CLASSIFYING THE SOURCES OF POLLUTION OF TRANSCARPATHIAN'S TERRITORY FOR THE OIL WELL'S CONSTRUCTION

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Abstract : The basis reasons of environmental pollution during the work execution for oil and gas in the work are analysed. Classification of the sources of pollution taking oil-gas-exploratory wells of Boryslav-Pokuttya subzone of the Precarpathian, foredeep as example is made. Three classes: natural, man-caused and man-caused-natural are distinguished.

Key words: oil-gas borehole, pollution, sources of pollution.

Geological – prospecting works, hydrocarbon extraction, refring and transportation cause a considerable man-caused loading upon ecological sphere of the Carpathian region.

The reasons of the environmental pollution of oil- gas- bearing regions by natural and man-caused processes are caused. For example, coming of hydrocarbon fluids from the oil – gas field to the surface, the rocks opened by deep boreholes waters and sewage should be referred to the first ones. Nevertheless, in most cases a natural constituent of pollution is practically absent, but man-caused one is prevailing and determinative. The man-caused pollution of the environment at the early stages of exploration prospecting works for oil and gas is already observed. Imperfection and breach of the nature – protective demands, as well as chemical composition of the components of drilling fluid and enrichment of drilling waste by harmful compounds in the process of opening of producing seams during the construction of oil – gas boreholes do contribute to this.

The author has carried out the investigations within the bounds of Boryslav-Pokuttya subzone of Precarpathian foredeep that make it possible to classify the sources of the landscape pollution during drilling of oil – gas boreholes.

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1. Natural sources. According to our data (Karabyn, 2000) the rocks of the section, oil, gas and edge waters belong to the natural sources of the landscape pollution in the process of borehole building.

Rocks. According to data of deep drilling, flysch deposits of the Cretaceous and Palaeogene systems and molasse deposits of neogene took place in geological structure of the area. The flysch deposits contain lead, zinc, chrome, sometimes cobalt in a superclarke number. The rocks of the Menilite suite are the most enriched by heavy metals. They contain chrome, zinc, ytterbium, zirconium and especially (more than three times) lead and molybdenum in superclarke number. Moreover, according to data (Porfiriev et al, 1963) the Menilite shale contain a great number of organic matter. Thus, Menilite shale of the Lyubyntsi – Verkhnye Syniovydne – Skole area have organic matter concentration within the bounds 7 (Lyubyntsi) - 33% (Verkhnye Syniovydne, Skole), resin content varies from 2 to 6,7%, bitumen output – 2-9,2% per organic mass.

Oil and gas. Oil and gas become a potential to contamination sources of the landscape pollution in a case of opening of producing horizons and their flowing beyond the bounds of the drilling area. Excepting high content of hydrocarbons, oil of metals in a case of their reaching the landscape which can be dangerous. Oil of the Precarpathian foredeep contains increased content (compared with oil of Euroasia) of lead, copper, titan, zinc, cobalt, chrome, barium, magnesium, silver, bismuth, mercury, arsenic. An absolute accumulation in regard to the rocks in oils of the region is characteristic of bismuth, silver, mercury, arsenic.

Edge water. According to date (Goldberg, Gazda, 1984; Kolodiy, 1983; Hoshovsky et al, 1998), edge waters of oil fields contain considerable amount of ions and organic compaunds. Often their influence upon the environment is more dangerous in comparison with other sources of pollution.

Man-caused sources. According to date (Fesenko et al, 1998; Karabyn, Yarontovsky, 1999; Solontseva, 1998) drilling catings (DC) drilling waste waters (DWW), drilling fluid (DF) and components for its preparation (substances that increase fluid weight, reagents of active force upon the seam, water-oil emulsion, corrosion inhibitors of de-emulgators, surficial active substances, $Ca(NO_3)_2$, $Mg(NO_3)_2$, Na_2SiO_2, HCl, KCl, NaOH, $NH_4(OH)$, polymers, mechanical admixtures etc.) belong to man-caused source of the landscape pollution.

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Composition of drilling fluid and drilling waste is remarkable first of all for formula of drilling fluid and for the rocks of the section and edge waters (Karabyn, Yarontovsky, 1999). Geological section which is expected to be drilled is a determinative factor in employment of one or another formula of drilling fluid. In difficult geological conditions of the Carpathian region, on the territory of Ukraine, high-inhibited (to potash type). Low-filtration drilling fluids were used, often of oil-base, that influence harmfully upon the environmental state.

Drilling fluids the author has studied contain a great amount of organic matter. Especially oil products and phenols. The values of chemical need for oxygen can reach 9000 mg O_2/ l, oil-products concentration – 800 mg/dm^3 , phenols – 4 mg/dm^3.

Two reasons of enrichment of drilling fluids and drilling waste by organic matter were established. The first reason: contact of drilling fluids with hydrocarbon deposits and edge waters enriched by organic matters. The second one : high concentration of organic compounds in components of drilling fluid. The data on concentration of oil-products and phenols in components of drilling fluid are given in the Table.

Tabl. Concentration of oil-products and phenols in chemical reagents and components of drilling fluids of Precarpathian oil-gas borehols

Name of chemical reagents and components	Concentracion in mg/dm^3 for fluings, mg/kg for solid phase	
	Oil-products	Phenols
Natural oil (Stary Sambir borehole - 8)	230000,0	2135,0
Powder-like carbon-alkaline reagent	417,96	2,45
Bentonitic clay	14,1	N/f
Oxidized bitumen	99,2	0,305
Barite	16,4	N/f
Hematite	41,3	N/f
Sulphite-alcohol mixture	N/f	48,90
Lignosulphates	N/f	57,07

Note – N/f – not found

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Drilling fluids and waste, excepting hydrocarbon compounds, in liquid phase are saturated by hydrocarbon gases. High solubility of single hydrocarbons in water promotes their transportation to the surface together with drilling fluids and edge waters. Moreover, in the process of upward subvertical migration, hydrocarbon geses can independently saturate surface deposits including humus layr of soil, with surface waters and subsoil and near-surface air. According to the results of analytical investigations of hydrocarbon gas concentrations in drilling fluids and drilling waste waters (Table) we have established that methane concentration in the objects under study reached 0,1158 %, ethane 0,0017 %. As a whole, hydrocarbon gases reached 0.1270 %. High concentration of heavy homologues the sum of which comes up to 0.0113 %, is a characteristic feature of hydrocarbon gas composition of the object under study.

Coming of high concentrations of ions chlorine, hydrocarbonate calcium, magnesium, sulphate-ion and other, that in a great amount are present in drilling fluid and drilling waste into the landscape is not less dangerous. The formation of salt composition of DWW occurs at the expens of natural and man-caused components. To the first component one can refer enrichment of DF and henoe DWW by salts in the process of opening of high-mine-ralised water learning horizonts, for exemple, Vorotyshahenska series (see part 1). Difficult geological conditions, in its turn, nid geological conditions, in its turn, need employment of high-mineralized fluids with a great concentrations of potassium chloride, soda and other reagent. The most dangerous is high concentration of ion-amonium that accompanies hidrocarbon deposits and also can be formed as a result of thermochemical reactions of compones of DF with edge waters. In the process of decomposition of ion-ammount, nitrates and nitrites are formed a hi harmfulness of witch is proved by a great number of investigators. As a result, high-mineralized fluids are formed with, high chargebylity of its composition and alignment of the principal ions.

The author has found a conciderable amount of heavy metals in drilling fluids and drilling waste, espesialy lead, cobalt and chromium

According to the results of statistical processing of data on analytical determination, paragenetic assotiations of metals in drilling fluids, drilling waste and rocks of the elements of siderophile group to drilling fluid, of chalcophylic group.

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The sources of the landscape pollution of the searching areas for oil should be devided into natural (edge, fluids, rocks of well section), man-caused (drilling fluid, drilling waste waters, fuel-lubricating and technonatural (drilling cuttings). Figure shows a principal scheme of classification of the sourse of pollution during the work execution in searching for oil and gas.

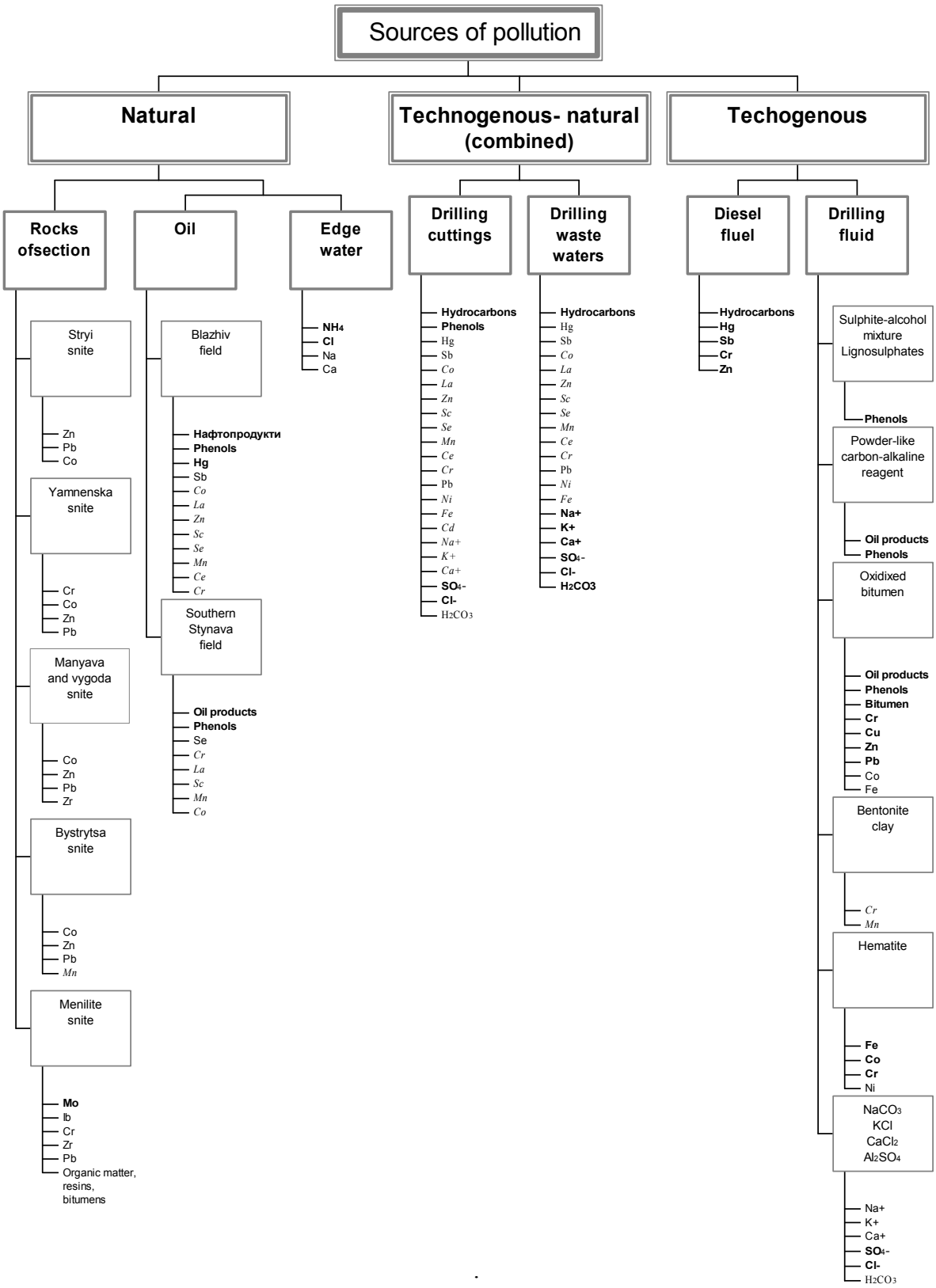

Fig. Classification of the sources of the environmental pollution during well building and recovery (taking Boryslav-Pokuttya subzone of Precarpathian foredeep as an example); semi-bold type – contaminations from concentrations koeficient (CK) > 3, straight type CK > 1.1, inclined CK ≈ 1

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