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SOCIAL ASSESSMENT OF THE IMPACT OF OIL EXPLOITATION ON LIVES OF INHABITANTS AND THE ENVIRONMENT**

1. INTRODUCTION

Nowadays performing any investment activity requires social acceptance. Its lack may significantly disturb entrepreneur's performance. This problem is especially important in production, particularly in oil and gas exploitation, which is influenced by many negative stereotypes. Each exploitation activity is connected both with profits and dangers. Oil and gas companies need to face social anxiety concerning negative influence of hydrocarbons on environment and people's lives. In Poland there have been many-year delays in investment completion, including oil investment, due to the local community disapproval, protests and court cases. Such an example brings Zalesie field near Rzeszów, where inhabitants' protests did not allow to complete the investment for more than 10 years.

On the exploitation area we can observe many factors which affect numerous components of natural environment, such as air, surface water, aquifer, soil, plants, animals, landscape and people's health [1]. This issue has been described in details in literature [2–5].

Environment pollution concerning oil exploitation influence as follow:

- **Air** – mainly due to gas and dust emission from boilers and combustion engines as well as road transport. The main risk, however, is connected with occasional eruptions of oil.

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- **Aquifer and surface water** – due to production of waste water, failure of exploitation facilities and improper performing of exploitation intensification.
- **Soil** – as a direct result of activities related to the exploitation of hydrocarbons or indirect contamination of other components of the environment. Oil compounds affect in a negative way the physio-chemical properties of soil and water.
- **Plants and animals** – similarly to soil, contamination can be caused both in a direct and indirect way. They are responsible for worsening conditions of plants and animals development as well as a total disappearing of flora and fauna.
- **Landscape** – as a result of the construction of required installation, what leads to environment change.
- **People's health** – contamination of particular components of natural environment, indirectly affects the health of residents of areas related to the process of oil production. The biggest risk convey aromatic hydrocarbons such as benzene, toluene, xylene (BTX) and aromatic polynuclear hydrocarbons (WWA) [6].

In Poland, the range of pollutants' affects on individual environmental components is regulated by the law:

- Act of 27 April 2001. Environmental Law ([7] as amended).
- Regulation of the Minister of Environment of 18 November 2014 on the conditions to be met when placing waste in water or ground and on substances particularly harmful to the water environment [8].
- Notice of Minister of Environment of 15 October 2013 on announcing consolidated act of Regulation of the Minister of Environment on permissible levels of noise in the environment [9].
- Regulation of the Minister of Environment of 13 September 2012 on assessing the levels of substances in the air [10].

In order to reduce the impact of oil exploitation on the environment, preventive and corrective actions have been taken. Through the elimination of wells, leakage of oil to the surface and into watercourses is prevented. Restoration works aim to remove risk and damage caused by mining activities and the restoration of land to the state before its start. By implementing a new mechanism of air protection as well as adjusting modern filters, it is possible to achieve a significant reduction in greenhouse gas emissions.

All these and other preventive activities lead to major reduction of negative impact of oil exploitation on environment.

In this article, the interpretation of the results of the survey were carried out within the project MUSE, one of its objectives was to determine the effect of oil exploitation on the environment and people's lives. The research was carried out on a trail of 90 people, residents of southern-east Polish Carpathia, where oil exploitation has been performed since XIX century (Krosno, Jedlicze and Rymanów). In an attempt dominated people between 41 and 50 years of age (29%) and with higher education (57%). The detailed description of the attempt contains publication [11] analysing other issues raised in the same survey. In the received data analyses, programme STATISTICA by StaftSoft was used.

2. ANALYSIS OF THE RESULTS

Analysis of responses to the questions, concerning oil exploitation on residents' lives and natural environment was carried out in three thematic parts:

- Interpretation of questions relating to the assessment of the state of the environment by tested community.
- Analysis of respondents' opinions about the impact of oil exploitation on the individual components of the environment and human health.
- Interpretation of answers given by the community, regarding questions about the impact of the observed pollution of the environment on people's lives.

1. Figure 1 shows respondents' answers to a question concerning general condition of environment in their place of living. As mentioned in the introduction, respondents live in the area where oil exploitation is performed. It is satisfactory though, that more than half of them (53%) admitted that environmental condition in their area is good, 31% perceive it as average and only 11% of respondents admitted that it is bad (4% of respondents ticked "I don't know" answer).

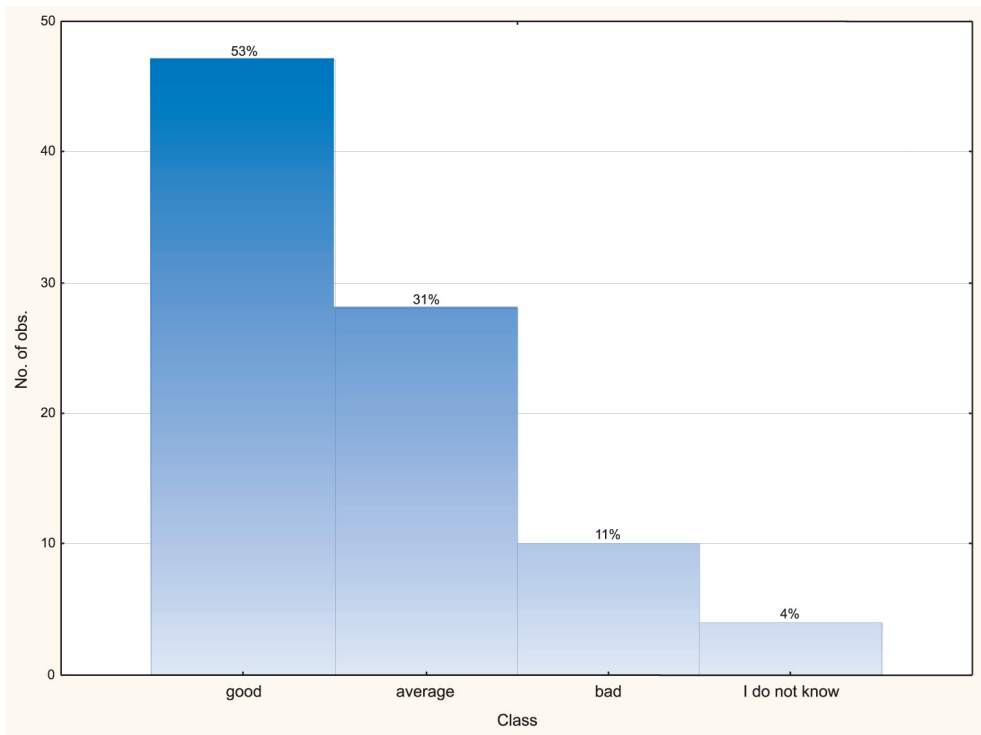


Fig. 1. Respondents' answers to the question concerning general condition of environment in their towar/region

2. Changes of natural environment caused by oil exploitation (Fig. 2) are noticed by 36% of respondents, and 23% do not notice these kinds of changes. Significant part of questioned community (41%) do not know whether observed changes in environment are caused by oil exploitation. It is worth noticing that marking answer “I don’t know” in the question: “Are there any environmental changes connected with oil exploitation?”, may mean that level of these changes is not significant and are not noticed by the local community.

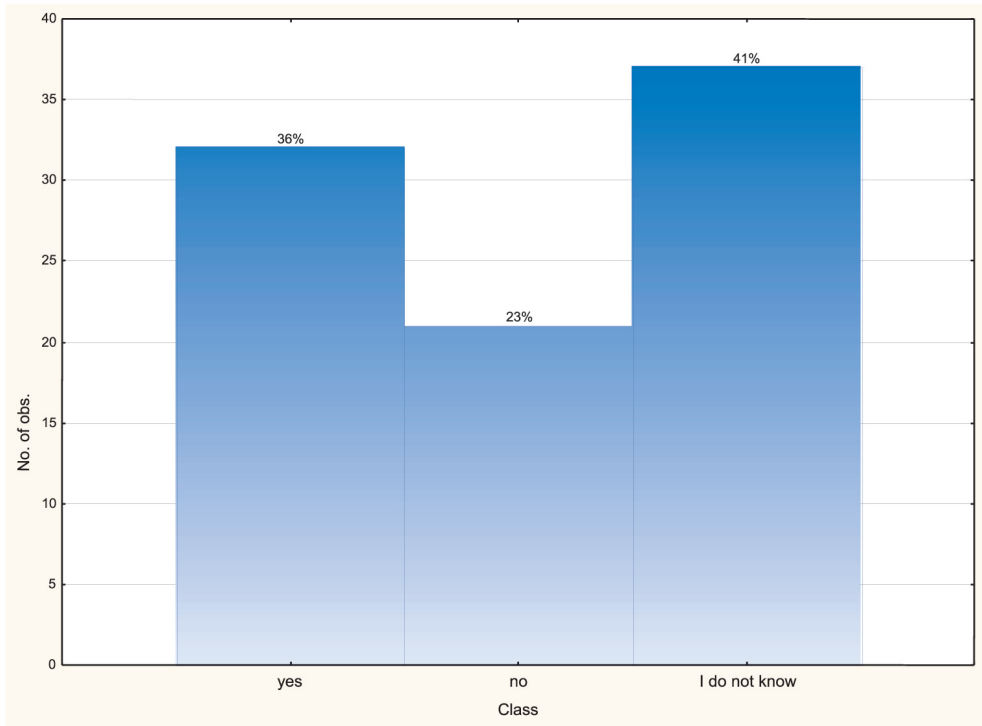


Fig. 2. Respondents’ answers to the question: “Are there any environmental changes connected with oil exploitation?”

The survey included questions concerning assessment of the level of oil influence on particular components of natural environment (Figs 3–7 and 9) and people’s health (Fig. 8).

Since the area of research is largely used for agricultural purposes by the local community, a separate analysis checked oil exploitation on soil degradation and reduction of arable agricultural land (Figs 10–11).

It is worth highlighting, that in each of the question concerning influence of oil exploitation on particular environmental components on people’s health, only a small amount of respondents claim it is “large”. The biggest percent in majority

of questions are answers: affects in a “small” level (Figs 6, 7 and 9), and “no effect” (Figs 3–5 and 8).

Based on respondents’ answers’ analyses, one can assume that the air is most affected (Fig. 7) – respectively, 10% of respondents marked answer “large”, 31% “average”, 47% “a small” level, and 11% “not affected”.

Influence of oil exploitation on water environment (Figs 5 and 9) by majority of respondents is assessed as “insignificant” (respectively: surface water 38%, aquifer – 21%) or its lack (31%, 45%). Similar percentage of answers was received both for surface water and aquifer for answer “large” (7% and 8%) and in “average” (24% and 25%).

Questions concerning plant and animal world (Figs 3 and 4) the biggest percentage of respondents have not observed influence of oil exploitation on their condition (respectively: “large” – 6%, 3% of answers, “medium” – 18%, 25%, “small” – 30%, 31%, “do not affect” – 45%, 41%).

In the question concerning influence of oil exploitation on animals obtained the lowest percentage of responses for “large” in comparison to the other questions.

Analysing respondents’ answers concerning oil exploitation on the landscape (Fig. 6) it can be noticed that in this case the biggest number of respondents claim they have not noticed this kind of impact (37%) or describe it as “small” (42%). Only 7% of the respondents think that the influence is “large” and 14% say it is “average”.

Affect of oil exploitation on people’s health (Fig. 8) is unnoticeable for 40% of respondents. 3% of respondents claim that the influence is “average” (here we observe the largest share of this type of response in relation to the other questions), 22% describe it as “small”, and 8% do not notice this kind of influence.

In many cases plots located nearby exploitation area are agriculturally used and therefore in the analysis of the impact of oil production on the soil, the responses to the following questions were taken into account:

- Are there any signs of soil degradation in your place of living/region caused by oil exploitation? (Fig. 10).
- Does the process of oil exploitation have a negative impact on the reduction of usable agricultural land in your place of living / region. (Fig. 11).

Based on the survey results shown in Figure 10 it can be claimed that majority of respondents believe that within the area there are no signs of soil degradation associated with the operation of oil exploitation (51%). 34% of respondents admitted the lack of knowledge regarding mentioned issue. Only 15% of respondents state that signs are noticeable.

Distribution of answers to the question of noticing limitation the amount of land as a result of oil exploitation of agricultural land (Fig. 11) indicates that the majority of respondents do not have knowledge related to this issue (51%). 6% of respondents notice the influence of oil exploitation on limitation the amount of agricultural land, while 44% of respondents admit they do not observe such limitations.

Figures 3–9 – summary of responses concerning questions of oil exploitation on particular components of natural environment.

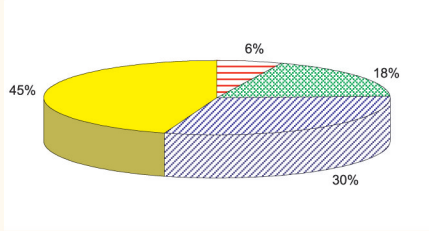


Fig. 3. To what extent oil exploitation affects the degradation of the plant world in your area?

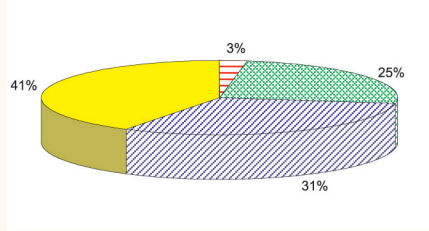


Fig. 4. To what extent oil exploitation affects the degradation of the animal world in your area?

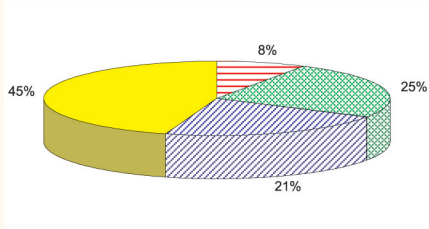


Fig. 5. To what extent oil exploitation affects groundwater contamination in your area?

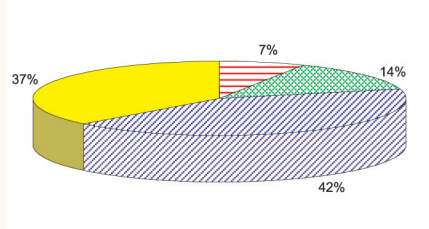


Fig. 6. To what extent oil exploitation influences the degradation of the landscape in your area?

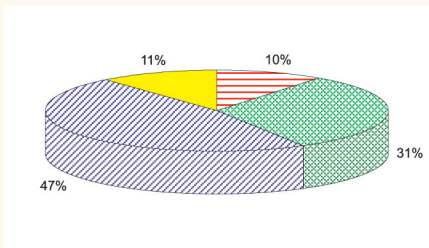


Fig. 7. To what extent oil exploitation affects the air pollution?

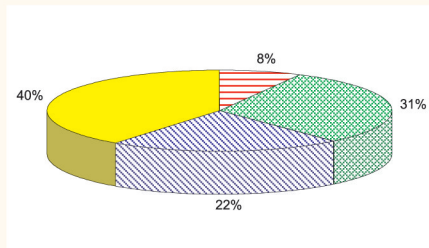


Fig. 8. To what extent oil exploitation affects the health of residents of your area?

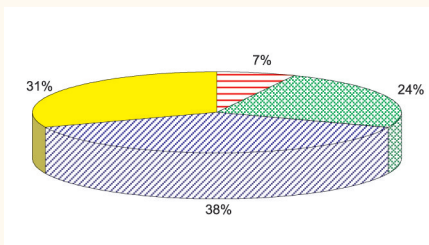
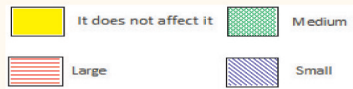
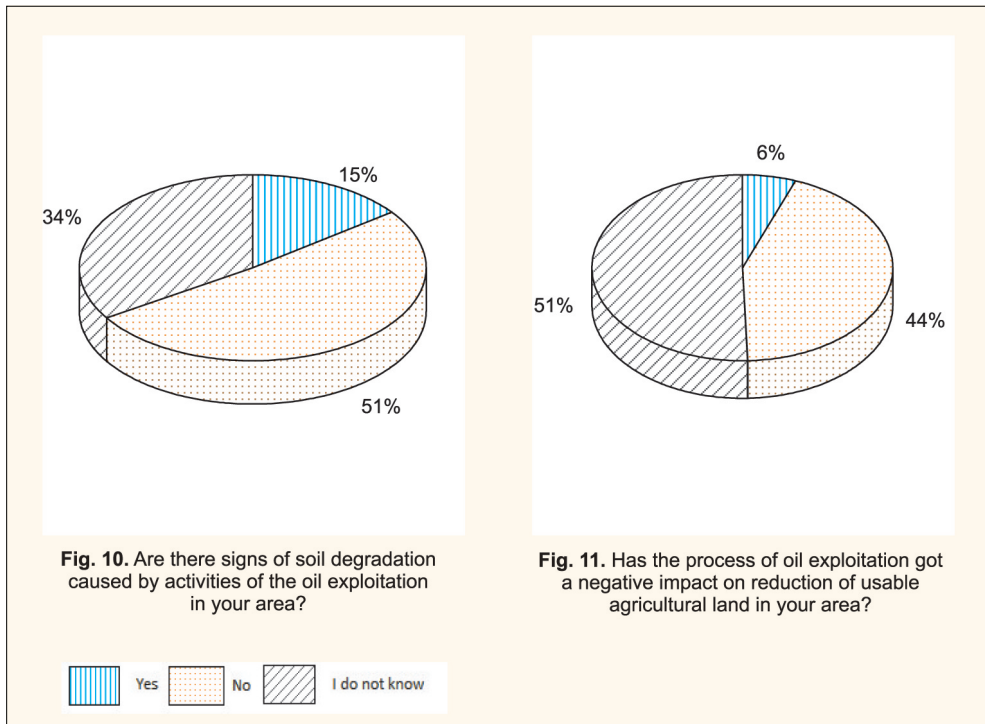


Fig. 9. To what extent pollution of surface water is related to the exploitation of oil?



Figures 10–11 – summary of responses concerning influence of oil exploitation on soil degradation and limitation of agricultural land.



3. In the last part of this analysis, the impact of pollution of individual components of the environment on people’s lives was interpreted.

According to respondents, the greatest impact on inhabitants’ lives, among pollutants caused by the oil exploitation, is air pollution – Figure 12 (31% of respondents marked the answer “yes”, 30% “no” and 39% “do not know”).

Impact of water pollution is not noticeable – Figures 14 and 16 (relatively for surface water 41% and aquifer 42% of respondents marked answer “no”, 35% and 38% marked “no”, and 24% and 20% chose “yes”).

Similar distribution of response can be observed in questions concerning plant and animal world (Figs 13 and 15). Here we can see the highest percentage of answers “no” (48% percent in both cases). “I do not know” answer was given by 36% of respondents and 38% of them marked “no”, while “yes” 17% and 14%.

The influence of landscape degradation related to the oil exploitation on the life of inhabitants (Fig. 17) indicate 13% of respondents, 37% do not see such effect, while 50% did not declare lack of knowledge enabling attitude to this question.

The smallest effects of pollution caused by oil exploitation on people’s lives is observed for contamination of soil – Fig. 18 (51% of respondents marked the answer “no” 35% – “do not know” and 15% – “yes”).

Figures 12–18 – summary of responses relating to questions on the impact of the observed pollution of the environment on people’s lives.

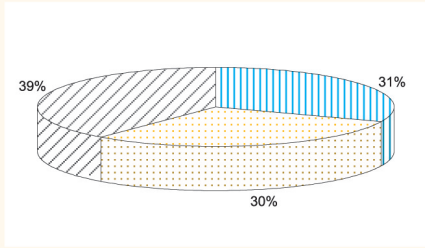


Fig. 12. Does the air pollution caused by petroleum exploitation affect people’s lives in negative way?

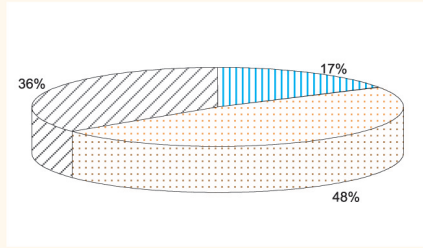


Fig. 13. Does the degradation of plant world affect the quality of life of residents in your area in negative way?

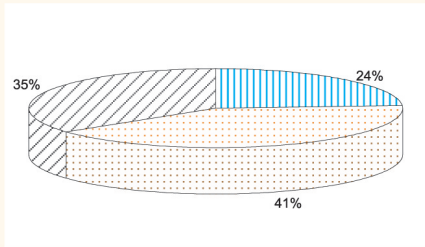


Fig. 14. Does the surface water pollution affect the standard of living of people in the area you reside in negative way?

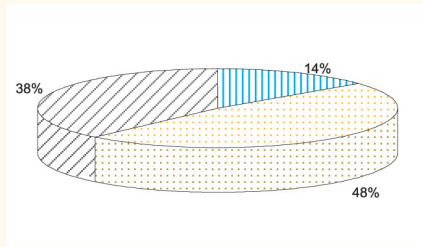


Fig. 15. Does the degradation of the animal world affect the standard of living of residents in your region in negative way?

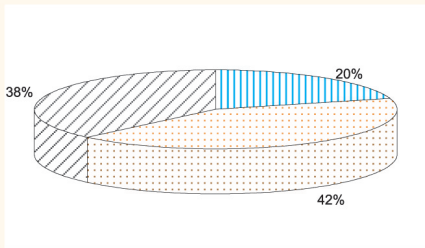


Fig. 16. Does the current state of groundwater quality affect negatively the standard of living of residents in your area in negative way?

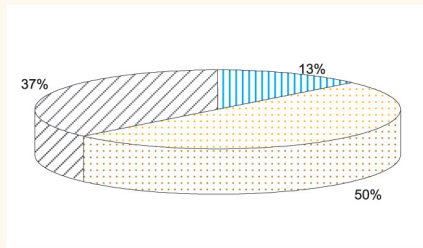


Fig. 17. Does the landscape degradation affect the quality of life of residents in your area in negative way?

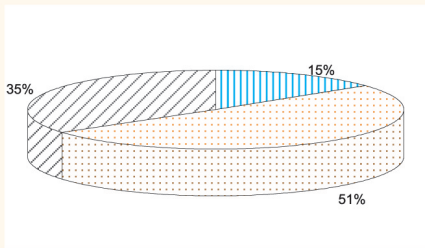


Fig. 18. Does the soil quality affect the quality of life of the residents in your area in negative way?



3. DISCUSSION ON RESEARCH RESULTS

Influence of oil exploitation on majority of environmental components is not noticeable or described as insignificant. Only a small percentage of respondents describe it as large. Analysing the answers to questions about the influence of pollution of individual environmental components on people's lives, it can be said that in most cases it is not observed or is declared as lack of knowledge of mentioned issues.

Indication by the respondents the air as environmental component which has been affected most by the oil exploitation and its pollution has the greatest impact on people's lives allows to draw the following conclusions:

- In the area where the survey was conducted mainly dominated by small mines of crude oil. This fact makes the transport of oil from the mines by the tankers, which cause pollution of exhaust fumes and dust and generate noise. Moreover, mines are old and their infrastructure needs necessary upgrades, involving, among others, exchange reheating and pumping motors driving cranes, which will allow for the reduction of emissions to the atmosphere.
- The threat of air pollution in the oil mining occurs mainly during oil drilling. In the study area refining industry has a long tradition. Its activities also have an impact on air quality. It can be assumed that respondents when answering the question about the impact of oil exploitation on air pollution could make generalizations, identifying exploitation process of the entire oil production activity or identifying it with the process of oil processing, including refining.
- Respondents assessment regarding exploitation impact on air pollution, may also result from the lack of sufficient knowledge concerning impacts of the individual processes – within activities of oil production and refining industry – on the environment and people's health. Education of the public regarding mentioned subject seems to be a necessity, as it depends on the perception and acceptance of oil exploitation activities by the local community.
- Among factors influencing air pollution a key role plays combustion of fuels. These kind of impurities are emitted by households and road transport and are a side product of the process of energy production. Economic reality of inhabitants of the region in many cases make them to heat buildings by poor quality coal, and use outdated furnaces and elevators that influence air pollution with harmful to human health benzopyrene and suspended particulates.
- Lack of awareness of part of the local community about the risks arising from the combustion of certain substances means that in many cases the waste is used as the main fuel material. All these factors have negative effect on air quality that is why it can not be identified only with oil exploitation

Influence of exploitation on the water environment is referred to as rather small, or even negligible, and in the case of surface water is slightly greater than that of ground-water.

This may be connected with the fact that the state of the surface watercourses can be easily assessed by the local community on the basis of simple observation, while the status of groundwater can not be assessed so easily.

Water pollution in the area may be caused by leaky sewage installations (tanks, septic tanks) and emptying the waste water directly into rivers, so that is why not necessarily bad condition of water is caused by the oil exploitation.

Similarly, as in the previous unit, influence of oil exploitation on plant and animal world is insignificant. A majority of respondents hardly observed it.

As mentioned before, within examined area, oil exploitation has been presented for a long time. Distribution of answers to the question on impact of oil exploitation on degradation of the landscape in the study area, indicates that elements related to the exploitation of oil, are to local communities ordinary view and are treated as part of the natural landscape.

Analysing the impact of oil exploitation on human health can be observed greater share of answers “large” and “medium” compared to most of the questions.

Similar tendency can be observed with the question concerning the air. Therefore, the conclusion is that for the respondents oil exploitation can negatively affect their health through air pollution.

4. CONCLUSIONS

The undeniable fact of impact of oil exploitation on the environment. However, one must be aware, that the most important threat to the oil environment are sporadic eruptions and failures of technical installations.

Based on the survey it can be stated that oil exploitation is one of the processes of oil production, and its negative impact on the environment is the least perceptible by the local community.

Indication of the air by respondents as part of the natural environment, which has been largely changed by oil exploitation, may result from the lack of proper knowledge of the impact of the individual processes within the oil industry.

Education of society on the impact of oil exploitation on the environment and people's health is essential, as it depends on the perception and acceptance of oil production activities by the local community.

This article can serve as a starting material for activities aimed at reducing the impact of oil exploitation on the most vulnerable components of the environment and human health, as well as the spark of inspiration for conducting informational and educational campaigns targeted at local communities.

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