

# Analysis of the degree of environmental impact during the construction of the tourist and recreational complex Elbrus

*Natalya Sasikova*<sup>1</sup>, *Anna Khadzhidi*<sup>1</sup>, *Aleksandra Samartseva*<sup>1</sup>, *Lyudmila Kravchenko*<sup>2\*</sup>, and *Aleksey Belts*<sup>1</sup>

<sup>1</sup> Kuban State Agrarian University named after I.T. Trubilina, 13, Kalinina str, 350044, Krasnodar, Russia

<sup>2</sup> Don State Technical University, 1, Gagarin Sq., 344003, Rostov-on-Don, Russia

**Abstract.** The analysis of the degree of environmental impact as a result of the construction and operation of the projected tourist infrastructure facilities on the territory of the all-season tourist and recreational complex Elbrus consists in the urgent need to control the anthropogenic impact as a result of the active development of the tourism industry in the territory of the National Park Prielbrusye in the areas of recreational use and educational tourism.

## 1 Introduction

The relevance of the analysis of the degree of environmental impact as a result of the construction and operation of the projected tourist infrastructure facilities on the territory of the all-season tourist and recreational complex Elbrus lies in the urgent need to control anthropogenic impact as a result of the active development of the tourism industry in the territory of the National Park Elbrus in areas of recreational use and educational tourism [1].

The main purpose of the analysis is to prevent or minimize the impacts that may arise during the conduct of planned economic activities on the environment, public health and related social, economic and other consequences.

To date, due to the lack of an organized resting place for specialized snowmobiles on the territory of the all-season tourist and recreational complex [2-4].

Elbrus, equipped with all necessary resources to eliminate negative environmental impacts, their basing is carried out on an unprepared free territory of ski slopes near the settlement of Polyana Azau, which negatively affects all components of the environment. The purpose and need for the implementation of the design and construction of a snow truck garage is to improve the environmental situation and eliminate direct negative effects on all environmental components associated with the operation of specialized equipment in an unprepared area.

---

\* Corresponding author: [Lyudmila.Vl.Kravchenko@yandex.ru](mailto:Lyudmila.Vl.Kravchenko@yandex.ru)

## 2 Materials and methods

The object of the study is the projected garage complex for snow trucks. The proposed construction site of the facility is the southern slope of Mount Elbrus near the settlement of Polyana Azau, the absolute marks of the design site are from 2500.00 m to 2503.50 m.

When designing the facility, the option of placing a garage on the territory of the nearest settlement Polyana Azau was considered. The current location of the snowmobiles near the ski slopes was considered the place of design. However, due to the tightness of the territory, the lack of sufficient areas and the already formed infrastructure of the settlement, which is the main place of concentration of year-round tourist activity, this option was excluded. In addition, the placement of the projected facility on the territory of the Azau Clearing would cause a larger environmental impact during the operation of the facility, due to the longer path of snow trucks from the garage to the place of direct activity.

In case of abandonment of the planned design and construction, specialized equipment will continue to work in a specially protected natural area due to the need for clearance during the seasonal season, serving as an uncontrolled source of environmental pollution. Thus, the rejection of the planned economic activity is unacceptable.

The subject of the analysis of the degree of environmental impact is the components of the environment that are subject to anthropogenic impact during the construction and operation of the projected facility, namely, atmospheric air, water bodies, flora and fauna, land resources and soil cover.

Various methods have been used for predictive assessment of the impact of construction and operation of the projected facility on the environment, including identification, data collection and processing, forecasting, mathematical modeling, as well as computational methods for determining projected emissions of pollutants into the atmosphere and standards for the formation of production and consumption waste.

In the process of analysis, much attention is paid to the study of the existing situation and background conditions, legislative, regulatory, natural and social limiting factors, assessment of potential significant impacts from economic activity, assessment of existing uncertainties and recommendations for their elimination.

The degree of detail and completeness of the assessment is determined based on the characteristics of economic activity, and should be sufficient to identify and assess possible environmental and related social, economic and other consequences of the implementation of economic activities.

The result is decisions on the possibility or impossibility of carrying out economic activities, as well as recommendations on the development of necessary measures to prevent or reduce the identified significant environmental consequences, the definition of conditions and restrictions for the implementation of economic activities.

## 3 Discussion

During the construction period, 23 pollutants (of which 23 are unorganized ones) will be released into the atmospheric air from 23 sources of pollutants, 7 of them solid and 16 liquid/gaseous, belonging to hazard classes 1-4 in accordance with SanPiN 1.2.3685-21, and 10 groups of substances with a summation effect. The gross emission of harmful substances is 15.233113817 tons/year, of which solid – 1.112293513 tons /year, liquid and gaseous – 14.1200820304 tons /year.

During operation, from 17 sources of pollutant emissions (15 of them are unorganized, 2 are organized ones), 21 pollutants will be released into the atmospheric air, 7 of them solid and 14 liquid/gaseous, belonging to hazard classes 1-4 in accordance with SanPiN 1.2.3685-21, and 6 groups of substances with a summation effect. The gross emission of harmful

substances is 40.80917246 tons/year, of which solid – 3.127772664 tons /year, liquid and gaseous – 37.681399796 tons /year.

Calculations of emissions of pollutants into the atmospheric air for the period of construction and operation of the facility were performed on a computer according to the ERA-AIR program, version 3.0. The results of calculations of chemical pollution levels showed that at all design points the concentrations of all emitted pollutants and groups of summation of harmful effects in a specially protected natural area, including on the border of sanitary and the protective zone and the border of the enterprise territory does not exceed 0.8 MPC (for areas with increased requirements for atmospheric air quality), taking into account background pollution. Calculations of the dispersion of pollutants have shown that the levels of exposure to atmospheric air are significantly lower than the sanitary and hygienic quality standards for populated areas.

The assessment of the results of the dispersion of pollutants into the atmospheric air and the calculation of the KIZA for the construction period shows the KIZA value of 1.5613, and for the period of operation shows the KIZA value of 1.3465, thus, the relative level of atmospheric air pollution during the construction and operation of the projected facility belongs to the norm (H) class and corresponds to the level of air pollution below the average in the cities of the country.

To assess the impact of noise, an acoustic calculation was carried out for the periods of construction and operation of the projected facility using the ERA Shum PC software package (version 3.0). Based on the results of calculations of noise levels, it can be concluded that the sound levels from the planned economic activity during the construction and operation of the projected facility do not exceed the established hygienic standards for populated areas. Exceeding the permissible noise exposure at the border of the nearest normalized territory (specially protected natural area) will be within the norm due to the decisions taken on the production of planned works.

The drainage system of household sewage is provided by gravity from the building of the ratrac garage with a release device into the existing on-site sewerage network of the VTRK Elbrus. The project provides for the collection of rainwater: from the roof of the projected building, from driveways and footpaths, from lawns and other green spaces. The drainage of rainwater from the pitched roof of the building is provided through an external organized drain. After organized collection, rainwater flows to the treatment facilities “BloPlast SOF-30”, followed by discharge into the surface water body of the stream without a name. Rain treatment facilities are designed to purify surface wastewater from suspended solids of organic and mineral origin, as well as from petroleum products.

The limit values of the main water quality indicators before and after purification at the BloPlast SOF-30 installation are shown in Table 1.

**Table 1.** Limit values of the main water quality indicators before and after purification at the “BloPlast SOF-30” installation

Name of the parameter	In the input no more than	In the output no more than
Density of petroleum products, kg/m <sup>3</sup>	850-900	-
Suspended solids, mg/l	1000	2.9
Petroleum products, mg/l	502.4	0.05
OBC	153.1	2

In accordance with Table No. 1 of the Attachment to the Order of the Ministry of Agriculture of the Russian Federation from December 13, 2016 No. 552, the following water quality standards for water bodies of the highest fisheries category are established:

- for petroleum products – 0.05 mg/dm<sup>3</sup>;
- during discharge of return (waste) waters by a specific water user, during work on a water body and in the coastal zone, the content of suspended solids in the control line (point) should not increase by more than 0.25 mg/dm<sup>3</sup> compared to natural conditions;
- BOD – 3.0 mg/dm<sup>3</sup>.

In accordance with the data of the Technical Report on the results of engineering and environmental surveys on the object, the content of suspended solids in the natural (background) water of the stream without a name was:

- suspended solids – 4.6 mg/dm<sup>3</sup>

For clarity of perception of the concentration of pollutants in treated wastewater, after treatment facilities planned to be discharged into the waters of an unnamed stream, and their compliance with the order of the Ministry of Agriculture of the Russian Federation dated December 13, 2016 No. 552 are summarized in Table 2.

**Table 2.** Concentrations of pollutants in treated wastewater planned to be discharged into the waters of an unnamed stream

Name of the substance	un. meas.	background	The standard, by order of the Ministry of Agriculture of the Russian Federation from December 13, 2016 No. 552	Concentration of a contaminant in wastewater planned to be discharged into an unnamed stream
Suspended solids	mg/dm <sup>3</sup>	4.6	+0.75 to the background	2.9
Petroleum products	mg/dm <sup>3</sup>		0.05	0.05
OBC	mg/dm <sup>3</sup>		3.0	2.0

It can be seen from Table 2 that the projected wastewater treatment plants provide surface wastewater treatment. The qualitative composition of the treated runoff corresponds to the water quality standards for water bodies of the second fisheries category, established by Order No. 552 of the Ministry of Agriculture of the Russian Federation from December 13, 2016 “On approval of water quality standards for water bodies of fisheries importance, including standards for maximum permissible concentrations of harmful substances in the waters of water bodies of fisheries importance”.

Deterioration of the existing impact on the aquatic environment is not expected, in view of the local treatment facilities provided for in the design documentation for the periods of construction and operation of the facility. Contamination of surface water bodies with household waste and petroleum products is not provided.

In compliance with the requirements of the Water Code of the Russian Federation and the implementation of a set of environmental protection measures, a negative impact on the aquatic biological resources of surface water bodies and their habitat during the construction and operation of the projected facility is excluded.

Compliance with existing restrictions is an integral part of a set of environmental protection measures to improve the hydrological, hydrochemical, hydrobiological, sanitary and ecological condition of water bodies and the improvement of their coastal territories and will minimize the negative impact on aquatic bioresources during the work and operation of the facility.

In compliance with measures aimed at reducing the level of negative impact, as well as measures to protect aquatic biological resources and their habitat, the implementation of

economic activities during the construction and operation of the projected facility will not lead to contamination of surface and groundwater, as well as to depletion of water resources.

The transfer of production and consumption waste for placement during the construction and operation of the projected facility is provided for at the MSW landfill included in the State Register of Waste Disposal Facilities (SRWDF). Before being transferred to specialized enterprises for disposal, neutralization and disposal, waste is sorted in order to identify the possibility of their further use for their own needs. Waste is transferred to organizations that have the appropriate license for the collection, transportation, neutralization, disposal and disposal of waste.

During the construction of the projected facility, the total amount of waste planned for formation is 10. Of these, waste of hazard class I – 0, waste of hazard class II – 0, waste of hazard class III – 2, waste of hazard class IV – 5, waste of hazard class V – 3. The list of production and consumption wastes for the construction period includes: cleaning material contaminated with oil or petroleum products (oil or petroleum products content 15% or more); sand contaminated with oil or petroleum products (oil or petroleum products content of 15% or more); garbage from office and household premises of organizations, unsorted (excluding bulky); containers of their ferrous metals, contaminated with paint and varnish materials (content less than 5%); estimates from the territory of the enterprise are low-risk; waste (precipitation) from cesspools; paint and varnish tools (brushes, rollers), contaminated with paint and varnish materials (in an amount less than 5%); residues and stubs of steel welding electrodes; unsorted food waste from kitchens and catering organizations; sewage sludge from car washes is practically non-hazardous.

During the operation of the projected facility, the total amount of waste planned for formation is 18. Of these, waste of hazard class I – 1, waste of hazard class II – 1, waste of hazard class III – 3, waste of hazard class IV – 11, waste of hazard class V – 2. In the list of production and consumption waste for the period operation included: mercury, mercury-quartz, fluorescent lamps, which have lost their consumer properties; lead batteries, spent, undamaged, with electrolyte; surfaced petroleum products from oil traps and similar structures; cleaning material contaminated with oil or petroleum products (oil or petroleum products content of 15% or more); sand contaminated with oil or petroleum products (oil or petroleum products content of 15% or more); garbage from office and household premises of organizations, unsorted (excluding bulky); garbage and estimates from cleaning warehouses, low-risk; estimates from the territory enterprises are low-risk; estimates from the territory of the garage, parking lot are low-risk; sediment (sludge) of mechanical purification of oily wastewater containing petroleum products in an amount of less than 15%, watered; spent air filters of motor vehicles; waste of rubber-asbestos products, uncontaminated; scrap and waste of ferrous metals contaminated with petroleum products (oil products content less than 15%); scrap and waste of non-ferrous metals, unsorted with a predominant content of aluminum, zinc and copper, contaminated with petroleum products (oil products content less than 15%); packaging of their ferrous metals, contaminated paint and varnish materials (content less than 5%); paint and varnish tools (brushes, rollers) contaminated with paint and varnish materials (in an amount less than 5%); vegetable waste in the care of lawns, flower beds; residues and stubs of steel welding electrodes.

Waste removal is planned to be carried out by the Municipal Unitary Enterprise Ecotechprom to the landfill MSW SRWDF 07-00001-Z-00168-070416, located in Nalchik in the village of Urvan. The range of the carriage is 141 km. The remaining types of waste are transferred to specialized licensed organizations LLC Zelenaya Marka, LLC Agency "Mercury Safety, MP UK Chladnensky Vodokanal G.O. Cool KBR, including the regional operator for the management of production and consumption waste LLC Ecologistika for transportation, neutralization, disposal and processing.

When handling waste, specially equipped collection and accumulation sites are provided, including in closed containers, and methods of their neutralization and placement. The EIA materials present the planned methods of handling each type of waste generated as a result of economic activity, indicating the approximate amount of their formation, as well as specialized organizations in the region that have the ability to accept waste for the purpose of disposal or neutralization. The above-mentioned organizations have granted licenses for the management of waste generated as a result of economic activity in the design volumes. Thus, the environmental impact, if all the conditions for waste collection and storage are met, as well as timely removal, will have minimal environmental impact.

During construction work, the vegetation cover will be damaged only within the boundaries of the right-of-way. Directly on the territory of the planned economic activity, the sources of impact on the flora are emissions of pollutants into the atmospheric air during the combustion of fuel from motor vehicles and mobile diesel power plants.

The main type of impact on the animal world is anxiety and scaring away from the place of planned economic activity. As a result of the project implementation, the qualitative and quantitative composition of the wildlife of the planned work site will change. However, due to the absence of absolutely unique habitats directly on the site, such an impact cannot be considered completely unacceptable, the implementation of the project can be recommended subject to compliance with all norms of current environmental legislation and compensation for damage caused to wildlife and their habitat (measures to prevent and reduce negative impacts on wildlife and compensatory environmental measures).

If environmental protection measures, including compensatory measures, are observed to preserve flora and fauna during the construction of the projected facility, as well as during its normal trouble-free operation, no negative impact on flora and fauna is predicted.

According to the Federal State Budgetary Institution High-Altitude Geophysical Institute of the Federal State Budgetary Institution (HAGI), Elbrus is considered a “dormant” volcano. The manifestation of volcanism is expressed in the form of the release of gases (fumaroles).

According to the description of the boundaries of the functional zones of the national park, presented in Appendix 2 to the Regulations on the National Park Prielbrusye, and graphic material, the territory of the planned activity belongs to the recreational functional zone. In this zone, economic activities are allowed, focused on meeting the needs of visitors for comfortable recreation, the formation of forest park landscapes resistant to recreational loads, haymaking and grazing of livestock belonging to the local population on sites fixed by decisions of local governments, as well as the construction of economic facilities that ensure the livelihoods of recreational institutions. Thus, the planned economic activity does not contradict the Land Code of the Russian Federation and the Regulations on the National Park Prielbrusye.

According to the studied sanitary and chemical (sanitary and toxicological) indicators, soil samples taken at the facility: “All-season tourist and recreational complex Elbrus, Kabardino-Balkarian Republic. Ratrac garage” meets the requirements of SanPiN 2.1.3684-21 “Sanitary and epidemiological requirements for the maintenance of urban and rural settlements, for water bodies, drinking water and drinking water supply, atmospheric air, soils, residential premises, operation of industrial, public premises, organization and conduct of sanitary and anti-epidemic (preventive) measures”, SanPiN 1.2.3685-21 “Hygienic standards and requirements for ensuring the safety and (or) harmlessness of environmental factors for humans”. According to all indicators, no excess was found in soil samples, the concentration of substances does not exceed the established maximum permissible concentration. Based on the calculations carried out, it was found that according to the level of pollution with both organic and inorganic pollutants, soils and soils in the studied territory belong to the permissible pollution category. Thus, over the entire survey area, the value of the total Zc index in soils and soils is <16.

The main impact that will be exerted on land resources and soil cover is the mechanical impact and violation of the integrity of soils, including soil and vegetation cover, associated with earthworks (digging trenches and ditches, filling embankments), as well as chemical effects associated with emissions from the operation of vehicles, construction mechanisms, welding works , etc.

## 4 Conclusions

During the period of construction work, when organizing technical and biological reclamation of lands involved in temporary allotment, it is possible to exclude negative effects on soil cover and land resources.

During the operation of the projected facility, activities will be carried out on a fully landscaped land plot, equipped with organized collection and purification of rain and industrial wastewater, a household sewerage system, a hard road surface in places where equipment passes, sites for collecting production and consumption waste.

The deterioration of the existing impact on land resources and the geological environment is not expected. In compliance with environmental protection measures, the process of construction and operation of the projected facility will not have a negative impact on land resources and soil cover.

Analyzing the results of the assessment of the significance of environmental impacts, it can be concluded that the environmental acceptability of the options for the development of the economic activity under consideration when taking measures in the project to reduce the negative impact on the components of the environment, which will be able to ensure its sustainable condition and guarantee the absence of adverse environmental and related social and economic consequences.

Based on the results of the analysis of the degree of environmental impact as a result of the construction and operation of the projected tourist infrastructure facility on the territory of the all-season tourist and recreational complex Elbrus, it can be concluded that, subject to the implementation of environmental protection measures, the level of environmental impact associated with the implementation of economic activities is acceptable and is within the norms and requirements ensuring environmental safety in accordance with the current environmental legislation of the Russian Federation.

However, the construction and operation of the projected facility is possible with strict observance and mandatory fulfillment of the following conditions: compliance with all existing environmental restrictions, control over the condition of the air basin, water body, aquatic biological resources, flora and fauna, as well as land resources and soil cover in the area of influence of the projected facility, as well as ensuring trouble-free operation during the construction and operation of the facility.

## References

1. Bachiev R.A., Buraev R.A. *Izvestiya vuzov. The North Caucasus region. Series: Natural Sciences.* 2010. **№5**.
2. Kochetov T.V. *Forum of Young Scientists.* 2019. **№2 (30)**.
3. Order of the Ministry of Natural Resources and Ecology of the Russian Federation No. 999 dated December 1, 2020 "On Approval of Requirements for Environmental Impact Assessment Materials".
4. Rusetskaya G.D., Dmyterko E.A. *Izvestiya BSU.* 2017. **No.4**.