, reuse, etc.). This tax is paid by companies owning landfill sites and companies that dispose their waste by landfilling. Tax is paid as per two rates for every tonne of waste[702]:

- reduced rate of £2.80 (3.5 US dollars) for inert[703] wastes;
- standard rate of £88.95 (113.85 US dollars) per tonne of wastes.

[701] The Law of the Russian Federation dated February 21, 1992. N 2395-I "On Subsurface Resources"
[702] Environmental taxes, reliefs and schemes for businesses
[703] Inert - inactive wastes, for example sand o stones

Collected funds are transferred to Landfill Communities Fund to support landfill operators that integrate technologies and advanced practices on waste management[704].

In case of unauthorized disposal of wastes on landfills not authorized for landfill, companies must pay a landfill tax on top of the penalty for violation of environmental legislation.

Companies do not have to pay landfill tax on:

- dredging activities;
- quarrying and mining [705] etc.

Companies can get tax credits if waste from landfill send to be recycled, incinerated or reused.

10.2.2. Water abstraction/withdrawal fee

Water can be withdrawn according to licences issued by the Environment Agency. In order to withdraw water, a company shall make administrative payments, which include fee for a licence ranging from £135 to £1500 (172-1920 US dollars) and administrative fee for the work of the Agency in the amount of £100 (128 US dollars). Additionally, facilities withdrawing water pay annual fees calculated for every water source. Annual fees for water withdrawal are paid as per two rates: standard and compensating. Fees at the standard rate cover expenses by Agency to support and manage water withdrawal of water bodies. Fees at the compensating rate also cover administrative expenses related to updates in licencing conditions.

Rates of fees for water withdrawal are calculated separately for every water source. When calculating individual charge rates, the Agency takes into account such factors as planned *volumes* of water withdrawal, *source factor* of a water body, *season factor*, and *loss factor*[706].

10.2.3. Fees for state services

To cover expenses of Environment Agency, operators of regulated facilities are obliged to pay administrative fees. Amount of payments depends on activities carried out[707]. Any consulting services provided by specialists from the Agency are also subject to payment. For example, hour of consultation by the Agency expert costs £100 (128 US dollars)[708].

[704] OECD database, 2018.
[705] Wastes of Environmental taxes, reliefs and schemes for businesses
[706] Abstraction Licences Charging Scheme
[707] Environment Agency fees and charges
[708] Environment Agency fees and charges

Companies pay a fixed fee for general and industry-specific permits[709]. Rates of charges for review and issue of environmental permits are validated by authorised Ministries[710]. Companies pay those fees in case when their activities are regulated by *Environmental Permitting Regulations (EPR)* and require a permit for:

- Facilities regulated by EPR;
- waste management;
- mining waste management;
- mobile units;
- effluent discharges to land, surface water bodies, pump up to subsoils; transfer to outside companies;
- activities associated with hazardous substances, etc.

Fee rates of some permits[711] depend on OPRA rating (*operational risk appraisal*) of an organisation being set by the Agency. OPRA is calculated considering the following factors: technological complexity of activities, volumes of PS release and discharge and waste disposal, location of a production facility, environmental parameters and rating of compliance with legislative requirements[712]. If company has environmental management system in place, is ISO 14001 certified, and improves its environmental performance, it can claim to increase their OPRA rating. This, in its turn, will lead to decreased fee rates for environmental permits[713].

Authorised bodies can levy additional fees for technical or research works required for assessment of environmental permit application.

Facilities under *Control of Major Accident Hazards Regulations (COMAH)* pay fees for state inspections for compliance with COMAH.

All funds collected are used to support Agency operation, as well as their research works.

10.3. Norway

System of environmental charges in Norway includes environmental taxes and fees for state services. As Statistical Management of Norway defines, environmental taxes include all taxes, levy base of which specifically impacts the environment[714].

[709] Complete list of payments is available at link
[710] Complete list of rates is available on websites of Agencies of England, Scotland
[711] Permits for technical plants, waste operations, activities related to exploitation of underground waters, for wastes of subsoil usage.
[712] Environmental Permitting Regulations Operational Risk Appraisal
[713] Environmental Permitting Guidance
[714] Environmental taxes in Norway 1991-2004

In Norway, environmental taxes are levied on companies whose activities directly or indirectly lead to unfavourable environmental consequences[715]. Profit from environmental taxes is used to finance measures on efficient exploitation of natural resources[716]. It should be noted, that in Norway, *exploitation* of natural resources itself (including extraction of minerals) is not taxed.

10.3.1. Environmental Pollution taxes

This group of taxes includes charges for emissions of certain PS into the ambient air (NO_x, SO_2), charges for waste management and hazardous chemical compounds and substances used in production, which may negatively impact the environment. However, taxes for carbon dioxide (CO_2) are not included in this category of environmental charges, since they serve as an instrument encouraging energy efficiency in production, according to international practice of taxation[717].

Table 31. Environmental pollution taxes in Norway[718]

Type of tax	**Taxation basis**	**Tax rate in Norwegian krone, NOK**	**Tax rate, US USA[719]**
Taxes for SO_2 release	Sulphur content in fossil fuel, per liter (or for every 0.25 % of sulphur content in fuel)	0.136	0.0165
Taxes for NO_x release	Flare, per kg of nitrogen oxide (NOx) released	21.59	2.6153
	Motors, boilers, turbines with total installed power more than 10 MW, per kg of nitrogen oxide (NOx) released	21.59	2.6153
	Power plants with total installed power more than 750 MW, per kg of nitrogen oxide (NOx) released	21.59	2.6153
Tax for NO_x releases in oil and gas industry on continental shelf	Flares on oil and gas platforms, per kg of nitrogen oxide (NOx) released	21.59	2.6153
	Motors, boilers, turbines with total installed power more than 10 MW, per kg of nitrogen oxide (NOx) released	21.59	2.6153
	Power plants with total installed power more than 750 MW, per kg of nitrogen oxide (NOx) released	21.59	2.6153
Taxes for ozone depleting substances (HFCs and CFCs)	HFCs, per kg	0.45	0.0545
	CFCs, per kg	0.45	0.0545
Tax for hazardous chemical compounds	Production or import of tetrachloroethylene, per kg	71.15	8.6188
	Production or import of trichloroethylene, per kg	71.15	8.6188

[715] Main features of the Norwegian tax system, p.3
[716] Official Norwegian Report NOU 2015:15 2015 Environmental Pricing Chapter 2
[717] See "Greenhouse Gases Management" section
[718] OECD PINE Database. Environmental tax rates
[719] Rates are given according to the average exchange rate for 2017.

Type of tax	Taxation basis	Tax rate in Norwegian krone, NOK	Tax rate, US USA[719]
Waste Management	Waste removal (transportation to landfill), per t	294	35.6137
	Waste removal (wastes exempted from ban on dumping in landfills for biodegradable wastes), per t	488	59.1139
	Lubricating oils, per l	2.17	0.2629

The following is not subject to taxes for environmental pollution:

- Petroleum products with weight content of sulphur not more than 0.05 %;
- Petroleum products, lubricating oils and hazardous chemical compounds exported;
- Petroleum products and lubricating oils utilized beyond the territorial waters of Norway;
- Nitrogen oxide sources covered by environmental agreements on NOx emission reduction;
- Lubricating oils used as a part of finished products (less than 0.15 l in volume);
- Lubricating oils used in plants and ships located in the zone of continental shelf of Norway;
- Hazardous chemical compounds produced in a company for its own needs;
- Wastes consisting of contaminated soils;
- Wastes designated for special treatment, sorting, repeat usage and processing with the purpose of recovery;
- Wastes consisted of sorted out inorganic material, disposed on specifically prepared areas.

10.3.2. Fees for state services

Unlike taxes, environmental fees are not levied for environmentally unfavourable activities themselves, but are special payments for administrative services provided by competent bodies on the environmental protection.

Table 32. Fees in Norway[720]

Type of fee	Basis liable for fee	Tax rate in Norwegian krone, NOK	Tax rate, USA[721]
Administrative fees for services by competent bodies on the environmental protection	Control of chemical compounds in the environment (100 items of the most important compounds), per 1 compound a year	820	99.3307
	Control of chemical compounds in the environment (additional compounds), per 1 compound a year	135	16.3532
	Declaration of hazardous wastes (first 1000 t of wastes from a company per year), per t	35	4.2397
	Declaration of hazardous wastes (additional volume of wastes from a company per year), per t	0	0
	Permits for emissions	Rate is not determined and is estimated for every application separately	0

In addition to the above fees, municipal bodies can establish special fees for treatment of wastes and effluents. Rates of those payments vary and are calculated as per principle of full reimbursements of expenses for waste management and service of water treatment facilities.

10.4. Germany

All entities and individuals who are committed by legislation to pay environmental charges and whose activities negatively impact the environment are subject to environmental payments.

Legal practice of Germany distinguishes several categories of environmental payments: taxes and other duties, including fees and special fees.

[720] OECD PINE Database. Environmental tax rates

[721] Rates are given according to the average exchange rate for 2017.

Fiscal legislation of Germany defines taxes (*Steuern*) as follows: "Taxes are monetary payments, excluding payments considering certain benefits, collected by a state body with the aim of revenue and levied on entities responsible for such payments according to the legislation. However, tax increase shall not be the major objective"[722].

Fees for state services (*Gebühren*) are levied as payment for services of a state sector, which can be individually distributed for entities obliged to pay fees, and their major objective is to finance such services (principle of equivalence). Examples of fees regarding environmental protection serve charges for treatment of effluents and wastes, and administrative fees for permits complying with the Law on rielease control.

In addition to collection of taxes and fees, legislators can levy special fees (*Sonderabgaben*). Since special fees compete with taxes directly, but are applied to certain groups only and not accumulated in the overall budget, they must meet strict conditions, according to the court practice of Federal Constitutional Court, determined so that such fees would correspond to budgetary system of the country and guideline principle of equality established by Constitution[723]. It should be noted that environmental taxes do not determine *rates of charges for certain emissions*, i.e., amount of tax does not depend on amount of emissions.

10.4.1. Classification of environmental payments

10.4.1.1. Financing environmental payments

These are aimed to increase the revenues of the budget so that to directly finance measures on the environment protection. Usually, they are defined as special fees directed to a certain goal determined by legislation.

Fees for water withdrawal officially are not established on the federal level, however, in majority of states so-called "water pfenning" (*Wasserpfennig*) has been introduced. Fees are levied for withdrawal of water from surface water bodies and/or ground waters (Baden-Wurttemberg, Bremen, Hamburg, Lower Saxony, Mecklenburg-Western Pomerania, Saxony) or from underground waters only (Berlin, Schleswig-Holstein). Actual volume of water withdrawn in a year (cubic meters) serves as a ground for fee. Value of rate vary depending on type of waters (surface, ground) or the goal of withdrawal, for example, in order to supply water to

[722] (Article 3, (1), 1st sentence, of Revenue Code of Germany (Abgabenordnung).
[723] Promotion of Environmental Protection in German Laws on Taxes and Levies including ecological tax and fiscal reforms 2nd (updated) version April 2003, Federal Ministry of Finance, Germany

population (public water supply), for industrial supply of cold water, for industrial purposes, for special purposes, etc.

Rates of fees for water withdrawal established by States range from 0.0051 to 0,2046 € (0,0059 – 0,24 US dollars) for cubic meter[724].

Revenue from charges for water withdrawal may stay in each particular State and may be transferred both to overall budget or used for certain measures on water resources management aimed to protect underground waters or considered as compensations for agricultural limitations for water exploitation in water conservation zones.

Fees for permits of emissions are payable by operators of plants whose activities require an emission permit.

10.4.1.2. Managed environmental payments

Aimed to encourage environmentally friendly operations by applying financial incentives against polluting activities. Such charges may include charges for discharge of effluents, fees for hazardous wastes and energy taxes.

Charges for discharge of effluents are established by Federal Law "On charges for discharge of effluents into waters" (*Abwasserabgabengesetz*)[725]. This law constitutes discharge of effluents into water bodies. Discharges from industrial companies and municipal treatment facilities are subject to fees.

Law “On charges for discharge of effluents into waters” strengthens provisions about principles of effluent assessment. Degree of contamination of effluents expressed in units of harmfulness is a basis for effluent assessment. As a rule, harmfulness of water is determined according to allowable values established for oxidizers, phosphorus and nitrogen, organic halogen compounds and mercury, cadmium, chrome, nickel, lead, copper and toxicity for fish expressed in units of harmfulness as per Appendix 1 of the Law. Harmfulness is assessed according to values of pollutants specified in a permit for effluent discharge. Charge rate for effluent discharge is 35 Euro (39.6 US dollars) per unit of harmfulness of the water discharged[726].

According to the Law, a payer is any entity discharging effluents into water bodies. A part of received fees is paid to the budget of the State as a payment for effluent discharge, and another part is kept by local authorities and spent to support treatment facility operations.

Furthermore, in order to encourage appropriate treatment of effluents, legislation offers special conditions:

[724] OECD PINE database
[725] Abwasserabgabengesetz - AbwAG
[726] OECD PINE database

- in case, when a company meets requirements on content of pollutant in effluents (discharge limits), determined by a permit for discharge considering the best available technologies (part 7a of Law on water resources management), a charge rate for unavoidable units of harmfulness is reduced by 50 %.
- in case, when a non-compliance with the standards and other conditions of discharge (values of monitoring, volume of water discharged) has been discovered as a result of monitoring, a charge rate may be increased proportionally by the value which exceeds the norm; the same as "units of harmfulness" established for a company may be recalculated proportionally to the level of their exceedance.

Responsibility for payment of charges for effluent discharge does not cover[727]:

- discharge of water which was contaminated before its extraction from water body, on condition that this water was not additionally contaminated;
- effluent discharge into surface waters generated in mining industry, under the condition that this water is used to clean materials extracted and does not contain any harmful substances, except for those extracted in the process of mining, and under the condition that no harmful substances will get into other water bodies;
- discharge of effluents from ships where they have been produced;
- discharge of rainwater flowing from commercial platforms covered with concrete and asphalt, with the area up to 3 hectares, and from railway tracks, where sewage system is not provided for this purpose;
- discharge of effluents into subsoils, if quality of water embedded there (with traditional treatment methods) does not meet portable water standards.

Legislation provides opportunity to cover payments for discharge of effluents against expenses incurred by a company in reconstruction and expansion of treatment facilities, if a project ensures a reduction of contamination of effluents at least on one of pollutants by not less than 20 %. Relief from charges will be effective up to 3 years from putting that treatment facility into operation.

All revenues received from payments for effluent discharge are forwarded to local authorities of the States, which ensure *designated use of funds* by financing measures on improvement of water quality.

Fees for removal of hazardous wastes. Those fees are established by powers of the States in accordance with the hazard level of substances that is presented in waste. All revenues received are used to support scientific research and developments

[727] Art. 10 of Law "On charges for effluent discharge into waters"

directed to prevent generation of hazardous wastes as well as to control subsequent pollution.

Charge rate for removal of hazardous wastes ranges from 57.8 to 173.4 US dollars per tonne of waste[728].

10.5. Brazil

The purpose of environmental taxation in Brazil is to encourage commercial or other activities to comply with state requirements on the environmental protection and to switch to application of clean technologies. Distingushing feature of Brazilian tax regime is that environmental tax rates depend on the income of the companies.

Environmental payments in Brazil include:

- tax for environmental inspection and control (*TCFA*);
- fees for exploitation of natural resources;
- administrative fees (federal, state and municipalities).

Emissions are not taxed in Brazil, except for CO_2 emissions which are indirectly regulated by a tax for power generation.

National Congress of Brazil has adopted several legislative initiatives directed for support of environmental business, namely[729]:

- relief from tax for production of industrial commodities (*IPI*) provided with environmental certification and environmental labelling in particular; as well as offering benefits for environmentally-friendly equipment;
- tax reduction for industrial commodities with disposable packaging at rate of 50 %;
- deduction of the amount at a double rate (as operation expenses and costs), which was invested into purchasing and installation of the equipment for pollution reduction (*but limited up to 15 % of the profit taxed*).

10.5.1. Tax for environmental inspection and control (TCFA)

The main environmental tax in Brazil is the tax for environmental inspection and control, which is levied by *IBAMA* (Brazilian Institute of Environment and Renewable Natural Resources).

This tax refers to all activities potentially polluting the environment. According to the legislation of Brazil, an entity subject to environmental tax is any entity carrying

[728] OECD PINE database
[729] Environmental Fees and Compensatory Tax in Brazil

out activities in such field as mining and processing of minerals, metallurgy, machine industry, chemical industry, transportation of hazardous wastes, transportation through pipelines, fuel trading, as well as petroleum products and hazardous chemical substances trading, etc.[730]

TCFA is paid on a quarterly basis by companies depending on their revenue and degree of impact on the environment:

Table 33. TCFA tax rates for companies depending on their size

Polluting potential and exploitation of natural resources	**Micro companies**[731]	**Small companies**[732]	**Medium companies**[733]	**Large companies**[734]
Low	-	BRL 112.50 (29.25 US dollars)	BRL 225 (58.5 US dollars)	BRL 450 (117 US dollars)
Average	-	BRL 180 (46.8 US dollars)	BRL 360 (93.6 US dollars)	BRL 900 (234 US dollars)
High	-	BRL 225 (58.5 US dollars)	BRL 450 (117 US dollars)	BRL 2,250 (585 US dollars)

Part of income from tax is designated for environmental inspections on three levels of regulation (country, state, municipality). Entities relieved from tax are federal, state, municipal state institutions, charitable organizations, farmers engaging in subsistence production.

10.5.2. Water abstraction/withdrawal fee

Management of water resources in Brazil is carried out according to source principle, and, thus, charge for water withdrawal is established by local committees of water sources. Subjects of water charges are water supply and sanitation sectors, production sector, hydroelectric power and agriculture.

According to Federal Water Law, target purpose of charge for water has an economical component encouraging efficient exploitation of water, and financial component including financing of projects and integration of technologies which allow to support effective water exploitation and water withdrawal for natural facilities. Majority of the funds collected is used by local bodies for programs in

[730] Environmental Policy Act 6.938, Art. 17-C
[731] Income of a company is less than 2.4 mln. reals
[732] Income of a company is 2.4–16 mln. reals
[733] Income of a company is less than 16 – 90 mln. reals
[734] Income of a company is more than 90 mln. reals

regions where they were collected. Law establishes, that 7.5 % of revenue from charges for water withdrawal covers administrative costs of National Water Resources Management System, and 92.5 % are provided for projects and training programs within plans on river basin management, including investments for integration of effluent disposal technologies.

Calculation of water payment for all basins is unified and is based on simplified equation multiplying three variables:

1) basis for calculation includes parameters of three types of usage: water withdrawal, consumption, discharge;

2) a parameter based on invested basin management programs and on operational costs of water agencies;

3) adjusting factor considering specific points, for example, water quality classification, volume of water used in relation to permitted volume, water loss, paying capacity of subjects in agriculture.

10.5.3. Administrative fees

Some states establish administrative environmental payments by almost completely repeating federal ones, for purpose of state environmental regulation, and inspection of companies distinguished as potentially polluting the environment.

For example, in Macae city (Rio de Janeiro state), where marine oil deposits and largest auxiliary industrial companies in Brazil are located, a charge is established to cover expenses for environmental licencing, regular administrative management and inspection of production, commercial activities and service sector, as well as to set limits for exploitation of natural resources.

10.6. USA

According to the federal law, a tax is an instrument to increase revenues, while fees and duties are designed to compensate expenses of the state. Funds collected from environmental fees and charges are accumulated in General Treasury Fund. However, part of accumulated funds is transferred to budgets of controlling bodies and environmental protection institutions.

10.6.1. Waste management taxes

Taxes in waste management in different states and their rates are given in the table below[735]. It should be noted, that taxes for disposal of *hazardous* wastes is a common practice in different states of the USA. Additionally, in Vermont, in addition to taxes

[735] See OECD data base for information about all rates

for waste disposal, there are rates of taxes for any kind of waste utilization, including processing and burning.

Table 34. Taxes in waste management on the state-level

State / name of instrument	Amount of tax, in US dollars per ton
Indiana – tax for disposal of hazardous wastes	11.50
Alabama – tax for management of hazardous wastes	From 66.6 to 103.6
California – tax for removal of incineration residues	6.73
California – tax for disposal of wastes in mining industry	17.50
California – tax for hazardous wastes, including asbestos	21.95
California – tax for hazardous not classified wastes	54.37
California – tax for disposal of hazardous solid wastes in landfills	1.40
Mississippi – Charge for disposal of hazardous wastes in landfills	10.00
Mississippi – Charge for generation and processing of hazardous wastes	1.00

10.6.2. Fees for state services[736]

Administrative payments for environmental permits are carried out according to rates established on the state-level for every tonne of emission/discharge of pollutants[737].

10.7. Canada

In addition to federal taxes, every province and territory in Canada establishes its own tax regime, as well as a list of mandatory environmental payments for various sectors of economy. Depending on field of tax/environmental charge application, subjects committed to environmental payments are both individuals (private citizens, executive officers, managers of companies) and legal entities (all legal organizational forms of business, provinces and municipalities of Canada, state institutions).

Funds from taxes and payments are allocated depending on federal or local jurisdiction. Federal taxes are transferred to the state budget. Provinces determine target application of environmental payments: they can either use them for environmental projects or any other state projects not related to environmental protection.

[736] Official data/rates on fees for emission permits (ton/year) in Canada were used in calculations of data on payments for emissions in Appendix 2.
[737] See comparative tables for emission payments in Appendix 2.

10.7.1. Administrative fees for emission permits[738]

Provinces introduce their charge rates for emissions (*contaminant fees*) based on SERA. In British Columbia, fee is levied in obtaining permits for releases and discharges of pollutants. Depending on toxicity of a substance, rates can vary from 0.4 to 500 US dollars per tonne.

10.7.2. Water abstraction/withdrawal fee

Fee rates for water withdrawal in provinces of Canada vary greatly depending on target application of water. Thus, for example, water withdrawn from natural sources and injected in subsoil is taxed in the amount of 261 US dollars per foot [739]a second[740], however, total amount of fee cannot exceed 3,840 US dollars. For the application of water in cooling systems, companies pay fees in the amount of 27 US dollars per 50,000 gallons[741] a day. Fees for water for other industrial purposes can vary from 1 US dollar to 253 US dollars. In British Columbia, in addition to these fees, water users also pay annual fees for "renting" (*rental fees*) of water from the state. Federal and local (provincial) bodies and companies are relieved from such fees.

[738] Official data/rates on fees for emission permits (ton/year) in Canada were used in calculations of data on payments for emissions in Appendix 2.
[739] 1 cubic foot is 0.026 m^3
[740] Injection rate is basis for payments.
[741] 3.78 liters

11. GREENHOUSE GASES MANAGEMENT

This section provides current regulating systems for GHG emissions in the countries studied. Emissions trade system (ETS) on the state level is implemented in EU countries, while regional ETS operates in USA and Canada.

Quotas in studied ETS are allocated both by free allocation and by auctions. However, ETS of EU, Quebec (Canada) and California (USA) provide instruments to support the most energy intensive and trade exposed industries sensitive to so-called "carbon leakage".

Another feature of ETS of countries studied is a flexible mechanism which provides an opportunity to transfer extra quotas to further periods (banking). Such opportunity is provided in ETS of EU, Quebec (Canada), California (USA) and in Regional initiative on GHG (RGGI).

In some EU countries (UK, Norway), and Canada (Alberta province)there is an additional instrument of GHG regulation - carbon tax, which aims to encourage companies to choose low-carbon technologies.

11.1. Russia

The Russian Federation has voluntarily committed to constrain greenhouse gas (GHG) emissions within 75 % compared to1990 by 2020[742]. In 2016, an Action Plan was confirmed to implement Decree of the President including mechanisms of national regulation system for GHG emissions.

Presently, Russia has not ratified Paris agreement and has not committed to further reductions of GHG emissions. According to Order No. 2344-p of RF Government dd. November 3, 2016[743], by the first quarter of 2019 Ministry of Natural Resources and Environment and Ministry of Economic Development must prepare a final report to the President of RF about feasibility of ratification of Paris agreement. This report also determines frames for a draft Decree of the President of RF about validation of targets on GHG emission limits by 2030 (December, 2019). Presently, works have been carried out to prepare a draft of federal law on state regulation of GHG emissions with deadlines by June, 2019.

According to the requirements of UN Framework convention on climate change, as well as Kyoto Protocol, Russia established a country assessment system for GHG emissions and a registry of carbon credits[744]. Assessment is carried out according to categories of sources and covers all types of GHG specified in Appendix A to Kyoto Protocol:

[742]Decree of President of the Russian Federation "On GHG release reduction" dd. 30.09.2013 No.752
[743] Ordinance No. 2344-p of the government of RF dd. November 3, 2016
[744] RF Government Order dated April, 22, 2015 N 716-p On Concepts of systems of monitoring, reporting and inspecting the volumes of greenhouse gase releases in RF (updated and amended)

- carbon dioxide (CO_2);
- methane (CH_4);
- nitrous oxide (N_2O);
- hydrofuorocarbons (HFC);
- perfluorocarbons (PFC);
- sulfur hexafluoride (SF6).

Results of assessment are recorded in inventory, which is annually provided to the secretariat of UN Framework convention.

By Order No.716-p of RF Government dd. April 22, 2015, a concept of forming a monitoring system, reporting and inspection of volumes of GHG emissions in Russia has been confirmed, and its implementation is carried out in three stages:

On stage I (2015 - 2020), normative legal, methodological and institutional base is to be developed for implementation and functioning of system of monitoring, reporting and inspection of volumes of GHG emissions in Russia, involving all largest organisations in key sectors of economy. It is also planned to develop methodological recommendations on inventory control of emissions from GHG sources in territorial entities of Russia, and to test them in some pilot regions.

Starting from 2019, within frame of improvement of statistical reporting system, normative legal, methodological and other documents are to be developed and adopted, which ensure reports on GHG emissions. The largest industrial and energy organisations and companies with volume of direct GHG emissions more than 150 thsd. tonnes of CO_2-equivalent in a year, including airline and railway companies carrying out passengers and cargo transportation, must annually provide such reports.

Necessary normative legal and other acts are planned, which ensure creation of a registry of certified expert organisations carrying out inspections of reports or information about reduction of GHG emissions, as well as assessment of projects allowing mechanisms of state support, inspections and validation of information about GHG emission reduction as a result of their implementation.

On stage II (2021 - 2024), measures to improve system of monitoring, reporting and inspection of GHG emissions in RF are to be applied, and this system is to be implemented in other sectors of economy and organisations considering indirect GHG emissions[745].

On stage III (from 2024) all and any organisations with GHG emissions more than 50 thsd. tonnes of CO_2-equivalent in a year, as well as airline companies and railway

[745] RF Government Order dated April 2, 2014 N 504-p On validation of Action plan ensuring reduction of GHG emissions by 75 % of volume of those emissions in 1990 by 2020 (updated and amended)

companies, and companies carrying out sea and river transportations, must provide such reports.

Currently, a separate procedure for state control of GHG emissions does not exist in Russia. However, in the process of primary public registration of facilities negatively impacting the environment, natural resource user submits data according to the validated form[746]. Form is submited as a notification procedure indicating information about impact of a facility on the environment, including actual mass of GHG emissions in terms of tons of CO_2-equivalent. Calculations are done according to methodological instructions[747].

A confirmed list of regulated sectors of economy does not exist on the federal level in Russia. However, the Order N. 300 of the Ministry of Natural Resources and Environment of the Russian Federation dd June 30, 2015 “On validation of methodological orders and guidelines on quantitative determination of GHG emissions by organisations carrying out commercial or other activities in the Russian Federation”, specifies requirements for content and creation of a report on GHG emissions[748].

11.2. Countries of the European Union

11.2.1. European Union Emissions Trading Scheme (EU ETS)

The main instrument of the European Union in implementation of climate policy is European Union Emissions Trading Scheme (EU ETS), which establishes limits of GHG emissions for various sectors of economy. EU ETS is functioning in 31 countries of European Economic Area (EEA). The system limits emissions from about 11,000 power stations and production plants, as well as emissions of more than 500 operators of aircrafts with flights within the boundaries of EEA.

In 2005, European Union launched EU ETS as a major mechanism to reduce carbon dioxide emissions (CO_2) and other greenhouse gases all over Europe. System was divided into 4 phases, so called “trade periods”[749]:

[746] Order of the Ministry of Natural Resources and Environment of the Russian Federation of December 23, 2015 N 554 "On validation of application form about state registration of facilities negatively impacting the environment, which will include information about registration in state registry of facilities negatively impacting the environment, including electronic documents with enhanced encrypted and certified digital signature" (updated and amended)
[747] Order of the Ministry of Natural Resources and Environment of the Russian Federation of June 30, 2015 N 300 "On validation of methodological orders and guidelines on quantitative determination of GHG emissions by organisations carrying out commercial or other activities in the Russian Federation"
[748] Planned to implement, dates are not clarified
[749] The EU Emissions Trading System (EU ETS) fact sheet

- *2005-2007*: 1st trade "pilot" period: number of quotas based on assumed needs turned out to be in excess, thus, price for quotas in the first period fell to zero.
- *2008-2012:* In the 2d period, Iceland, Norway and Liechtenstein joined the group of EU ETS countries. In 2012, the number of regulated sectors included aviation. Despite this, the number of quotas was decreased by 6.5 %, economic crisis contributed to reduction in production volumes, and, thus, GHG emissions. Thus, demand for quotas remained low in the market, which negatively influenced prices of carbon credits. However, thanks to the flexibility mechanism that provides opportunity to transfer remained quotas to further periods (*banking*), prices of quota were maintained at 5 Euros (5.6 US dollars) per unit[750].
- *2013-2020*: In the 3d trade period, main reforms of systems came to effect. The largest changes were limits for emissions in the whole EU (reduction of total emissions by 1.74 % a year) and transition to auctions of quotas instead of free allocation. In 2013, Croatia joined EU ETS;
- *2021-2030*: 4th trade period. Legislative proposal to review EU ETS for the 4th period was submitted to the European Commission in July, 2015.

Currently, the system is at the third phase (2013–2020) and covers about 45 % of GHG emissions in EU[751].

EU ETS regulates three types of GHG: carbon dioxide (CO_2), nitrous oxide (N_2O) and perfluorocarbons (PFC) depending on a company's activities[752]:

Carbon dioxide (CO_2) emissions

- in production of electricity and heat;
- for energy intensive sectors of industry, including oil refineries, metallurgic plants and production of iron, aluminum, metals, cement, lime, glass, ceramics, cellulose, paper, cardboard, acids and particulate organic compounds;
- for commercial aviation.

Nitrous oxide (N_2O) emissions

- for producers of nitrogen, adipinic, and glyoxylic acids and glyoxal.

Perfluorocarbon (PFC) emissions

- in production of aluminum.

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[750] Brink C., Vollebergh H.R.J., van der Werf E., "Carbon Pricing in the EU: Evaluation of Different EU ETS Reform Options," CESIFO Working Paper No.5633, November 2015

[751] EU Emissions Trading System (EU ETS)

[752] DIRECTIVE 2003/87/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC

Participation in EU ETS is obligatory for companies in the above sectors. However, some plants[753] may be excluded from quota system, if the state undertakes to apply economical instruments or other regulating measures in order to ensure reduction of GHG emissions. Facilities releasing less than 25 thsd tonnes of CO2-e a year, if they are incinerator units with thermal nominal power of at least 35 MW, are considered as small plants.

Quota allocation in EU ETS

Quotas for GHG emissions between EU ETS members are allocated downwards ("*top-down"*). With such approach, as total carbon budget of quoted sector has been set, it is allocated based on "benchmarking" so that less "carbon-intensive" companies will get quotas in volume exceeding their average emissions, and they could sell spare quotas to more "carbon-intensive" companies.

Quotas in EU ETS are provided through free allocations (free of charge) and auctions. Companies producing electrical power must buy 100 % at an auction, except for cases of modernization of equipment specified by art. 10 of EU ETS Directive.

Companies in industrial sector and producing heat energy acquire part of quotas free of charge based on benchmarks. Share of free allocations decreases annually: if, in 2013, industrial companies obtained 80 % of free quotas, then by 2030 they will shrink by 30 %, as planned.

EU ETS provides supporting instruments for highly energy-intensive and trade exposed sectors of industry with high risk of so called "*carbon leakage*". "Carbon leakage" is understood as a situation when companies lose the competitive power due to extra costs associated with reduction of GHG emissions and subsequently transfer their production to countries with less stringent emission constraints[754].

Sectors of industry with high risk of "carbon leakage" get 100 % of quotas free of charge.

Share of quotas for free allocation for different sectors of industry is shown in Table 35.

Table 35. Share of free quotas allocated based on benchmarks

Share of free quotas	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Electrical power production	0%	0%	0%	0%	0%	0%	0%	0%
Industry	80%	72.9%	65.7%	58.6%	51.4%	44.2%	37.1%	30%

[753] Determined by a member country individually; plants with such insignificant GHG emissions that administrative charges for a unit of emissions can be disproportionately high

[754]Carbon leakage, EU Commission website

Share of free quotas	2013	2014	2015	2016	2017	2018	2019	2020
Sectors of industry with high risk of "carbon leakage"	100%	100%	100%	100%	100%	100%	100%	100%

Official lists of industries and sub-industries with high "carbon leakage" are developed in EU[755]. As art. 10a of 2003/87/EC Directive states, industry or sub-industry is exposed to "carbon leakage", if:

- amount of direct and indirect additional costs due to implementation of Directive will cause considerable increase in production costs calculated as a share of gross value added by at least 5 %;
- trade intensity with third countries defined as total volume of trade with third countries[756] to total volume of EU market ratio exceeds 10 %.

Industry or sub-industry is considered as exposed to such risk, if the amount of additional costs (direct and indirect) is 30 % minimum, or trade volume with other countries exceeds 30 %[757].

There are three kinds of quotas which can be credited[758] within EU ETS:

- free of charge quotas, bought at auctions and bought in the secondary market from other regulated subjects within EU ETS (EU Allowance - EUA);
- international quotas bought in the secondary market from other countries with similar ETS – units of specified quantity (Assigned Amount Units –AAU)[759];
- Certified Emission Reductions – CERs and Emission Reduction Units – ERUs.

Currently, EU ETS allows to count carbon credits against quotas, which have been obtained as a result of international projects on GHG emission reduction. Thus, such reduction credits may be obtained by means of two mechanisms within Kyoto Protocol[760]:

[755] COMMISSION DECISION of 27 October 2014 determining, pursuant to Directive 2003/87/EC of the European Parliament and of the Council, a list of sectors and subsectors which are deemed to be exposed to a significant risk of carbon leakage, for the period 2015 to 2019
[756] Countries outside European economic area
[757] DIRECTIVE 2003/87/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC
[758] Quotas can be written off at the end of corresponding period
[759] Trade of units of a specified quantity is possible between countries from Appendix B of Kyoto Protocol only
[760] Use of international credits, EU Commission website

- *Clean development mechanism (CDM)* - allows developed countries committed to reduce GHG emissions (countries of Appendix 1) to invest in projects on emission reduction in developing countries, as an alternative to costly emission reduction in their own countries;
- *Joint implementation (JI)* – allows developed countries to perform a part of their appropriate GHG emission reduction by implementing projects focused on reduction of emissions in other developed countries.

GHG emission reduction as a result of JI projects are accounted as *emission reduction units (ERU),* and reduction on CDM projects – as *certified emission reduction (CER).* Starting from phase 3 of EU ETS , ERU and CER are not longer considered as credits of compliance of European quoting system and are subject to exchange for main EUA quotas. Emission reduction credits can be used by plant operators up to 2020, then CDM and JI will be replaced with market mechanisms designed to mitigate consequences of climate change, specified in Paris agreement, art. 6.

It is important to note, that EU ETS does not include an accounting mechanism for credits for domestic offset projects[761]. The reason is, that due to the fact that EU ETS covers a large number of facilities, additional credits originated by domestic offset projects may cause decrease in price for main quotas.

Measures to control volatility of quota prices

A fundamental problem EU ETS faces today is the result of excessive allocations of free quotas in the first phases of regulation, which caused their surplus in the market after great recession in 2008 followed by fall in carbon prices, which have not recovered yet to the pre-crisis level.

To stabilize prices for carbon credits, measures to manage surplus of quotas have been taken. One of such measures is *back-loading* that is considered as the short term target, and another is a long-term solution - *market stability reserve*[762].

Back-loading measures are focused on transferring a certain number of quotas to future auctions, in order to ensure efficient balance of demand and supply in the short-run and stabilize prices without affecting competitive power of companies. Thus, 900 mln. units of quotas planned for allocation on an auction between 2014-2016 were suspended until 2019-2020. Hence, *back-loading* does not reduce the overall number of allowances to be auctioned, but re-allocates them over the period[763].

Market Stability Reserve (MSR) assumes creation of unallocated quota reserve, which not only will allow to manage surplus credits effectively, but will make the

[761]Where next for the EU Emissions Trading Scheme? Results from a LIFE-funded research project on the future of the scheme.
[762] Market Stability Reserve, European Commission Climate Action
[763] Commission Regulation (EU) No 176/2014 of 25 February 2014 amending Regulation (EU) No 1031/2010 in particular to determine the volumes of greenhouse gas emission allowances to be auctioned in 2013-20

system more stable in cases of external pressures. Focused on that, quotas can be withdrawn from circulation and carried over to MSR in periods of considerable surplus, and in case of deficit – released into market[764]. Transfer of quotas to MSR will start in 2019. It is planned, that every year 12 % of total quotas subject to auctioning will be transferred over to the reserve for 12 months (starting from September 1, 2019). In case if total number of quotas in the market decrease by 400 mln., then additional 100 mln will be released from the reserve in order to cover deficit and to support price stability in the market[765].

Update of phase 4 in EU ETS (2021-2030)

In order to achieve the Europe-wide target on GHG emission reduction by 43 % by 2030 compared to the level of 2005, a set of measures are to be implemented in phase 4 (2021-2030) on STE modernization and to increase its efficiency.

To accelerate the rate of GHG emission reduction, starting from 2021, total number of quotas will be decreased by 2.2 % annually, compared to 1.74 % today.[766]

Market stability reserve (MSR) will be expanded between 2019 to 2023 by increasing the volume of quotas transferred to the reserve by 24 % of the total number in circulation.

A considerable amount of free quotas will be allocated for new and expanded plants, and their volume will include free credits not allocated by phase 3 (2020) and 200 mln. units from MSR.

It is planned to implement a new system of carbon credits allocation that better reflects specifics of technological process and accounts for the production rates of companies.

11.2.1.1. Improving mechanisms of energy efficiency in EU

From 2010, a programme to support low-carbon energy efficiency projects NER 300 has been functioning in EU[767]. NER 300 programme finances projects demonstrating best technologies for *carbon capture and storage* (- *CCS*) and integration of renewable energy sources (*innovative renewable energy* - *RES*)[768].

In the first selection phase of NER 300 Programme, 20 projects focused on development of renewable energy have been selected, with their total volume of financing amounting to 1.1 bln. Euros (1.2 bln. US dollars). Implementation of projects from the first selection phase shall start at the end of 2018.

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[764] International Carbon Action Partnership (ICAP), p.9

[765] Decision (EU) 2015/1814 of the European Parliament and of the Council of 6 October 2015 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC

[766] Revision for phase 4 (2021-2030), EU Commission website

[767] Programme got its name thanks to 300 mln. quotas from the reserve for new plants (NER - New Entrance Reserve), and money form their sales created its monetary fund.

[768] NER 300 programme, EU Commission website

The second selection phase includes financing of 18 projects on renewable energy and 1 project on carbon capture and storage for the total amount of 1 bln. Euros (1.1 bln. US dollars). Implementation of projects from the second selection phase shall start in June, 2020.

In phase 4 of EU ETS (2021-2030), integration of additional mechanisms allowing industrial and energy sectors to settle investment challenges due to transition to green economy are planned in addition to NER 300.

The following are the new funds that will be established within the NER[769]:

- *Innovation fund* – expansion of existing support for development of innovative technologies in the industry. Financing volume will correspond to the market value of at least 450 mln. quotas;
- *Modernization fund* – assist investments for modernization of energy sector and raise efficiency of energy consumption in 10 EU states with low GDP.

11.2.1.2. Reporting and its verification

With the purpose of annual control and compliance with EU ETS rules, companies must undergo monitoring, reporting and verification procedures (MRV)[770].

Operators of regulated facilities must have a validated plan on GHG emission monitoring, which is developed for periodical assessment of GHG emission volumes and their removal. This plan is a part of environmental permit for operation of industrial plants.

Every year, subjects under regulation shall provide to an authorised body a report on GHG inventory[771] according to 601/2012 regulation of EU Commission. Annual data shall be validated by an accredited verifier[772] by March 31 of the year following the reporting one.

Inventory report, monitoring plan, verification report, report on implementation of improved monitoring systems may be submitted as follows:

- in standardized electronic XML format for further integration with automated GHG record systems;
- using templates developed for standard computer OS, including Excel-files and Word-files.

Emission reports shall be available for the general public, in compliancewith 2003/4/EC Directive, except for commercially sensitive information.

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[769] Revision for phase 4 (2021-2030), Funding low-carbon innovation and energy sector modernisation, EU Commission website
[770] Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions
[771] Requirements to the reports are given in Appendix 10 Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions
[772] Certified legal entity undertakes validation and verification of GHG

Quota registry and emission inventory (Union registry)[773] contains all data about GHG emissions of regulated facilities. After an audit of GHG inventory report by an authorised body, operators of regulated facilities must provide an equivalent number of quotas to be written off by April 30 of the same year. In case of non-compliance, operators subjected to penalty amounting to 100 Euro per ton of CO_2.

Verifiers obtain accreditation in their own countries in National Accreditation Centers according to ISO 14065[774]. This international standard defines principles and requirements for bodies providing validation and verification of data about GHG emissions[775].

In addition to ISO 14065, EU Commission Regulation No.600/2012 dd. June 21, 2012 on GHG emission monitoring in accordance with 2003/87/EC Directive of European Parliament establishes requirements for verifiers[776]. According to this regulation, verification is conducted by specialists technically competent to carry it out. Obligations and qualification requirements for verifiers[777] are outlined in articles 7 and 37:

- one lead EU ETS auditor or a group of EU ETS auditors and technical experts can carry out verification;
- for independent review of activities, a verifier appoints an independent reviewer, but not a member of the team conducting the review;
- every team member shall have a clear vision of his individual role in the review process;
- a group of verifiers shall include at least one person with sufficient technical competences; and another person speaking the national language of EU country subject to verification;
- if a verifier meets all requirements for competences of EU ETS auditor[778], then they can carry out the inspection without support of other verifiers.

According to these rules, a verifier is responsible for work completed and subsequent inspections. Non-complaince with the rules may lead to suspension, partial or complete cancellation of accreditation. In addition, Regulation art. 53 specifies the following cases when National Accreditation Center can revoke accreditation:

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[773] EU ETS Registry

[774] ISO 14065:2013,ISO/IEC 14065: 2013 , Partial Assessment Report/Checklist DIN EN ISO 14065

[775] Monitoring, reporting and verification of EU ETS emissions

[776] Commission Regulation (EU) No 600/2012 of 21 June 2012 on the verification of greenhouse gas emission reports

[777] A verifier is an accredited individual or legal entity; regulations No. 600/2012 and No. 765/2008 prescribe requirements for accreditation

[778] EU ETS auditor must have knowledge of 2003/87/EC Directive, 601/2012 EU Regulation, the present Rules, appropriate standards and other appropriate legislation of EU member country. Also, to have knowledge of methodologies in data and information audit, including risk analysis, as well as knowledge and experience in certain industrial aspects of technical monitoring and reporting.https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32012R0600

- if the management of an organisation responsible for validation and verification of reports is found guilty of fraud;
- if the verifier deliberately provided false information.

An authorised body or operators of regulated facilities have a right to file a complaint to accreditation centers against verifiers. Prior to applying any measures, accreditation centers ascertain that a state body or a operators have grounds to file a complaint. Verifiers shall be informed about a complaint against them.

Requirements to responsibilities of verifiers in carrying out and approving reports are also set forth in 600/2012 Regulation of EU Commission. According to Regulation art. 40, a verifier shall develop, confirm and apply procedures and standards specifying the following aspects:

- means of communications with a subject under regulation and other parties concerned;
- prevention of confidentiality violation when obtaining information from clients;
- appeals procedures;
- response procedures to complaints;
- procedures on repeated report preparation, in case of inconsistencies or errors in a verification report or in a report obtained from a subject under regulation;
- procedure for outsourcing of verification works to external organisations[779].

11.3. UK

Great Britain signed and ratified Paris Agreement, and by its commitment it must reduce emissions by 80 % by 2050 compared to 1990 and implement a set of 5-year carbon budgets, to achieve the target[780].

The major instrument to achieve the target on GHG emission reduction is EU ETS. Within emission trading system, more than 1000 companies, including power stations, oil refineries, offshore platforms, and industries producing iron, steel cement and lime, paper, glass, ceramics, and chemicals, are regulated in Great Britain[781].

Additionally to EU ETS, a carbon tax– *Climate Change Levy* (CCL) is implemented in the UK.

[779] Commission Regulation (EU) No 600/2012 of 21 June 2012 on the verification of greenhouse gas emission reports
[780] UK climate action following the Paris Agreement, October 2016
[781] Guidance Participating in the EU Emissions Trading System (EU ETS)

11.3.1.1. Climate Change Levy

The main target of this type of taxation is to encourage integration of energy-efficient technologies in companies, as well as to reduce GHG emissions. This tax covers all industrial, commercial, agricultural, and state companies using electrical energy, carbon, gas, and coke[782].

CCL includes *main rates* and *carbon price support (CPS) rates*.

CCL main rates are levied for energy supplied to an ultimate customer, while CPS rates are levied on plant operators that use fuel in production of electrical energy for their own needs.

Main CCL tax rates vary depending on type of energy source (Table 36)

Table 36. Main rates of CCL tax[783]

Taxable energy sources	**Rate in GBP (£)**	**Rate in USD ($)[784]**
Electricity (per kW/h)	0.00583	0.00751
Gas (per kW/h)	0.00203	0.00262
Liquified petroleum gas (kg)	0.01304	0.01680
Other fuels (kg)	0.01591	0.02050

Energy-intensive companies may apply for rate reduction from 65% to 90% of the amount of tax by signing an agreement (*Climate Change Agreement*) with Environmental Agency. Targets of a company on GHG emission reductions are revealed in this agreement, and after they have been successfully achieved, a company may get a "discount" on tax payments[785].

Table 31 shows the other tax rates that are applied to energy producers[786].

[782] Excise Notice CCL1: a general guide to Climate Change Levy, Updated 16 March 2018
[783] Guidance "Climate Change Levy rates"Updated 17 May 2016
[784] Rates are given hereinafter according to the average exchange rate for 2017.
[785] Gov.uk. Environmental taxes, reliefs and schemes for businesses. 2018
[786] Guidance "Climate Change Levy rates"Updated 17 May 2016

Table 37. Carbon price support CPS rates

Type of energy source	Rate in GBP (£)	Rate in USA [787]
Gas, (kW/h)	0.00331	0.00426
Liquified petroleum gas, (kg)	0.05280	0.06802
Carbon and other solid natural resources (GJ)	1.54790	1.99418

CPs is a constituent part of the carbon price support mechanism, which was named as *Carbon Price Floor* (*CPF*). CPF was implemented by the Government of UK in 2013 with the purpose of strengthening market prices for quotas within EU ETS on such a level that will encourage companies in energy sector to shift to low-carbon technologies[788]. CPF value comprises the existing market price for unit of carbon and CPS rate. Thanks to CPF, the price for a carbon credit raised from 9 GBP to 18 GBP in UK in April, while the price in EU ETS did not exceed 5 Euros (5.6 US dollars)[789].

Part of revenue from CCL transfers to special Energy Efficiency Fund regulated by *Carbon Trust* organisation[790]. In its turn, organisation uses funds to provide tax benefits to companies investing in energy-efficiency and energy-conserving technologies. Remaining revenues are used to fund other state programs.

Companies integrating energy efficient and green technologies may claim to reduction of total income tax by the amount of the cost of those technologies. This incentive is valid only during the first year when technology is introduced[791].

11.3.1.2. Climate change agreements

Additional mechanisms of GHG emission reduction are voluntary agreements on climate change (*CCA*)[792]. CCA are agreements signed by industrial companies and Environmental Agency. They are designed to reduce energy consumption and emissions of carbon dioxide (CO_2). Member-companies of agreements get a discount for carbon tax CCL.

[787] Rates are given according to the average exchange rate for 2017.
[788] Hirst, D., "Carbon Price Floor (CPF) and the price support mechanism," House of Commons Briefing Paper No. 05927, 8 January 2018
[789] Meeting Carbon Budgets: Closing the policy gap 2017 Report to Parliament, CCC, June 2017
[790] McEldowney & Salter, 2015.
[791] Energy Technology Product List
[792] Climate change agreements

For operators with CCA, CCL can be decreased by 90 % for electrical energy and by 65 % for natural gas, LHG, and other fuels, in 2018. In 2019, the amount of discount will be raised and will be 93 % and 78 % respectively[793].

There are two types of CCA:

- *Umbrella agreements* are signed between Energy and Climate Change Department and industrial sector (on a group level), who determine target parameters for the whole sector. Afterwards, agreements are forwarded to Environmental Agency and industrial associations, in order to execute the requirements for the achievement of target on energy efficiency.
- *Frame agreements* are signed by an operator of one ore more production facilities (individually) and by an authorised body. This agreement specifies target parameters on energy efficiency or emission reduction appropriate for the sector type of the operator. Associations in every sector of economy control execution of obligations on frame agreements by companies in their sector. A company willing to sign CCA shall apply to its industrial association first.

Current CCA scheme came into force in April, 2013 and will remain valid until March 31, 2023. A company that has signed such agreement must report on volumes of energy used and carbon emissions released according to agreed targets within its agreement during two- or four-year periods (depending on validity period of that agreement). If an operator has more than one facility in the same sector, they can sign separate CCA for every facility or join them within one CCA. Afterwards, targets will be distributed between grouped facilities. If an operator achieves company's targets by the end of every reporting period, they continue operating on this scheme and can claim for a discount for CCL tax.

11.3.1.3. Energy efficiency scheme

For GHG emission reduction, there is Energy Efficiency Scheme CRC [794]in Great Britain, registration for which ended in 2014. This programme is aimed to improve energy efficiency of state and large companies[795], as well as to reduce carbon dioxide emissions (CO_2) by 2019. Environment Agency administers this programme in UK and regulate it in England. Scotland Environmental Protection Agency, Environmental Protection Agency in Northern Ireland, and Natural Resources Protection Agency in Wales regulate this scheme in their countries.

Companies that have signed agreements on climate change (CCA), or are subjects of EU ETS are not members of this programme, as their emissions are covered by other regulating systems. However, CRC programme members are obliged to buy

[793]Guidance "Climate Change Levy rates"Updated 17 May 2016
[794] CRC Energy Efficiency Scheme: qualification and registration
[795] Equipped with at least one half-hour electric meter registering energy consumption of 6000 MW and higher

quotas equal to GHG emission volumes and provide them as measures complying with programme, but obligations to reduce them are excluded. Some state bodies including all departments of Central Government of UK take part in the programme irrespective of electrical energy consumption rates.

Presently, the second stage of the programme is implemented (April 1, 2014 to March 31, 2019). Each step has a year of qualification, i.e., a year to register for that programme. In each year of conformity, organisations must:

- provide information about energy sources;
- provide a report on their energy supply;
- purchase and transfer quotas equal to their CO_2 emissions;
- notify Environment Agency about technological or administrative changes in their organisations.

All members make a registration fee amounted to 950 GBP, as a part of online registration process. Fee covers administrative expenses for organisation inspections and opening of user account of conformance in CRC registry. Annual subscription duty in the amount of 1290 GBP is paid after registration.

11.3.1.4. Green Business Fund

From 2016, small and medium businesses in Great Britain may apply for support[796] when purchasing energy efficient equipment or conducting *energy opportunity assessment* from an independent organisation *Carbon Trust UK*. Carbon Trust operates based on subsidies from state bodies and private financial supporters[797]. Green Business Fund provides free training in energy efficiency and technical and administrative assistance for companies that integrate energy-efficiency technologies.

Carbon Trust UK is also the administrator of the *Enhanced Capital Allowance Scheme*[798], according to which companies can return 100 % tax paid for purchased and integrated technology from *Energy Technology List*[799]. This list includes such technologies as automated systems of monitoring and detection of electrical energy consumed, boilers, pumps, heating units, or air-conditioning units, etc. Technologies have to meet the criteria established by Ministry of Energy and Clean Development[800].

[796] up to 5,000 GBP
[797] The Carbon Trust Green Business Fund
[798] Energy Technology Criteria List (ETCL) and claim values
[799] Energy Technology List
[800] Energy Technology Criteria List, February 2018

11.4. Norway

Norway has launched a policy on combatting climate change starting from 1980s. Currently existing policy frames are based on UN FCCC and Paris Agreement. More than 80% of emissions are regulated by mandatory trade system and CO_2 emission tax. European ETS is a key mechanism in achieving obligations of Paris Agreement. Within this agreement, Norway undertakes to reduce GHG emissions by 40% lower than in 1990, by 2030.

The largest source of CO_2 emissions in Norway is oil and gas extraction sector, which releases about 30% (7.2 mln. t of CO_2) of total CO_2 emissions in the country [801].

ETS in Norway applies to the following energy and industrial sectors: energy production; oil and gas extraction, oil and gas processing; coke production; production and processing of cast iron and steel including backing and sintering of iron ore; production of cement, lime, glass, fiberglass and ceramic products; and production of paper, cardboard and cellulose from wood or other fiber materials. Transportation sector is not included in ETS, as well as burning of biomass, hazardous wastes or municipal wastes.

11.4.1.1. Carbon tax

Starting from 1991, Norway applies CO_2 tax in the following sectors: gasoline, fuel oil production, oil and gas extraction in the North Sea, pulp and paper industry, fish flour production, domestic aviation and domestic traffic. EU ETS covers GHG emissions in the majority of sectors of industry on land, in oil and gas industry offshore and in aviation. Apart from EU ETS, oil sector and domestic aviation shall pay CO_2 tax.

Rates of carbon tax in Norway are given in Table 38.

Table 38. CO_2 tax rates

Type of tax	Taxation basis	Tax rate in Norwegian krone, NOK	Tax rate, US USA[802]
CO_2 tax in petroleum products burning	Petroleum products (fuel oil, gas oil, diesel), per l	1.2	0.1454
	Natural gas, € per cm³	0.9	0.1090

[801] Norwegian petroleum. Emissions to air

[802] Rates are given according to the average exchange rate for 2017.

Type of tax	Taxation basis	Tax rate in Norwegian krone, NOK	Tax rate, US USA[802]
	Natural gas utilized in industry or regulated within EU ETS, per cm^3	0.057	0.0069
	Unleaded gasoline, per l	1.04	0.1260
Tax for CO_2 emissions in oil and gas industry on continental shelf	Natural gas burned on oil and gas platforms, per st. m^3	1.04	0.1260
	Natural gas released to the atmosphere, per st. m^3	7.16	0.8673
	Liquid hydrocarbons burned on oil and gas platforms, per l	1.04	0.1260

Tax rate varies in different sectors. For example, higher tax rates are referred to activities related to oil extraction, while mineral oil production is levied with lower rates. Other energy-intensive industries exposed to international competition are relieved from tax.

11.5. Germany

Presently, German climate plan of actions 2050 (*Klimaschutzplan 2050*) is the essential political document in control of climate change and GHG, which is validated by the government of Germany dd. November 14, 2016[803]. The plan assumes reduction of GHG emissions by at least 80% (and up to 95%) from the level of 1990 by 2050. To achieve targets within Paris Agreement, Germany develops renewable energy sources and energy efficiency in different sectors of economy, along with quota allocations for emissions according to EU ETS.

A major share of potential reductions of CO_2 emissions (from 25 to 30 mln. tonne) is planned by means of measures on improvement of energy efficiency described in details in National Energy Efficiency Action Plan (*Nationaler Aktionsplan Energieeffizienz, NAPE*)[804]. Generally, NAPE measures are designed to support

[803] Klimaschutzplan 2050

[804] Making more out of energy, National Action Plan on Energy Efficiency, Federal Ministry for Economic Affairs and Energy (BMWi), 2014

individuals (housing sector), small business, NGOs and state sector[805]. National Plan provides financial assistance as tax benefits or low interest loans and consultations for entities that consider implementation of energy efficient and clean practices. Additionally, educational trainings for the above entities are provided within National Plan.

The major part of the plan is focused on modernization of buildings and integration of energy-efficient technologies by means of tax benefits to companies and loans from the development bank *KfW*[806]. 500 "*communications networks*" combining from 8 to 15 companies with collective targets in energy efficiency will be created within National Plan.

Basic measures in National Energy Efficiency Action Plan includes:

- implementation of competitive bidding systems (tenders) where participants can compete for funds for implementation of energy projects; government allocated funds amounting to 15 mln Euro in 2015, annually increasing to 150 mln. Euro (169.3 US dollars) from 2018 to 2020;
- 1 bln. Euro (1.1 bln. US dollars) of tax benefits from 2015 to 2019 to encourage modernization of buildings;
- additional 200 mln. Euro (225.8 US dollars) will be provided for modernization of buildings on low interest loans via KfW bank;
- energy efficiency ratings for energy intensive products (household appliances, boilers, etc.) within *Top Runner* strategy;
- mandatory energy audit, which a company must carry out itself every four years for all large companies.

11.6. Brazil

Brazil, being a member country of UN Framework Convention on Climate Change,signed and ratified Paris Agreement in 2016. Although, Brazil is not obliged to fulfill commitments on reduction of GHG emissions within Paris Agreement, the state has voluntarily committed to reducing GHG emissions by 37% lower than in 2005, by 2025[807].

To achieve targets, Ministry of Environment amended its National Policy on climate change (Law 12 187/2009) and Law on forest protection (Law 12 651/2012). The state implements programs on GHG emission reductions in forestry, energy and industrial sectors within these documents. It should be noted, that GHG reduction in

[805] Energieeffizient Bauen und Sanieren - Zuschuss Brennstoffzelle
[806] National Energy Efficiency Action Plan (NEEAP) 2017 for the Federal Republic of Germany
[807] Federative Republic of Brazil intended nationally determined contribution towards achieving the objective of the United Nations framework convention on climate change

forestry sector of economy is a priority of developed plans and programs, since GHG emissions as a result of deforestation and forest degradation comprise more than 55% of the total volume of GHG emissions in the country.

11.6.1.1. Reporting and its verification

Mandatory inventory of GHG in online-inventory "Brazilian GHG Protocol" was implemented in 2008, in order to prepare and keep reporting about total GHG emission volumes, as well as to take measures on loss of forest resources. This electronic platform allows the government to see growth or reduction dynamics on GHG emissions, as well as promotes transparency of GHG emission data and allows to spread them. GHG reporting shall be annually submitted and is subject to verification by accredited organizations[808].

Accreditation process of independent verifier companies for assessment of reports is based on technical requirements of ISO 14065[809]. Verifiers are accredited by National Institute of Metrology, Standartization and Industrial Quality (*Inmetro*).

In Brazil, inventory process covers the following six types of GHG: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), perfluorocarbons (PFC), hydrofluorocarbons (HFC).

11.6.1.2. Plans of implementation of Emission Trade System (ETS) in Brazil

Within "Partnership for Market Readiness (*PMR*)"[810] project of the World Bank, the government of Brazil researches implementation of market instruments so that to achieve voluntary obligations of Brazil on GHG emission reduction and reduction of total expenses on mitigation of consequences of climate change. Currently, Brazil does not assess different economical mechanisms regulating GHG emissions, including system of quota trading and implementation of carbon tax. Assessment of emission reduction mechanisms is under development with the support of *PMR*.

Ministry of Finance has also started developing strategies on raising awareness about economical instruments for GHG emission control and engagement of all concerned parties in decision making, through cooperation with other state bodies and public consultancies.

[808] Especificações de Verificação
[809] ISO 14065:2013 Greenhouse gases — Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition
[810] https://www.thepmr.org/country/brazil-0

11.7. North America

11.7.1. Canada

On October 5, 2016 after parliamentary voting, Canada officially ratified Paris Agreement on Climate Change regulating measures on reduction of carbon dioxide and other GHG emissions. By 2030, Canada intends to achieve targets on GHG emission reduction by 30% lower than in 2005[811]. As a first step in the commitment to reduce emissions, Canada validated Vancouver declaration about clean growth and climate change, with Pan-Canadian Framework Program on Clean Growth and Climate Change (*PCF*)[812] regulating GHG emissions all over the country.

Carbon pricing is a central key of PCF and provides different mechanisms on emission reduction for provinces of Canada. Each province may implement its particular mechanisms on GHG regulation.

As of now, British Columbia applies tax for carbon dioxide emissions, Alberta applies a hybrid system combining carbon tax with a system based on the best performance indicators (benchmarks) for large industrial companies, while Quebec and Ontario adopt emission trading systems (EST).

11.7.1.1. Hybrid system in Alberta province

As British Columbia, Alberta province applies carbon tax for purchase and consumption of fuel. Carbon tax is applied for diesel fuel, gasoline, natural gas, propane, etc. Production of electrical energy is not subject to this tax[813].

Table 39. Rates of carbon tax in Alberta province[814]

Type of fuel	30 CAD, t CO_2e	US USA
Diesel ¢/liter	8.03	6.2
Gasoline ¢/liter	6.73	5.2
Natural gas $/GJ	1.517	1.2
Propane ¢/liter	4.62	3.6

Apart from carbon tax, companies in Alberta are also regulated by GHG benchmarking system.

[811] CANADA'S INDC SUBMISSION TO THE UNFCCC
[812] Pan-Canadian Framework on Clean Growth and Climate Change
[813] Alberta Climate Change Office Carbon levy rates: page 106 of the 2016-19 Fiscal Plan
[814] Main types of fuel are given in the Table, complete list of taxed types is available at: https://finance.alberta.ca/publications/tax_rebates/rates/carbon-levy-rates.html

GHG emissions are regulated within *Carbon Competitiveness Incentive Regulation Programme - CCIR*[815].

CCIR covers companies from energy-intensive and trade exposed industries[816] which annual emissions amount for 100,000 t CO_2 or more, and with activities in the following fields:

- electrical power production;
- production and consumption of heat energy;
- oil and gas extraction and processing;
- natural gas processing and transportation;
- chemical production, etc[817].

Companies with emissions less than 100,000 t CO_2e a year have a right to take part in CCIR programme, if they compete with subjects regulated within CCIR and their annual emissions exceed 50,000 t CO_2e. Companies with high intensity factor of GHG emission per unit of product manufactured, and those which annual volume of emissions reaches 50,000 t CO_2e can take part in CCIR programme[818].

Emissions of CCIR regulated companies shall not exceed established performance indicators (benchmarks). Benchmarks are established considering "best performance indicators" in industry[819]. Although, if a regulated industry shows a risk of "carbon leakage", then strict benchmarks may be decreased to 90%[820].

11.7.1.2. Reporting and its verification

All regulated subjects shall provide annual reports about GHG inventory. Companies exceeding 1 mln t CO_2e a year must provide an *annual forecasting report* on GHG emissions and quarterly reports on compliance GHG emissions with their quotas. Verified GHG inventory reports for a reporting year must be submitted to an authorized body (Alberta Administration on climate change) not later than March 31 of the year following the reporting one. GHG reports shall be validated and verified by an accredited organization.

The Standards Council of Canada - SCC is the only Canadian organization offering international accreditation of bodies on validation and verification of greenhouse gases (GHG)[821]. Within the framework of obtaining accreditation, relevant bodies on GHG validation and verification must prove that their specialists have sufficient technical knowledge in appropriate sectors regulated by legislation. Although,

[815] Carbon Competitiveness Incentive Regulation
[816] EITE designating criteria for industries are established in item 4 (1) CCIR
[817] Regulated Facility Fact Sheet
[818] Alberta Regulation 255/2017: Carbon Competitiveness Incentive Regulation
[819] Standard for Establishing and Assigning Benchmarks V2.1
[820] CCIR Fact Sheet
[821] SCC Accreditation Program for Greenhouse Gas Validation/Verification Bodies

accreditation is issued for four years, SCC are entitled to annually assess competencies of organizations carrying out validation and verification of GHG inventory reports[822].

11.7.1.3. Emission Trading System (ETS) of Quebec

Quebec system of GHG emission trade was adopted in 2012. Commitment to comply with the programme came into force on January 1, 2013[823]. Quebec ETS covers seven greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), perfluorocarbons (PFC), hydrofluorocarbons (HFC), nitrogen trifluoride (NF_3).

Regulated facilities are municipality and any other legal entities engaging in business activities in sectors covered by this programme and whose volume of GHG emissions amount for 25,000 t/CO_2e or more. Free quotas are allocated in sectors exposed to international competition. They include production of aluminum, lime, cement, chemical industry, metallurgy, mining industry and granulating, pulp and paper sector, petroleum processing, and others. List of companies that may receive free quotas is reviewed on an annual basis. Starting from 2015, number of credits allocated for free is decreasing by about 1-2% a year. 13,506,240 free units of quotas were allocated for 51 companies in 2018, which comprised 75% of the carbon budget[824].

Producers of electrical energy together with fuel distributors are not subjects for free quotas and must purchase quotas for GHG emissions at an auction or in the secondary market.

Emission permits are identified according to type or year of issue. There are three types of emission permits[825]:

1. *Quota units* allocated free of charge and auctioned or sold in the secondary market by other companies;
2. *Carbon units of internal projects related to GHG emission reduction in sectors not covered by ETS*. Thus, carbon intensive companies may use carbon units on five domestic (except for Kyoto) kinds of projects:
    - CH_4 capture within manure storage projects;
    - gas capture from waste landfills;
    - eradication of some ozone depleting substances contained in insulating foam, and certain refrigerant gases recovered from household appliances in Canada;

[822] Accreditation Services Accreditation Program Overview, Standards Council of Canada 2018
[823] the Québec Cap and Trade System for Greenhouse Gas Emissions Allowances
[824] Règlement concernant le système de plafonnement et d'échange de droits
[825] A Brief look at the Québec Cap-and-Trade-system for emission allowances

- CH_4 capture from drainage system CH_4 in active underground or surface carbon mines;
- CH_4 capture from ventilation systems in underground mines.

3. *Early reduction credits*[826]. These units are granted to companies that voluntary took measures on emission reduction before ETS had been adopted. They could be used from the first period of compliance[827] for compensation of emission quotas.

Quebec has been a member of Western climatic initiative (WCI) from 2008, and has formally associated its system with ETS of California from January 1, 2014 and with ETS of Ontario from January 1, 2018. A set of new internal units of GHG absorbtion and reduction together with ETS of Ontario is currently developing.

Quebec ETS is divided into 6 periods according to the commitments where marginal emission level are reduced in each period:

- the first period (2013-2014) – 23.2 mln t/CO_2e;
- the second period (2015 – 2017) – from 65.3 to 61.08 mln. t/CO_2e;
- the third period (2018 – 2020) - from 58.96 to 54.74 mln. t/CO_2e;
- the fourth period (2021 – 2023) - from 55.26 to 52.79 mln. t/CO_2e;
- the fifth period (2024 – 2026) - from 51.55 to 49.08 mln. t/CO_2e;
- the sixth period (2027 – 2029) - from 47.84 to 45.37 mln. t/CO_2e.

Accounting of emissions only exists in electronic form in capital investments and trade tracking system: in online registry of quotas and carbon credits (*Compliance Instrument Tracking System Service - CITSS*)[828]. Regulated facilities and members of the system shall have a user account in CITSS where their quotas for emissions are contained.

Quota units not provided free of charge are auctioned by the government of Canada four times a year.

Floor price in the amount of 10.75 US dollars was established for 2013, and is raised by 5% considering inflation every year up to 2020. Floor price ensures stable prices for carbon in EST market and, thus, allows participants of trade to plan long-run investments in green technologies[829]. For joint auctions with California, floor price is established at the cost of preservation of higher price from two floor prices of both systems at an exchange rate actual for the time of auction.

In addition to floor price of Quebec ETS, there is another regulating instrument for quota prices in the periods of high demand in the market as *ceiling price*, allowing

[826] equivalent to emissions reduced from 2008 to 2011 with regard to 2005 – 2007http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/Q-2,%20r.%2046.1
[827] from 2013
[828] Compliance Instrument Tracking System Service
[829] The Quebec CAp-and-Trade system, Strengths and Advantages, p.6

to curb disproportionately high price growth. Establishing mechanism of ceiling price for a unit of quota by transferring a certain percent of quotas to the reserve. Reserved quotas, in case of higher demand, may be released for sale on fixed prices in unscheduled trades depending on their category[830]. Only regulated facilities that struggle to comply with commitments within ETS are allowed to take part in trades to get quotas from the reserve[831].

All revenues from auctions are transferred to Quebec Green Fund that is designated to fund programs to reduce GHG emissions and assist to Quebec society to adapt to consequences of climate change.

Quebec ETS is a flexible system allowing companies to regulate emission intensity considering long-run plans on production development using opportunity to carry over surplus of quotas between compliance periods[832].

Compliance control on emissions is provided in GHG reports. A regulated subject must submit a report until June 1 of every year. Operators participating in ETS shall send a verified report completed by an organisation accredited in accordance with ISO 14065.

In case of non-compliance with ETS rules, operators may incur penalty for the amount ranging from 3,000 CAD to 600,000 CAD (2,316 – 463,260 US dollars)[833]. Imprisonment up to 18 months and penalty serve as a punishment for individuals. Moreover, Ministry on sustainable development, environment and climate change may suspend activities of any regulated subject in case of non-compliance with ETS commitments.

11.7.2. USA

In USA, GHG emissions from mobile and stationary sources are regulated by Environmental Protection Agency (*EPA*), according to *Clean Air Act*.

Additionally, governing bodies of every state regulate GHG emissions irrespective of the federal government. Quota trade system exists in California only, while states on the east coast of USA regulate GHG emissions through joint regional initiative on emission reduction.

11.7.2.1. Regional GHG Initiative

Regional Greenhouse Gases Initiative - *RGGI* is a joint program between Connecticut, Delaware, Mann, Maryland, Massachusetts, New Hampshire, New

[830] (category A=40$, category B=45$, category C=50$)
[831] The Quebec CAp-and-Trade system, Strengths and Advantages, p.7
[832] The Quebec CAp-and-Trade system, Strengths and Advantages, p.8
[833] Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere

York, Rod Ireland and Vermont, with the goal to reduce CO_2 emissions in energy sector.

RGGI is the first mandatory market program on CO_2 emission reduction in USA[834]. Commitments to comply with RGGI are applied to power stations operating natural fuel and whose production capacity exceeds 25 MW and higher.

RGGI consists of separate programs on CO_2 quotas trading in every participating state. State governments limit CO_2 emissions from power stations and put up quotas for an auction. Regulated subjects do not get free quotas in this program, and must buy them through a regional quarterly auction from state bodies or in the secondary market from other companies. CO_2 quota is a limited permit for emission of one tonne of CO_2 from regulated source, which has been issued by a member state. Regulated power stations can purchase quotas for CO_2 emission in any program member state.

According to RGGI, emission source operators must purchase quotas equal to their CO_2 emission within three-year reporting period. RGGI provides an opportunity to carry over volume of quotas remained to the next reporting period. Currently, the fourth reporting period has come into force and it will last from January 1, 2018 to December 31, 2020.

An administrator of the program creates reserve comprising 10 mln. quotas every year. Quotas from reserve fund are used to regulate prices in the market, when high demand leads to excessive prices for a unit of quota[835].

Member states may reinvest revenues from those auctions to energy efficiency improvement programs and programs aimed to accelerate integration of renewable energy sources in the states.

11.7.2.2. Emission Trade System (ETS) of California

In 2016, California adopted legislation directed at emission reduction by 40% compared to 1990 levels, by 2030. Californian ETS operates from January 1, 2013 and is officially associated with EST of Quebec from January 1, 2014[836]. Emission sources in five sectors of economy are covered by EST: transportation, electrical energy, business and housing sector, industry, agriculture, and forestry, accounting for 85% of GHG emissions in the state[837].

ETS of California regulates seven greenhouse gases: CO_2, CH_4 and N_2O, SF_6, HFC, PFC, NF_3. Regulated subjects in EST of California are companies whose emissions comprise 25,000 t CO_2e or more for one year. Subjects of administration will be

[834] RGGI, Program overview
[835] considerably exceeding the planned cost
[836] Cap-and-Trade Program, California Air Resources Board
[837] Cap-and-Trade Regulation Instructional Guidance, Chapter 1

considered operators from 10,000 t CO_2e a year. Subjects of administration[838] must conduct internal audits, quality control and management systems for a data transfer program.

AB32 Law (*California Global Warming Solutions Act of 2006*)[839] establishes the necessity to take measures on minimization of "carbon leakage" risks. Energy-intensive and competition-oriented industries may obtain quotas free of charge. When calculating quotas for free allocation, a risk level of "carbon leakage" is determined for each industry by assessment of emission intensity factors (t CO2e/ mln$ of added value) and exposure to market competition (market share). Industry assistance factor is estimated based on these assessments. Assistance factor determines a share of free quotas. Thus, industries with high risk of "carbon leakage" get 100% free of charge, industries with middle risk level – 50%, and industries with low risk level – 30%[840].

All regulated facilities can purchase quotas on quarterly auctions managed by a state government or through a private secondary market. Current price for tCO_2e is 15.06 US dollars (clearing price[841] at the auction in November, 2017).

Within ETS of California, quotas are allowed to accumulate and transfer within compliance periods, as well as to be borrowed from future periods in rare and individual cases.

11.7.2.3. Reporting and its verification

Reporting about GHG inventory is mandatory for all facility operators in the following sectors (irrespective of emitted quantity):

- electrical energy production;
- cement production;
- lime production;
- nitric acid production;
- petroleum processing;
- geological capture of carbon dioxide;
- carbon dioxide (CO_2) pumping.

Operators of the following facilities in California must provide reports if GHG emissions are 10,000 tCO_2e or more for a calendar year:

- glass production facilities,

[838] in Kazakhstan understanding
[839] California global warming solutions, Assembly Bill No. 32
[840] Cap-and-Trade Program: Emissions Leakage Research and Monitoring," CARB public hearing materials, July 30, 2012
[841] Clearing price – ensures supply and demand equilibrium. Price at which quantity demanded by consumers equals to quantity producers ready to supply to the market.

- hydrogen production facilities,
- cast iron and steel production facilities,
- pulp and paper production facilities,
- oil and natural gas extraction facilities,
- lead production facilities,
- geothermal electrical energy production facilities with stationary fuel burning.

Reports on inventory of GHG equal or above 25,000 tCO_2e a year require independent inspection by a third party (organizations providing validation and verification) for all regulated subjects.

Validating and verifying organization must[842]:

- be a legal entity, which has responsibilities and may be held accountable by law;
- have an internal policy in respect of conflict of interests, and mechanisms of monitoring, and requirement to settle disputes if they arise.

Additionally, specialists of the organizations must have technical knowledge in sectors regulated by legislation.

[842]California Air Resources Board Greenhouse Gas Verification Program: Requirements for Accreditation of Verification Bodies and Verifiers

12. ENVIRONMENTAL AUDIT

Environmental audit is designed to assess compliance with legislation requirements, discover deficiencies in the environmental protection management and determine potential environmental risks.

Environmental audit in all studied countries is basically a voluntary initiative of companies. However, Brazil and Canada practise mandatory audit depending on requirements of laws in states/provinces. For example, Alberta province in Canada requires external environmental audit for stations of continuous air monitoring, according to Directive on air monitoring. In Brazil on the level of separate states, a mandatory environmental audit is regulated for a definite list of industries, including petrochemical industry: Rio de Janeiro state specifies annual inspection, and Minas Gerais state –biannual inspections.

It should be noted that legislation in Russia does not establish a stringent order for environmental audit procedures, however, projects follow foreign experience in this field. In EU countries, audit is carried out according to EMAS (Eco-Management and audit scheme), Brazil applies recommendations of environmental legislation resolutions, as well as certification of environmental management system (EMS) according to ISO 14001. The USA focuses on environmental audit and encourages to apply it. A voluntary monitoring program - Protocol for environmental audit for compliance with the environmental protection standards, and Law on Environmental Protection, Compensation and Responsibility have been developed for this purpose.

According to researches, in case of violations discovered in the process and as a result of the audit, auditors may incur administrative liabilities as per legislation of the majority of countries, except for Brazil, where a criminal liability may also be incurred.

12.1. Russia

"Basic principles of state policy of the Russian Federation on environmental sustainability up to 2030"[843] is a document dd. April 30, 2012 validated by RF President and establishes environmental audit as one of the most important implementation mechanisms of environmental policy in the country.

As Federal Law "On Protection of Environment" asserts, environmental audit is an independent, complex, documented assessment of a legal entity or entrepreneur for compliance with requirements, including norms, normative documents, federal rules

[843] Basic principles of state policy of the Russian Federation on environmental sustainability up to 2030

and regulations on the environmental protection, requirements of international standards and preparation of recommendations for the purpose to improve such activities[844].

Based on the definition of environmental audit given within the Law "On Protection of Environment" and theLaw "On auditing activities"[845], goals of audit may be the following:

- assessment of activities of a company on the environmental protection and efficient exploitation of natural resources, and their compliance with RF legislation;
- determining how much the environment of a facility is degraded, if its activities involve negative impact on the environment;
- determining polluted areas of the environment, types and scale of pollution;
- discovering and assessing the equipment and technologies designed to protect the environment of a facility;
- assessment of environmental impact on the health of personnel of the enterprises;
- necessary research of additional environmentally significant information about a facility.

Order No. 181 of RF State Committee on environmental protection dd. 30.03.1998 specifies general objectives of environmental audit:

- feasibility of environmental strategy and policy of a company;
- priorities in planning environmental protection activities of a company;
- inspection for compliance with the environmental legislation;
- improve efficient regulation of impact on the environment;
- risk reduction of emergencies related to the environmental pollution.

As Order No. 181 dd. 30.03.1998 of RF State Committee on environmental protection implies, environmental audit can be mandatory or initiative (voluntary). Mandatory environmental audit is carried out in cases specified by normative legal acts of RF[846]. However, current normative legal acts of RF do not define conditions for mandatory environmental audit. Voluntary environmental audits may be arranged voluntarily as decided by the subject of commercial activities.

Presently, a draft Federal Law "On Environmental audit and environmental auditing activities" is in review process. If it is adopted, then the following cases for mandatory environmental audit will be regulated by legislation:

1) activities including neutralization and disposal of waste, class I–IV;

[844] Federal law "On Protection of Environment"
[845] Federal law dated December 30, 2008. N 307-FZ "On auditing activities"
[846] Order No. 181 of RF State Committee on environment protection

2) development and execution of plans aimed to reduce releases and (or) discharges (environmental measures, best available technologies and (or) other environmental protection projects with gradual achievement of allowable emission limits);
3) development and implementation of a project focused on environmental recovery works;
4) measures of special environmental programs designed to rehabilitate areas contaminated with radioactive substances;
5) in other cases specified by federal laws and other normative legal acts of the Russian Federation.

It is important to note that current legislation does not establish a stringent procedure for environmental audit in RF. Projects in this field follow the example of foreign experience of similar audits and adapt policies and procedures of the audit of financial statements.

Auditor organizations providing environmental audits must maintain confidence regarding information about operations of entities audited and entities receiving services, and must also ensure security of information and documents they received and (or) draw up in the process, and they are forbidden to hand this information and the documents or their copies over to third parties, or disclose them without written consent of audited entities.

- Responsibilities and liabilities of auditors are set forth in the following normative acts regarding financial audit: Code of professional conduct for auditors[847], Principle of independence for auditors[848], FL "On auditing activities"[849], and entails the following: an auditor must compensate for lost opportunities in case of significant error when estimating results of services provided earlier;
- if auditors violate Code of professional conduct or Principle of independence, then they receive a warning about inadmissibility of actions. A licence for auditing activities may also be revoked or suspended;
- auditors may incur criminal liabilities for disclosure of confidential information.

If draft FL "On environmental audit and environmental auditing activities" is adopted, then if an auditor provides a positive opinion to a company as a result of audit procedures, and subsequently it is discovered that the audited company has caused damage to the environment, material harm, damage to honor, dignity and business reputation, then the auditor is administratively liable.

[847] Code of professional conduct for auditors
[848] Principle of independence for auditors and auditing organizations
[849] Federal law dated December 30, 2008. N 307-FZ "On auditing activities"

12.2. European countries

Environmental audit in EU is voluntary. A customer organization subject to environmental audit defines goals and criteria of the audit. Hence, assessment for compliance with current legislation, assessment of environmental obligations when purchasing and selling assets, assessment for compliance with local policies and standards of the organization, as well as assessment of environmental management system may serve as goals of the environmental audit.

Issues on voluntary participation for organizations in *Eco-management and audit scheme – EMAS* are governed by Regulation (EC) No. 1221/2009 of European Parliament and Council of November 25, 2009[850].

Standard procedures of internal audit according to EMAS include:

- to determine goals, scope and criteria of the audit;
- to conduct inspection involving discussion with personnel, inspection of operating conditions of equipment and check records, written procedure and other appropriate documentation;
- to issue a report subsequent to the results of the audit;
- to inform corporate management about the results;
- to develop action plan based on the results of the audit and implement it.

EMAS system specifies independent inspection of current environmental management system – certification audit. An accredited auditing firm or an expert auditor with permit to certify environmental management system may carry out an inspection. Organizations violating EMAS are deprived from certification until the problems are eliminated.

An appropriate law can be enacted as a practice in regulation of issues of environmental audit on the country level. Hence, in Germany, Law on environmental audit,[851] defining requirements for accreditation of environmental auditors is effective. Under that law, environmental auditors must follow principles of integrity, independence and must work within their competences in the course of an audit. In order to act as verifiers (auditors), auditors must prove that methods and procedures of inspections (including quality control and measures on confidentiality) are documentally supported.

Environmental auditor does not follow *the principles of integrity* in the process of an audit, if he violates:

- criminal law regarding property infringements, falsification of documents, wrongdoings leading to threats to society and the environment;

[850] Regulation (EC) No1221/2009 of the European Parliament and the Council of 25 November 2009
[851] Announcement of the revised Environmental Audit Act (UAG)

- law on illicit traffic control, law on waste management, law on water resources management, law on protection of environment and landscape, law on chemical substances, law on genetic engineering, law on nuclear energy or law on radiation protection;
- law on disease monitoring;
- commerce law or labor and safety act;
- law on drugs, fire weapons, or explosives, and received punishment or penalty at a rate of more than five hundred euros.

Environmental auditor does not follow the *principles of integrity* in the process of an audit, if:

- apart from duties on environmental audit, an auditor:
  - is the owner of an organization or is the majority shareholder in the organization whose activities are subject to the environmental audit provided;
  - is an employee in the organization whose activities are subject to the environmental audit provided;
  - is a public servant;
  - has a job as a judge.
- follows instructions in his activities that contradict his convictions, but are specified by contractual or other relations;
- cooperates with third parties, and their influence on the environmental audit is impossible to determine.

Requirements for competences of an environmental auditor include:

- appropriate academic education, in such fields as economics or business management, natural science and engineering, biological science, agriculture, forestry, geoscience, medicine, or law, in particular;
- specialized knowledge regarding: 1) methodology, implementation and assessment of environmental audit, 2) environmental management and assessment of environmental information, 3) issues in protection of the environment concerning accreditation and reporting including appropriate legal and published administrative provisions, and 4) environmental law, guidelines and relevant norms of environmental management;
- at least three years of professional experience in the course of which an auditor acquired practical knowledge about environmental protection in production.

If an auditor and his procedures within audit do not infringe specified requirements, then an accrediting body is entitled to issue an accreditation according to Law on environmental audit, art.9.

Accredited auditors must confirm their knowledge and compliance with requirements every 24 months after accreditation.

Germany levies penalties at a rate of 5 to 25 thousand Euros depending on violations of environmental auditors.[852] Federal Ministry on Environment, Protection of Nature and Reactor Safety regulates activities of environmental auditors and establishes penalties.

Environmental auditors incur administrative liabilities, if they:

- do not store copies of agreements with organizations, reports, all documents signed in the process of an audit, records on attending companies. These documents must be stored until an inspection by an authorised body, but not more than five years;
- have not provided all necessary information and documents to an authorised body in the course of preparation for a scheduled inspection of environmental auditors;
- are accredited in other european countries and willing to work in Germany, but have not obtained additional permission from an authorised body in Germany. In such cases, an authorised body can carry out additional audit (*witness audit*) while auditors work in an organization.
- are specialists from other european countries willing to work on the territory of Germany, and did not notify an authorised body about their actions minimum for four weeks prior to work. as Additionally, did not provide complete information about themselves (name, address, qualification, education and nationality) and about members of a group conducting the audit, about place and time of the audit.
- sign documents without confirmation of their knowledge and verification by an authorised body.

12.3. Brazil

Environmental audit is a system procedure allowing to assess potential risk of damage to the natural environment resulting from operation of a facility.

Resolution No.306[853] of July 5, 2002 specify the following objectives to inspect compliance with norms of environmental protection legislation:

1) To determine federal, state, and municipal legislation on environmental protection, as well as current environmental standards applicable to the activities of a company inspected.

[852] Announcement of the revised Environmental Audit Act (UAG)
[853] Conama Resolution 306

2) To check compliance of an organisation inspected with current environmental laws and normative acts.
3) To identify existence and validity of environmental licences.
4) To check whether conditions specified in environmental permits are complied with.
5) To determine agreements and commitments in the environment protection and to check whether they are complied with.

In order to assess efficiency of environmental management system, there are following objectives for an auditor:

- inspection of documented environmental policy implemented in organizations, and evidence that all personnel including subcontractors have read and understood it;
- inspection of environmental policy that is relevant to nature, size of an organization, and its impact on the environment;
- inspection of monitoring procedures of updated environmental legislation and other requirements;
- assessment of environmental targets that are achieved, tasks that are fulfilled, and inspection of compliance with environmental legislation (including principles of pollution prevention, where applicable);
- inspection of procedures developed to determine significant environmental aspects of activities, products and services, and assessment of their implementation;
- inspection of plans on technical check-up and their implementation for assessment of operating conditions and maintenance of facilities and equipment related to environmental aspects;
- assessment of current procedures on cooperation with parties concerned;
- inspection of records of monitoring and measurements of emission sources to the environment or systems of collection and processing of solid wastes, liquids, and gases;
- inspection of procedure on risk determination and assessment and related management plans;
- inspection of an individual action plan in case of emergency;
- records of emergencies;
- inspection of reporting procedures regarding environmental indicators and internal audit systems;
- records on personnel training;
- available control procedures;
- inspection of handling, storage and transportation conditions of products which may damage the environment.

Targets of an audit are specified in laws on the state level. Additionally, as Law 1.898/91[854] of Rio de Janeiro specifies, an environmental audit determines:

- actual or potential levels of pollution, deterioration of the environment as a result of activities of individuals or legal entities;
- operating conditions of equipment and pollution control systems;
- actions, which must be taken to recover the environment and protect human health.

Law 4.802[855] in Espirito Santo of August 2, 1993 additionally considers the following goals of environmental audit:

- assessment of quality of environmental management systems, systems and equipment employed by a company;
- inspection of company guidelines and standards designed to preserve the environment and life;
- proposal of solutions allowing to minimize risks of emergencies.

Minimal requirements and recommendations to environmental audits are expressed in Resolutions No. 306 of July 5, 2002 and No. 308 of December 14, 2006[856].

As Resolution No. 306 [857]specifies, audit procedure includes the following stages:

1. Determining scope and goals of an audit.
2. Preparation of an audit (document analysis, preparation to site-visit, etc.)
3. Conducting an audit (interview with corporate managers and personnel responsible for operation and functions of a facility; site inspections; information and document analysis; analysis of observations and conclusions; results of an audit; and preparation of a final report).
4. Drawing up a plan of corrective measures based on results of an audit.

Moreover, number of companies in Brazil certified for EMS according to ISO 14001, being another instrument of compliance with environmental protection legislation, has been considerably increasing recently.

Technical guidelines of environmental audit according to ISO 14010, ISO 14011 and ISO 14012, which are developed on the federal level, are used for assessment of EMS conformance.

Despite the fact that environmental audit is voluntary on the national level, lists of industries subject to mandatory environmental audits are specified on the state level.

[854] Lei 1898/91
[855] Lei Nº 4.802
[856] Brazilian Environmental Legislation
[857] Resolução CONAMA nº 381 de 14/12/2006

Thus, according to Law 1.898[858] of November 26, 1991 in Rio de Janeiro, annual environmental audits are mandatory for:

- oil refineries, oil-loading racks;
- harbor facilities;
- facilities for storage of toxic and hazardous substances;
- units for treatment and ultimate disposal of toxic or hazardous wastes;
- heat and nuclear power plants;
- units for ultimate disposal of effluents;
- petrochemical and steel industries;
- chemical and metal industries.

Legislation of Minas Gerais[859] establishes mandatory audits for facilities responsible for pollution and/or deterioration of the environment. Companies with high risk of pollution must periodically conduct environmental audit (maximum interval – every two years). The following facilities are subject to such audits:

- oil refineries, petroleum pipelines and terminals;
- units for storage of toxic and hazardous substances;
- units for treatment and ultimate disposal of toxic or hazardous wastes;
- heat and nuclear power plants;
- sewage treatment plants and residential effluent disposal systems;
- petrochemical and steel industries;
- chemical and metal industries;
- paper and pulp-and-paper industries;
- dams with wastes, tails and water.

A state authority body on the environmental protection may develop criteria and recommendations on inspections for mandatory audits. State bodies do not interfere with voluntary audits as they are conducted exclusively for internal goals of a company.

Responsibilities of environmental audit are regulated by Civil Code of Brazil and by Federal Law 6.938/81, which assume compensation for damage due to illegal actions of an auditor. Criminal liability may result from illegal actions depending on consequences.

[858] Lei 1898/91
[859] Minas Gerais, Lei 10627

12.4. USA

Policy of Environmental Protection Agency on environmental audit[860] includes encouraging companies to conduct environmental audit so that to comply with environmental protection legislation, as well as determining and correcting uncontrolled environmental risks and dangerous situations. This Policy assumes:

- encouraging organizations to develop, implement and update programs on environmental audits;
- determining cases, when Agency can or cannot request audit reports;
- promoting an initiative of state and local environmental audit;
- determining conditions of effective audit programs.

USA developed a program of voluntary monitoring by organizations for compliance with requirements of environmental protection legislation. This program specifies environmental audit for organizations is based on mechanisms allowing to reduce penalties within the program of environmental audit of Environmental Protection Agency. Thus, the procedure described in "*Announces Renewed Emphasis on Self-Disclosed Violation Policies (5/15/2018)*"[861] assumes the following:

- reduction of penalty up to 100% depending on severity, if nine conditions of *Audit policy* are observed[862]. Moreover, organizations can seek relief of criminal liability;
- reduction of penalty by 75%, if all conditions of Audit policy are observed, except for inconsistencies during a systematic audit[863].

Protocol for Conducting Environmental Compliance Audits and the Comprehensive Environmental Response, Compensation and Liability Act has been developed to govern assessment of companies for compliance with environmental protection legislation on management and cleaning of areas contaminated with hazardous wastes, and to encourage audits and discover violations in general[864]. Environmental audit can comprise 2 stages: stage 1 – assessment of retrospective data on actual or potential pollution of the environment, stage 2 follows in case if pollution has been determined, and current condition of soil and subsoil waters is assessed.

Comprehensive list of protocols is available on the website of Environmental Protection Agency[865].

[860] Environmental Auditing Policy Statement
[861] Report. EPA Announces Renewed Emphasis on Self-Disclosed Violation Policies (5/15/2018)
[862] Notice. Incentives for Self-Policing: Discovery, Disclosure, Correction and Prevention of Violations (Audit Policy)
[863] Notice. Incentives for Self-Policing: Discovery, Disclosure, Correction and Prevention of Violations (Audit Policy)
[864] Protocol for Conducting Environmental Compliance Audits under CERCLA
[865] Audit Protocols, EPA

12.5. Canada

Environmental Protection Act (*CEPA*)[866] in Canada defines environmental audit as "internal inspections arranged by companies and state bodies to confirm compliance with legislation requirements, as well as with internal policies and standards of a company itself". Audits are voluntary[867] and may be carried out both by corporate specialists and by outsourcing an independent entity. The goal of environmental audits is assessment of compliance with requirements of legislation, discovering of deficiencies in environment protection management system, as well as determination of potential environmental risks.

In order to encourage environmental audits, state inspectors are not entitled to request reports on environmental audits as a confirmation of compliance with requirements of environmental legislation in the course of regular inspections.

In the course of scheduled inspections, an access to reports on environmental audits can be requested in the following cases[868]:

- violation of the law has been discovered;
- audit results can be used as a proof in investigation of violations;
- necessary information can not be obtained by any other way within the powers of a state inspector.

Any request for access to reports on environmental audits within investigations shall be effected with a search warrant from the court. The only exclusion is, when damage to the environment, health of people, or loss or destruction of evidences can result from awaiting of a warrant.

A company can be subject to audits on the federal level, it they are permitted in accordance with federal laws (Environmental Protection Act of Canada, 1999, Transportation of Dangerous Goods Act, 1992 (*TDGA*), Environmental Assessment Act (*CEAA*), and etc.).

External environmental audit is required, if a company provides reports complying with directives and acts assuming audits on the level of separate provinces. For example, Air Monitoring Directive in Alberta province[869] assumes audits of stations for continuous air monitoring. Conclusions of audit results are submitted to the government.

[866] The Canadian Environmental Protection Act
[867] Environmental law and practice in Canada: overview
[868] Canadian Environmental Protection Act: compliance and enforcement policy
[869] Air Monitoring Directive

13. ENVIRONMENTAL INSURANCE

Environmental insurance is designed to protect the environment, and concerns life, health and property of legal entities and individuals in case of environmental risks. Both compulsory and voluntary environmental insurance is practiced in the studied countries. According to the research, if a company does not have an insurance in Germany, then its activities can be completely or partially banned. Russia and Canada exercise both types of insurance; and this issue of environmental regulation is being developed in Brazil.

In Russia, insurance rates and procedure of payments are governed by the Federal Law; In the USA and Canada, insurance companies developing their own policies and fixing insurance rates are in charge of these aspects. Legislation in EU countries does not define this issue, but environmental insurance is governed according to 2004/35/EU Directive.

13.1. Russia

As the Federal Law of the RF "On Environment Protection" implies, environmental insurance is provided in order to protect the property interests of legal entities and individuals in case of environmental risks.[870]

The RF's legislation does not include a separate law on environmental insurance regulations. Statutory provisions of environmental insurance are created based on normative acts governing constitutional guarantees of rights of citizens for compensation of harm caused to their health and property, pollution of the environment, as well as based on the acts of civil legislation, insurance legislation and legislation on environmental liability.

Compulsory insurance

There are two forms of environmental insurance in Russia: compulsory and voluntary. The RF's Federal Law "On industrial safety of hazardous production facilities"[871] establishes *compulsory insurance* of liabilities for harm caused by operation of a hazardous production facility. An organization operating such facility is obliged to insure liabilities for harm caused to the life, health, or property of other individuals and the environment in the case of an accident at the facility.According to the Law of the RF "On compulsory civil liability insurance for owner of a hazardous facility for causing harm resulted from an accident at a hazardous facility"[872], dangerous facilities include:

- facilities where the following substances are produced, processed, used, generated, stored and transported:

[870] N7-FZ "On Environmental Protection"
[871] N116-FZ
[872] N 225-FZ

- flammable substances – gases, which become flammable under normal pressure and mixed with air, and which boiling temperature at normal pressure is 20 degrees Celsius or below;at normal pressure;
- oxidizing agents;
- combustible substances;
- explosives;
- toxic substances, highly toxic substances and substances that are hazardous to the environment;

- facilities using equipment operating under excessive pressure (more than 0.07 MPa):
  - steam, gas (in gaseous and liquefied state);
  - water at t>115°C;
  - other liquids at temperatures above their boiling temperature at a pressure of 0.07 MPa.

However, the procedures for siggning and terms of the agreement for compulsory environmental insurance are not regulated by standards.

Insurance event is the occurence of civil liability of insurant for obligations arising from harm to victims suffered during the validity period of compulsory insurance agreement, and an insurer is liable to make insurance compensation to those suffered[873].

Insurance rates are specified in the Decree No. 4234 of of the Central Bank of Russia dated December 19, 2016, "On insurance tariffs, structure of insurance tariffs...under the contract on compulsory civil liability insurance for owner of a hazardous facility for causing harm resulted from an accident at a hazardous facility". The following rates are set for oil and gas industry (coefficient multiplied by the insurance amount): [874]

- for production facilities (drilling sites, pumping stations, stations for oil preparation and collection, gas preparation sites, etc.) – 0.199;
- for the main pipeline transport – 0.227;
- for geological exploration – 0.199;
- for oil products supply facilities (petroleum depots, fuel depots, tanks and drainage systems) – 0.081;
- for well stock – 0.0045%*number of wells (but not less than 0.00675% and not more than 0.5175%).

The payment procedure of any insurance is governed by the Federal Law "On compulsory civil liability insurance for owner of a hazardous facility for causing

[873] N 225-FZ
[874] Directive of Bank of Russia, 2016 N 4234-У

harm resulted from an accident at a hazardous facility"[875]**.** After the receipt of conclusion about causes and circumstances of an accident, complaint from a victim and documents confirming the harm caused and its extent, an insurance act is drawn up by the insurer within 20 working days. And within 25 working days from the date of determining the causes of the accident in accordance with the legislation of the RF, the insurer is obliged to make insurance payments to the victim or send it to the person who applied for insurance payment, or send an insurance act containing a reasoned refusal of insurance payment.

The legislation framework for environmental insurance in the RF includes provisions of the "Merchant Shipping Code"[876]. The object of marine insurance can be any property interest related to merchant shipping: a ship, a ship under construction, cargo, freight; as well as passenger fare, ship service fee for vessel use, profit expected from the cargo, salary to the captain of the vessel and other crew members, liabilities of the ship owner.

According to Chapter 8 “Liability for Oil Pollution Damage from Ships” of this Code, the owner of a vessel registered in the RF and carrying in bulk as cargo more than 2,000 tons of oil shall insure possible pollution damage or provide other financial security for liability.

Voluntary insurance

Based on "Standard provision on procedures of voluntary environmental insurance in the RF"[877], an insurance organisation (insurer) provides to insurants *voluntary insurance protection* of civil (property) liabilities. Damage the may be caused to the third parties as a result of sudden, unintentional and unexpected pollution to the environment on the RF’s territory is insured. Based on the Standard provision, insurance organizations develop their own rules on voluntary environmental insurance.The object of voluntary environmental insurance is the risk of property claims to the insurant from individuals or legal entities according to *norms of civil legislation* on compensation of damage for pollution of land, water environment or air basin on the territory, where a certain insurance agreement is valid. An insurance event is sudde, unintentional damage to the environment as a result of accidents leading to the emission of pollutants into the atmosphere, to the pollution of the earth’s surface and / or discharge of wastewater.

[875] N 225-FZ
[876] Merchant Shipping Code of RF
[877] Standard provision on procedures of voluntary environmental insurance in RF

13.2. European countries

On the territory of European Union, environmental insurance is governed by 2004/35/EC Directive "On environmental liabilities related to prevention and liquidation of damage to the environment" (*Environmental Liability Directive - ELD*)[878]. According to Article 14 of Directive, member countries must take all measures to implement financial mechanisms, including liability insurance in case of damage to the environment, to ensure that natural resource users comply with liabilities on the environment and people health protection.

In Germany, environmental insurance is governed by *Environmental Liability Act*[879]. The object of insurance is liability of natural resources user for harm caused to life and health of individuals as a result of environmental damage. This Act defines a list of activities, whose operators are subjects of compulsory environmental insurance[880]. Financial provisions to cover expenses as a result of environmental damage is mandatory for these operators. If an insurance is not available, a competent body can partially or completely ban the activities.

Insurance events are the events that cause death, injury or other harm to health of a human or damage to his property. Legislation requirements specify amount of insurance payments up to 85 million euros. Also in EU countries, the legislation in the environmental liability insurance system does not establish insurance rates on insurance of environmental liabilities.

Basic insurance principle in the UK:[881]

- *Liability insurance for pollution,* which can protect from losses due to pollution, including legacy contamination;
- *Professional accident insurance;*
- *Indemnity insurance of remedial actions* can be obtained to cover costs exceeding those planned in the course of recovery from pollution;

Norway

Pollution liability insurance for contractors. According to the Act on petroleum activities of Norway validated by Royal Decree of 27 June 1987, permission for geological, petrophysical, geophysical, geochemical and geotechnical activities is

[878] Directive 2004/35/CE
[879] Environmental Liability Act
[880] Please refer to Appendix 1 of Act Environmental Liability Act
[881] Environmental law and practice in the UK (England and Wales): overview

provided through licence for researches[882]. Although, the activities carried out by the licensee must be insured. Insurance should cover at least:

- cases of damage to production facilities;
- damage from pollution and other liabilities to third parties;
- handling emergencies and accidents;
- insurance of workers at production and administrative facilities.

13.3. Brazil

Currently, Brazil develops legislative acts to establish compulsory environmental insurance, namely, bills providing liability insurance in case of environmental damage resulted from hazardous activities, transportation of hazardous materials or emergencies[883].

13.4. USA

The USA introduces mandatory financial provision for potentially hazardous industrial activities. Such provision assumes not only risk insurance, but also the fomation of appropriate funds.[884]

The main objectives of comupulsory insurance in the USA are:

- guaranteeing the availability of certain funds both for carrying out measures to restore the consequences of the damage caused, and for compensation to the injured;
- fulfillment of safety requirements, strengthening control over potentially hazardous activities.

A certain type of insurance is applied depending on the objectives. The main types of environmental insurance in the USA are:

- insurance of an owner of industrial facility / operator: also known as environmental pollution insurance, liability insurance for damage to the environment and legal liability for pollution;
- pollution liability insurance for a contractor;
- insurance of underground and surface reservoirs.

Risks related to legacy contamination are not subject to insurance in the USA. The main law regulating environmental insurance is the Federal Law on Environmental

[882] Regulations to Act relating to petroleum activities
[883] Ecological Society of America
[884] Liability for environmental damage in Eastern Europe, Caucasus and Central Asia, OECD

Protection, Compensation and Responsibility (*CERCLA*), also known as *Superfund*.[885]

The Law provides a wide range of liabilities for responsible parties, including any costs incurred by government or private parties for recovery or compensation of any other damage to natural resources.

The Law specifies requirements for financial provision of different types of activities able to cause significant environmental damage (for example, operation of underground reservoirs, facilities for hazardous waste disposal)[886].

This Law establishes a trust fund to finance recovery of areas contaminated with hazardous and polluting substances. The Fund is formes by the investments from members polluting the environment, as well as tax liabilities from oil and chemical industries.

Insurance companies are responsible for the development of insurance policies and calculation of insurance rates. Judicial practice in USA does not have a unified approach on determining of environmental liability covered by insurance (insurance event). Since important issues are regulated by state legislation, court apply an appropriate act to treat conditions of the insurance agreement. Thus, the conclusions about recognizing the same case as insurance in different states differ[887].

13.5. Canada

- As in the USA, *Environmental insurance system in Canada* is represented from insurance companies that develop their own policies and set insurance rates. Insurance organizations in Canada offer a range of products to cover environmental risks[888]: insurance for pollution liability;
- insurance of capital spendings for environmental restoration projects;
- liability insurance for consultants on environmental issues;
- liability insurance of top executives (can cover costs for damage compensation).

In Canada, insurance implies mandatory contributions to funds, which will be used for insurance payments to depositors. Also, a voluntary insurance system, with insurance companies using products offered, is functioning in the country.

Environmental insurance in Alberta province is regulated by requirements of a number of documents: Alberta province Directives 024: *Large facility liability*

[885] Superfund 1980
[886] Liability for environmental damage in Eastern Europe, Caucasus and Central Asia, OECD
[887] The Role of Insurance in Environmental Liability
[888] Environmental law and practice in Canada: overview

management program - LFP)[889] and 075: *Oilfield waste liability - OWL*)[890]. Documents regulate requirements for environmental liability insurance of oil and gas companies. According to the Directives, a fund is created (Orphan Fund), which covers the costs of suspension of activities, conservation, liquidation and restoration of wells, facilities or pipelines for members of the fund, at the expense of their investment. Program and Fund members are listed in Appendix 1, Directive 075.

[889] Directive 024
[890] Directive 075

APPENDIX 1. INTERMEDIATE GOALS AND FINAL STANDARDS FOR SAO PAOLO STATE

I - SO_2:
a) for average concentrations within 24 consecutive hours:
1. MI1 - 60 µg / m³
2. MI2 - 40 µg / m³
3. MI3 - 30 µg / m³
4. PF - 20 µg / m³
b) for annual average arithmetical values:
1. MI1 - 40 µg / m³
2. MI2 - 30 µg / m³
3. MI3 - 20 µg / m³
II - CO: only the final standard is set – average for 8 consecutive:
1. PF - 9 ppm
III - for solid particles with aerodynamic diameter 10 µm - MP10:
a) for average concentrations within 24 consecutive hours:
1. MI1 - 120 µg / m³
2. MI2 - 100 µg / m³
3. MI3 - 75 µg / m³
4. PF - 50 µg / m³
b) for annual average arithmetical values:
1. MI1 - 40 µg / m³
2. MI2 - 35 µg / m³
3. MI3 - 30 µg / m³
4. PF - 20 µg / m³
IV – for solid particles with aerodynamic diameter 2.5 µm - MP2.5:
a) for average concentrations within 24 consecutive hours:
1. MI1 - 60 µg / m³
2. MI2 - 50 µg / m³
3. MI3 - 37 µg / m³
4. PF - 25 µg / m³
b) for annual average arithmetical values:
1. MI1 - 20 µg / m³
2. MI2 - 17 µg / m³
3. MI3 - 15 µg / m³
4. PF - 10 µg / m³
V – suspended particles:
A) for average concentrations within 24 consecutive hours:
1. PF - 240 µg / m³
b) for annual average geometrical values:

1. PF - 80 µg / m³

VI – suspended particles in the form of fume:

a) for average concentrations within 24 consecutive hours:
1. MI1 - 120 µg / m³
2. MI2 - 100 µg / m³
3. MI3 - 75 µg / m³
4. PF - 50 µg / m³

b) for annual average arithmetical values:
1. MI1 - 40 µg / m³
2. MI2 - 35 µg / m³
3. MI3 - 30 µg / m³
4. PF - 20 µg / m³

VII – Lead in solid particles – for observations in specific areas only, as CETESB decides, Final standard for annual average arithmetical values is set only

1. PF - 0.5 µg / m³

VIII - NO_2:

a) for average concentrations per 1 hour:
1. MI1 - 260 µg / m³
2. MI2 - 240 µg / m³
3. MI3 - 220 µg / m³
4. PF - 200 µg / m³

b) for annual average arithmetical values:
1. MI1 - 60 µg / m³
2. MI2 - 50 µg / m³
3. MI3 - 45 µg / m³
4. PF - 40 µg / m³

IX - O_3, for average concentration during 8 consecutive hours:
1) MI1 - 140 µg / m³
2) MI2 - 130 µg / m³
3) MI3 - 120 µg / m³
4) PF - 100 µg / m³.

APPENDIX 2. RATES OF CHARGES FOR PS RELEASE AND DISCHARGE

Table 1. Comparative table on charge rates for PS emissions into the ambient air

Pollutants	Kazakhstan*		Russia	Norway	UK	Brazil	USA**	Canada***
	Stationary sources	APG flaring						
Sulfur oxyls	69	-	-	-	-	-	15	9.45
Sulphur dioxide	-	1,392	0.8	16	-	-	-	9.45
Nitrogen oxyls	69	-	1.6	-	-	-	15	8.2
Nitrogen Dioxide	-	1,392	2.4	2,615	-	-	-	8.2
Dust and cinder	34.8	-	0.3	-	-	-	-	-
Lead and its compounds	13,871	-	312.8	-	-	-	-	-
Hydrogen sulphide	431.5	8,630	11.8	-	-	-	-	-
Phenols	1,155.4		31.3	-	-	-	-	12.15
Hydrocarbons	1.1	310	1.9	-	-	-	-	12.15
Formaldehyde	1,155		31.3	-	-	-	-	-
Carbon oxyls	1.1	102	0.03	-	-	-	-	0.32
Methane	0.07	6	1.9	-	-	-	-	-
Soot	83.52	1,670	-	-	-	-	-	-
Iron oxyles	104.4	-	-	-	-	-	-	-
Ammonia	83.52	-	2.4	-	-	-	-	12.15
Chromium VI	2,777	-	62.5	-	-	-	-	487.5
Copper oxyls	2,081	-	93.8	-	-	-	-	-
Benz(a)pyrene	3,468,229	-	93,846.3	-	-	-	-	-

Mercaptan	-	1,387,291	938.5	-	-	-	-	-

Data are given in US dollars per ton at the exchange rate of National bank of RoK for 2017
**local bodies can double rates*
***on the example of Mann*
**** on the example of British Columbia*

Table 2. Comparative table on charge rates for PS discharges

Pollutants	Kazakhstan	Russia*	Norway	Germany**	Brazil	USA	Canada
Nitrites	4,663.3	127.6	-	+	-	-	-
Zink	9,326.6	1,261.2	-	-	-	-	197.7
Copper	93,279.6	12,612.4	-	+	-	-	197.7
Biological demand in oxygen	27.8	4.2	-	-	-	-	14.9
Saline ammonia	236.6	20.4	-	+	-	-	74.5
Petroleum products	1,865.3	252.3	-	-	-	-	49.7
Nitrates	7	0.3	-	-	-	-	29.8
Total ferrum	932.7	102	-	-	-	-	197.7
Sulphates	2.8	0.1	-	-	-	-	-
Suspended substances	7	16.8	-	-	-	-	-
Synthetic surfactants	187.9	20.4	-	-	-	-	-
Chlorides	0.7	0.04	-	-	-	-	197.7
Aluminum	187.9	315.3	-	-	-	-	197.7

Data are given in US dollars per ton at the exchange rate of National bank of RoK for 2017
**charges for PS discharged to water bodies only*
***charge is set based on methodology for hazard assessment; charge for unit of hazard is 35 Euro (40 US dollars)*

APPENDIX 3. STANDARDS APPLIED IN EU FOR CONTINUOUS RELEASE/DISCHARGE MONITORING

Standards applied in EU for continuous monitoring of emissions to the ambient air

Standard	Name
EN ISO 9169:2006	Air quality - Definition and determination of performance characteristics of an automatic measuring system (ISO 9169:2006)
EN 14181:2014	Stationary source emissions - Quality assurance of automated measuring systems
EN 15259:2007	Air quality - Measurement of stationary source emissions - Requirements for measurement sections and sites and for the measurement objective, plan and report
EN 15267-1:2009	Air quality - Certification of automated measuring systems - Part 1: General principles
EN 15267-2:2009	Air quality - Certification of automated measuring systems - Part 2: Initial assessment of the AMS manufacturer's quality management system and post certification surveillance for the manufacturing process
EN 15267-3:2007	Air quality - Certification of automated measuring systems - Part 3: Performance criteria and test procedures for automated measuring systems for monitoring emissions from stationary sources

Standard applied in EU for monitoring of releases to water bodies

Standard	Name
EN 1085:2007	Wastewater treatment – Vocabulary
EN ISO 5667-1:2006	Water quality - Sampling - Part 1: Guidance on the design of sampling programmes and sampling techniques (ISO 5667-1:2006)
EN ISO 5667-3:2012	Water quality - Sampling - Part 3: Preservation and handling of water samples (ISO 5667-3:2012)
EN ISO 5667-14:2016	Water quality - Sampling - Part 14: Guidance on quality assurance and quality control of environmental water sampling and handling
EN ISO 5667-16:2017	Water quality - Sampling - Part 16: Guidance on biotesting of samples (ISO 5667-16:2017)
EN ISO 15839:2006	Water quality - On-line sensors/analysing equipment for water - Specifications and performance tests (ISO 15839:2003)
EN 16479:2014	Water quality - Performance requirements and conformity test procedures for water monitoring equipment - Automated sampling devices (samplers) for water and wastewater
CEN/TS 16800:2015	Guideline for the validation of physico-chemical analytical methods