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Environmental pollution and oil and gas Zagađenje životne sredine i nafta i gas

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Abstract- The paper presents environmental pollution through the production, processing, transportation and consumption of oil and gas. It analyzes the sources of marine pollution by hydrocarbons, pollutants in the air from the industrial sector, especially oil, the main air pollutants in the combustion process and specific emissions of pollutants in traffic by type of fuel.

Index Terms- oil and gas, production, processing, transport, consumption

Apstrakt - U radu je predstavljeno zagađenje životne sredine kroz proizvodnju, preradu, transport i potrošnju nafte i gasa. Analizira izvore pomorskog zagađenja ugljovodonicima, zagađenje vazduha iz industrijskog sektora, posebno nafte, glavne zagađivače vazduha u procesu sagorevanja i specifične emisije zagađenja u saobraćaju prema vrsti goriva.

Ključne reči: nafta i gas, proizvodnja, prerada, transport, potrošnja

INTRODUCTION

The production of electricity and fossil fuels is considered the biggest polluter of the environment, followed by the oil and chemical industry. In all phases of the oil industry's activity, from exploration, oil and natural gas production, their processing, transport, to the consumption of petroleum products, there are more or less emissions of waste streams with harmful and dangerous substances that affect the environment. The nature and size of these emissions are different for different activities within the oil industry.

METHODS AND RESULTS

It is believed that the process of exploration and production of oil, especially at sea, and then the overseas transport of oil, is largely responsible for the pollution of the sea with hydrocarbons. The total amount of hydrocarbons, which is released annually into the sea and oceans, is estimated at about 3.25×10^6 m³. Table 1 shows the contribution of individual sources in marine pollution to hydrocarbons¹, and Table 2 shows the sources of air pollution with special reference to sources originating from the oil industry itself and from the consumption of petroleum products. [2]

TABLE 1. Sea pollution by hydrocarbons [1]

source	quantity 106 t/god	% (mass)
Natural sources	0,25	7,69
Offshore oil production	0,05	1,54
Transport	1,47	45,23
Tankers	0,7	21,54
Terminals	0,02	0,61
Polluted water from ships	0,3	9,23
Tankers-wrecks	0,4	12,32
Wrecks of other ships	0,02	0,61
Other	0,03	0,92
Air transport	0,3	9,23
Cities and industry	1,18	36,31
Municipal waste	0,7	21,54
Oil refineries	0,1	3,08
Waste streams from other industries	0,2	6,15
Other	0,18	5,54

The fact is that the total share of offshore oil production in its pollution is only 1.54%, but the pollution caused by oil transport, terminals, tanker accidents, refineries on the coast and the entire overseas and air supply is 54.5% while pollution from cities and other industries is about 40%.

According to the data in Table 2, which do not include heating plants and power plants on liquid and gaseous fuels for urban heating, power plants for industrial needs, emissions originating from oil production, oil and gas refining and traffic consumption is about 7% for solids up to 45% for sulfur dioxide relative to total industry emissions. Air emissions are usually compared to emissions from the electricity industry. Table 3 shows the emissions of electricity (solid fuels), industrial furnaces, individual furnaces and traffic. These data show that by far the largest emissions of carbon monoxide, hydrocarbons and nitrogen oxides, 91.54 and 40% respectively, from all combustion processes come from traffic, with emissions from most industrial furnaces and many individual ones also coming from oil and gas combustion. Table 4 also shows specific emissions from traffic by type of fuel. According to these data, the largest emissions of carbon monoxide come from internal combustion engines that use

gasoline as fuel, and emissions of sulfur dioxide, particulate matter and unburned hydrocarbons from engines that use diesel fuel. [3]

TABLE 2. Air pollution from the industrial sector as a whole with special reference to the impact of oil [2]

Sector	Pollutants (t / year)				
	CO	NO ₂	PM10*	SO ₂	VOC**
Total industry	3.721373	8 485 100	549 002	1 876 932	1 769 789
Oil and gas production	132747	389 686	4 576	238 872	114 601
Oil refinery	299546	334 795	25 271	292 167	26 421
Road traffic	153631	594 672	2 338	101 775	5 542
Water transport	179	476	676	3 514	3 775
Air transport	1244	960	133	1 815	144
Airports	4261	5 705	890	3 705	10 804
Stationary engines	19700	31 127	3 900	125 755	6 212
Total from oil	611298	1 357 421	37 784	837 603	177 499
Oil share expressed in% (wt)	16,4	16,0	6,9	44,6	10,0

Legend:

* PM10- particles smaller than 10 µm

** VOC - volatile organic compounds

TABLE 3. Main air pollutants from the combustion process [3]

Pollutants	Emissions of pollutants in %(mas)				
	CO	CmHn	NO ₂	SO ₂	particulate matter
Electric power industry	2	9	20	43	27
Industrial furnaces	2	13	19	28	20
Individual fireboxes	5	14	20	20	33
Traffic	91	54	40	3	13
Total combustion processes	100	90	99	94	93
Other processes in industry	0	10	1	6	7
UKUPNO	100	100	100	100	100

TABLE 4 Specific emissions of pollutants in traffic by type of fuel [3]

Fuel	Specific emissions of pollutants in g/GJ				
	CO	CmHn	NO ₂	CO ₂	particulate matter
Petrol	10 000	22	1 000	240	40
Diesel	1 000	180	1 100	600	400
Kerosene	200	36	70	100	20

Pollution of land with oil and derivatives is the result of eruptions in wells, sprinkling of hydrocarbons on the surface of the earth, cracking or leaking of oil pipelines, leaking of tanks and other

equipment in oil fields, refineries, derivative warehouses and gas stations, large workshops, airports and military bases. Spilled or released oil moves through the soil, pollutes it and endangers groundwater and drinking water sources, evaporates and pollutes the air. Many of these pollutants are difficult to detect and it is very difficult to quantify the losses caused in this way.

In order to reduce all harmful effects on the environment and due to stricter legislation, special attention is paid today in the oil industry of developed countries to operations and processes in which emissions of pollutants occur - gaseous, liquid or solid waste streams, assessment of their impact on the environment, environment, mechanisms and ways of movement of these substances, procedures for efficient waste management, methods that reduce the volume and / or toxic waste, reduces the mobility of certain hazardous substances, waste disposal methods, methods for removing harmful and hazardous substances from contaminated sites. [4,5,6,7]

Each activity of the oil industry has its own characteristic waste streams:

Waste in oil and gas exploration and production can be classified into four categories:

- Punching material, which is solid waste generated by drilling
- Used working fluid-mud
- Reservoir, formation or production water and
- Other accompanying waste

Transport of oil and gas to users-consumers by oil pipeline, ie gas pipeline, is better from the aspect of environmental protection. The fact is that leaks at the joints are possible here as well, that there can be damage and leakage of fluids, that there is solid waste from pipeline cleaning, but it is the safest, cleanest and cheapest transport. In addition to pipe transport, oil can be transported to users by tankers, cars and tank wagons, depending on the distance of the oil source from the refinery, and thus the number of potential sources of environmental pollution grows.

Refinery processing with its waste streams can endanger air, surface and groundwater and soil. Emissions to air contain carbon dioxide, carbon monoxide, nitrogen oxides, sulfur oxide, hydrogen sulfide, mercaptans, hydrocarbons, especially volatile organic compounds (voc), soot particles and catalysts, and polycyclic aromatic hydrocarbons. Surface waters of a number of cations and anions also contain hydrocarbons from petroleum, hydrogen sulfide, and phenols. Soil is most often polluted by spilling oil and derivatives during manipulation, leaking tanks and other equipment or inadequate disposal of solid waste, whereby pollutants penetrate into the soil by gravity or washing with atmospheric water and can reach groundwater. [8,9,10]

Due to relatively short distances, the transport of derivatives from refinery to large storage facilities and gas stations in our country is mainly done by car and tanker, but in other parts of the world it can be by pipelines, tankers or river barges to storage, and then by car and tanker. to gas stations. Loading and transshipment of oil and derivatives is accompanied by spillage and pollution of the soil with hydrocarbons, and due to their movement through the ground and groundwater. During the storage of derivatives in refineries, storage facilities, when filling

tanks and filling automobile tanks, a significant amount of volatile hydrocarbons is released.

CONCLUSION

The largest emissions of pollutants into the air originating from oil are not the result of the production, processing and transport of oil, but the consumption of petroleum products. [10] Consumption of derivatives in internal combustion engines causes significant emissions of pollutants. The products of complete and incomplete combustion of fuels are released into the air - carbon monoxide, carbon dioxide, nitrogen oxides, sulfur dioxide, unburned hydrocarbons and soot particles with polycyclic aromatic hydrocarbons. These pollutants are present along larger roads, but also in large settlements, where they are not only a consequence of traffic but also heating with fossil fuels in the winter season. Similar emissions occur in thermal power plants and heating plants that use solid and liquid fuels, as well as in industrial and individual furnaces.

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