APPROVE
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«____» _____ 2021.

Construction of the third line of the underground gas pipeline from GDS " Navoi-4" (from KP 0.0 to KP 8.9) to "Navoi TPP" JSC 8.9 km long on the territory of Karmaninsky district of Navoi region

Draft environmental impact statement (DEIS)

DEVELOPED:
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CONTENT

1. INTRODUCTION

AND JUSTIFICATION OF THE NECESSITY OF CONSTRUCTION

This draft environmental impact statement (DEIS) was developed for the construction of the third line of the underground gas pipeline 15.53 km long, from GDS "Navoi-4" (from KP 0.0 to KP 8.9) to Navoi TPP JSC on the territory of Karmaninsky district, Navoi region

Diameter of the gas pipeline under construction is 1020 mm. The gas pipeline will pass through the land plots of Karmaninsky district of Navoi region. Capacity - 240 thousand m^3 / hour.

Connection point of the projected gas pipeline is the existing gas distribution station (GDS) "Navoi -4».

The gas pipeline will be laid through Yangi Arik MPG, Uyrot MPG, Durman MPG, Jaloyir MPG of Karmaninsky district.

A land plot of 17.8 hectares is temporarily allotted for the construction of the gas pipeline.

The gas pipeline is designed for uninterrupted supply of natural gas, which does not contain sulfur compounds, of the projected 3,4 steam-gas-turbine unit (CCGT), belonging to Navoi TPP OJSC and for increase in the plant capacity.

The gas pipeline is connected to existing GDS "Navoi-4" through shut-off valves and valve assembly with one-side blowdown DN 150 mm.

The project envisages construction of:

- Underground gas pipeline with diameter of 1020 x 10 mm, connected to existing gas distribution station "Navoi-4" through shut-off valves;
- Gas pipeline with 8.9 kilometers long, from existing gas distribution station (GDS) Navoi-4 with diameter DN-1020 mm (from KP 0.0 to KP 8.9) of the existing gas pipeline of JSC “Navoi TPP”.

For the existing gas pipeline from KP 8.9 to Navoi TPP JSC, all design documentation has been developed and approved, as well as draft EIS has been developed and conclusion of the state ecological expertise has been issued. At the same time, this draft EIS is being developed only for the gas pipeline 8.9 km long from KP 0.0 to KP 8.9

The section of the detail design "Environmental impact assessment" is carried out in accordance with the requirements of ShMK 1.03-06-03 and Regulations on the State Ecological Expertise in the Republic of Uzbekistan. At the first design stage, as part of the detailed design documentation, "Draft Environmental Impact Statement" (draft EIS) is developed, which is the first stage of EIA procedure.

The main tasks of this work are:

- assess the degree of negative environmental impact during the gas pipeline operation;
- conduct environmental analysis of the design solution, while determining types, objects and nature of the impact;

The assessment of the environmental impact during gas pipeline operation was based on the analysis of the current natural environmental condition, operating equipment, vehicles, and identification of sources of emissions, discharges and waste.

The level of air pollution from the gas pipeline emissions was calculated after the implementation of the proposed in the draft solution and its compliance with the requirements of the State Environmental Committee was determined.

When performing the work, we were guided by the "Regulations on the State Environmental Expertise in the Republic of Uzbekistan", Resolutions of the Cabinet of Ministers of the Republic of Uzbekistan No. 541dated 07.09.20, defining the composition and scope of the presented section of the environmental impact assessment

Determining the enterprise category by environmental impact

In accordance with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan. Dated September 7, 2020 No. 541 (Annex No. 2) this object refers to 3 category of environmental impact.

2. Environmental condition in the construction area

Location– Navoi region, Karmaninskiy district, Yangi Arik MPG, Uyrot MPG, Durman MPG, Jaloyir MPG 8,9 km long.

The gas pipeline is being laid on the territory of Karmaninsky district along Bukhara-Tashkent railway at a distance of 300 meters, located on northern side of the laid gas pipeline.

The laid gas pipeline is bordered on all sides with the pasture areas of Karmaninsky district.

The gas pipeline does not cross roads and railways.

3. BRIEF PHYSICAL- GEOGRAPHICAL AND CLIMATIC CHARACTERISTICS OF THE AREA

The site of the projected facility is located in the territories of Kiziltepa district. The climate has features common to all Uzbekistan and its own specific features.

In the annual wind rose, eastern direction is predominant, however, its distribution throughout the year varies, so, in the summer months the frequency of winds of northern and north-eastern directions increases, and in winter, it decreases sharply.

One of the meteorological factors that determine the conditions for dispersion of pollutants in the atmosphere is wind speed. In the study area, the average wind speeds throughout the year vary from 1.9 to 3.5 m / s. The average annual wind speed is 2.4 m / s.

Location of the study area in the depth of the continent determines its climate: sharply continental, warm, very dry in summer and humid, relatively cold in winter, as well as significant annual and daily fluctuations in air temperature. The average

annual air temperature in the region is 15.7 ° C. The coldest month is January (4.1 ° C), the hottest is July (28.5 ^{0}C).

Climatic data

№	Characteristic	Unit of measurement	Value
1	Coefficient A, depending on the temperature stratification of the atmosphere and determining the conditions for the dispersion of pollutants in the atmospheric air	-	200
2	Average temperature of the hottest month (July)	^{o}C	28,5
3	Average temperature of the coldest month (January)	^{o}C	4,1
4	Average annual temperature	^{o}C	15,7
5	Average annual frequency of wind directions for 8 points:		
	N	%	2
	NE		18
	E		30
	SE		18
	S		3
	SW		9
	W		10
	NW		10
	No wind		15
6	The highest wind speed, exceeding which will be 5%, U*	m/s	7.0

The annual distribution of precipitation is characterized by the greatest moisture in the spring - winter period, and the least- in the summer, the minimum falls in September.

4.
CHARACTERISTIC OF THE CURRENT ENVIRONMENTAL CONDITION

4.1. Existing atmospheric air condition

In the area of the gas pipeline construction, there are no existing sources of environmental impact, a small impact may be from Bukhara-Tashkent Railway, which runs along the south side of the gas pipeline at a distance of 300 meters.

Natural sources of pollution of the atmosphere, soil and vegetation at high wind speeds include dry underlying surface.

4.2. Surface water and groundwater.

The main waterway of the area is the river Zarafshan.

The main water receiver of the surface and ground runoff, drained through the collection-drainage network, is the river Zarafshan.

With regard to the classification of groundwater deposits, the study area refers to group 3 with complex hydrogeological conditions due to the variability of thickness, structure of the aquifer and filtration properties of water-bearing rocks. Groundwater is opened at a depth of 2.5-3.0m.

In terms of chemical composition, groundwater is sulfate-chloride, sodium-calcium with dry residue from 2.0 to 5.0 g/l.

4.3. Soils, vegetation and wildlife

The gas pipeline will be located on the even land of the Zarafshan Valley. Fluctuations in the amplitude of absolute marks of the territory does not exceed 0.1 - 0.2 m. Quaternary deluvial-proluvial deposits, represented by macrofragmental soils with interlayers of loam, are present in the geological structure.

Soils - The surface of the district soil is composed of gray soils, which are the original soil type. On typical gray soils, formed mainly on the underlying loess-like rocks, dry land farming is developed.

The period of the most intense and deep soil-forming processes falls on spring and part of winter. When maximum moisture is reached, determining quite deep leaching of easily soluble salts and accumulation of carbonates in the upper part of the soil profile. Exuberant vegetation contributes to the formation and accumulation of organic matters, as well as the main elements of plant nutrition.

Uniform development of the humus horizon is observed, its thickness is 30-40 cm. Content of humus is 3-6%, nitrogen – 0, 2-0,7 %.

Soils are weakly alkaline: pH varies insignificantly over the area: from 7.5 to 8.5 and for most of the territory is 8.

Content of toxic elements in ground and soils does not exceed the background value for the soils of the region.

The allotted area is unsuitable for agricultural use, despite this, before the start of **construction, top soil 30 cm (0.3 m) thick is removed.** The soil is temporarily stored in a dump at the border of the site. After the completion of construction work, the soil is transported to the nearest cultivated fields for planting green spaces, and part of it is used for reclamation of the construction site.

Among the animals of the area under consideration, which is highly dusty and noisy, it is possible to name only groups that can hide from noise exposure, in the soil - these are insects and reptiles (desert lidless skink, rapid fringe-toed lizard, tessellated water snake, Central Asian turtle), or species that can quickly leave unfavorable areas - birds (tree sparrow, Senegal turtle dove, common starling, European swallow, red-rumped swallow, black swift, myna, magpie). Amphibians - toads and frogs - settle in areas with stagnant or running water. Among mammals, the house mouse, mole vole, common bat, tamarisk gerbil, eared hedgehog, and pygmy shrew are ubiquitous.

There are no previously planted trees and other constructions on the construction site.

4.4. Assessment of current environmental condition

Ecological state in the considered location area is determined by natural conditions and the nature of the environmental components impact from anthropogenic sources of impact.

The natural conditions of the region are characterized by sharply continental climate and extremely unfavourable conditions, characterized by high air pollution potential.

Soil pollution in the area in question is caused by intensive irrigation farming using mineral fertilizers and chemicals.

According to the totality of factors characterizing anthropogenic impact, the state of the environment in the area under consideration is assessed as acceptable.

5. ENVIRONMENTAL ANALYSIS OF THE DESIGN SOLUTION

Technological process

The project envisages construction of:

- Underground gas pipeline with diameter of 1020 x 10 mm with length of 8.9 kilometers, which connects to existing GDS "Navoi- 4"

The gas pipeline is connected through shut-off valves from the existing gas distribution station (GDS) Navoi-4 to the existing gas pipeline with diameter DN-1020mm (KP 8.9) of the existing gas pipeline of "Navoi TPP" JSC.

- The capacity of the gas supply system is 240,000 Nm3 / hour..

The projected pipeline has the following basic characteristics:

- gas pipeline diameter - 1020 mm;
- thickness of the pipe wall - 10 mm;
- pressure - 12 kgf/cm^2;
- length - 8,9 km;
- capacity - 240000 nm^3/hour;
  or 2102400 thousand m^3/year

The gas pipeline branch is laid underground at depth of 0,8 m, width of the trench along the bottom is 0,8 m.

The project also provides for the possibility of blowing the measuring strands of pipelines DN 150 by bringing it to the purge plug DN 150 mm

The safety valves assembly consists of a switching device and two safety valves DN 150 mm. The assembly is designed to protect against an increase in gas pressure, from the given pressure at the outlet of the gas distribution station. When the gas pressure rises, gas is released through the purge plug DN 150 mm.

Sources of air pollution at the designed facility will be:

- emissions during commissioning of new gas branch pipelines DN-1020 and when pre-valves are blown
- emissions during cleaning of the gas pipeline branch DN-1020
- leakiness of connecting nodes and elements in the gas pipeline system
- when carrying out electric welding.

All sources of release and emissions of harmful substances into the atmosphere are subdivided into permanent and periodic- technological and inevitable.

The first group includes gas leaks from the gas pipeline. The source of the periodic action is the purge plug.

Emergency gas emissions through the purge plugs are produced within 10 minutes. Thus, emissions from intermittent sources are classified as salvo.

The projected gas pipeline has 3 emission sources, of which, source No. 2 is permanent, source No. 1 is salvo or emergency, and one more unorganized source (source No. 3) during electric welding works.

4. IMPACT DURING CONSTRUCTION

Installation and piping of the main auxiliary equipment, pipelines and instrumentation and control equipment in safe and organized manner will be carried out by specialized divisions of the enterprise.

Excavation, concrete or other construction and installation works have negligible impact on the environment

In general, no adverse impact on air quality, water quality, soil and groundwater pollution during construction is expected.

5. TYPES AND LEVELS OF ENVIRONMENTAL IMPACT AFTER COMMISSIONING.

5.1. Characteristics of the facility as a source of atmospheric pollution.

Calculations of emissions of harmful substances into the atmosphere are given in Annex No. 1. According to the calculations, 8 types of hazardous substances are emitted from gas pipelines into the atmospheric air during an annual period of time in the amount of **264,54118** t / year (taking into account welding emissions).

Name of the emitted substance	Emissions t/year
Methane	252,8862
Sum of methane and ethylene	9,2559
Sum of propane and propylene	1,7592
Butane	0,4601
Pentane	0,1353
Odorant NMM (Natural Mercaptans Mixture)	0,0433
Iron oxide	0,00101

Manganese oxide	0,00017
Total:	**264,54118**

According to the calculations made during an annual time interval, 264,54 tons of hazardous substances of 6 names (excluding emissions during welding) are emitted from gas pipelines into the atmospheric air, of which salvo emissions are 24,1207 tons / year.

Sources of air pollution at the projected facility will be:

Emissions during commissioning of new branch gas pipelines DN-1020 and during cleaning of the branch gas pipelines;

Leakage of connecting nodes and elements in the gas pipeline system;

During electrical welding.

Sources of release and emissions of harmful substances into the atmosphere are subdivided into permanent, periodically technological and inevitable. The first group includes gas leaks from the gas pipeline.

Thus, emissions of periodic sources are classified as salvo emissions.

The projected gas pipeline has 3 emission sources, of which, source No. 2 is permanent, source No. 1 is salvo or emergency, and one more unorganized source (source No. 3) when conducting electric welding works.

When calculating the fields of dissipation of harmful substances, salvo and emergency (blowdown) emissions and temporary emissions that are formed during electric welding work are not taken into account.

The calculation of the harmful substances dissipation in the ground layer of the atmosphere is carried out only for sources of constant action.

Calculations and analysis of the results of calculating the dissipation of surface concentrations of harmful substances in the atmosphere

Calculation results Cm, Mm, Xm for emissions of harmful substances, performed on a computer. Where:

Cм- maximum surface concentration of harmful substances in fractions of maximum allowable concentration.

Mм – dangerous wind speed, m / s.

Xм - distance from the emission source at which the maximum surface concentration is observed in m.

All initial data are entered into the electronic computer. The calculation of the dissipation of harmful substances in the atmosphere contained in emissions was carried out in accordance with the "Methodology for calculating the concentration of harmful substances in the atmospheric air contained in emissions from enterprises" (IND-86).

Calculation was carried out on the computer of "PENTIUM-4" type using "Rainbw" program recommended by the bodies of the State Environmental Committee of the Republic of Uzbekistan

In the calculation, master site layout was used on a scale 1:50000.

Size of the calculated rectangle is 6000x6000m.

Emission sources are placed in the center of the calculated rectangle. The computational grid spacing is taken as 200 m.

Dangerous wind speed and dangerous wind direction are automatically selected by the computer. Spacing of selecting dangerous wind direction is 45 degrees.

The main criterion for assessing the environmental impact for sources of pollutants emissions into the atmosphere is the ratio:

$$\frac{C}{MAC} < K$$

Where: MAC – maximum allowable concentration of a harmful substance, mg/m^3

C – calculated concentration of harmful substances in the surface air layer from all emission sources at the border of the sanitary protection zone.

- Quota, which should not exceed the established norms at the border of the sanitary protection zone.

To assess the impact of emissions, quotas were used, adopted in accordance with the "Quotas for pollutants emitted into the atmosphere by enterprises of the Republic of Uzbekistan."

At that, its territorial location (Navoi region) and the hazard class of harmful substances emitted into the atmosphere were taken into account. For substances for which the hazard class was not determined, the quota was adopted based on the value of established SRLI. Quotas for all ingredients are shown in the tables below.

Calculation of the dissipation of surface concentrations was made only for source No. 2. Sources 1,3 are salvo and temporary emissions.

5.2. Water supply and drainage

Drinking water during the installation of engineering structures is imported. Technical water is not used.

Drinking water is stored in a mobile tank 2.0 m^3 that meets sanitary requirements. The tank is filled periodically with the help of special water carriers. Drinking water is used only for household needs.

Drinking water consumption

Estimated calculation of water consumption for household needs was carried out according to SNiP 2.04.01 — 85.

Water consumption per worker is 25 l/day.

25 l/day * 6 workers. = 150 l/day.

According to the project, the number of working days for the construction of utilities is 120 (3 months) days per year.

120 * 150 = 1800 l/year, or 18 m^3/year

where: 120 – number of working days per year.

5.3. Generation and disposal of production and consumption waste

During the installation and operation of the gas pipeline branch, the following production wastes are generated:

- waste of electrodes ANO -3.

When conducting electric welding works, wastes of electrodes (cinders) ANO-3 are generated in the amount of 20 kg or 0.02 tons

Household waste

Solid household waste is formed during human processes, calculated according to the formula:

$$M = N \times 50,$$

Where: N – list-based number of employees, engaged in construction work, people;

50 – annual waste generation rate, kg/person.

Construction work is carried out for 3 months a year

50:4 = 16,7 kg from 1 worker M_1= 6 x 16,7 /1000 =0,10 t/year.

Household waste and waste from the outdoor toilet is buried at the place of formation in the steppe zone.

6. ASSESSMENT OF EMERGENCY SITUATIONS.

Emergency situations include a gas pipeline break-off caused by wear of the gas pipeline metal, failure or malfunction of shut-off valves and pipelines for transporting natural gas and possibility of injury and burns during purging (blow off) and other construction work.

In this case, natural gas is emitted into the atmospheric air and explosive mixture is formed.

The radius of the blast wave action with gas pipeline diameter of 1020 mm is 50-60 meters.

In the event of damage to the gas pipeline, it is necessary to stop the technological process and, with the help of shut-off valves, stop the supply of natural gas to the section where the emergency occurred.

In the above cases, it is necessary to stop the natural gas supply (purge) process and provide first aid and call an ambulance. Fire protection is carried out according to the approved instruction containing specific fire-fighting measures, as well as determining for it the number and place of storage of primary fire-extinguishing means and firefighting equipment.

The specified instruction must be agreed with the fire authorities

7. Measures for environmental protection

Environmental protection measures for all types of construction and installation work should be carried out in accordance with the method statement (MS), agreed with the local environmental authorities.

In order to reduce environmental intervention, all construction and installation work must be carried out exclusively within the right-of-way area.

Pipe laying should be carried out within right-of-way area.

• enlargement and increase of technological readiness of structures and materials should be widely used, including carrying out in basic conditions of welding of pipe sections;

• preparation and sealing of pipe edges for orbital welding;

• installation, insulation of in-line valve assemblies and gate valves;

• cleaning and protection of the inner cavity of pipe sections and equipment from the ingress of foreign objects, soil, dirt and snow.

When performing construction and installation work, it is necessary to reclaim lands with bringing them to the state suitable for further use and to take measures to preserve and restore the vegetation cover.

After completion of construction work at the construction site, all construction and auxiliary waste, artificial protective materials are transported to the solid household waste landfill in Navoi.

8. CONTROL SYSTEM

During the operation of the gas pipeline, periodic monitoring (annually) of atmospheric emissions from gas pipelines is carried out. Control is carried out by the relevant services after the construction of the facility (after development of the Statement of environmental effects).

9. CONCLUSION

(FORECAST OF THE ENVIRONMENTAL CONDITION AFTER PROJECT IMPLEMENTATION)

Assessment of environmental changes as a result of the pipeline commissioning showed the following results

9.1. Atmospheric air

Emissions of hazardous substances of natural gas components will be continuous, mostly they will have volley (salvo) character, however, supply of hazardous substances at the construction and operation site will not create concentrations exceeding those permitted by the State Environmental Committee of the Republic of Uzbekistan.

According to the calculations carried out to determine surface concentrations using "Rainbow" program, there is no excess of the established quota.

"Rainbow" program calculates the emission of harmful substance at one point, therefore, it exceeds quotas; these emissions are actually emitted from different points along the gas pipeline. For this, in fact, the maximum one-time and average daily concentration of the above substances does not exceed established permissible norms (quotas) for the residential area and will not have a significant impact on the environment and public health.

Waste of electrodes in the amount of 0,02 tons (during the installation of the gas pipeline) is temporarily stored in the allotted place and then handed over to "Vtorchermet" of Navoi.

Household waste in the amount of 0,1 tons is collected in a special pit, and buried after the completion of construction work. Waste from the outside toilet is buried at the place of formation in the steppe zone.

Generated industrial and household waste will not have significant impact on the environment.

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ANNEX №1

Source № 1

Calculation of emissions when purging gas pipelines

D, m	N, m	W, m/s	V, m^3/s	T, ^0C	Source type
0,05	4,0	59,1	0,116	20,0	Organized point source

After completion of construction and installation work and filling of gas pipelines, in the process of putting them into operation, it becomes necessary to purge or release the pipe from gas.

Emitted into the atmospheric air: natural gas.

The gas pipeline is 8.9 km long.

Emission duration 20,0 min.

Natural gas components:

Name	Indicator	Average
Methane	93,41 – 93,47	93,44 %
Sum of ethane and ethylene	3,40 – 3,43	3,42 %
Sum of propane and propylene	0,64 – 0,65	0,65 %
Butane	0,16 – 0,17	0,17 %
Pentane	0,04 – 0,05	0,05 %
Odorant NMM (mixture of natural mercaptans)	0,016 g/m^3	0,016 g/m^3

Gas loss calculations were made according to L.9

The volume of gas Vin m required for purging and filling with gas of the external gas pipeline, medium and high pressure, is taken not more than 100000 Pa.

Calculation of one-time gas volumes required for purging and filling gas pipelines during their commissioning after the completion of construction and installation work is determined by the formula:

The nature of the emission is salvo.

$$V_p = \frac{0{,}0036 \times V_c \times (P_a + P_r)}{273{,}15 + t_r}, \ m^3$$

Geometric volume:

$$V_c = \frac{\Pi \times d^2}{4} \times L = \frac{3{,}14 \times 1{,}0}{4} \times 8900 = 6986{,}5 \ m^3$$

$$V_p = \frac{0{,}0036 \times 6986{,}5 \times (97000 + 100000)}{273{,}15 + 20} = 16902 \ m^3$$

Total for gas pipelines upon commissioning – 16902 m^3

Emission can occur during commissioning and testing of the gas pipeline or during the technical examination of the gas pipeline, which is carried out 2 times a year, and pre-valves blowing is carried out periodically.

In this regard, the volume of gas from the source is equal to 16902*2= 33804 m^3/year.

The average annual amount of pollutants, emitted into the atmosphere, is calculated by the formula:

$$G_{year} = V_p * R * J * 10^{-3} \quad t/year.$$

Where: $V_{пр}$ - gas consumption for purging gas pipelines and gas equipment, m3 / year.

R - gas density, kg / m^3 R = 0,73

J - average proportion of pollutants in gas composition, %

During the annual time interval, it is emitted from the source in t / year:

Name of dangerous substances	**Gas losses, m^3/year**	**Gas density kg/m^3**	**Gas composition, %**	**Emissions in t/year**
Methane	33804	0.73	93.44	23.0581
Sum of ethane and ethylene			3.42	0.8440
Sum of propane and propylene			0.65	0.1604
Butane			0.17	0.0420
Pentane			0.05	0.0123
Odorant NMM (mixture of natural mercaptans)			0.016	0.0039

Maximum amount of pollutants emitted into the atmosphere is calculated using the formula:

$$V_{sec} = V_p / T^* \ m^3/sec$$

Where: **T** - emission time, seconds (T = 20*2=40,0 min/year * 60 sec. = 2400 sec./year).

V_p - gas consumption for purging gas pipelines and gas equipment, m^3 / year

The amount of emissions of harmful substances in g / sec is determined by the formula:

$$G = V_{sec} \ x \ g \ x \ C \ x10 \ g/sec$$

Where: **g** - gas density, kg/m^3

C - percentage of harmful substances by weight in the composition of natural gas.

It is emitted from the source in g / sec:

:

Name of dangerous substances	**Gas losses, m^3/year**	**Gas density kg/m^3**	**Gas composition, %**	**Emissions in t/year**
Methane	14.085	0.73	93.44	9607.5475
Sum of ethane and ethylene			3.42	351.6461
Sum of propane and propylene			0.65	66.8333
Butane			0.17	17.4795
Pentane			0.05	5.1410
Odorant NMM (mixture of natural mercaptans)			0.016	1.6451

Source № 2

Natural gas leakage emissions calculation (through leakage of flange and threaded connections, in glands)

D, m	N, m	W, m/s	V, m^3/s	T, ^0C	Source type
0,5	2,0	2,4	0,471	28,5	Unorganized point source

The source of emission is the leakage of gas pipelines under normal operating conditions (through leakage of flange and threaded connections, in the glands).

Emitted into the atmospheric air: natural gas.

Duration of emission 24 hours a day, 365 days a year.

Natural gas components:

Name	Indicator	Average
Methane	93,41 – 93,47	93,44 %
Sum of ethane and ethylene	3,40 – 3,43	3,42 %
Sum of propane and propylene	0,64 – 0,65	0,65 %
Butane	0,16 – 0,17	0,17 %
Pentane	0,04 – 0,05	0,05 %
Odorant NMM (mixture of natural mercaptans)	0,016 g/m^3	0,016 g/m^3

Gas losses in gas pipelines and structures associated with leakage of gas pipelines under normal operating conditions (through leakage of flange and threaded connections, in glands)

Calculation of gas losses through non-density of flange and gland connections of gas pipelines.

Determining gas losses G, g/s, and gas volume V, m^3/h lost through leakage of gas pipeline flange connections.

Inner diameter of the blow-off gas pipeline, d	1,0 m.
Gas pipeline length, l1	8900 m.
Excessive gas pressure in the gas pipeline, Pг	120000 Pa.
Absolute gas temperature, Tг (273,15 + 200˚C)	293,15 K.
Safety factor, ή	2
Non-tightness (leakage) factor, m	0,002
Gas density, ρ	0,73 kg/m^3.
Molecular weight of methane, M	16,043 kg/kmol

The volume of the gas pipeline cavity V, m3, between the disconnecting devices is determined by the formula (7) and is:

$$V_{г1} = \frac{\pi \times d^2}{4} = \frac{3,14 \times 1,0^2}{4} \times 8900 = 6986,5$$

Gas losses G, g / s, released through leakage of the gas pipeline flange joints, is determined by the formula (21) and is:

$$G = 3,57 \times 0,278 \times 10\text{-}5 \times \eta \times Pг \times m \times Vx \sqrt{\frac{M}{T}} =$$

$$= 3,57x0,278x10^{-5}x2x12,0x10^5x0,002x6986,5 \times \sqrt{\frac{16,043}{293,15}} = 7,786$$

The volume of gas losses released through leaks of flange connections of gas pipelines V, m3 / h, is determined by the formula (22) and is:

$$V = \frac{G}{\rho_г} = \frac{7{,}786 \times 3600}{0{,}73 \times 1000} = 38{,}396 \text{ m}^3\text{/hour}$$

Determining gas consumption, Q_{leak}, $1x10^3$ m^3/month, lost with losses through leaks of shut-off valves joints.

For gland joints:

Gas leakage through gland leaks, q_{leak}	0,021 kg/h
Working time fund (load factor) for the analyzed period, τ	730 h
Percentage of joints (seals) that have lost their tightness, a	0,293
Gas density, ρ	0,73 kg/m^3
Number of shut-off and control valves, b1	2
Number of flanges per valve, b2	2

$$Q_{утеч} = \frac{Q_{leak} \times т \times a \times b_1 \times b_2 \times 10^{-3}}{\rho} = \frac{0{,}021 \times 730 \times 0{,}293 \times 4 \times 2 \times 10^{-3}}{0{,}73} = 0{,}049 \text{ thousand m3/month}$$

$$Q_{leak} = \frac{0{,}049 \times 1000 \times 12}{365 \times 24} = 0{,}067 \text{ m}^3\text{/hour.}$$

Total gas losses in gas pipelines and structures associated with leakage of gas pipelines under normal operating conditions (through leaks in flange and threaded connections, in glands)

Q_{year} = 38,396+0,067=38,463 m^3/hour or 38,463x365x24=336936 m^3/year.

Average annual amount of pollutants emitted into the atmosphere is calculated by the formula:

$$G_{year} = V_p * R * J * 10^{-3} \quad \text{t/year.}$$

Where: V_{leak}- total volume of gas leakage entering the atmosphere, m3 / year.

R - gas density, kg/m3 R = 0,73

J - average proportion of pollutants in gas composition, %

During the annual time interval, it is emitted from the source in t / year:

Name of dangerous substances	**Gas losses, m^3/year**	**Gas density kg/m^3**	**Gas composition, %**	**Emissions in t/year**
Methane	336936	0.73	93.44	229.8281
Sum of ethane and ethylene			3.42	8.4119
Sum of propane and propylene			0.65	1.5988
Butane			0.17	0.4181

Pentane			0.05	0.1230
Odorant NMM (mixture of natura mercaptans)			0.016	0.0394

The maximum amount of pollutants emitted into the atmosphere is calculated using the formula:

$$V_{sec} = V_p \ / \ T^* \ m^3/sec$$

Where: **T** – emission time, seconds (T = 8760 ч//year * 3600 sec. = 3153600 sec/year).

V_{leak} - total volume of gas leakage entering the atmosphere, m3 / year.

The amount of emissions of harmful substances in g / sec is determined by the formula:

$G = V_{sec} \times g \times C \times 10$ g/sec

Where : g- gas density, kg/m3

C- percentage of harmful substances by weight in the composition of natural gas. Emitted from the source in g / sec:

Name of dangerous substances	**Gas losses, m^3/year**	**Gas density kg/m^3**	**Gas composition, %**	**Emissions in t/year**
Methane	0.0107	0.73	93.44	7.2986
Sum of ethane and ethylene			3.42	0.2671
Sum of propane and propylene			0.65	0.0508
Butane			0.17	0.0133
Pentane			0.05	0.0039
Odorant NMM (mixture of natura mercaptans)			0.016	0.0012

During the installation of gas pipelines, electric welding works are carried out. Calculation of emissions of harmful substances into the atmosphere during electric welding

Calculation of the emission of harmful substances during the production of electric welding works is carried out according to the formula:

$$M = K * q * 10^{-6} \ t/year$$

$$M = K * q / T / 3600 \ g/s$$

Where: K – specific indicator of the formation of harmful substances, g / kg

q – mass of consumable materials, kg / year

T – duration of work, year.

Source № 3

1. Source parameters:

D, m	N, m	W, m/s	V, m^3/s	T, ^{0}C	Source type
0,5	2,0	2,4	0,471	28,5	Unorganized flat source

2. Emission source is a mobile welding machine.

3. Emitted into the atmospheric air: iron oxide, manganese oxide.

4. Welding machine works - 8 hours a day 180 days a year or 1440 hours a year. Electrodes ANO-3 are used for electric welding.

Calculation of emissions of harmful substances is summarized in the table

№	Electrode type	Name of the emitted substance	Specific emissions g / kg	Material consumption in kg.		Working time, hour		Emissions	
				Per year	Per day	Per year	Per day	g/sec	t/year
1	ANO-3	Iron oxide Manganese oxide	5,05 0,85	200	0,7	720	6	0,00039 0,00006	0,00101 0,00017