Annex 8 to Grant Agreement

No. 35 dated November "26" , 2021

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

1. GENERAL INFORMATION ON THE SUBPROJECT AND THE PROJECT SITE

1.1. DESCRIPTION OF THE SUBPROJECT

Name of the subproject

"Setting-up a pilot plant for the production of nanostructured carbon-containing materials for chemical engineering processes".

Subproject location

Industrial zone, 122/A Saken Seifullin str., Bakanas village, Balkhash district, Almaty region.

Subproject purpose

The problem of rice husk use or removal is particularly acute for rice producers. An average of 10 kg of rice husk is accumulated in the processing of every 50 kg of raw rice. Thus, with an annual yield of 1 million tons, about 200,000 tons of rice husks are produced. With a bulk weight of 140 kg/m3 this amounts to 1.4 million m3. Even after burning the husks, 0.14 million m3 of ash is produced. And although some firms are developing a market for rice husk and its derivatives, still 75% of rice husk is burned. It should be noted that rice-growing wastes are difficult to burn (smouldering), and the smouldering process is accompanied by a significant impact on atmospheric air. Thus, the main environmental direction of the Subproject is to make rice production wasteless by setting up the production of nanostructured silica-carbon materials based on plant raw materials consisting of rice processing products.

Subproject scope

Production workshop:

Rectangular industrial building with dimensions in axes 17.0 x 48.0 m.

In terms of space planning, the projected building accommodates:

- a production workshop and a warehouse for finished products.

Technology description: Rice husk (RH) is an ash rich, non-marketable plant biomass that does not lend itself to the process of rotting and complete combustion.

With a variety of existing technologies for RH utilization, *the thermal treatment technology of rapid pyrolysis without oxygen access* in carbonization furnaces was chosen. The advantage of the thermal treatment of husk is that the entire process is carried out in a closed loop in a single stage.

Due to the fine fraction of RH, there is no need for additional mechanical action on the raw material, such as milling and grading. This greatly simplifies processing, since the husk itself consists of pellets which ensure optimum heat treatment in the absence of oxygen.

There is also no need to pre-dry rice husk as is necessary for wood processing. The carbonization furnace uses advanced technology to extract, purify and circulate combustible gases such as carbon monoxide, hydrogen and oxygen generated during the carbonization of the material, while simultaneously solving the environmental pollution caused by the thick smoke generated during the carbonization of a simple furnace, and also solving the thermal energy

problem. This completely solves the problem of switching the main natural gas to pyrolysis gas produced by the furnace.

After thermal treatment, the lignin and cellulose contained in RH are converted into amorphous carbon without air access. The result is an organic residue (carbonizate), which is a compound of silica and carbon. Processing 1,000 kg of RH produces up to 400 kg of carbonizate. On entering the screw reactor of the furnace, the mixture is heated to 750 ºC. The carbonization lasts about 40 minutes. The liquid organic products from the thermal decomposition of RH are captured in the water filter system and condensed, then discharged into a collection tank for further processing, while the volatile products in the form of energy gas, mainly consisting of carbon monoxide, methane and other volatile gases from the carbonization process, are sent to the incinerator for afterburning, after treatment, as the main fuel. The main natural gas is used for initial ignition. The resulting material, RH carbonizate, as the main component, after pre-cooling:

- *product 1.* Is sent to the production of pressed charcoal briquettes;
- *product 2.* The operation is fine grinding of the resulting carbonizate at the mill to a fraction of 40 microns.

The mill's integrated blower carries the ground material to the bag filter system, where fine dust fractions are captured and coarse dust fractions are returned to the mill until they are completely ground. There is no waste produced during milling. The finished product goes to the filling machine.

It is planned that the processing line will be used around the clock.

On an industrial scale, the technology will be realized through the purchase of a processing line from the PRC.

When processing 1,000 kg of RH with a moisture content of 3 to 5%, it is subjected to a pyrolysis process after preliminary drying. The process results in several types of products:

- 0.4 tons of rice husk carbonizate (RHC), a factor of -2.5 is introduced;
- 0.37 tons of organic aqueous product (OAP), a factor of - 2.7 is introduced;
- 208 tons of energy pyrolysis gas (EPG), a factor of -4.8 is introduced;
- 0.022 t - unexpected losses

Information on the equipment used:

The following is used in the manufacturing process:

- Rice husk (RH) carbonization production line with a raw material processing capacity of 6.0 t/h. Supplier - Zhengzhou New Energy Equipment Co., Ltd (China);
- YGM95 mill with a grinding capacity of 1-3 t/h. Supplier - ZHENZHOU CORIN MACHINERY CO. LTD (CORINMAC) (China)

Stages of subproject implementation

- Construction of a production workshop for the installation of production equipment with internal communications – 6 months;
- Conclusion of contracts with equipment suppliers, purchase and delivery to location - 6 months;
- Installation and commissioning – 2 months.

1.2. LEGISLATION AND ADMINISTRATION

National legislation

- Environmental Code No. 400-VI ZRK dated 02.01.2021 of the Republic of Kazakhstan.
- Methodology for determining environmental emission limits, approved by the Order No. 63 dated March 10, 2021 of the Minister of Environmental Protection of the Republic of Kazakhstan.

- Environmental Action Plan Framework approved by Minutes of Meeting No. 0/2802-vn dated 21.05.2021 of the Steering Committee of the Stimulating Productive Innovation Project.
- World Bank Operational Manual OP/BP 4.01 (Environmental Assessment).
- World Bank Operational Manual OP 17.50 (Disclosure of Information).
- World Bank Group Environmental, Health and Safety Guidelines 2007.

Land or facility title

The Company owns a land plot of 0.9936 hectares under a long-term lease with a permanent extension for 5 years.

Title documents:

The deed for the right of gratuitous (long-term, short-term) land use (lease), registered in the record book of the local Land Committee of Bakanas village under No. 3351 on 10.06.2020.

Intended use of the land plot: for maintenance of buildings and structures.

Cadastral number of the land plot: 03-043-010-039

Land Plot Lease Agreement No. 42 dated 04.05.2020 between the Balkhash District Land Committee and the Director of Biocarbon LLP.

2. ENVIRONMENTAL DESCRIPTION (INITIAL DATA)

General description of the environment at the project site

The site is characterized by a sharply continental climate. The climate is peculiar because of its geographical location in the central part of the Eurasian continent, its remoteness from oceans and seas, the proximity of deserts and large mountain ranges. A climatic feature of the area is the turbulent exchange conditions that prevent the development of stagnant phenomena, due to the low atmospheric dynamics of the south-eastern region.

Dry and hot weather with lots of cloudless days prevails here, with periodic short-term thunderstorms, often with prolonged rainless periods. Summers are hot, winters moderately cold, mild, with little snow.

The topography of the site is relatively flat, with a general dip from south to north.

Weather conditions

Metrological characteristics and coefficients determining the conditions of dispersion of pollutants in the atmosphere are given in Table 1 according to Kazgidromet data on Bakanas, the nearest weather station.

Table 1.

Name of characteristics	Value
Coefficient depending on atmospheric stratification, A	200
Terrain relief coefficient in the city	1.00
Average maximum outdoor temperature	33.9
Of the coldest month (for boiler houses operating according to the heating schedule), C^{o}	-15.3
Average wind rose,%	
N	11.0
NE	25.0
E	10.0
S	8.0
SW	11.0
W	11.0
NW	10.0

Average wind speed, m/s	1.0
Wind speed (according to long-term average data), the frequency of exceedance of which is 5%, m/s	3.0

Hydrogeological conditions and hydrography

Groundwater. In hydrogeological terms, the area is characterized by the presence of favorable conditions for the formation of Cenozoic groundwater deposits of the upper structural stage, comprising a number of aquifers and complexes, which have different filtration and reservoir properties.

Groundwater is confined to aquifers of Quaternary alluvial-proluvial deposits of piedmont plains. Within the piedmont-sloping plain, groundwater is not widespread. Groundwater supply is due to infiltration of atmospheric precipitation and inflow from the pinch-out zone bordering the piedmont plains.

Within Almaty region, the waters of the alluvial cones have low salinity and stable chemical composition. Fresh sulphate-hydrocarbonate sodium-calcium water.

Groundwater, as per excavations from the bottom of the pits, depending on the depth, lies at a depth of 2.2 to 2.5 m.

According to the regime observations (stock records), the maximum groundwater level position is observed from August to January and the minimum - from March. The amplitude of the level fluctuation is 1.0 m.

The degree of aggressive action of groundwater on concrete of W4 grade in terms of water resistance, in terms of sulfate content to concrete on Portland cement (according to GOST 10178) is non-aggressive; to concretes on sulfate-resistant cements (according to GOST 22266) - W4 grade, is non-aggressive.

Surface water.

No surface water sources were found in the area in question. The area is unswamped and unsinkable.

The worksite is located in a man-made developed area of the village, outside of water protection zones and strips. The nearest Ili River flows on the north side at a distance of more than 206 m from the construction site. The main factors in the formation of surface runoff are natural and climatic conditions which directly depend on the terrain, the nature of river nourishment and the quantitative ratio of water balance elements, mainly determined by the altitude and orographic position of the catchment area.

Atmospheric air quality

The pollution of the site area is determined by the general background air pollution. Data on background concentrations of environmental quality parameters are provided by the Hydrometeorological Service of the Republic of Kazakhstan. Due to the absence of regular observations of background concentrations in the Bakanas village, the dispersion was calculated in accordance with the regulatory document RD 52.04.186-89 “Guidelines for Atmospheric Pollution Control”. Data from RD 52.04.186-89 are presented in Table 2.2 (9.15 RD 52.04.186-89).

Table 2 - Approximate values of background concentration of impurities (mg/m^3) for cities with different population sizes.

Population size, thousand inhabitants	**Dust** mg/m3	**Sulfur dioxide** mg/m3	**Nitrogen dioxide** mg/m3	**Carbon monoxide** mg/m3
1	2	3	4	5
250-125	0.4	0.05	0.03	1.5
125-50	0.3	0.05	0.015	0.8
50-10	0.2	0.02	0.008	0.4
less than 10	0	0	0	0

The population of the Bakanas village is less than 10,000 people. Consequently, the dispersion of pollutants in the surface layer of the atmosphere is calculated without taking into account the background concentration.

Geological engineering conditions

The geological and lithological structure of the site is attended by Upper Quaternary alluvial - proluvial deposits (apQIII), represented by loams with a thickness of no more than 0.8 - 1.0 m, well-washed sandy varieties from medium (top of the section) to coarse sands with the inclusion of fine pebbles and gravel. The sands are obliquely layered. Irregularly dense, loose and medium-dense, lightly water saturated and saturated, with thin interlayers of loam. Below is a lithological section from the surface:

1. 0.0 - 0.1 m - The topsoil is humous loam with roots of herbaceous vegetation.

2. 0.1 - 1.0 m - Grey sandy loam of firm to compact consistency, macroporous, carbonated, with shell remains;

3. 1.0 - 2.6 m - Sand of medium coarseness, loose and medium density, medium degree of water saturation;

4. 2.6 - 3.7 m - Medium coarse sand with gravel, with interlayers of loam, medium degree of water saturation, medium density with gravel and small pebbles up to 10%, water saturated;

5. 3.7 - 6.0m - Coarse, medium-dense sand with thin loam interlayers, with gravel and small pebbles up to 20%, water saturated.

Flora

The flora of the area is determined by high-altitude zones. In the lower belt of the mountains, up to an altitude of 600 m, there is vegetation of the desert type: wormwood, alkali grass, prostrate summer cypress. The steppe belt is higher: feather grass, timothy grass, dog rose, honeysuckle, apple-aspen forests with hawthorn and bird cherry in the river valleys. The forest-meadow belt rises up to an altitude of 2,200 m. The forests consist of Tien Shan spruce, Siberian fir. Then there is the Alpine belt: Cabresia, Altai violet, Saxifraga, Alpine poppy.

The site is influenced by a multi-component anthropogenic impact, in a technologically developed area of the site.

There are no rare endangered Red Book plants in the area of influence.

There are no natural food and medicinal plants.

Fauna

The fauna of the region is mixed, mainly Altai and Tien Shan animals are found here. In the lower belt of the mountains there are hares, ground squirrels, hamsters, badgers, etc. In the forest-meadow belt there are brown bears. In the highlands there are wild mountain goats, argali and European ground squirrels.

Among the birds in the forests are the Siberian three-year-old woodpecker, nutcracker, birch owl, Tien Shan kinglet. In the highlands there are dark-bellied lancers, Central Asian jackdaws, partridges and pheasants.
The fauna of the project area is represented mainly by small rodents, reptiles, birds and insects. A feature of the site is the abundance of domestic animals, as well as synatropic animal species well adapted for life and reproduction.

The following animal species may live in the area of influence:

- the class of reptiles: sand lizard, toad agama, grass snake, viper, stepperunner, moccasin;
- the class of mammals in the rodent family:field mouse, root vole, common mouse, ground squirrel, jerboa, eared hedgehog;
- the class of amphibians: toad, sharp-footed frog, etc;
- the class of insects: phalanx, mosquito, common fly, lacewing, dragonfly;
- the class of birds: Spanish sparrow, lark, rook, hooded crow, starling, wagtail, roller, common bee-eater.

The site area is influenced by a multi-component anthropogenic impact.
Seasonal migration routes and resting places, birds and mammals during migrations were not observed in the area.
There are no rare or endangered animal species listed in the Red Book.

Landscape

The site is located away from environmentally sensitive areas.
There are no environmentally sensitive areas and valuable natural habitats (nature reserves, nature monuments), waterfalls, natural reservoirs of valuable tree species and other ‘monuments’ of historical, aesthetic, scientific and cultural value in the immediate vicinity of the site.

3. DETERMINING POTENTIAL IMPACT

Production and consumption waste

3.1. Waste for the construction period

Special containers for storing materials are provided at the site, for the duration of reconstruction. Paints and loose building materials used for finishing work will be delivered in sealed containers and packaging.

The calculation of waste generation was carried out in accordance with the Methodological Recommendations for the Development of Draft Limits for the Maximum Permissible Disposal of Production and Consumption Waste.

Solid household waste (SHW).

Solid waste generated during construction. The number of construction workers permanently on site will be 33. According to Appendix No. 16 to Order No. 100-p of the Minister of Environmental Protection of the Republic of Kazakhstan dated 18.04.2008 “Methodology for Development of Draft Limits for the Maximum Permissible Disposal of Production and Consumption Waste”, household waste generation rate is 0.3 m^3/person, and waste density is 0.25 t/m^3. The volume of waste will be:

((0.3 m^3/person * 33 people * 0.25 t/m^3)/365)*260 = 1.7623 t/construction period

Welding electrode stubs

1.9509123 tons of welding electrodes are used on the construction site, the generation rate will be: 1.9509123*0.015=0.0293 t/construction period.

Paint and varnish containers
The waste formation rate is determined by the formula:

$N = \Sigma M_i \cdot n + \Sigma M_{ki} \cdot \alpha_i$, t/year,

where M_i - mass of the i -th type of packaging, t/year; n - number of types of packaging; M_{ki} - mass of paint in the i -th type of packaging, t/year; α_i - content of paint residues in the i - th type of packaging in fractions of M_{ki} (0.01-0.05).

N=((0,001*10+0,0860021*0,03)+(0,001*19+0,1720042*0,05))+(0,001*40+0,35891937*0,03)+(0,001*15+0,13311*0,05)+(0,(0,000091*9+0,0373657*0,03)= 0,1126 t/construction period

Construction waste

Construction waste generation calculation

Name of type of work and materials	a, Loss and waste rates %	Q_D amount of material, m^3,m^2,m,	Q_D amount of material, tons	q_n, amount of waste, tons
Drywall	4.0	246.67 m^2	1.850025	0.074
Profiled flooring	4.0	459,5 m^2	3.8598	0.1544
Gas concrete blocks 200x250x600mm	1.0	90 m^3 (3000 pcs.)	49.5	0.495
Total:				0.7234

Information about the limits of waste generated is given in the table below

Table

Name of waste	Generation, t/year	Disposal, t/year	Transfer to outside organizations, t/year
1	2	3	4
Total	2.6276	-	2.6276
Incl. production waste	0.8653	-	0.8653
consumption waste	1.7623	-	1.7623
Amber hazard level			

paint and varnish containers	0.1126	-	0.11262
Green hazard level			
Construction waste	0.7234	-	0.7234
Electrode stubs	0.0293	-	0.0293
Municipal (solid household) waste	1.7623	-	1.7623

3.2. Waste for the period of operation of the administration and warehouse complex

During the period of operation, the following types of waste are generated:

- Solid household waste
- Charcoal, rice husk and modified starch containers
- Sweepings from the area
- Used mercury-containing fluorescent lamps

Solid household waste (SHW)

The amount of solid waste is calculated on the basis of household waste accumulation norms according to SNiP RoK 3.01.02-2001.

0.3 tons of solid waste per person will be generated per year.

The company will employ 33 people.

Consequently, the amount of solid household waste will be:

0.3 * 33 = 9.9 tons/year.

- solid household waste in the amount of 9.9 tons is classified as waste of the GO_{060} index. The hazard level is green. Storage method - temporary storage in metal containers. Waste is removed under an agreement with the service provider.

Charcoal bags

The charcoal will be delivered in polyethylene bags (Big-Bags) of 500 kg each. The annual demand for charcoal is 1,120 tons, the weight of one polyethylene bag is 2.3 kg. Hence:

$W_{bags\ of\ coal}$=1120/(500/1000)*(2.3/1000)=5.152 t/year.

Rice husk bales

The rice husk will be delivered in polyethylene bales of 40 kg per bag. The annual demand for rice husk is 1,140 tons, the weight of one bag is 0.04 kg. Hence:

$W_{bags\ of\ rice\ husk}$=1140/(40/1000)*(0,04/1000)=1.14 t/year.

Modified starch bags

The modified starch will be supplied in polyethylene bags of 10 kg each. The annual demand for modified starch is 80 tons, the weight of one bag is 0.026 kg. Hence:

$W_{bags\ of\ modified\ starch}$=80/(10/1000)*(0,026/1000)=0.208 t/year.

Sweepings from the area

The amount of rubbish (sweeping) from the area is determined according to the norms per $1m^2$ of the Company's area to be swept:

$W_{m/t}$ = f * S (t/year)

Where:

f – the average annual rate of waste generation per 1 m^2 of the area to be swept;

S – the Company's area to be swept, m^2.

The calculations are summarized in the table:

Name of the unit	Area to be swept, m^2	Garbage density, t/m^3	Garbage generation rate		Annual amount of garbage	
			t/m^2	m^3/m^2	t/year	m^3/year
Company's paved area	3307	0.25	0.0045	0.018	14.8815	59.526

Storage method. Temporary storage in a metal container.

Disposal method. Solid waste landfill.

Information about the limits of waste generated is given in the table below.

Table

Name of waste	Generation, t/year	Disposal, t/year	Transfer to outside organizations, t/year
1	2	3	4
Total	110.696	-	110.696
Incl. production waste	100.796	-	100.796
consumption waste	9.9	-	9.9
Amber hazard level			
		-	
Green hazard level			
Charcoal bags	5.152	-	5.152
Rice husk bales	1.14	-	1.14
Modified starch bags	0.208		0.526
Storage pond sediment	34.77		34.77
Sweepings from the area	59.526		59.526
Municipal (solid household) waste	9.9	-	9.9

3.4. Arrangement of waste collection, temporary storage, transportation and disposal

Waste collection, temporary storage, transportation and disposal will be carried out in accordance with the regulatory documents of the Republic of Kazakhstan.

During the construction period, additional places for temporary waste accumulation will be arranged by the construction contractor.

Solid household waste will be collected in containers installed next to the construction site, which, as it generates, will be removed by a specialized organization to an authorized landfill according to the agreement.

Construction waste will be collected in a designated special container, which, as it accumulates, will also be removed by a specialized organization to an authorized landfill for burial on a contractual basis.

Waste paint and varnish materials, used brushes, hardened varnishes, thinners, paint containers resulting from painting will be transferred to specialized companies for further disposal on a contractual basis.

Sweepings, charcoal bags, modified starch bags and rice husk bales will be collected in containers installed for the solid waste collection areas and, as they accumulate, will be removed to the solid waste landfill.

3.5 Land impact assessment

The use of toxic materials on the construction site is not planned, and the ingress of construction mixes on the ground surface is excluded. All construction and household waste are planned to be stored in designated areas in closed containers. Upon completion of the construction and installation works, technical reclamation of the soil and vegetation layer will be carried out.

No significant impact on soils is expected for the period of operation of the buildings and structures of the plant. The ingress of household wastewater is excluded.

Flora and fauna impact assessment

There are no trees on the site that are subject to forced demolition. Upon completion of construction, landscaping is provided for: planting of European white elm (55 pcs.), Thuja occidentalis (8 pcs.), lawn on an area of 3702.63 m^2.

The operation of buildings and structures of the project plant will not have a significant impact on the flora and fauna of the surrounding area.

3.6. Harmful physical impact assessment

The following physical impacts will occur during construction work: noise, light and possibly minor electromagnetic and vibration impacts.

The sources of physical impact will be construction machinery, vehicles, etc.

The design solutions provide for the use of equipment, the technical characteristics of which comply with SanPiNs, SNiPs and the requirements of international documents.

Noise

Sources of noise during construction will be construction machinery: tractors, bulldozers, graders, pipe-layers, welding machines, etc.

Table *Typical sound levels from different types of construction machinery (at 1 m away from the machinery)**

Machinery	Sound level, dBA
Dump truck,	84
Concrete mixer truck, truck crane	90
Excavator	92

The impact of noise will also depend on the set of machines used.

The protection of personnel is ensured by the implementation of hygienic standards (Order No. 139 of the Ministry of Health of the republic of Kazakhstan) and the interstate standard (GOST 27409-97), that regulates the noise characteristics of machines, mechanisms and other equipment.

Vibration

The maximum vibration levels from all vibration generating equipment during construction at the site will not exceed the maximum permissible levels set by SanPiN 3.01.032-97. All units are mounted on vibration-isolating bases.

Electromagnetic radiation

The sources of electromagnetic radiation during construction and operation of the facility will be installed in accordance with the requirements of sanitary regulations (SanPiN 3.01.036-97) and will not have a negative impact on the health of personnel.

Protective earthing is provided to protect personnel from electric shock.

No significant noise, electromagnetic, vibration impacts are foreseen in the project area during construction and installation works and operation of the projected facility.

Water consumption in the production building for process needs

During the pyrolysis process, when processing one ton of rice husk, with an initial moisture content of 3-5%, up to 50% of organic water condensate (OWC) is generated, which is discharged into evaporator settling tank. The pyrolysis unit operates around the clock, until the briquette production line is fully supplied with carbonized rice husk for a fortnight. The pyrolysis unit is then stopped for technical maintenance.

When carbonizing 1,000 kg of RH with an initial moisture content of 3-5%, up to 50 liters of water condensate is released.

An organic aqueous product (OAP) is an aqueous solution of carboxylic acids (22%), phenols (14%), ketones (12%), cyclic aliphatic hydrocarbons (4.5%), heterocyclic compounds (4%), alcohols and ethers (4.5%). A total of 61% aqueous solution of organic impurities.

Up to 3,000 kg of rice husk (RH) are processed per hour. Consequently, 3 tons of RH x 50 l x 24 hours = 3600 l (OWC) are generated per day.

The organic aqueous product is discharged into a storage pond, where it is settled and stratified into water and the above-mentioned organic impurities. The water is pumped out by a submersible pump for the technical needs of the production line in its entirety, thus, no evaporation takes place, while organic impurities are essential raw materials for the pharmaceutical industry and are collected in separate containers from the storage pond. The use of sediment from organic impurities will be considered in a separate detailed design.

The volume of water used back from the storage pond for process needs will be as follows:

$Q_{\text{water flow per day}}$=3600 l * (100%-61%)/100 = 1404 l/day.

1140 tons of rice husk will be processed per year.

1140 t * 50 l = 57000 l = 57 m^3/year.

$Q_{\text{water flow per day}}$= 57 m^3/year*(100%-61%)/100=22.23 m^3/year.

In the process, a charcoal mixture consisting of 30% rice husk carbonized, after pyrolysis, charcoal screening 65% and a binder in the form of modified starch 5%, and the whole mixture is poured with water. Everything is thoroughly mixed and fed to the pressing of briquettes, then the

pressed briquettes are placed in a drying oven and dried to a moisture content of 3-5%. The rest of the water in the briquettes evaporates.

The capacity of the selected processing line is 1,000 kg of charcoal briquettes per hour. The work is designed for one shift - 8 working hours. The need for process water per ton of briquettes is set by the technology - 620 liters. Consequently, 620 liters x 8 hours = 4960 liters of process water are needed for 8 hours. Part of the water is taken from the evaporator settling tank. The missing part is added from the supply well. The difference is 3556 **liters** per day.

The annual production capacity will be 1600 tons of charcoal briquettes. Hence, the annual need for water is 1600*0.62 m^3=992 m^3/year. The amount of recycled water used is calculated above and will amount to 22.23 m^3/year. The additional volume of water from the well is =992-22.23 =969.77 m^3/year.

Calculation of water consumption

The annual water consumption for sanitary and household needs will be:

1.825*260= 474.5 m^3/year.

The total water consumption for sanitary and household needs will be 1.825 m^3/day, 474.5 m^3/year.

Calculation of air emissions:

At the site, 6 fugitive sources of air emissions, one organized and one non-standardized mobile source were identified during the construction period.

A total of 16 hazardous substances are emitted into the atmospheric air during the construction period.

Emissions for the construction period are as follows: maximum single emission 2.0830234 g/sec, gross emission 1.36296 t/construction period.

For the period of operation, 4 organized sources of emissions were identified, one unorganized and one non-standardized (parking for cars and buses).

Emissions for the operational period are as follows: maximum single emission 3.97877 g/sec, gross emission 18.58876 t/year.

The calculation of the surface concentrations of pollutants contained in the emissions of the rice husk processing plant shows that the concentrations of pollutants, during operation, in the atmospheric air are limited to an area of 175 m. The plant will be classified as Hazard Class 4 Category 3 during the operational period.

4. Conclusions and proposals

According to the survey, study of information, project materials, regulatory documents, materials and observations for the region, it is concluded that:

- The technology used by the Company, with a minimum of cost and capital investment, is sufficiently reliable and safe to meet the current level and requirements for such facilities.

- The launch of such facilities in this area is of social importance, since it ensures the development of the infrastructure of the region, provides jobs and living standards to local residents, etc.

List of pollutants emitted into the atmosphere
during operation

Code of pollutant	Name of pollutant	MPC max. single, mg/m^3	MPC average daily, mg/m3	Safe reference levels of Impact-SRLI ,mg/m^3	Hazard class	Emission, g/s	Emission, t/year	HEC value (W/MPC)**a	Emission, c.t/year
1	2	3	4	5	6	7	8	9	10
0301		0.2	0.04		2	0.1982	1.1152	75.6625	27.88
0304	Nitrogen dioxide	0.4	0.06		3	0.0285	0.17438	2.9063	2.90633333
0330	Nitrogen oxide		0.125		3	0.4561	1.838	14.704	14.704
0337	Sulfur dioxide	5	3		4	1.6735	8.937	2.6709	2.979
0703	Carbon monoxide 3,4-Benzpyrene		0.000001		1	0.000002903	0.000003285	4.5558	2.44
2908	Inorganic dust: 70-20% silicon dioxide	0.3	0.1		3	1.622443	6.52417164	65.2417	65.2417164
2936	Wood dust (1058*)			0.1		0.00002453	0.00000461	0	0.0000461
	TOTAL:					3.978770433	18.588759535	165.7	116.151096

Notes: 1. In column 9: "W" - emission of pollutants, t/year; "MPC" - MPC average daily or (in the absence of MPC average daily) MPC maximum single or (in the absence of MPC maximum single) SRLI; "a" is a constant depending on the pollutant hazard class 2. Sorting method: ascending pollutant code (column 1)

In calculating the dispersion, no exceedances of the MPC have been found as a result of the plant's activities at a distance of 175 m, i.e., negative impact on atmospheric air in the water protection zone is excluded. In the nearest residential area, exceedances of MPCs are excluded. Thus, it is proposed that the calculated emissions be established as maximum permissible emissions (MPE) limits. The facility will therefore be classified as Hazard Class 4 Category 3 during the operational period. The numbering of pollution sources is adopted for the following positions:

- *Source 0001*. Chimney of natural gas and pyrolysis gas combustion furnace. The calculation takes the furnace operation mode - ignition and heating up to pyrolysis gas and the gas mode emitted during the carbonization of rice husk EPG (energy pyrolysis gas).

- *Source 0002.* Ventilation pipe of the section for rice husk carbonizate crushing and charcoal screening. After the pyrolysis process and the charcoal screening, the burnt RH carbonizate is further processed in the crusher to a particle size of 0.1-0.002 mm. The source of emissions is a hammer crusher. The site is equipped with a local exhaust hood. The volume of raw materials processed is 1,696 t/year.

- *Source 0003.* Extruder. Carbonizate is fed into extruders. Under the action of the extruder screw, it is pressed into various configurations of pini-kay shapes. When loaded, carbonized dust (rated as wood dust) is emitted into the atmosphere.

The emission limits by source are presented in the following table:

Table - Air pollutant emission limits by source at the plant for the period of operation

Production workshop, site	Emission source number	Pollutant emission limits				
		Period of operation for 2022		MPE		year of MPE reaching
Pollutant code and name		g/s	t/year	g/s	t/year	
1	2	3	4	5	6	7
Organized sources						
(0301) Nitrogen dioxide						
Production workshop	0001	0.1896	1.0576	0.1896	1.0576	
(0304) Nitrogen oxide						
Production workshop	0001	0.0271	0.16502	0.0271	0.16502	
(0330) Sulfur dioxide						
Production workshop	0001	0.408	1.516	0.408	1.516	
(0337) Carbon monoxide						
Production workshop	0001	1.544	8.07	1.544	8.07	
(0703) 3,4-Benzpyrene						
Production workshop	0001	0.000002803	0.00000244	0.000002803	0.00000244	
(2908) Inorganic dust: 70-20% silicon dioxide						

Production workshop	0001	1.45	5.38	1.45	5.38	
	0002	0.000636	0.000595	0.000636	0.000595	
	0003	0.000975	0.00055	0.000975	0.00055	
(2936) Wood dust (1058*)						
Production workshop	0003	0.00002453	0.00000461	0.00002453	0.00000461	
Total for organized sources:		3.978738433	18.588732895	3.978738433	18. 588759535	
Solid:		1.622438433	6.524152895	1.622438433	6.524152895	
Gaseous, liquid:		2.3563	12.06458	2.3563	12.06458	
Unorganized sources						
(2908) Inorganic dust: 70-20% silicon dioxide						
Production workshop	6001	0.000032	0.00002664	0.000032	0.00002664	
Total for unorganized sources:		0.000032	0.00002664	0.000032	0.00002664	
Solid:		0.000032	0.00002664	0.000032	0.00002664	
Gaseous, liquid:						
Total for the plant:		3.978770433	18.588759535	3.978770433	18.58875953	
Solid:		1.622470433	6.524179535	1.622470433	6.524179535	
Gaseous, liquid:		2.3563	12.06458	2.3563	12.06458	

Compliance with MPE limits is monitored in accordance with OND-90. It is the responsibility of the Company's management to ensure that pollutant emissions are regularly monitored and reported on a timely basis. The maximum emission (g/s) must not exceed the set MPE reference value for each source, the annual emission (t/year) must not exceed the set MPE value. The control system is based on determining the amount of pollutant emissions into the atmosphere and comparing them with the standard values.

Based on the comprehensive survey of the process design solutions used in the construction and operation of the production facility for processing rice husk, it is concluded that, taking into account the recommendations and proposals set out in the detailed design and the implementation of all the requirements of the controlling environmental and sanitary-epidemiological services, the operation of this facility can be characterized as environmentally safe, not having a significant impact on the flora and fauna, soil cover, pollution of surface and ground waters, the atmosphere of the region in question.

4. MITIGATION AND MONITORING PLAN

Mitigation plan

Construction phase				
Measure	Expected environmental impact	Proposed mitigation measure	Responsibility for implementing mitigation measures	Period of implementation of mitigation measures
1. Reconstruction of the workshop for the production line. Minor construction work.	Grading and generation of temporary dust and solid waste emissions are envisaged. Emissions for the period of reconstruction of the workshop are as follows: maximum single emission 2.0830234 g/sec, gross emission 1.36296 t/construction period A total of 15 hazardous substances are emitted into the air during the period of minor construction work, including iron oxides, manganese and its compounds, nitrogen dioxide, nitrogen oxide, soot, sulfur dioxide, carbon oxide, xylene, paraffin, white spirit, C12-19 saturated hydrocarbons , suspended	During grading, the ground will be moistened to reduce the dusting factor. The solid waste generated will be subject to segregation by class and sorted into separate containers with an indication of the type. An agreement for the removal and/or disposal of solid waste will be concluded with specialized organizations. Workers will be provided with adequate personal protective equipment. The area of the production site and the surrounding area will be landscaped with vegetation according to the species and types growing in the region. Wastewater will be collected in collection tanks that are 100% waterproofed and then disposed of under an agreement for the removal concluded with specialized organizations in the region.	Responsibility for the implementation of mitigation measures rests with the subproject team according to employment contracts based on the Environmental Law of the Republic of Kazakhstan, The volume of the released impurities is controlled according to process flow rates.	For the entire period of the workshop reconstruction, equipment installation and minor construction work

	particles, inorganic dust in the form of SiO2 silicon dioxide			
2. Installation and commissioning of production equipment	Generation of temporary dust and solid waste emissions. Waste water generation. Emissions for the operational period are as follows: maximum single emission 3.97877 g/sec, gross emission 18.58876 t/year.	During installation and commissioning, if necessary, moistening of dusty surfaces will be provided to reduce the dust factor. The solid waste generated will be subject to segregation by class and sorted into separate containers with an indication of the type. An agreement for the removal and/or disposal of solid waste will be concluded with specialized organizations. Workers will be provided with adequate personal protective equipment. Wastewater will be collected in collection tanks that are 100% waterproofed and then disposed of under an agreement for the removal concluded with specialized organizations in the region.	Responsibility for the implementation of mitigation measures rests with the subproject team according to employment contracts based on the Environmental Law of the Republic of Kazakhstan,	Directly for the entire period of installation and commissioning of the production equipment, according to the subproject implementation schedule.
Stage of the project work				
Workshops	In the production workshop, the main building is expected to have an environmental impact of low significance due to the launch of a carbonization plant, heated by natural gas	Develop an Emergency Response Plan (ERP) - ensure that there is sufficient space to carry out all types of work safely; - Facilities and buildings must be equipped with fire alarm sensors, fire	Compliance with MPE limits is monitored in accordance with OND-90. It is the responsibility of the Company's management to ensure that pollutant emissions are regularly monitored and reported on a timely basis.	For the entire period of commissioning of the production equipment, bringing the equipment into routine production mode and further operation according to the subproject implementation schedule.

	before the furnace goes into operation. It usually takes up to an hour. Once the furnace is operating, the natural gas supply is stopped and the plant switches to the consumption of purified pyrolysis gas from the carbonization furnace. The unit runs in a closed cycle.	alarm systems, and an automatic fire extinguishing system. The maximum emission (g/s) must not exceed the set MPE reference value for each source, the annual emission (t/year) must not exceed the set MPE value. The control system is based on determining the amount of pollutant emissions into the atmosphere and comparing them with the standard values. Category 1 sources are those for which at Smax/MPEmax.s > 0.5 the inequality M / (MPEmax.s*H) > 0.01 is satisfied at H>10 m and M/(MPEmax.s*H) > 0.1 at H≤10 m where M is the maximum mass emission of a pollutant from a source, g/s; max.s is the maximum permissible concentration of a pollutant, mg/m3; H is the source height, m (at H < 10 m, H = 10 m is taken for calculation) The number and size of emergency exits must be sufficient to evacuate as many people as possible in a safe and orderly manner. - Fire extinguishing equipment must be in good working order and in accessible places.		

		Workers and maintenance personnel will be provided with respirators. The workshop will be equipped with continuous exhaust and supply ventilation. Sensors will be installed to detect sources of air pollution. If the limit of permissible values is exceeded, an audible alarm will sound.		
Fire and explosion hazard	In the event of sources of ignition of inorganic materials in the main production workshop, a warning system will be triggered and then the automatic fire extinguishing system will be activated. The equipment will be disconnected and de-energized. After eliminating the source of the fire. The premise will be ventilated by the ventilation system. The Commission will start investigating the cause of the fire.	Provision of fire extinguishing equipment and automatically closing doors; when carrying out minor construction work, materials capable of withstanding the effects of flame for some time should be used. It is necessary to: - to arrange training of employees in working with flammable materials and in fire prevention and suppression techniques. - be at a sufficient distance from building entrances and exits. - be at a sufficient distance from the air intakes and exhausts of the ventilation systems of the plant or facility. - have natural/passive ventilation at floor and ceiling level and a degassing system in case of explosion. A Health, Safety and Environment (HSE) Officer is permanently elected and appointed by the Company's top management.	It is the responsibility of the plant Health, Safety and Environment (HSE) Engineer to conduct regular monitoring of fire and explosion safety and to report in a timely manner. Introductory briefing, monitoring the implementation of safety regulations and keeping the briefing log shall be carried out by an officer to whom the persons responsible for workshops are subordinate.	For the entire period of commissioning of the production equipment, bringing the equipment into routine mode and further operation according to the subproject implementation schedule.

		- all personnel must be provided with the necessary overalls and personal protective equipment.		
Accident data monitoring	The occurrence of accidents in performing the job functions.	The employer should put in place procedures and systems for reporting and recording of: - occupational accidents and diseases; - hazardous situations and incidents.	The responsibility lies with the Health, Safety and Environment (HSE) Engineer. who is permanently elected and appointed by the Company's top management.	For the entire period of commissioning of the production equipment, bringing the equipment into routine mode and further operation according to the subproject implementation schedule.

Monitoring plan

Construction phase				
Which *parameter should be monitored?*	**Where** *should the monitoring parameter be monitored?*	**How** *should the monitoring parameter be monitored (what should be measured and how)?*	**When** *should the monitoring parameter be monitored (time and frequency)?*	**Who** *should monitor this parameter (responsibility)?*
1. Compliance with emission limits for the construction period	Industrial site	The concentration of pollutants at the boundary of the construction site is determined by instrumental measurements. The following limits are set: - construction waste - 0.7234 - electrode stubs - 0.0293	At least once a quarter The emission of pollutants from the transfer of dusty materials, in K_1 coefficient values, for dust emissions shall not exceed the specified parameters, g/cm^3.	Measurements are carried out by an accredited laboratory with the appropriate scope of accreditation.

		- municipal (solid household) waste - 1.7623 - sand - 0.05 - clay - 0.03 - coal - 0.03 - ash - 0.06		
2. Fire and explosion hazard	Storage facilities and production workshop	The measures should be carried out according to the Emergency Response Plan (ERP). Employees must be trained in working with flammable materials and in fire prevention and suppression techniques. Equipped with fire-fighting equipment and automatically closing doors; materials capable of withstanding the effects of fire for some time should be used in the construction of the premises.	At least once a quarter The production facility must be so designed and technically constructed that people can be evacuated from the it before the maximum permissible fire hazards have been reached, and if evacuation is not feasible, people must be protected in the facility. To ensure evacuation , it is necessary: - to establish the number, dimensions and appropriate design of escape routes and exits; - to ensure the possibility of unobstructed movement of people along escape routes; - to control, if necessary, the movement of people along escape routes (lighted signs, audible and verbal announcements, etc.).	A Health, Safety and Environment (HSE) Officer.

3. Control of temporary waste storage sites (separate collection, compliance with sanitary requirements for collection and storage, time control - not more than 6 months, for solid waste no more than 3 days)	Industrial site, specially designated places	Maximum emission, t/year: - rice husk bales - 1.14 - starch bags - 0.208 - sweepings from the area - 59.26 - municipal (solid household) waste - 9.9 - inorganic dust with a SiO_2 content of 20-70% is assumed -- 0.043 g/s;	Checked as raw materials arrive at the warehouse. Emission of pollutants from all types of transfer of dusty materials (loading and unloading operations) is determined by the formulas [Methodology for calculating pollutant emissions into the atmosphere from enterprises producing construction materials. Approved by Order No. 100-p dated April 18, 2008 of the Minister of Environmental Protection of the Republic of Kazakhstan.	A Health, Safety and Environment (HSE) Officer.
4. Control of water consumption and wastewater disposal, liter (rational use of water resources, use of recycling water supply, control of timely disposal of domestic wastewater)	Industrial site	Water consumption m^3/year: Technological needs of the production building - 992 Sanitary and household needs - 474.5 Cleaning of premises – 119.4066 Watering of green spaces - 2221.578 Total: 4047.331	Regular inspection based on the methodology recommended in the Methodological Guidelines for Environmental Impact Assessment of Economic Activities (approved by Order No. 270-p dated October 29, 2010 of the Minister of Environmental Protection of the Republic of Kazakhstan).	Health, Safety and Environment Officer, Production Technologist.
Operation stage				
1. Compliance with emission limits for the construction period	In the production area	Compliance with MPE limits is monitored in accordance with OND-90.	At least once a year during the operational period of the production workshop.	Measurements are carried out by an outside organization on the basis of a contract for the

		The maximum emission (g/s) must not exceed the set MPE reference value for each source, the annual emission (t/year) must not exceed the set MPE value. The control system is based on determining the amount of pollutant emissions into the atmosphere and comparing them with the standard values. The plan-schedule* for monitoring compliance with the MPE limits at the emission sources and control points at the plant for the operational period is presented below.		provision of emission control services for the company.
5. Monitoring the efficiency of catalytic waste gas afterburning	Gas exhaust system	The content of gas impurities in the working area should not exceed, vol.%: CO_2 – 0.2 CO – 0.12 CH_4 – 0.03 C_2H_4 – 0.05 C_2H_6 – 0.05 C_3H_8 -0.05 C_4H_{10} -0.05 H_2 -0.02	Once per shift Control of achievable dust content levels: - average value of mg/m^3, no more than 30 - daily average value mg/m^3, 0.04-5.0	Measurements are taken using a gas analyser, a Health, Safety and Environment Officer.
6. Monitoring the efficiency of the dust collection system, timely replacement of filtering medium	Ventilation systems	Measurement of the suspended materials concentration in the air of the working area. The carbonizate is ground to minus 20 microns. The filter system is less than 1 micron. The	At least once a quarter. The dust collection system on bag filters must correspond to mg/m^3 - less than 5.0	Measurements are carried out by a laboratory technician of an accredited laboratory with the appropriate scope of accreditation.

		excess dust in the working area should not exceed 50 g/m^3.		
7. Acceptance and storage of raw materials	Raw materials warehouse	The loading and unloading area must have a foundation that ensures the stability of lifting and handling equipment, stored materials and vehicles. The stacking area must be marked with the boundaries of the stacks, the aisles and driveways between them. It is not permitted to place loads in aisles and driveways. The width of the driveways must ensure the safety of vehicles and material handling equipment. The loading and unloading area, including aisles and driveways, must have adequate natural and artificial lighting.	The packaging must ensure the tightness and safety of the material during loading and unloading operations, as well as during transportation.	Production technologist
8. Occupational health and safety briefing	Production personnel	The personnel must be provided with overalls, protective equipment for hands, respiratory organs, eyes.	Safety briefing is carried out daily before the start of the shift.	A Health, Safety and Environment Officer.
9. Equipping workplaces with warning signs	Production site, production workshop	- Hazardous areas, installations, materials, safety measures and emergency exits must be marked accordingly. - Colour-coded hazard memos should be displayed at emergency entrances to the hazardous area from the outside and next to the fire alarm system, where they will	Periodically, once a year, familiarization visits and inspections should be arranged with representatives of the local emergency and security services, who should have an understanding of the hazards at the plant.	A Health, Safety and Environment Officer.

		be immediately visible to emergency responders.		
10. Monitoring data on accidents and diseases	Production personnel	Logging data on accidents and diseases.	The log is filled in as the accident occurs.	A Health, Safety and Environment Officer.
11. Safe operation of equipment	Production workshop	The intensity of the thermal irradiation from the carbonization furnace must not exceed 140 W/m^2. In industrial premises, to prevent overheating, the operating temperature must not exceed 31 and 32°C.	It is checked regularly during the shift.	Production technologist
12. Quality control of finished products	Finished products warehouse	The control is carried out according to the "Quality Passport" and the regulatory document - STTOO 171040009247 – 01-2021 When processing 1,000 kg of RH with a moisture content of 3 to 5%, it is subjected to a pyrolysis process after preliminary drying. The process results in several types of products: - 0.4 tons of rice husk carbonizate (RHC), a factor of -2.5 is introduced; - 0.37 tons of organic aqueous product (OAP), a factor of - 2.7 is introduced; - 0.208 tons of energy pyrolysis gas (EPG), a factor of -4.8 is introduced;	The following is checked upon transfer of the finished material to the warehouse: - the name and location of the manufacturer; - product name; - date of manufacture; - net weight; - designation of these specifications;	Production technologist

		- 0.022 t - unexpected losses.		

*- The plan-schedule for monitoring compliance with the MPE limits at the emission sources and control points at the plant for the operational period

Production, workshop, site	Controlled substance	Control frequency	Control frequency during the periods of adverse weather	MPE limits		Who controls	Control method
				g/s	mg/m3		
Production workshop	Nitrogen dioxide Nitrogen	once a year		0.0086	393.29381	Outside organization	4004*
	oxide Sulfur dioxide	once a year		0.0014	64.024574	Outside organization	4004*
	Carbon monoxide	once a year		0.0481	2199.7014	Outside organization	4003*
	Inorganic dust: 70-20% silicon dioxide	once a year		0.1295	5922.2731	Outside organization	4010*
		once a year		0.1608	7353.6796	Outside organization	4104*

*4003 - Method of measurement (MM) of sulfur dioxide mass concentration in industrial emissions of organized suction in metallurgy, chemical industry, building materials industry and during fuel combustion (photometric method) (MM No. Pr. 2000/10). VAMI-NAUKA JSC
*4004 - MM of nitrogen oxides mass concentration in mineral fertilizer production emissions at the workshops: NPK, ammonium nitrate, nitric acid, ammonia. Akron OJSC
*4010 - MM of of carbon monoxide concentrations from fossil fuel combustion sources by gas chromatographic method (PND F13.1.5-97) Atmosphera Scientific Research Institute
*4104 - MVI of dust concentration in industrial emissions of organized suction (gravimetric method) (MM No. Pr. 2004/4). VAMI-NAUKA JSC

Public consultations

The EMP is publicly available on the website https://tenir.kz/blog/ и https://biocarbon.kz/glavnaya/news/

On 01.12.2021, an announcement about public consultations was posted on the announcement board of the Bakanan Village Akimat, the Land Committee Service (this is a standard method of notifying the villagers, since there is no local press in the village and not every resident, especially older ones, has the Internet). The public consultations took place. The public consultations took place at the address: Industrial zone, 122/A Saken Seifullin str., Bakanas village, Balkhash district, Almaty region. The time of the event is 14.12.2021 at 02.00 PM. The following topics were covered:

- creation of new jobs in the Bakanas village and the involvement of locals;
- possible process gas, solid or liquid waste;
- environmental safety of production;
- monitoring and the process controls used;
- social events;
- economic benefits to the Bakanas village from the implementation of the project.

Members of the project team, 25 locals and 3 representatives from the Akimat and the Land Committee of the village took part in the consultations (Signature sheet attached). During the discussion of the project, representatives of the relevant authorities as well as locals were introduced to the EMP, they asked questions and made comments and suggestions. The minutes of the public consultations are attached.

Annexes to this EMP:

1. Minutes of the public consultations on the EMP No. 01 dated 14.12.2021.
2. Statement of planned activities No. KZ69RYS00190025 dated 02.12.2021.
3. Project justification letter No. NK-IK-004 dated 06.12.2021
4. Screening report (expected in January 2021)