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| Approved by the order of the Acting Chairman of the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan dated December 25, 2015 No. 223(as amended byby order of the DirectorBureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstandated December 24, 2021 No. 48) |

**Methodology for the formation**

**indicators of environmental statistics**

**Chapter 1. General provisions**

1. Methodology for the formation of indicators of environmental statistics (hereinafter - Methodology) refers to the statistical methodology, formed in accordance with international standards and approved in accordance with the Law of the Republic of Kazakhstan "On State Statistics" (hereinafter - Law).

2. The methodology defines the main aspects of the formation and methods nationwide statistical monitoring of the main indicators characterizing the state and pollution of the environment.

3. This methodology was developed using the recommendations of The United Nations Economic Commission for Europe (hereinafter - UNECE) Guidelines for the Application of Environmental Indicators in the Countries of Eastern Europe, the Caucasus, Central Asia and South-East Europe and is a general methodology for the formation of basic environmental indicators in the Republic of Kazakhstan, comparable at the international level and required for submission to international environmental organizations and publication in national reports.

4. The methodology is applied by the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan and
(hereinafter - the Bureau) its territorial divisions and in the formation of statistical indicators for environmental protection.

5. Environmental protection and rational use of natural resources is characterized as a set of measures to prevent pollution and degradation, control, as well as partial conservation and replenishment of the main elements of nature, which are negatively affected by human activity.

The quantitative side of the processes of human interaction with the natural environment, the processes associated with the preservation, restoration and improvement of the quality of the environment, is studied by environmental statistics. The objects of statistical study of the natural environment are natural ecological systems: the earth, its bowels, surface and ground waters, atmospheric air, forests, wildlife, nature reserves and national parks.

The system of environmental statistics in the Republic of Kazakhstan is decentralized. State statistics in the field of environmental protection is formed by the Bureau , using data from nationwide statistical surveys, departmental statistical surveys and administrative data.

 6. This methodology uses concepts in the meanings defined in the Environmental Code of the Republic of Kazakhstan (hereinafter - Code).

**Chapter 2. Formation of environmental indicators**

**Paragraph 1. Atmospheric air**

7. The main task of statistics on the state and pollution of atmospheric air is the collection, compilation and publication of information on the anthropogenic impact of human economic activity on atmospheric air, the formation, capture (neutralization), disposal and emission of harmful substances by stationary sources, polluting the atmosphere.

The main indicators characterizing air pollution are:

1) emissions of pollutants into the atmospheric air;

2) air quality in urban areas;

3) consumption of ozone-depleting substances.

8. The indicator of emissions of pollutants into the atmospheric air indicates the degree of existing and the expected anthropogenic impact of emissions of harmful substances on the environment and allows you to determine the degree of achievement of target values.

The degree of anthropogenic load on the atmospheric air as a whole is determined, the impact on the environment from stationary and mobile sources is assessed, including by types of economic activity (in particular: energy, transport, industry, agriculture and activities for waste management), as well as from households.

The total volume of emissions of pollutants into the atmosphere is formed and determined as the sum of emissions from stationary and mobile sources of pollution.

For stationary emission sources, emissions of sulfur dioxide (SO 2), nitrogen oxides NO x (expressed as nitrogen dioxide), ammonia (NH 3), particulate matter (PM 10 , PM 2.5) and particulate matter (PM) total), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs), persistent organic compounds (POPs, including polychlorinated biphenyls (PCBs), dioxins/furans and polycyclic aromatic hydrocarbons (PAHs)) and heavy metals (primarily cadmium (Cd), lead (Pb) and mercury (Hg)) , as well as specific pollutants (chlorine, phenol, benzene and their compounds).

This indicator is measured in tons.

The indicator is observed in general and by type of economic activity in accordance with the " General classifier of types of economic activity " (hereinafter - GCTEA).

For interstate comparisons, the indicator is formed as the number of emissions per square kilometer (hereinafter - km 2) of the country's territory per capita and per unit of gross domestic product (hereinafter - GDP). GDP is expressed in constant prices in national currency and in United States dollars (hereinafter - USA), also in parity purchasing power (hereinafter - PPP) in US dollars.

To carry out a full analysis of this indicator, data on volumes are tracked. captured and neutralized pollutants, including recycled ones. At the same time, it is necessary to compare the current volumes emissions with established limit values.

 9. To form the indicator of emissions of pollutants into the atmosphere from stationary sources, the data of the annual national statistical observation on the protection of atmospheric air are used.

Data on the amount of substances emitted with gases used in technological processes for the production of products as raw materials or semi-finished products are not included in the total volume of emissions of pollutants into the atmosphere. In particular, substances generated and utilized during the purification of gases from reactors during the production of soot at carbon black plants, purification of gases from ore-thermal furnaces during the production of yellow phosphorus at phosphorus plants, purification of gases from furnaces of "boiling" layer" in the production of sulfuric acid at chemical plants. Ferrous metallurgy enterprises do not take into account carbon monoxide contained in blast-furnace gas, which is used as process fuel. Substances not taken into account captured by installations and systems of “double adsorption” and double contacting, which are used to obtain products from the off-gases of non-ferrous and ferrous metallurgy, chemistry, and petrochemistry plants. Accountable only pollutants released into the atmosphere as a result of incomplete capture and gas leaks due to tightness of technological equipment.

10. The indicator of atmospheric air quality in urban settlements characterizes the state of the environment in terms of air quality and the negative impact of increased concentrations of pollutants per population.

Elevated concentrations of pollutants in the surface layer of the atmosphere have a diverse negative impact on human health, vegetation and materials. Particulate exposure, measured as concentrations of PM 10 and PM 2.5 (particulate matter, 10 and 2.5 microns in diameter, that pass through a fractionated air intake at 50% absorption efficiency) in the surface atmosphere. A number of heavy metals and persistent organic pollutants (hereinafter - POPs) are one of the risks for human health due to air pollution. Breathing air with high concentrations of PM 10 and PM 2.5 for a short time causes pronounced symptoms of asthma and respiratory diseases, a decrease in lung capacity and increases the risk of serious illness. There is a lot of data on the negative effects on humans of carbon monoxide (CO), sulfur dioxide ( SO 2), nitrogen oxides ( NO x) and ozone, present in the atmospheric air.

The quality of atmospheric air in urban settlements is determined primarily by the number of days in a year when, during regular observations, the level of atmospheric air pollution in urban settlements exceeds the established values (maximum one-time/average daily) limit of permissible concentration (hereinafter - LPC). At the same time, it is necessary to determine the absolute values of the concentrations of pollutants in the atmospheric air, the percentage of the urban population of the country exposed to surface concentrations pollutants exceeding the established quality standards atmospheric air.

Air Pollution Observation Points ( hereinafter - POP) are organized to create an effective observational network to obtain reliable meteorological and hydrological information and information on air pollution. The main objective of the POP is to conduct systematic observations of atmospheric air pollution in settlements (automatic measurement of the concentration of pollutants and (or) sampling of atmospheric air for laboratory analysis). The number of posts (points) for atmospheric air monitoring is determined depending on a combination of factors: the population, the terrain, the actual level of pollution, the environmental load (repeated excesses of the maximum permissible concentrations of pollutants based on the results of preliminary measurements, the presence of industrial facilities near the settlement, workload settlement by road).

When determining the need for placement points of observation of atmospheric air pollution are guided by calculations: 1 post - up to 50,000 inhabitants; 2 posts - over 50,000 to 100,000 inhabitants; 3 posts - over 100,000 to 200,000 inhabitants; 3 - 5 posts - over 200,000 to 500,000 inhabitants; 5 - 10 posts - over 500,000 to 1,000,000 inhabitants; 10 - 20 posts - more than 1,000,000 inhabitants.

The number of air quality control posts can be increased if there are a large number of pollution sources, as well as if there are objects in the area for which air purity is of paramount importance (for example, unique parks, historical buildings).

In settlements with a population of less than 50,000 inhabitants, in the absence of located (up to 5 km) sources of atmospheric air pollution, to determine the need for placement of atmospheric air monitoring posts, preliminary measurements of pollutants are carried out. In the absence of excess LPC pollutants, the placement of atmospheric air monitoring posts is not carried out.

To obtain reliable information about the quality of atmospheric air, the space around the atmospheric air monitoring posts must be ventilated.

Atmospheric air monitoring posts are located in open areas.

To obtain a characteristic of the distribution of impurity concentration, atmospheric air monitoring posts are installed primarily in those residential areas where the highest average levels of pollution are possible, in the administrative center of the settlement, as well as in parks and recreation areas.

Taking into account the changes in the development of the area, the opening/closing of industrial enterprises, the organization of pollution sources, it is possible to revise the location of atmospheric air monitoring posts.

The state of air pollution is assessed based on the results of analysis and processing of air samples taken at stationary posts. The main quality criteria are the LPC values of pollutants in the air of populated areas. The level of air pollution with harmful substances in cities is estimated by the value of the complex index of air pollution (API5), which is calculated for five substances with the highest values, according to the formula:

API 5 \u003d Σ( q cf. i /LPC i) С i,

Where

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| q cf. i | ‑ | average concentration of the i-th substance; |
| LPC i | - | average daily maximum allowable concentration of the i-th substance; |
| C i | - | coefficient depending on the hazard class of the i-th substance, taken equal to 1.7; 1.3; 0.1 and 0.9 respectively for 1, 2, 3, and 4 hazard classes of the contaminant. |

The number of micrograms
(hereinafter - μg) of pollutants in a cubic meter (hereinafter - m 3) air.

There are four categories of air quality depending on the level of pollution:

1)API≤ 5 - low;

2) at 5 < API < 7 - increased;

3) at 7 ≤API< 14 – high;

4) with API ≥ 14 - very high.

11. The consumption of ozone-depleting substances (hereinafter - ODS) characterizes the degree of impact of ODS on the environment.

The ozone layer in the stratosphere is the most important component of the Earth's atmosphere. It protects human, animal and plant myrrh from damage by short-wave ultraviolet radiation (hereinafter - UV). Ozone is destroyed by reactions with some ODS when exposed to UV radiation. Compounds that strongly deplete the ozone layer include chlorofluorocarbons (CFCs), carbon tetrachloride, methyl chloroform, halons, hydrochlorofluorocarbons (HCFCs), hydrobromofluorocarbons (HBFCs) and methyl bromide. They are used as solvents, refrigerants, foaming and degreasing agents, aerosol propellants, fire extinguishers (halons); and agricultural pesticides (methyl bromide). The extent to which ODS affect the ozone layer depends on their chemical characteristics. In addition, some ODSs are simultaneously potential greenhouse gases.

The data collected contains information about all substances included in Annexes A-C and E to the Montreal Protocol, existing alone or in a mixture. Also includes the isomers of each ODS, except for substances listed in the relevant annex, but does not cover regulated ODSs or mixtures that are incorporated into the manufactured product, other than container used to transport or store such a substance.

consumption is calculated as the sum of production and imports for minus their exports. The total ODS is the sum of the annual national production (in tons) of each ODS multiplied by the respective ozone depleting potential (hereinafter -ODP). ODP is a relative measure of the ability of a substance to cause ozone dissociation. The indicator is measured in tons of ODS.

**Paragraph 2. Changing of the climate**

1 2. Qualitative data are needed to design and implement timely and appropriate climate change adaptation measures.

To inform society about climate change, the following main indicators are being studied:

1) air temperature;

2) precipitation;

3) greenhouse gas emissions.

Air temperature is directly related to the state Earth's climate system. The indicator characterizes the trends in fluctuations in the average annual temperature and allows you to determine the degree of changes associated with both the cyclical nature of natural climatic changes and anthropogenic impact on global warming.

The degree and spatial distribution of temperature changes, along with annual mean global temperatures, are necessary to determine the ability of natural ecological systems
(hereinafter - ecosystems) to adapt to climate change. The indicator is measured in degrees Celsius.

The temperature deviation for a certain period of time from the long-term norm is defined as the difference between the observed value and the average long-term value for the base period of years. Observations and research are carried out by the national hydrometeorological service.

13. The indicator of atmospheric precipitation characterizes the state of the climate system, as well as the impact on the volume of river runoff and groundwater, soil, flora and fauna. Analysis of long-term observations of the main climatic characteristics such as precipitation, air temperature and air humidity, allows not only to judge the change in the structure of precipitation in a certain area, but also to assess the dynamics of changes in the amount of precipitation in the future, as well as the associated climate changes.

Atmospheric precipitation (the total amount of water that has fallen on a certain area of the territory for a specific period of time) is water in a liquid or solid state that has fallen out of clouds or settled out of the air on the earth's surface, various objects or plants. Precipitation occurs in the form of rain, drizzle, snow, sleet, ice or snow pellets, hail or sleet.

Atmospheric precipitation is one of the most important climatic characteristics. Atmospheric precipitation is mainly form renewable fresh water resources (volume of river runoff and groundwater), which in turn affects the state of all components environment (soils, forests, flora and fauna). At the same time, the amount of precipitation affects the state of atmospheric air, regulating its humidity, which prevents the spread of concentrations of solid particles in the surface layer of the atmosphere. The quantity, quality, distribution, seasonal and annual course of precipitation have a significant importance for agriculture and forestry. The indicator is determined by the thickness of the layer of precipitated water in millimeters (hereinafter - mm).

United Nations Framework Convention on Climate Change
(hereinafter - UN FCCC), conducts systematic observations of changes in precipitation and ensures the creation of databases.

Precipitation data are collected by the National Hydrometeorological Service. The amount of precipitation is determined per day, month and year. Attitude the amount of precipitation that has fallen in a given period of time To multi-year norms for the same period, is calculated by the percentage method ratios.

1 4. The indicator of greenhouse gas emissions allows you to determine not only the extent of the existing and expected impact of greenhouse gas emissions on the environment, but also indicates the effectiveness of the national policy aimed at reducing greenhouse gas emissions in comparison with the target indicators and the level of progress of the country towards achieving specific goals.

The total volume of greenhouse gas emissions should be formed as a whole for the economy and by type of economic activity. This indicator must be given in publications per capita and per unit of GDP, which is expressed in constant prices in national currency and in US dollars and in PPP in US dollars.

Each of the greenhouse gases has its own impact on the global warming process, depending on the time of its stay in the atmosphere and the ability to absorb heat. Three greenhouse gases, CO2 , CH4 , N2O account for about 98% of the environmental load causing climate change. To calculate aggregated emissions and form a general graph describing the climate change issues, data on emissions of various greenhouse gases are expressed in CO 2 equivalent based on the principle of global warming potential (hereinafter - GWP). GWP describes the ability of greenhouse gases to absorb infrared radiation (thermal radiation) from the Earth's surface for a certain period of time (usually 100 years), and thereby contribute to global warming. (For example, the GWP value of methane (CH4) is 21, the GWP value of nitrous oxide (N2O) is 310. This means that 1 kilogram (hereinafter - kg) of methane affects the global warming process 21 times more than 1 kg carbon dioxide , and 1 kg N2O is 310 times stronger than 1 kg of CO2).

The calculation of greenhouse gas emissions is carried out by the subordinate organization of the authorized body for the environment on the basis of the annual national report on the inventory of anthropogenic emissions from sources and removals by sinks of greenhouse gases not regulated by the Montreal protocol for those activities that lead to a change in the concentration of greenhouse gases in the atmosphere (taking into account the sources of absorption of greenhouse gases). This report is submitted annually to the secretariat in accordance with the obligations of the Republic of Kazakhstan under the UN FCCC, and the adopted protocols and agreements to it, ratified by the Republic of Kazakhstan. Annual data on methane emissions from agriculture due to enteric fermentation are calculated from data on number of different animal species. Emissions conversion factors link the amount of emissions to statistical data on anthropogenic activities. A simplified method for calculating greenhouse gas emissions can be expressed as follows:

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| Greenhouse gas emissions | = | anthropogenic activity data | \* | emission factor |  |

Both internationally accepted emission factors developed within the framework of the UN FCCC and national emission factors are used for the calculation.

**Paragraph 3. Water resources**

15. The main task of statistics on the state, use and protection of water resources is the collection, compilation and publication of information on water intake from rivers, lakes, reservoirs, canals, underground horizons; on the use of water for industrial, household and drinking needs, in various irrigation systems, agricultural water supply; water losses and water savings due to the reuse and recycling of water; discharge of wastewater into surface water bodies and underground horizons; the amount of various pollutants discharged from wastewater.

To inform the public about the state and protection of water resources, the following main indicators are studied:

1) renewable fresh water resources;

2) fresh water intake;

3) usage;

4) household consumption per capita;

5) water supplied by the water supply industry and access of the population to

centralized water supply;

6) water loss;

7) reuse and recycling of water;

8) quality of drinking water;

9) biochemical oxygen consumption (hereinafter - BOC) and ammonium nitrogen concentration;

10) nutrients in fresh water;

11) nutrients in coastal marine waters;

12) the concentration of pollutants in coastal sea water and

bottom sediments;

13) the population provided with wastewater treatment;

14) treatment facilities;

15) contaminated wastewater.

16. The indicator of renewable fresh water resources is determined from the total volume of river runoff and groundwater formed in natural conditions solely due to precipitation in the country and the actual volume of river and groundwater inflow from neighboring countries.

Data collection on renewable freshwater resources is carried out at hydrological stations. The data are calculated based on long-term measurements of the level, flow rates, discharges of water produced in rivers and lakes, in underground aquifers, and taking into account the amount of precipitation throughout the country.

17. Freshwater abstraction and use indicators measure the amount of water withdrawn from freshwater sources, assess the environmental impact of abstraction of freshwater resources and its use in order to meet the needs of the population and economic activities. Freshwater abstraction determines the extent to which water resources are limited and the distribution of withdrawn water by type of economic activity.

The sources of impact on fresh water resources are their overexploitation and environmental degradation. Since the quality of water is highly dependent on its quantity, linking freshwater abstraction with the renewal of its supply is one of the central issues in the sustainable management of freshwater resources. This indicator characterizes the scale of use of fresh water resources, determines the need to adjust actions to regulate water intake and use. Based on changes in the index of exploitation of water resources (hereinafter - IWRE), an analysis is made of the dynamics of water withdrawal that affects freshwater resources. The threshold value of the IWRE index serves as the basis for distinguishing between regions with non-stressed and stressed water regimes and is about 20%. High tension is noted in cases where IWRE exceeds forty percent.

IWRE is defined as the ratio of total annual water withdrawal to the long-term average annual renewable freshwater resource, expressed as a percentage.

Fresh water withdrawal is defined as the total annual withdrawal of surface and ground fresh water by all water users.

The indicators are measured in millions of cubic meters per year, the total volume of water consumption per unit of GDP is expressed in cubic meters in international dollars (in constant 2017 purchasing power parity prices).

The indicator reflects data on the abstraction and use of fresh water, broken down by the main types of activities of the entities engaged in water abstraction. The volume of water abstraction is usually measured or calculated by enterprises based on the energy consumption of pumping installations. For water users (households and agriculture), a calculation method based on the application of models is used.

Freshwater abstraction and use indicators make it possible to determine the amount of water withdrawn from freshwater sources, to assess the impact on the environment in connection with the abstraction of fresh water resources and its use in order to meet the needs of the population and the needs of economic activities. Freshwater abstraction determines the extent to which water resources are limited and the distribution of withdrawn water by type of economic activity. They are monitored and formed on the basis of the annual departmental statistical observation on the intake, use and disposal of water.

18. Household water consumption per capita measures the environmental impact of water abstraction from various sources.

The rate of domestic water consumption in different areas is not the same and depends on many environmental and economic factors. The units of measurement of the indicator are million cubic meters per year per capita and liters per day per capita.

The indicator is calculated as the volume of water used to meet household and drinking needs of the population (including employees of enterprises) per capita.

Data are used based on the results of the annual nationwide statistical observation of the operation of water supply and sanitation facilities.

The volume of domestic water consumption is determined by measuring the volume of water supplied primarily through the centralized water supply networks. Water consumption of the population that does not have access to centralized water supply is determined by calculation. Household water consumption per capita is calculated by dividing the volume of water consumption by the number of resident population. To determine the indicator, data from enterprises and organizations involved in the water supply of the population, and data from local authorities are used.

19. Water supplied by the water supply industry and access of the population to piped water supply as an indicator provides a measure of the pressure on the environment and a measure of the measures taken in response to reduce this pressure. The indicator was developed using the recommendations of the "Guidelines for the Application of Environmental Indicators in the Countries of Eastern Europe, the Caucasus, Central Asia and South-Eastern Europe" of the United Nations Economic Commission for Europe and is important for determining the level of development of the water sector and the degree of access to water to meet all the needs of the population.

The indicator defines the total volume of water supplied to consumers by water supply companies, taking into account water losses during its transportation, as well as the share of the population with access to water supplied by water supply enterprises of the total population of the country.

The total volume of water supplied by the water supply industry is expressed in millions of cubic meters per year; the proportion of the population with access to centralized water supply is expressed as a percentage. The data of the annual nationwide statistical observation on the operation of water supply and sanitation facilities are used.

20. The water loss indicator determines the effectiveness of measures aimed at improving the water management system in the country.

Losses of water during transportation to points of use are an indicator of the efficiency of the water use system, including technical conditions affecting piped systems, water prices and public awareness in the country. Measured in millions of cubic meters per year and as a percentage of the total volume of water withdrawn.

The indicator is defined as the volume of fresh water lost during transportation (due to leakage and evaporation) between the point fence and point of use.

When forming, data are used on the volume of fresh water not supplied to consumers during transportation by water management enterprises involved in the collection, purification and distribution of water through a permanent infrastructure. The indicator is calculated and determined by the difference between the volume of water abstracted by enterprises in the water supply sector and the volume of water supplied to consumers (households; agriculture, forestry and fisheries; manufacturing, electricity; types of economic activities). Losses associated with illegal abstraction or illegal uses of water are not taken into account.

The data of the annual departmental statistical observation on the intake, use and disposal of water and the data of the annual national statistical observation on the operation of water supply and sanitation facilities are used.

21. The indicator of fresh water reuse and recycling measures the effectiveness of response measures aimed at improving systems for the rational use of water for industrial needs.

The rate of reuse and recycling of fresh water is measured in million cubic meters per year. The data of the annual departmental statistical observation on the intake, use and disposal of water are used.

The indicator is determined by the volume of reused and recycled water and its share in the total volume of water used to cover production needs. It is possible to determine the percentage of water saved through the use of water recycling and reuse systems for the country as a whole and by type of economic activity.

Data on water reuse is collected by the water supply industry, public or private bodies whose main functions are water collection, treatment and implementation of measures for the distribution of water for domestic and industrial needs, and recipients of water from water supply systems. The share of water reused is defined as the ratio of the volume of water reused to the total volume of fresh water used. The indicator is calculated using the following formula:

% Water reuse = (volume of water reused / volume of water used) \* 100

22. The indicator of drinking water quality allows to determine the risk of negative impact of low-quality drinking water on human health, characterizes the degree of compliance of drinking water with sanitary epidemiological requirements.

Improving the health status of the population is impossible without access to sufficient amounts of clean drinking water. This indicator allows assessing the degree of contamination of drinking water with chemicals and microbiological organisms, serves as a warning mechanism for situations that require additional in-depth study and appropriate measures.

The indicator is defined as the proportion of samples that do not meet drinking water quality standards in the total number of drinking water samples obtained from various types of sources (treated, open water intakes, wells, wells). Measured in percentage.

The indicator is calculated on the basis of available data on the compliance of drinking water with parameters directly related to human health. Sanitary and epidemiological monitoring is carried out by the state body and organizations in the field of sanitary and epidemiological welfare of the population.

The mathematical expression for each parameter is the proportion of analyzed drinking water samples that do not meet the standard indicators. Data collection applies to the total number of regulated samples carried out by an official drinking water monitoring organization or an authorized private organization within a given territorial unit (a water supply area or a regional unit that has been defined for regulatory purposes) during a given period of time (e.g. , one year) (T), as well as the number of nonconforming samples (E) in a given territorial unit. The "percent match" indicator can be calculated using the formula:

Sample compliance rate = ((T - E) / T) \* 100

The number of sampling points in the centralized and decentralized water supply system and the frequency of sampling provide statistical confidence in the number of samples that do not meet the standards.

23. The indicator of biochemical oxygen consumption (hereinafter - BOC) and the concentration of ammonium nitrogen in river water determines the state of rivers by the level of pollution with easily oxidized organic substances and ammonium nitrogen.

The presence of a large amount of organic substances (microorganisms and decaying organic waste) leads to a decrease in the chemical and biological quality of river water and to a decrease in the biodiversity of aquatic communities, microbiological pollution, which negatively affects the quality of the water used. Sources of organic matter are discharges from wastewater treatment plants, industrial wastewater and runoff from agricultural land. Organic pollution contributes to the acceleration of metabolic processes that require oxygen. This leads to oxygen deficiency (anaerobic conditions). The conversion of nitrogen to reduced forms under anaerobic conditions, in turn, leads to an increase in the concentration of ammonium nitrogen, which is toxic to aquatic communities at concentrations that increase a certain level depending on temperature, salinity and concentration of the hydrogen index (pH value) in water.

The indicator is defined as the level of oxygen content in water bodies, or BOC, the oxygen demand of organisms necessary for the oxidation of organic matter, and the concentration of ammonium ions (NH4) in rivers. The annual average value of BOC after a 5-7 day incubation period (BOC5 /BOC7) is expressed in milligrams O2 per liter; the concentration of ammonium ions is expressed in milligrams of ammonium ions per litre.

This indicator characterizes the current situation and trends in relation to BOC and NH4 in rivers. The number of observation points and their location should provide information on the background values of BOC for the main morphological types of watercourses and the values of this indicator in areas experiencing anthropogenic load. Time parameters of observations should correspond to hydrological phases.

The main regulatory document for assessing the quality of water in water bodies of the Republic of Kazakhstan is the “Unified System for Classifying Water Quality in Water Bodies”, approved by order No. 151 of the Chairman of the Committee on Water Resources of the Ministry of Agriculture dated November 9, 2016. The unified classification is ranked into five classes (I, II, III, IV, V) with the transition from class 1 of “best quality” to class 5 of “worst class” and taking into account the regulatory requirements of the main categories of water use (fisheries, household and drinking water supply, recreation, irrigation, industry).

24. The indicator of nutrients in fresh water measures the status of fresh waters (rivers, lakes and groundwater) in terms of their nutrient content.

The input of large amounts of nutrients into freshwater reservoirs from urban, industrial and agricultural areas leads to eutrophication of these reservoirs. Causes environmental changes that are accompanied by the loss of plant and fish species (deterioration of ecological conditions) and adversely affect the use of water for human consumption. This indicator is used to illustrate current nutrient levels and long-term trends.

The indicator is determined by the concentration of phosphates and nitrates in rivers, the total content of phosphorus and nitrogen in lakes and nitrates in groundwater. Nitrate concentrations are expressed in milligrams N03 per liter, phosphorus concentrations in milligrams per liter.

It is necessary to ensure the methodological and metrological unity of observations and information processing; chemical analysis works are carried out in accredited laboratories that have quality control systems for changes.

25. The indicator of nutrients in coastal marine waters measures the status of coastal marine waters in terms of nutrient concentrations.

This indicator reflects the presence in coastal sea waters of biogenic substances necessary for plants and autotrophic bacteria to maintain vital activity and the impact on biological productivity and the ecological state of coastal waters and is defined as the concentration of the main nutrients (nitrates and phosphates) in micrograms per liter.

Nutrients and a list of key measurable indicators should be defined in the basic monitoring program. The number of observation points and their spatial location provide information on the content of nutrients along the entire load gradient - from the background coastal marine areas to areas of coastal marine waters experiencing a significant anthropogenic (mainly agricultural) and household load. The temporal parameters of the observations take into account the temporal variability in the concentration of nutrients. The methodological and metrological unity of observations and information processing is ensured; work on the analysis of the chemical composition is carried out in accredited laboratories that have systems for ensuring the quality of measurements. Monitoring is carried out by the national hydrometeorological service.

Nutrients in the coastal sea waters of the Caspian Sea are determined according to the data of the marine coastal stations of the Middle Caspian (Kalamkas, Fort Shevchenko, Fetisovo) and coastal stations of the North Caspian (delta part and seashore of the Ural River).

26. The indicator of polluted wastewater determines the level and nature of anthropogenic impact on natural water bodies, provides an opportunity to obtain information necessary for the development of environmental protection mechanisms, and allows assessing the measures taken to improve the efficiency of the wastewater management system.

The indicator characterizes the volume of polluted wastewater discharged into water bodies and their share in the total volume of wastewater in the country for the year. It is measured in million cubic meters per year.

This indicator is monitored and formed on the basis of the annual departmental statistical observation on the intake, use and disposal of water.

**Paragraph 4. Biodiversity**

27. To inform society about the state and protection of the environment in terms of biodiversity conservation, the following main indicators are studied:

1) specially protected natural areas;

2) forests and other wooded lands;

3) endangered and protected species;

4) trends in the number and distribution of individual species.

28. Indicator of specially protected natural areas allows assessing the response to ecosystem degradation and loss of biodiversity in the country. It characterizes the degree of protection against misuse of areas valuable for the conservation of biodiversity, cultural heritage, scientific research (including background monitoring of processes occurring in these areas), recreation, conservation of natural resources and valuable components of the environment.

This indicator characterizes areas of land, water surface and air space above them, protected in accordance with national legislation. It includes the area of specially protected areas in the country and its share in the total territory of the country. Additionally, this indicator is broken down into categories of natural areas that have a special status of the International Union for Conservation of Nature (hereinafter - IUCN), or categories adopted at the national level for the protection regime, in order to determine the area and percentage of each category.

The indicator is formed by the authorized state body that carries out strategic, regulatory, implementation and control functions in the field of forestry, protection, reproduction and use of wildlife and specially protected natural areas.Measured in hectares (hereinafter - ha).

29. The forest and other wooded land indicator provides an assessment of the state of forests or wooded land in a country and shows trends in their use for environmental purposes.

This indicator provides a quantitative and qualitative assessment of forest resources and represents an average value that can hide significant discrepancies between forests and other wooded land, reflects the area of forests and wooded land, its ratio to the area of the country, as well as the percentage of different categories of forests and wooded land. lands. The indicator is measured in hectares. With small areas of certain categories of forests, the unit of measurement is km 2.

The indicators are formed by the authorized state body in the field of forestry and wildlife through state forest inventory, territory surveys, forest cadastral surveys, using remote sensing methods or a combination of all methods. This assessment is carried out once every five years.

30. Index of threatened and protected species makes it possible to assess the state of biodiversity in terms of the number and abundance of endangered species, indicates the effectiveness of measures taken in the country to preserve national and global biodiversity.

This indicator characterizes the number and size of populations of species by species groups that are endangered at the national and global levels, as well as being protected in the country. The number of species and the number of adults in units are used as units, percentage for trends.

Lists of threatened and protected species developed for globally threatened species serve as the basis for data collection. The number of endangered species and the number of protected species do not match, because protected species include rare species and species protected under the relevant multilateral environmental agreements, or because of their presence on the IUCN Red List of Threatened Animals and Plants disappearance. The number of species is distributed by species groups (animals , invertebrates, freshwater fish, reptiles, amphibians, birds and mammals; vascular plants; algae; lichens and fungi). Evaluation for each species group is carried out at least once every five years.

31. Indicator of the trend in the number and distribution of individual species allows assessing the state of the population of individual species, assessing the effectiveness of measures taken to conserve biodiversity.

This indicator characterizes the state of populations of representatives of fauna and flora belonging to species groups that have the most important resource value and play an important role in terms of biodiversity (“individual species”).

The indicator reflects changes in the number of individual species in the territory of a particular area (country, region or specially allocated area). Measured by the number of adults or an appropriate index of abundance in that particular area.

When developing monitoring programs, the following separate types are considered:

1) key species - species that play an important role in the structure, function or productivity of a habitat or ecosystem at a certain level (habitat, soils, seed dispersal). The loss of these species will have a significant adverse effect on the size of species populations in a given ecosystem and may lead to loss of species ("cascade effect");

2) the most important species include taxa that are of particular value (cultural and historical) for citizens of the country as a whole or its regions;

3) endemic species - species of international importance, the population of which in the country is a significant proportion of their number on a global or European scale.

Population trends are mainly determined by the totality of cyclical fluctuations. They reflect the totality of living conditions, protection and rational use of biological resources. For each type, the indicator is calculated separately. For species for which there are only estimates of absolute or relative abundance in territorial units of observation (in administrative territorial units, or individual reserves and national parks), the reference point for each territorial unit of observation is the estimate of abundance in the year the monitoring was introduced.

Data on the abundance of wild animals and game by species are tracked and compiled based on annual administrative data.

**Paragraph 5. Land resources**

32. The main task of statistics on the protection of land resources is the collection, compilation and publication of information characterizing the qualitative state of agricultural land , irrational use or misuse, illegal land use, reclamation and restoration of disturbed lands. The accounting of lands subject to water and wind erosion and (deflation) , waterlogging and waterlogging , salinization and similar processes is included.

To inform society about the state and protection of land resources, the following main indicators are studied:

1) withdrawal of land from productive circulation;

2) lands subject to soil erosion.

33. The indicator of land withdrawal from productive circulation provides an opportunity to quantify the impact on the environment and characterizes the trends in the expansion of built-up areas to natural and semi-natural lands.

The indicator is defined as the area of withdrawn land for transport infrastructure, development, landfills, landfills, tailings and waste rock dumps in the country. It is formed on the basis of departmental observations on the availability and distribution of land by category of the authorized body for land resources. Measured in hectares.

The indicator is formed as the average change and the percentage of different types of land used for transport infrastructure, urban development and landfills, landfills, tailings and waste rock dumps in relation to the total area of the country.

When compiling the indicator, methodological developments of the Food and Agriculture Organization of the United Nations are used, working to harmonize classification systems and databases in order to improve the quality of information on land use at the national and international level x. Activities aim at developing definitions and protocols, an automated database structure containing land use information, a broadly agreed land use classification framework.

34. The index of lands subject to soil erosion provides an opportunity to assess the state of land in terms of the degree of its susceptibility to wind and water erosion.

Data are collected separately for total land area (excluding areas covered by inland or tidal water , buildings, rocks and glaciers) and agricultural land.

Wind, water erosion (flat wash, gullies and ravines) are assessed as a net loss of soil and are assigned to one of four categories: insignificant (weak) , moderate (medium) , significant (strong) and extreme. These four categories of wind and water erosion refer to the total area of degraded land. Soil erosion index should be estimated at least once every five years based on a qualitative assessment of land. The information is formed by the authorized body that performs strategic, regulatory, implementation and control and supervisory functions in the field of land management.

**Paragraph 6. Agriculture**

35. To inform society about the state and protection of the environment in terms of pollution from agriculture, the following main indicators are investigated:

1) application of mineral and organic fertilizers;

2) application of pesticides.

36. The indicator of the application of mineral and organic fertilizers makes it possible to assess the impact exerted on the environment through the application of fertilizers (accumulation of excess amounts of nutrients in the soil, the resulting pollution of surface and groundwater, as well as the migration of nutrients along the trophic chains and their penetration into the components environment).

The indicator reflects the amount of applied mineral and organic fertilizers per unit area of cultivated land and perennial plantations. It is measured in kilograms per hectare for mineral fertilizers and in tons per hectare for organic fertilizers.

The survey on the use of mineral and organic fertilizers in agriculture covers all legal entities engaged in the cultivation of agricultural crops and having perennial plantations, hayfields and pastures. To obtain data on all categories of farms, selective observations are carried out on the use of fertilizers in peasant or private farms and households. The indicator is formed with an annual frequency.

The indicator of the amount of mineral fertilizers is formed in terms of 100% nutrient content. Data on the percentage of nutrient content, as a rule, are contained in the accompanying documents of supplying plants, branches, bases, warehouses - from invoices, payment requests and certificates.

To prevent double counting of fertilizers in physical weight, for complex fertilizers (for example, nitrophoska), the amount of fertilizer in physical weight is indicated only for nitrogen fertilizers, and in nutrient for nitrogen, phosphorus.

According to the group of organic fertilizers, the application of manure, various composts, organomineral mixtures, bird droppings is monitored.

The formation of data on the use of mineral and organic fertilizers in agriculture is carried out by the Bureau on an annual nationwide statistical monitoring of the harvest of agricultural crops.

37. The pesticide application rate measures the environmental impact in terms of the intensity of pesticide use.

The indicator is defined as the total amount of applied pesticides per unit area of agricultural land. Monitoring is carried out by the subordinate organization of the authorized body that carries out the state registration of pesticides and the issuance of registration certificates for the right to use pesticides on the territory of the Republic of Kazakhstan.

Collection of data on the consumption of pesticides by groups is carried out by separating insecticides, herbicides, fungicides. At the same time, the analysis of the impact of pesticides on the environment, based only on the number of active components present, cannot be considered complete. It is important to consider factors such as application methods, climate, time of year, as well as soil types and crops grown.

**Paragraph 7. Energy**

38. To inform the public about the state and protection of the environment in terms of energy pollution, the Bureau monitors and publishes the following main indicators:

1) final energy consumption;

2) primary energy consumption;

3) energy intensity of GDP;

4) the share of electricity produced by renewable energy sources in the total electricity production.

Energy statistics indicators are compiled by the Bureau in accordance with international standards and recommendations.

**Section 8. Transport**

39. The transport complex, which includes road, sea, inland waterway, rail and air transport, is one of the largest air pollutants.

To inform the public about the state and protection of the environment in terms of pollution from transport, the Bureau monitors and publishes the following main indicators:

1) passenger turnover;

2) cargo turnover;

3) the composition of the vehicle fleet, broken down by type of fuel used;

4) the average age of the vehicle fleet.

Transport statistics indicators are compiled by the Bureau , in accordance with international standards and recommendations.

**Paragraph 9. Waste**

40. In order to inform society about the state and protection of the environment in terms of waste management , the following main indicators are examined:

1) waste generation ( waste accumulation at the place of their generation, waste collection);

2) transportation and transboundary movement of hazardous waste;

3) processing and recycling of waste (waste recovery);

4) waste disposal.

The waste generation indicator reflects the amount of waste generated in the country, as well as the total amount of waste per unit of GDP (intensity) and broken down by type of economic activity (industrial and municipal solid waste) and harmful impact (hazardous waste). Measured in tons.

The intensity of the total volume of waste generation is expressed in kilograms per unit of GDP in constant prices (both in US dollars and in national currency), and the intensity of municipal solid waste generation in kg or m 3 per capita. However, the waste generation rate is expressed as a unit (kg) of generated waste per unit (tonne, kWh) of output.

The total amount of waste generated is calculated as the sum of industrial waste generated by economic activities (eg agriculture and forestry) and municipal solid waste.

Mining industry wastes are generated in the process of exploration, extraction, processing and storage of solid minerals, including overburden, host rock, dust, low-grade (substandard) ore, sludge from mechanical treatment of quarry and mine waters, tailings and enrichment sludge.

Hazardous waste figures are measured in tons per year. Monitoring is carried out by the authorized body in the field of the environment on the basis of data from the State Waste Cadastre, updated on the basis of the information in the report on the inventory of hazardous waste.

Data on municipal waste and how it is handled is compiled by the Bureau on the basis of annual nationwide statistical observations.

 41. Transportation of waste is associated with the movement of waste using specialized vehicles between the places of their generation, accumulation in the process of collection, sorting, processing, recovery and (or) disposal.

The transboundary movement of hazardous waste indicator is an indicator of the driving forces characterizing the transboundary movement of hazardous waste and is carried out in accordance with the Basel Convention adopted on March 22, 1989 on the control of transboundary movements of hazardous wastes and their disposal for the purposes of transportation. Trends in the volume of hazardous waste exported from the country indicate the need to minimize the existing hazardous waste and to recycle and reuse it within the country.

 42. Waste recovery operations include waste preparation for reuse, waste recycling, waste disposal.

The indicator of recycling and reuse (utilization) of waste characterizes the proportion of all waste or waste of a particular category that is recycled.

The indicator of recycling and recycling (utilization) of waste is an important component of waste management. Measured in tons.

The indicator reflects the amount of recycled and reused waste and its percentage of the total amount of waste generated in the country as a whole, by type of economic activity (industrial and municipal solid waste) and by harmful impact (hazardous waste). Measured in tons, calculated using the following formula:

R = (VR + Vtotal) / Vtotal \*100%

|  |  |  |
| --- | --- | --- |
| V R | ‑ | volume of recycled and reused waste; |
| V total | - | total volume of generated waste. |
|  |  |  |

The recycling and reuse indicator is obtained by dividing the amount of all recycled and reused waste or recycled and reused waste of a particular category by the total amount of all generated waste and generated waste of a particular category, expressing the result as a percentage. For municipal solid waste, the proportion of recyclable and reusable waste should be reported as a percentage of recyclable and reusable components, such as metals, plastics, paper, glass, textiles or organic materials.

I R = Q R / Q total \*100%

|  |  |  |
| --- | --- | --- |
| Q R | ‑ | quantities of all recyclable and reusable waste or recyclable and reusable waste of a specific category; |
| Q total | - | the total amount of all generated waste and generated waste of a specific category. |
|  |  |  |

Data on the volumes of processing and (or) disposal of waste are formed by the authorized body for the environment according to the State Cadastre of production and consumption waste.

waste disposal indicator measures the impact on the environment and the extent to which the effectiveness of the waste management (response) system is taken into account.

 The indicator reflects the volume of waste finally disposed of by disposal in authorized landfills or by incineration (without energy recovery) and its percentage of the total volume of waste generated in the country as a whole, by type of economic activity (industrial and municipal solid waste) and by harmful exposure (hazardous waste). Measured in tons.

D = V d / V o total \*100

|  |  |  |
| --- | --- | --- |
| V d | ‑ | the volume of waste finally disposed of by disposal in authorized landfills or by incineration (without energy recovery); |
| Vo totall | - | total volume of generated waste. |

A combination of several methods is used to measure the proportion of waste disposed of by various means. It is important to know where the records are kept in the waste movement system in order to avoid double counting.

When calculating the volume of waste disposed to authorized landfills, waste disposed to unauthorized landfills is not taken into account.

Monitoring of the handling of all types of waste is carried out by the authorized body that implements the state policy in the field of waste management on the basis of data from the State Cadastre of production and consumption waste.

**Paragraph 10. Costs for environmental protection**

44. Environmental protection involves the implementation of various environmental protection measures.

Environmental activities are classified into the following types :

1) protection of atmospheric air and problems of climate change ,

 - of which, reduction of greenhouse gas emissions

2) wastewater treatment;

3) waste management;

4) protection and rehabilitation of soil, underground and surface waters;

5) reduction of noise and vibration impact;

6) conservation of biodiversity and landscapes;

7) radiation safety (excluding issues of external state security)

8) scientific research and development in the field of environmental protection;

9) other areas of environmental protection :

 a) of which, activities in the field of renewable energy sources,

 b) activities in the field of energy-saving technologies and energy efficiency.

The total amount of costs for environmental protection is carried out by summing up the following types of costs:

investments in fixed capital directed by enterprises and organizations for the implementation of measures for environmental protection and rational use of natural resources;

current costs of enterprises and organizations associated with environmental protection and rational use of natural resources.

The total cost of environmental protection should be grouped by type of economic activity in accordance with the GCTEA.

The total cost of environmental protection is measured in thousands tenge.

45. Investments in fixed assets aimed at protecting the environment and rational use of natural resources include the costs of new construction, expansion, reconstruction and modernization of facilities (including the costs of upgrading the facility carried out during major repairs), leading to an increase in the initial cost of the facility.

The source of information on environmental investments in fixed assets is the annual nationwide statistical survey on investment activity. This observation reflects investments in the fixed capital of enterprises and organizations related to environmental protection activities, broken down by types of environmental activities in accordance with the international Classification of activities and costs for environmental protection 2000 (The Classification of activities and costs for environmental protection (CACEP 2000).

The composition of current environmental protection costs includes:

maintenance and operation of fixed assets for environmental protection: raw materials, materials and products, fuel and electricity used in the operation of environmental funds; costs for the current repair of these funds, for the maintenance of personnel serving these funds; rent (leasing) payments, insurance payments relating to environmental structures and equipment;

the costs of collection, storage and burial, and processing or neutralization, destruction, placement of production and consumption waste on their own;

organization of independent control over the harmful impact on the environment and monitoring activities, scientific and technical research, management of environmental activities in the organization;

current measures to preserve and restore the quality of the environment, disturbed as a result of previous economic activities;

current measures to reduce the harmful impact on the environment.

To form the indicator on the costs of environmental protection, data from annual nationwide static observations on the current costs of environmental protection activities of enterprises and on investments of enterprises in environmental protection activities are used.