

**SUMMARY
OF ENVIRONMENTAL MONITORING AND INDUSTRIAL CONTROL
RESULTS FOR 2019**

**Chayvo Well Site
Sakhalin-1 Project**

Yuzhno-Sakhalinsk
2020

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Abbreviations

ANO – Autonomous Non-Profit Organization
AS – anionic surfactants
BOD₅ – biological oxygen demand, 5-day
BOD_{full} – biological oxygen demand, 20-day
WS – well site
TPL – tentative permissible levels
GN – Hygienic Standards
GOST (R) – State Standard (directive)
H – hardness unit
PL – pollutant
CFU – colony-forming unit
LPB – lactose-positive Bacillus coli
MM – measurement methodology
MU – Guidelines
MUK – Guidelines for Control
TC – total coliforms
TMC – total microbial count
MPE – maximum permissible emission
MPC – maximum permissible concentration
MPC_{o.t.} – maximum permissible concentration, one-time
MPL – maximum permissible level
PND F – environment protection regulatory documents, federal
RD – directive document
DN – distribution network
CWT – clean water tank
SanPiN – Sanitary Codes and Standards
SPZ – sanitary-protection zone
SP – Sanitary Regulations
TTCB – thermotolerant coliform bacteria
GWL – ground water level
FSFHI TsGiE – Federal State-Funded Healthcare Institution Sanitary and Epidemiological Center
ENL – Exxon Neftegas Limited

1. Introduction

This report presents the results of the field and laboratory studies for 2019, performed in accordance with the existing Program of Environmental Monitoring and Industrial Control for Chayvo Well Site (hereinafter referred to as Chayvo WS) located on the east coast of Sakhalin Island, on a sand spit between Chayvo Bay and the Sea of Okhotsk. The Chayvo WS location map is shown in Fig. 1.1.

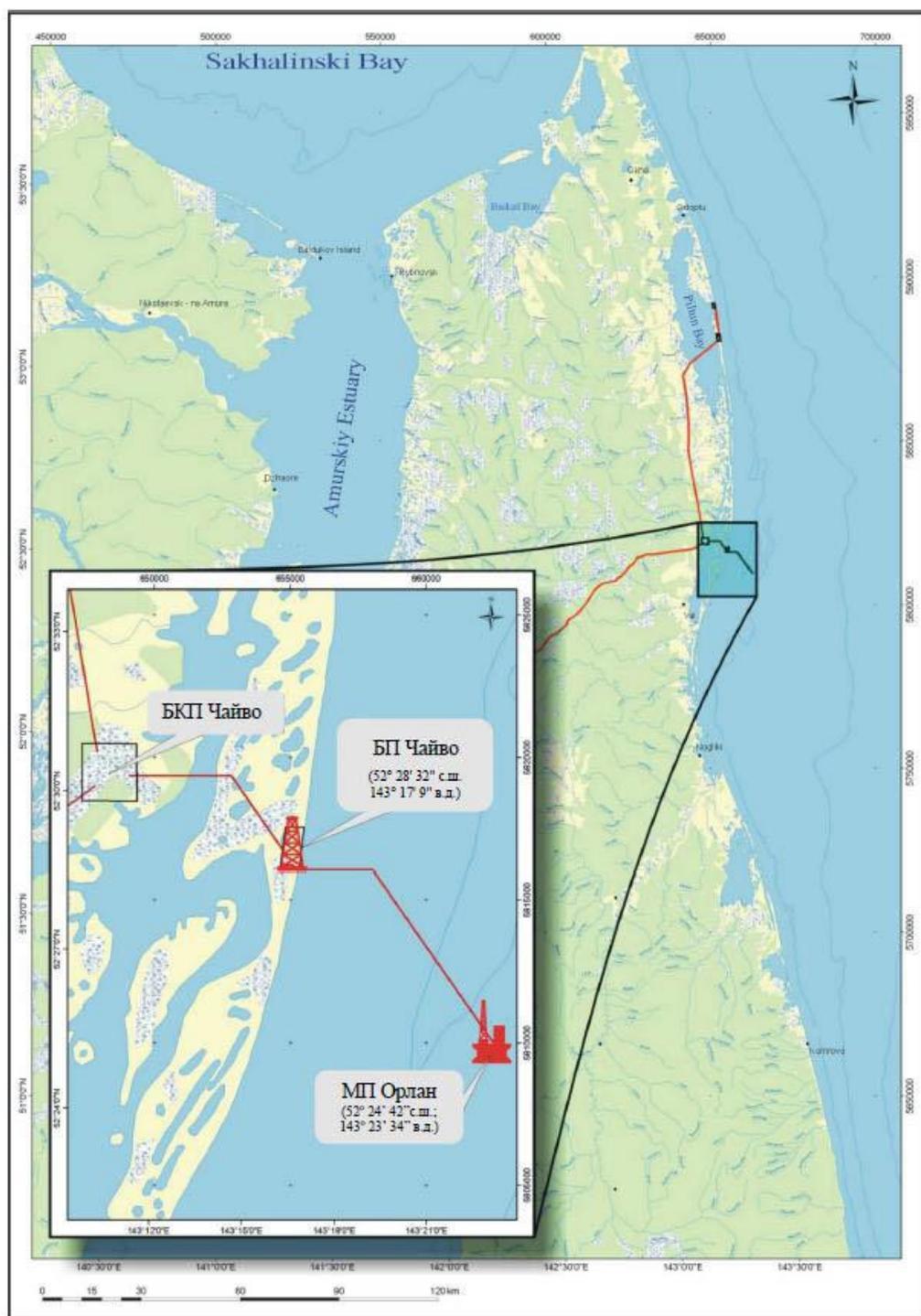


Fig. 1.1. Chayvo WS location map

The main goal of the industrial environmental control is to timely obtain and provide to the persons concerned the reliable information on the ecological and sanitary-and-hygienic conditions of the components of the environment at the facility and within its impact zone for information support and decision making in the sphere of environmental protection and operating conditions safety.

The main objectives of the industrial environmental control are as follows:

- Monitoring and subsequent assessment of conditions of the components of the environment in the facility impact zone in operations period vs the background indicators and the established regulatory requirements;
- Assessment of effectiveness of the environmental and sanitary-hygienic measures, if any;
- Obtaining information that allows taking timely measures to ensure safety and health of the company's employees.

The following activities have been implemented at Chayvo WS:

- monitoring of ground water level;
- monitoring of ground water quality;
- monitoring of air quality in the work and residential zones;
- monitoring of atmospheric air quality;
- monitoring at the sanitary zone boundary;
- monitoring of physical impact factors;

The laboratory tests have been done by the accredited laboratories of Sakhalin Hydrometeorological Agency, OOO Sakhalinsky Expert Center.

2. Russian Federation Legislative Framework in the Sphere of Environmental Monitoring

2.1. Protection of Environment (in general)

Requirements for environmental monitoring are provided for by the Russian Federation laws and regulations as well as by regulatory-technical documents of the federal architecture and urban development bodies, federal bodies for protection of natural environment, for sanitary and epidemiological oversight, for civil defense, prevention of and response to emergency situations, for land resources and management, for protection of subsoil, waters, atmospheric air, soils; by regulatory-technical documents of other federal bodies of state control and oversight; by laws and regulations of the constituent entities of the Russian Federation.

The principal provisions for environmental monitoring in the Russian Federation are set forth in the Federal Law #7-FZ "On Protection of Environment" of 10 January 2002, Art. 34:

- Economic and other activities that have, or may have, a direct or indirect negative impact on the environment are carried out in accordance with environmental requirements;
- When carrying out these activities, measures are taken to protect the environment, including the preservation and restoration of the natural environment, the rational use of natural resources, ensuring environmental safety, preventing negative impact on the environment and eliminating the consequences of such activities.

2.2. Monitoring of Atmospheric Air

Protection and monitoring of atmospheric air pollution are regulated by Federal Law # 96-FZ *On Protection of Atmospheric Air* of 04 May 1999.

Article 25 reads: “Industrial control of atmospheric air protection shall be implemented by legal entities, individual entrepreneurs that have sources of harmful chemical, biological and physical impacts on atmospheric air, and who shall appoint persons responsible for industrial control of atmospheric air protection and/or establish environmental services”.

In performing the control, legal entities should comply with RF law, rules and regulations established by authorized governmental atmospheric air protection oversight bodies.

2.3. Sanitary-Hygienic Control (Monitoring)

Sanitary-hygienic monitoring is governed by Federal Law No. 52-FZ *On Sanitary-Epidemiological Welfare of Population*.

Responsibilities of companies and organizations are set out in Article 11, which says that companies and organizations are required to:

- comply with requirements of health legislation, as well as orders and citations issued by federal state sanitary and epidemiologic oversight officials;
- develop and implement sanitary and epidemic control measures;
- conduct in-process control (i.e. by means of laboratory tests and studies) of compliance with sanitary and epidemiological requirements and sanitary and epidemic control (preventive) measures during the execution of work and provision of services, as well as transportation, storage and sale of goods.

2.4. Goals and Objectives of Environmental Monitoring

The purpose of environmental monitoring is control over environment pollution sources, as well as condition of geosystems and components thereof.

Objectives of the monitoring are as follows:

- timely identification of sources and focal points of disturbance, pollution and degradation of environment resulting from operations;
- assessment of identified changes in environment and forecast of possible adverse effects;
- acquisition of data on entry of various wastes into the environment during construction activities and operation;
- identification of emissions and discharges of pollutants that exceed regulatory limits, identification of pre-emergency situations, prediction of potential situations in order to apply appropriate environment protection measures;
- evaluation of consequences of emergencies and incidents;
- efficiency check of environmentally sound design solutions and environment protection measures based on monitoring results;
- information support of government bodies controlling the condition of environment; check of compliance with environmental legislation, regulatory and other documents that cover the condition of natural sites.

3. Work Types and Scope

Types and scope of work performed in 2019 are listed in Table 3-1.

Table 3-1: Work types and scope

| Work type | Target (monitoring points) | Number of control points | Frequency, as per PO |
|--|--|-----------------------------------|---|
| Ground water level measurements | Monitoring wells 001, 002B, 003B | 3 | Once a month |
| Ground water quality control | Monitoring wells 001, 002B, 003B | 3 | Once a quarter |
| Work environment air quality control | Parker Drilling camp: SHE work place, fire team Module 40: work place #1 | 3 | Once a quarter |
| Residential area air quality control | Parker Drilling camp. Living rooms | 2 | Once a quarter |
| Atmospheric air quality control | Sanitary-protection zone: Point 1 – from NW side, 1000m from the site | 1 | Once a quarter |
| Physical impact factors (noise, electromagnetic field) | | 1 | Once a quarter |
| Physical impact factors (electromagnetic emission) | | 1 | Once a quarter |
| Wastewater quality monitoring | Treatment facility YORSH-100 | 1, before treatment; 1 - after | Twice a month |
| Physical impact factors (EM radiation) | Transceiver antenna zone; Diesel gen sets room in the Instrumentation room; gen sets (powering the camp) room; premises with PCs | 11 | Once a year |
| Physical impact factors (microclimate) | Offices and living quarters, including: radio shack, radio shack (servers room), Diesel gen sets control room | 12 | Twice a year (during the warm and cold periods) |
| Physical impact factors (noise, vibration) | Operations facilities (premises) | - | Once a year |
| Physical impact factors (illuminance) | Offices and operations facilities | - | Once a year |
| Physical impact factors (ionizing radiation) | Insulated sump pit. Wellsites | 10 | Once a year |
| Waste water quality monitoring data processing | | - | 2 |

4. Field and Laboratory Work Methods

4.1. Field Work Methods

List of equipment used for industrial environmental control is included in Attachment A hereto.

4.1.1. Ground Water Level and Quality Monitoring

Ground water level was measured using EU-100 downhole level gage and tape measurer.

Downhole level measurements were taken in compliance with *Russian Federation Ministry of Natural Resources Guidelines for the Arrangement and Performance of Ground Water Monitoring in Shallow Batch Water Intakes and Individual Development Wells* of July 25, 2000.

In addition to measuring water table, groundwater quality was tested by the indicators like power of hydrogen, mercury, anion surfactants, phenols, petroleum products and electric conductivity.

Water sampling, sample storage and transportation procedures were in conformity with GOST R 31861-2012 «Water. General requirements for sampling».

4.1.2. Work Area Air Monitoring

Work area air studies were conducted in compliance with RD 52.04.186-89 *Atmosphere Pollution Control Guidelines. Methods of Mass Pollutant Concentration Measurements in Atmospheric Air using GANK-4 Gas Analyzer*, RD 52.04.792-2014, RD 52.04.831-2015, RD 52.04.822-2015, KPGU 413322002 PS.

4.1.3. Atmospheric Air Quality Monitoring

Measurements were taken in compliance with RD 52.04.186-89 *Atmosphere Pollution Control Guidelines*, RD 52.04.792-2014 *Mass Concentration of Nitrogen Oxide and Dioxide in Atmospheric Air Samples. Methods of Photometric Measurements Using Sulfanilic Acid and I-Naphtylamine*, MVI 4215-002-565914009-2009 *Methods of Mass Pollutant Concentration Measurement in Atmospheric Air Using GANK-4 Gas Analyzer*, RD 52.04.831-2015, RD 52.04.822-2015, PND F 13.1:2:3.23-98.

Meteorological parameters were determined during instrumental measurements (wind direction, temperature, pressure).

Atmospheric air and residential and work area air quality measurements were taken in the reporting period by ANO Sakhalin Meteoagency laboratory.

4.1.4. Physical Impact Factors

Measurements were taken in compliance with GOST 23337-14 *Noise. Methods of Noise Measurement in Residential Areas and in Premises of Residential and Public Buildings*, SanPiN 2.1.2.2645-10 *Sanitary-Epidemiological Requirements for Housing Conditions in Residential*

Buildings and Premises. Sanitary-Epidemiological Regulations and Standards, MUK 4.3.2194-07 Noise Level Control in Urban Development Areas, in Residential and Public Buildings and Premises.

Regulatory and technical documents based on which microclimate measurements were taken: SanPiN 2.2.4.3359-16 *Hygienic Requirements for Physical Factors at Work Places*, GOST 30494-2011 *Residential and Public Buildings. Microclimate Parameters in Premises*, SanPiN 2.1.2.2645-10 *Sanitary-Epidemiological Requirements for Housing Conditions in Residential Buildings and Premises*, MUK 4.3.2756-10 *Control Methods. Physical Factors. Guidelines for Measurement and Assessment of Microclimate in Production Premises. Guidelines.*

Non-ionizing radiation was measured in compliance with SanPiN 2.2.4.1191-03 *Electromagnetic Fields in Production Conditions*, SanPiN 2.1.8/2.2.4.1383-03 *Hygienic Requirements to Location and Operation of Transmitting Radiotechnical Facilities*; GOST 12.1.006-84 SSBT *Electromagnetic Fields of Radio Frequencies. Permissible Levels at Work Places and Requirements to Control*, GN 2.1.8/2.2.4.2262-07 *Maximum Permissible Levels of Magnetic Fields with a Frequency of 50 Hz in the Residential and Public Building Premises and in Residential Areas*, GOST 12.1.002-84 SSBT *Electric Fields of Industrial Frequency. Permissible Levels of Intensity and Requirements to Control at Work Places*, MUK 4.3.2491-09 *Hygienic Assessment of Electric and Magnetic Fields of Industrial Frequency (50 Hz) in Production Conditions.*

Ionizing radiation was measured in compliance with SanPiN 2.6.1.2523-09 *Radiation Safety Standards* (NRB-99/2009) and in observance of MKS-01SA1M dosimeter-radiometer operation manual.

Illuminance was measured in compliance with the following regulatory and technical documents: GOST 24940-2016 *Buildings and Structures. Illuminance Measurement Methods*, Guidelines: MU OT RM 01-98 / MU 2.2.4.706-98 *Work Place Illuminance*, SP 52.13330.2011 *Regulations. Natural and Artificial Lighting. Updated Version of SNiP 23-05-95*, SanPiN 2.2.1/2.1.1.1278-03 *Hygienic Requirements to Natural, Artificial and Combined Illumination of Residential and Public Buildings.*

4.2. Methods of Laboratory Work

All laboratory work was conducted in compliance with the current regulations and based on certified methodologies that are included in RD 52.18.595-96 *Federal Inventory of Measurement Methodologies Approved for Use in Environment Pollution Monitoring Activities.*

Measurement devices used for laboratory research activities have timely passed state calibration and calibration certificates have been issued.

Labware preparation for tests process was in accordance with guidelines for determination of a specific component and, it was performed in the laboratories.

5. Laboratory Study Results

5.1. Ground Water Levels

The level of ground waters was determined by the depth of occurrence below the surface.

In 2019, observations were held monthly in three wells at Chayvo WS using EU-100 electric level gage.

Results of level measurements taken in wells over the reported period are indicated in figure (Fig. 5.1-1).

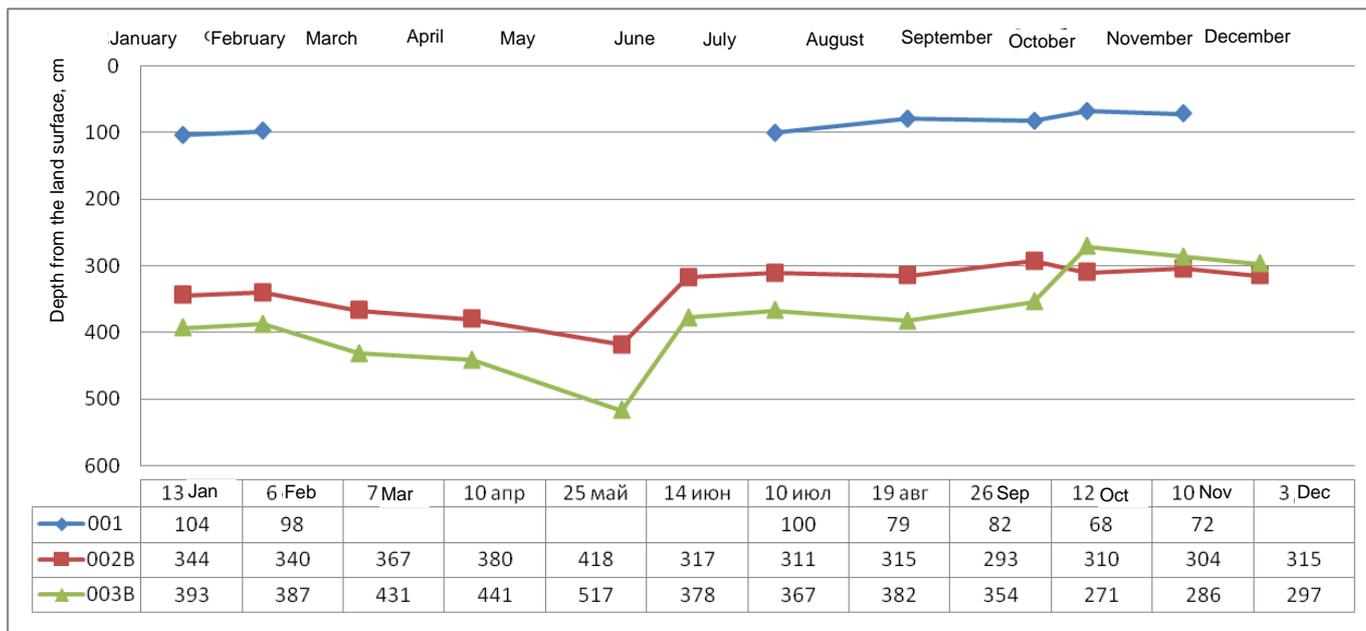


Fig. 5.1-1: Ground Water Occurrence Depth Variation Chart

The depth of ground water occurrence below the surface measured in Chayvo WS observation wells varies over the entire observation period.

Variations of ground water depth at the territory of Chayvo WS stayed within the natural seasonal variation ranges during the entire observation period.

5.2. Ground Water Quality Monitoring

In 2019, chemical parameters of ground water quality were monitored quarterly in the same wells where ground water levels were measured.

In the second, third and fourth quarters, samples were taken before and after the well washing in compliance with GOST 17.1.5.04-81. Samples were stored and preserved in compliance with GOST 31861-2012.

The measured parameters and methods of ground water quality measurements in observation wells at Chayvo WS are set out in Table 5.2-1

Table 5.2-1: Measured parameters and methods of ground water quality measurements in observation wells

| Item | List of measured parameters | Measurement unit | Contractor laboratory | Measurement methodology |
|------|--------------------------------|--------------------|-----------------------------|-------------------------|
| 1 | Synthetic surfactants | mg/dm ³ | ANO Sakhalin Meteoagency | RD 52.24.368-2006 |
| 2 | pH | pH unit | | RD 52.24.495-2005 |
| 3 | Mercury | mg/dm ³ | | RD 52.24.479-2008 |
| 4 | Petroleum products | mg/dm ³ | | PNDF 14.1:2:4.168-2000 |
| 5 | Specific electric conductivity | μS/cm | | RD 52.24.495-2005 |
| 6 | Phenols | mg/dm ³ | | PNDF 14.1:2:4.182-02 |

The measured pH values (5.66 to 7.88) are common for natural waters. In terms of pH values ground waters were characterized primarily as subacid (pH = 5.0-6.5), except samples taken in March prior to well washing; ground waters were determined as neutral (pH – 6.5 – 7.5) and, in Well 003B as neutral (pH – 6.5 – 7.5) except samples taken in March prior to well washing, where ground waters are weakly alkaline (pH = 7.5-8.5).

Ground water quality monitoring results indicate that concentration of petroleum products in samples varied from the detection limit (below 0.020 mg/dm³) to 0.08 mg/dm³. Since the waters are not used for potable water supply, these concentrations are acceptable.

In all the samples taken from all wells throughout the monitoring period, mercury levels were below the detection limit (<0.000010 mg/dm³).

Synthetic (anionic) surfactant concentrations in the ground water varied from values below the detection limit (below 0.01 mg/dm³) to 0.14 mg/dm³, and phenol concentrations varied from 0.0006 mg/dm³) to 0.005 mg/dm³.

Specific electric conductivity of samples was within the range of 103-314 μS/cm.

It should be noted that presently there are no standards in the Russian Federation for maximum permissible concentrations of pollutants in ground waters.

5.3. Work Zone Air Quality Monitoring

In 2019, work zone air quality studies were conducted in Parker Drilling camp office premises and at the work place 1 of Module 40. The measured parameters and methods of work zone air measurements are indicated in Table 5.3-1.

Table 5.3-1: Measured parameters and methods of work zone air measurements

| Item | List of measured parameters | Measurement unit | Contractor laboratory | Measurement methodology |
|----------------------|-----------------------------|-------------------|--------------------------|-------------------------|
| Work zone air | | | | |
| 1 | Nitrogen dioxide | mg/m ³ | ANO Sakhalin Meteoagency | RD 52.04.792-2014 |
| 2 | Nitrogen oxide | mg/m ³ | | RD 52.04.792-2014 |
| 3 | Benzapyrene | mg/m ³ | | RD 52.04.186-89 |
| 4 | Soot | mg/m ³ | | RD 52.04.831-2015 |
| 5 | Sulfur dioxide | mg/m ³ | | RD 52.04.822-2015 |

| Item | List of measured parameters | Measurement unit | Contractor laboratory | Measurement methodology |
|------|-----------------------------|-------------------|-----------------------|-------------------------|
| 6 | Carbon monoxide | mg/m ³ | | KPGU 413322002 PS |
| 7 | Kerosene | mg/m ³ | | M-01-05 |

Results of work zone air quality instrumental measurements are set out in Table 5.3-2.

Table 5.3-2: Work zone air quality study results

| Measured parameters | Measurement results | | | | MPC* |
|--|-----------------------|-----------------------|-----------------------|-----------------------|----------------|
| | Mar 26, 2019 | Apr 14, 2019 | Sep 11, 2019 | Nov 17, 2019 | |
| Parker Drilling camp (SHE office) | | | | | |
| Nitrogen dioxide, mg/m ³ | 0,055 | 0,080 | 0,025 | 0,086 | 2 |
| Nitrogen oxide, mg/m ³ | 0,033 | 0,036 | <0,026 | 0,028 | 5 |
| Sulfur dioxide, mg/m ³ | 0,009 | 0,006 | <0,0025 | 0,0081 | 10 |
| Carbon monoxide, mg/m ³ | 2,8 | 2,3 | 2,7 | 2,8 | 20 |
| Soot, mg/m ³ | 0,066 | <0,030 | <0,030 | 0,035 | 4 |
| Benzapyrene, mg/m ³ | <0,2x10 ⁻⁶ | <0,2x10 ⁻⁶ | <0,1x10 ⁻⁶ | <0,2x10 ⁻⁶ | 0.00015 |
| Kerosene, mg/m ³ | 0,57 | <1 | <1 | <1 | 600 |
| Module 40 (work place No.1) | | | | | |
| Nitrogen dioxide, mg/m ³ | 0,068 | 0,047 | 0,034 | 0,064 | 2 |
| Nitrogen oxide, mg/m ³ | 0,039 | 0,042 | <0,028 | <0,028 | 5 |
| Sulfur dioxide, mg/m ³ | 0,0092 | 0,008 | <0,0025 | 0,0073 | 10 |
| Carbon monoxide, mg/m ³ | 2,7 | 2,4 | 2,8 | 2,8 | 20 |
| Soot, mg/m ³ | 0,069 | 0,030 | <0,030 | 0,050 | 4 |
| Benzapyrene, mg/m ³ | <0,2x10 ⁻⁶ | <0,2x10 ⁻⁶ | <0,1x10 ⁻⁶ | <0,2x10 ⁻⁶ | 0.00015 |
| Kerosene, mg/m ³ | 19,4 | <1 | <1 | <1 | 600 |

*GN 2.2.5.3532-18 Maximum Permissible Concentrations (MPC) of Harmful Substances in Work Zone Air.

The measured mass concentrations of pollutants in the work zone air meet the requirements of GOST 12.1.005-88 *General Sanitary and Hygiene Requirements to Work Zone Air* and GN 2.2.5.3532-18 *Maximum Permissible Concentrations (MPC) of Pollutants in Work Zone Air*.

5.4. Sanitary Protection Zone

5.4.1. Atmospheric Air Quality Monitoring at Sanitary Protection Zone (SPZ) Boundary

In the report period, atmospheric air quality was monitored at the boundary of the sanitary protection zone, 1000 m away from the Chayvo WS work area boundaries. The measured parameters and methods of atmospheric air measurement at the boundary of the sanitary protection zone are set out in the table below (Table 5.4-1).

Table 5.4-1: Measured parameters and methods of atmospheric air measurement at the boundary of the sanitary protection zone

| Item | List of measured parameters | Measurement unit | Contractor laboratory | Measurement methodology |
|------|---|-------------------|--------------------------|-------------------------|
| 1 | Nitrogen dioxide | mg/m ³ | ANO Sakhalin Meteoagency | RD 52.04.792-2014 |
| 2 | Soot | mg/m ³ | | RD 52.04.831-2015 |
| 3 | Sulfur dioxide | mg/m ³ | | RD 52.04.822-2015 |
| 4 | C ₁ -C ₅ hydrocarbons | mg/m ³ | | KPGU 41 3322002 RE |
| 5 | C ₁₂ -C ₁₉ hydrocarbons | mg/m ³ | | KPGU 41 3322002 RE |
| 6 | Carbon monoxide | mg/m ³ | | KPGU 41 3322002 RE |

Results of instrumental measurements of atmospheric air quality at the sanitary protection zone boundary are set out in Table 5.4-2.

Table 5.4-2: Results of instrumental measurements of pollutants in the atmospheric air at the sanitary protection zone boundary.

| Measured parameters | Measurement results | | | | MPC* |
|--|---------------------|--------------|--------------|--------------|-------------|
| | Mar 26, 2019 | Apr 14, 2019 | Sep 11, 2019 | Nov 17, 2019 | |
| Nitrogen dioxide, mg/m ³ | 0,040 | 0,050 | 0,051 | 0,034 | 0.2 |
| Sulfur dioxide, mg/m ³ | 0,009 | 0,008 | 0,0027 | 0,0063 | 0.5 |
| Carbon monoxide, mg/m ³ | 2,8 | 2,8 | 2,6 | 2,8 | 5 |
| Soot, mg/m ³ | 0,060 | <0,030 | <0,030 | 0,047 | 0.15 |
| C ₁ -C ₅ hydrocarbons, mg/m ³ | <25 | <25 | <25 | <25 | 50** |
| C ₁₂ -C ₁₉ hydrocarbons, mg/m ³ | 0,25 | 0,21 | 0,43 | 0,16 | 1 |

*MPC per GN 2.1.6.3492-17 Max Permissible Concentrations in the air of urban and rural settlements.

**SRLI standard (per GN 2.1.6.2309-07).

During the entire observation period, mass concentrations of pollutants in the atmospheric air at the Chayvo WS sanitary protection zone boundary fully met the requirements of GN 2.1.6.3492-17 *Maximum Permissible Concentrations (MPC) of Pollutants in Atmospheric Air of Urban and Rural Settlements*, and Safe Reference Levels of Impact (SRLI) (per GN 2.1.6.2309-07 *Safe Reference Levels of Impact (SRLI) of Pollutants in Atmospheric Air within Populated Areas*) for atmospheric air.

5.4.2. Noise Levels at SPZ Boundary

In 2019, noise measurements were taken, 1000 m away from the Chayvo WS work area boundaries, at point 1, to check conformity of noise and noise pressure levels with regulatory standard values in the daytime.

The measured parameters and methods of measurement are set out in the table below (Table 5.4-3).

Measurement results are indicated in Table 5.4-4.

Table 5.4-3: Measured parameters and methods of noise measurement at the SPZ boundary

| Item | List of measured parameters | Measurement unit | Contractor laboratory | Measurement methodology |
|------|--------------------------------|------------------|-----------------------------|-------------------------|
| 1 | Noise level and noise pressure | dBA | ANO Sakhalin Meteoagency | GOST 23337-2014 |

Table 5.4-4: Equivalent and peak sound level measurement results

| Date of measurement | Equivalent sound levels L_{Aeqiv} , dBA | Max. sound levels L_{A} , dBA |
|---------------------|---|---------------------------------|
| 26.03.2019 | 30,1 | 38,5 |
| 18.04.2019 | 34,3 | 39,9 |
| 11.09.2019 | 44,8 | 61,0 |
| 17.11.2019 | 38,7 | 51,4 |
| Regulatory values* | 60 | 75 |

*SN 2.2.4/2.1.8.562-96 "Noise at Workplace, in Residential, Public Premises and in Residential Area

Results of non-continuous noise impact monitoring at the SPZ boundary show that the measured values of equivalent sound level meet the requirements of SN 2.2.4/2.1.8.562-96 *Noise at Work Places, in Premises of Residential and Public Facilities and in Housing Development Areas* for the daytime.

Measured maximum levels meet the requirements SN 2.2.4/2.1.8.562-96 "Noise at Workplace, in Residential, Public Premises and in Residential Area for the day time and, did not exceed regulatory levels.

5.4.3. Electromagnetic Emissions at SPZ Boundary

Measurements were taken in 2019 at Point 1, 1000 m away from the Chayvo WS work area boundaries, on the north-west side. The purpose of those measurements was to assess conformity of electromagnetic fields with the requirements of SanPiN 2.1.2.2645-10 *Sanitary-Epidemiological Requirements for Housing Conditions in Residential Buildings and Premises*, GN 2.1.8/2.2.2.4.4.2262-07 *Maximum Permissible Levels of Magnetic Fields with a Frequency of 50 Hz in the Residential and Public Building Premises and in Residential Areas*, and SanPiN 2.2.1/2.1.1.1200-03 *Sanitary Protection Zones and Sanitary Classification of Plants, Structures and Other Facilities*.

The measured parameters and measurement methods are set out in Table 5.4-5.

Results of non-ionizing electromagnetic emission measurements are indicated in Table 5.4-6.

Table 5.4-5: Measured parameters and methods of electromagnetic emission measurement at the boundary of SPZ

| Item | List of measured parameters | Measurement unit | Contractor laboratory | Measurement methodology |
|------|---|------------------|-----------------------------|-------------------------|
| 1 | Intensity of electromagnetic field's electric component | kV/m | ANO Sakhalin Meteoagency | SanPiN 2.1.2.2645-10 |
| 2 | Magnetic field intensity | A/m | | |

Table 5.4-6: Results of instrumental measurements of non-ionizing electromagnetic emission

| Measured parameters | Maximum permissible level (MPL)* | Measurement results | | | |
|--------------------------------|----------------------------------|---------------------|--------------|--------------|--------------|
| | | Mar 26, 2019 | Apr 18, 2019 | Sep 11, 2019 | Nov 17, 2019 |
| Electric field intensity, kV/m | 1 | <0.01 | <0.01 | ≤0.01 | ≤0.05 |
| Magnetic field intensity, A/m | 8** | <0.1 | <0.1 | ≤0.1 | ≤0.1 |

* SanPiN 2.1.2.2645-10 Sanitary-Epidemiological Requirements for Housing Conditions in Residential Buildings and Premises.

** SanPiN 2.1.2.2645-10 and GN 2.1.8/2.2.4.4.2262-07 Maximum Permissible Levels of Magnetic Fields with a Frequency of 50 Hz in the Residential and Public Building Premises and in Residential Areas.

Values of electromagnetic field electric component intensity measured at Point 1 on the north-west side, 1000 m away from the Chayvo WS work area boundary, meet the requirements of SanPiN 2.1.2.2645-10 *Sanitary-Epidemiological Requirements for Housing Conditions in Residential Buildings and Premises*.

Values of magnetic field intensity measured at Point 1 on the north-west side, 1000 m away from the Chayvo WS work area boundary, meet the requirements of SanPiN 2.1.2.2645-10 *Sanitary-Epidemiological Requirements for Housing Conditions in Residential Buildings and Premises* and GN 2.1.8/2.2.4.4.2262-07 *Maximum Permissible Levels of Magnetic Fields with a Frequency of 50 Hz in the Residential and Public Building Premises and in Residential Areas*.

5.5. Monitoring of Physical Factors

Physical factor study was conducted in 2019. These studies are conducted once a year. Microclimate measurements are taken in twice a year, in cold and warm seasons.

Methods of measurements and a list of measured parameters are indicated in Table 5.5-1.

Table 5.5-1: List of measured parameters and methods of physical impact factor measurements

| Item | List of measured parameters | Measurement unit | Contractor laboratory | Measurement methodology |
|------|--------------------------------------|---------------------------------------|-------------------------------|--|
| 1 | Microclimate parameters | °C, %, m/s | Sakhalin Expert Center LLC | SanPiN 2.2.4.3359-16; |
| 2 | Ionizing radiation | μSv/h, mSv | | Operational manual for the MKS AT1117M SanPiN 2.6.1.2523-09 |
| 3 | Electromagnetic field measurement | μW/cm ² , V/m, nT, kW/m | | SanPiN 2.1.8/2.2.4. 3359-16; |
| 4 | Illuminance | lx, % | | SanPiN 2.1.8/2.2.4. 3359-16; GOST 24940-2016 |

5.5.1. Ionizing Radiation Monitoring

In 2019, ionizing radiation was measured in the waterproof pit for drilling waste and in drillwells. Ionizing radiation measurement results are indicated in Table 5.5-2.

Table 5.5-2: Ionizing radiation measurement results

| Place of measurement | Date of measurement | Measured value, $\mu\text{Sv/h}$ | MPL* |
|-----------------------------------|---------------------|----------------------------------|------------|
| Waterproof pit for drilling waste | 28.06.2019 | 0.145 | ≤ 2.5 |
| 9 drillwells | | 0.120 | ≤ 2.5 |

* - regulatory values are indicated in line with SanPiN 2.6.1.2523-09 Radiation Safety Standards NRB-99/2009

In 2019, in the area of waterproof pit for drilling waste and at drilled wells the ionizing radiation fully conformed with NRB-99/2009. SanPiN 2.6.1.2523-09 Radiation Safety Standards.

5.5.2. Monitoring of Microclimate Parameters

In 2019, microclimate parameters were measured in Chayvo WS offices.

Microclimate parameter measurement results are indicated in Table 5.5-3 and 5.5-4.

Table 5.5-3: Microclimate parameter measurement results (in cold season)

| Item | Measurement point location | Date of measurement | Air temperature*, $^{\circ}\text{C}$ | Air humidity*, % | Air velocity, m/s | Thermal radiation, W/m^3 |
|---------------------------------|--|---------------------|--------------------------------------|------------------|------------------------------|-----------------------------------|
| Operator office premises | | | | | | |
| 1 | Operator workplace (against entrance) | Jun 28, 2019 | 20-22 | 40 | $\leq 0,1$ | <10 |
| 2 | Operator workplace (right corner) | | 20-22 | 40 | $\leq 0,1$ | <10 |
| 3 | Operator workplace (to the right of entrance, near window) | | 20-22 | 40 | $\leq 0,1$ | <10 |
| 4 | Operator workplace (opposite entrance, in the corner) | | 20-22 | 40 | $\leq 0,1$ | <10 |
| Permissible conditions** | | | 20-25 | 15-75 | $\leq 0,1$ | - |

Table 5.5-4: Microclimate parameter measurement results (in warm season)

| Item | Measurement point location | Date of measurement | Air temperature*, $^{\circ}\text{C}$ | Air humidity*, % | Air velocity, m/s | Thermal radiation, W/m^3 |
|---------------------------------|--|---------------------|--------------------------------------|------------------|------------------------------|-----------------------------------|
| Operator office premises | | | | | | |
| Permissible conditions** | | | 20-25 | 15-75 | $\leq 0,1$ | - |
| 5 | Operator workplace (against entrance) | Jun 28, 2019 | 23 | 47 | <0.1 | <10 |
| 6 | Operator workplace (right corner) | | 23 | 47 | <0.1 | <10 |
| 7 | Operator workplace (to the right of entrance, near window) | | 23 | 47 | <0.1 | <10 |
| 8 | Operator workplace (opposite entrance, in the corner) | | 23 | 47 | <0.1 | <10 |
| Permissible conditions** | | | 21-28 | 15-75 | 0.1 | - |

* average values

**SanPiN 2.2.4.3359-16 Hygienic Requirements to Physical Factors at workplaces

Microclimate parameter measurement results in tables 5.5-3 and 5.5-4 fully meet the hygienic requirements to microclimate in work spaces set by SanPiN 2.2.4.3359-16 Hygienic Requirements to Physical Factors at workplaces.

5.5.3. Artificial and Natural Lighting Monitoring

In 2019, luminance was measured in Chayvo WS office premises.

The results of artificial and natural lighting monitoring are shown in the table 5.5-5 below.

Table 5.5-5: Artificial and natural lighting monitoring results

| Office premises | Date | Artificial lighting, lx | | Natural lighting, lx | | |
|--|--------------|-------------------------|-------------------|----------------------|-------------------|--|
| | | Actual value | Regulatory value* | Actual value | Regulatory value* | |
| Operator office space | | | | | | |
| Operator workplace (against entrance) | Jun 28, 2019 | 700 | 400 | 0,5 | ≥0,5 | |
| Operator workplace (right corner) | Jun 28, 2019 | 700 | 400 | 0,5 | ≥0,5 | |
| Operator workplace (to the right of entrance, near window) | Jun 28, 2019 | 800 | 400 | 0,5 | ≥0,5 | |
| Operator workplace (opposite entrance, in the corner) | Jun 28, 2019 | 750 | 400 | 0,5 | ≥0,5 | |

* SanPiN 2.2.4.3359-16 Sanitary-Epidemiological Requirements to Physical Impact Factors at Work Places

Natural and artificial lighting measurement results (in Table 5.5-5) are in compliance with the limits set by Sanitary-Epidemiological Requirements to Physical Impact Factors at Work Places.

Artificial and natural lighting parameters at all measurement points met the regulatory values set by SP 52.13330.2011. *Regulations. Natural and Artificial Lighting*. Updated Version of SNiP 23-05-95 and SanPiN 2.2.2/2.4.1340-03 *Hygienic Requirements for Personal Computers and Work Process*.

5.5.4. Electromagnetic Field and Electrostatic Field Intensity Monitoring

Parameters of electric field intensity, magnetic field intensity and electrostatic field intensity were measured in 2019 at operator work places.

Electric and magnetic field intensity and electrostatic field intensity measurement results are indicated in Table 5.5-6.

Table 5.5-6: Electromagnetic field and electrostatic field intensity measurement results

| Location of measurement | Electric field intensity (E), W/m | Magnetic field density, mCTI | Electrostatic field intensity (E), kW/m |
|---------------------------------------|-----------------------------------|------------------------------|---|
| | 50 Hz | 50 Hz | |
| Operator office premises | | | |
| Operator workplace (against entrance) | 12 | 0,270 | <0,1 |
| Operator workplace (right corner) | 11 | 0,213 | <0,1 |

| | | | |
|--|----|-------|-----------|
| Operator workplace (to the right of entrance, near window) | 11 | 0,175 | <0,1 |
| Operator workplace (opposite entrance, in the corner) | 13 | 0,221 | <0,1 |
| MPL* | - | - | 15 |

*SanPiN 2.2.2/2.4.1340-03 Hygienic Requirements for Personal Computers and Work Process and SanPiN 2.2.4.3359-16 Hygienic Requirements for Physical Factors at Work Places

**Measurements were taken at elevations – 0.5 m; 1.0 m; 1.5 m

Electric and magnetic field intensity and electrostatic field intensity measurement results (Table 5.5-6) indicate that sanitary-epidemiological requirements to work place arrangement are met.

References

1. GN 2.1.6.3492-17 «Maximum permissible concentrations (MPC) of pollutants in the atmospheric air of urban and rural settlements»;
2. GN 2.2.5.3532-18 «Maximum Permissible Concentrations (MPC) of Harmful Substances in Work Zone Air»;
3. GOST R 51232-98 Drinking water. General requirements for organization and quality control methods;
4. GOST 31861-2012 Water. General requirements for sampling;
5. GOST 31862-2012 Drinking water. Sampling;
6. MU 2.1.5.800-99 Water disposal from inhabited locations, sanitary protection of water reservoirs Gossanepidnadzor's organization of wastewater treatment;
7. MUK 4.2.1018-01 Sanitary and microbiological analysis of drinking water
8. MUK 4.2.2794-10 Sanitary and microbiological analysis of drinking water. Amendment 1 of MUK 4.2.1018-01;
9. MUK 4.2.1884-04 Sanitary and microbiological and parasitological analyses of water from the surface water bodies;
10. MUK 4.2.2661-10 «Methods of sanitary-parasitological tests»;
11. SANPIN 2.1.4.1074-01. Drinking water and water supply to inhabited areas. Hygienic regulations of the water quality of centralized drinking water supply system. Quality control Hygienic requirements for hot water supply systems;
12. SANPIN 2.1.5.980-00. Water disposal in inhabited areas. Sanitary protection of water bodies. Hygienic requirements to surface waters protection;
13. SANPIN 3.2.1333-03. Prevention of parasitic diseases in the Russian Federation.

6. Attachment A. List of devices used for industrial environmental control

| DEVICE | CALIBRATION | SPECIFICATIONS |
|---|---------------------------------------|--|
| Air aspirator, single-channel AVA-1-120-02A  | No. 15-19, until April 28, 2020. | Volume of sample, dm ³ /min – not limited. Sample volume measurement error - 5% |
| Aspirator A-01  | № 013221 до, until May 24, 2020. | Gas rate settings in the range upto 45 dm ³ /min measurement error - 5% |
| GANK-4 Gas analyzer  | No. 17006287498, until Dec.25, 2019. | Measurement range – 0.5 MPC daily avg. to 20 MPC work zone. Measurement error – not more than 20% |
| “Assistent” noise analyzer  | No. 19/11898, until April 11, 2020 | Used for measurement and analysis of infrasound, sound, ultrasound, overall and local vibration. - Sound level measurement range 20 ÷ 140 dB; measurement frequency range: 2 ÷ 40000 Hz; - dynamic range of vibration acceleration level measurement 70 ÷ 170 dB; frequency range of vibration acceleration measurement 0.8 ÷ 1250 Hz. |
| “Zaschita-K” acoustic calibration unit  | No. 3/340-0004-19, until Jan 9, 2020. | <i>Zaschita-K</i> device is used for the calibration and operability check of noise meters. - Nominal (setpoint) values of sound pressure levels, dB rel. 20 µPa 94, 114; - Nominal value of the primary SPL, dB rel. 20 µPa 114 |

6. Attachment A. List of devices used for industrial environmental control

| DEVICE | CALIBRATION | SPECIFICATIONS |
|--|---|--|
| <p>Electric and magnetic fields measurement tool VE Metr AT-002</p>  | <p>№ 2607/18-Э until May 14, 2020</p> | <p>The tool is designed for measuring rms values of EMF within the frequency ranges characteristic of the personal computer monitors. The relative error tolerance is 20%.</p> |
| <p>“Meteoskop” microclimate parameter measurement unit</p>  | <p>No. 9286/18-H, until December 17, 2020. № 207/18-02225п until Apr 15, 2020</p> | <p>Temperature measurement range: -40 to +85 °C Relative humidity measurement range: 3 to 97% Air stream velocity measurement range: 0.1 to 20 m/s Air pressure measurement range: 80 to 110 kPa (600 to 825 mm Mercury)</p> |
| <p>Dosimeter of X and gamma radiation «DKS-AT1123»</p>  | <p>№ 4/410-0236-19 until 25.02.20</p> | <ul style="list-style-type: none"> - Measures the dose and intensity of ambient dose equivalent continuous, short exposure and flash X and gamma ray radiation; - Detects sources of X-ray, gamma and hard (with the highest energy of spectrum over 500 keV) beta-radiation. <p>Broad range of measured doses and energy Measures dose rates and exposure during short-time radiation flash, from 0,03 s Measures average dose rates of pulsed radiation at pulse length ranging from 10 ns (AT1123 model) Remote panel enables remote measurements</p> |
| <p>Combined instrument (flicker meter +luxometer) TKA-PKM (08)</p>  | <p>№ 210-12377 until Feb.5.2020</p> | <p>The meter is designed to measure percent flicker generated by various randomly placed sources of light, and luminance in visible spectrum (380 ÷ 760) nm. Luminance measurement range: 10 ÷ 200 000 lx. The flicker measurement range: 1 ÷ 100 %.</p> |

6. Attachment A. List of devices used for industrial environmental control

| DEVICE | CALIBRATION | SPECIFICATIONS |
|--|--|---|
| <p>Electrostatic field intensity meter ST-01</p>  | <p>№ 5461/18-Э until 23.08.19</p> | <p>Designed for express tests for biologically hazardous level of electrostatic fields generated by electrically powered equipment, information displays (PC display, TV set, slot machine), and building finishes. ES field intensity measurement range: 0,3 - 180 kW/m. The range for nominal error in measuring electrostatic field is: $\pm 15\%$.</p> |
| <p>Barometer gage M-67</p>  | <p>No. 008800, until Jan 20, 2021.</p> | <p>Atmosphere pressure measurement range, kPa (mm Mercury) - 80 to 120 (610 to 790) Permissible error limits after corrections, mm Mercury ± 0.8</p> |
| <p>Temperature and relative humidity meter DewCheck 4</p>  | <p>№ SP 2721182 until 29.09.2020</p> | <p>Measures the relative humidity, ambient temperature and surface temperature and calculates the dewpoint temperature and the difference between the dewpoint temperature and the surface temperature indicating the optimal climate conditions for painting. Calculates the difference between the surface temperature and dew point and shows the data on display</p> |