

The Impact of Oil Development Activities on Environment and Sustainable Development in Fier Area, Albania

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Abstract

In this area, a dynamic technological activity is still exerted, which arrived to evidently influence in around environment with their wastes, making so a dangerous risk for human health and natural. That's why; this region is classified by the UNDP among the nine hot spots in Albania. The selected surface for study is around 200km². The oil and gas field of Fier area is considered as one of the less managed zones, because of absence and damages in land, water and air, where the throwing of the oil waste in surface has not permitted the development of pedogenic processes. It has brought the deficit of soil, and consequently the right agrarian cultivation has not been permitted. The light hydrocarbons, which disturbed the two cities, introduce toxic indications in concentration of 3-5mg/l. Among the main problems are the stream waters that have in their composition oil components, such as phenol, different hydrocarbons, tension-active matters, etc. They have years that have asphyxiated the vegetal and living beings in environment pond, as channels, etc. The soil pollution with oil in area has penetrated in the depth of 0.1-1m, as a result the grown plants in land has also absorbed the oil elements. The water pollution has touched the life cycle of the community, so we are challenge with the health problems top them. In accordance with the objectives of the paper is made possible the evaluation of pollution extension, started from the source down to the river and finally to the sea. The purpose of the article is to assess polluted level in oil field of this area and to give the respective recommendations to a sustainable development by minimizing the oil activity impacts to the environment and especially to the living being health.

Keywords: *Oil industry, hydrocarbon components, air emissions, Risk assessment, human health.*

1. Introduction

Oil industry has been and it still is an activity which has had a direct impact on air, soil, water and, as a consequence, on human health. The impact is further increased, especially when it is missing a clear and detailed management plan, such as the use of oil in the Fier region. It has been a long time since in this region, considerable contamination has been identified. Therefore, it have had huge effects on the health of the community, as we shall see below. The main reasons for such problems have come as a consequence of old technology, amortized equipment, irresponsibility and lack of due sensibilization of the community, decision makers and employees, as well as failure to implement correctly environmental

standards relating the norms of emissions in the air, water and soils. Waters discharged from petroleum industry, have hydrocarbon components in their composition, such as aromatics, tension-active matters, etc., which have harmed living plants and animals in aquatic environment, where they are discharged. The analysis of environmental data and indicators makes it possible to present a correct assessment of the actual environmental situation, based and substantiated in the comparison of such indicators with the ones in national and international level. Observing the environmental and social plight which this community deals with, it is difficult to speak about a sustainable economic development, where, on one side, this region has modest benefits from petroleum industry and on the other side, the cost of environmental contamination they are obliged to deal with is many times greater. Professional illnesses have turned into anxiety for the residents of oil areas. More than 90% of them have been affected from phenols in blood. Hundreds of residents in these areas suffer from health problems. Life expectancy has been reduced sensibly and living in this region has been reduced sensibly and living in this region is becoming more difficult each passing day.

2. Description of the Actual Environmental Situation

There are more than 2000 wells which cover approximately 200km² of the oil field in Patos-Marinza, which constitutes one of the greatest oil fields of Albania (UNEP, 2000)¹. Its source produces, at the moment, 400ton/per week crude oil, a decrease from initial production of 2,000tons. Unfortunately, the oil field is a terrible contamination source for the soils, underground waters and air. Severe contamination of soil and underground waters comes from various sources. According to national experts, wells of potable water receive water from a bottom layer of water, which is protected from a non-homogenous clay layer. Oil wells, however, have drilled the clay layer and it is very likely that it allows hydrocarbons contaminate potable water². Such cases have been revealed several times. Sulfuric gas and hydrocarbon emissions contaminate the surrounding atmosphere. A part of the oil obtained during the pre-treatment is anticipated to be recycled. Nevertheless, since the equipment of pre-treatment does not operate properly, untreated waters with crude oil contents are discharged directly into environment and drain into Gjanica River. The Refinery in Ballsh, processes 300,000 tons of oil per year, or less than one third of its capacity. The plant discharges huge quantities of oil in the surrounding environment, particularly into Gjanica River³. It is much probable that local private water wells, along the river, be contaminated. One of the reasons for oil spillage into environment is the impossibility of proper operation at the contaminated water treatment unit. As a result⁴:

- huge oil quantities from the oil of Refinery are spilled into the surrounding environment.
- contaminated water, which contains oil impurities, is thrown to a channel, by polluting Gjanica River and it is much probable that it influences local resources of water.
- the refinery emits several toxic pollutants into atmosphere.

Water, which contains oil and oil components discharges directly into the channel, which flows into Gjanica river. In the past, Gjanica River used to provide, through underground communications, potable water by means of private wells by the river. According to local authorities, deposits of crude oil have been identified several kilometers down the flow from the refinery. A visual inspection of the river confirms such problems, and a water sample obtained 2.5-3 kilometers in the bottom flow had oil traces. The refinery also emits sulfur dioxide, hydrogen sulfur, hydrocarbons and carbon dioxide in atmosphere. There has not been duly drafted monitoring or investigation programs in order to assess the level of contamination in the soil and underground waters, in the ground of the Refinery and in the surrounding areas down the stream.

3. The Environmental Condition

Environmental degradation has been the result of accumulated impacts, mainly caused by the lack of an integrated planning in environment management.

3.1 Pollution from air emissions

¹ UNEP, Environmental Assessment in Albania. 2000

² Prof. Asc. S. Guri, Environmental Impact from hydrocarbon activity in Fieri areas, 2005

³ Report of Environment monitoring, Environment Ministry, Albania, 2008

⁴ Dr. N. Tole, Environmental impact of oil exploitation activities in Patos-Marinza, Fier, 2002

It is often accepted that the main sources of air pollution in the region under study consist of oil extraction and elaboration, oil production, heating used by families, uncontrolled rubbish combustion and transport. Despite the insufficient data quantity, it may be stated that the air quality in Fier is aggravated due to pollution from SO₂, NO_x, O₃, CO and heavy metals. In the district of Fier, there are no good and proper systems for monitoring air quality. Oil storage in open tanks in the oil field of Marinza contaminates the atmosphere with slight evaporation hydrocarbons. Every day, pumps emit almost 8,000m³ gas, which contains sulfurs. From this quantity, only 1/5 is used to generate energy for the wells, the other (more than 115 ton of sulfur per year) goes to atmosphere. The surrounding air contains high percentage of H₂S, which causes damages in respiratory tract. In the center of Fier, it is observed a sensible excess of norms for particle content in the air (dust total LGS and fine dust PM 10).

- in the village of Zharrëz in the oil field Patos-Marinza, it is observed a sensible excess (about 2 times) of the content norm for sulfuric gas H₂S on the air, typical for the field of oil extraction. Such excess may be considered problematic for the health of local population.
- we deem that excesses of dust particle contents in the city of Fier are mainly related to the discharges from automobile transport, from the vehicles which use diesel fuel and the dirty condition of roads.
- sensible excess of sulfuric gas content H₂S in the air of Zharrëz village is linked with uncontrolled discharges and failure to pack the wells of oil extraction in the relevant area.

Tab. 1. Annual values of monitored air indicators from EFA, IPH and INP for 2008 and 2011

| | LNP µg/m³ | PM 10 µg/m³ | PM 2.5 µg/m³ | NO₂ µg/m³ | SO₂ µg/m³ | O₃ µg/m³ | Pb µg/m³ |
|----------------|---------------------------------------|---|--|--|--|---|--------------------------------------|
| Fier (2008) | 238 | 112 | - | 33 | 32 | 70 | 0.32 |
| Fier (2011) | 185 | 89 | - | 31.5 | 19.6 | 76 | 0.23 |
| Albanian limit | 140 | 70 | 15 | 60 | 60 | 65 | 1 |
| EU limit | 80 | 50 | 15 | 40 | 40 | 65 | 0.5 |

3.2 Contamination from liquid discharge

The area under study has sufficient water resources which include rivers, underground water and artificial reservoirs. Gjanica and Seman rivers flow across this region. During the past decade, the district of Fier has had almost 13% of population, which moved from rural areas to urban one, and this movement of population has incurred huge problems for water infrastructure. Industrial waters and sewage waters spill directly into systems, where water is collected. Spilled quantity is not measured and the quality of surface and underground waters is not duly monitored. Industrial pollutants are oil and gas extraction, as well as their elaboration. The main activities, which bring more water pollution, are oil extraction (in 100%) and sewage water (in 90%). The Law for water resources (No. 8093/1996) is the main legislation for the management of water resources. According to it, the National Council of Water, including its technical secretariat (as well as other Water Institutions) provides protection, development and use of consistent water resources. Law has also brought the concept of permits, concession and authorizations for water use and discharge of waste water. Although, Laws deals with the inspection and preservation of water resource quality, it does not stipulate very strict conditions for waste discharge.



Foto 1. View from a shallow water well for a village home polluted by hydrocarbons (A. Guri, 2012)

Tab. 2. Concentrations of contaminants in water *in* mg / liter (Prof. asc. S. Guri, 2008)

| Chemical indicator | Fier | Zharrëz | Marinëz | Albanian limit |
|---------------------------|-------------|----------------|----------------|-----------------------|
| pH | 7,4 | 6,8 | 6,9 | 6-9. |
| Suspended matter | 14 | 32 | 45 | 50 mg/l |
| COD | 32 | 70 | 50 | 150 mg/l |
| BOD | 8 | 42 | 35 | 50 mg/l |
| NH3 | 5 | 10 | 8 | 10 mg/l |

From comparison with limit values reported in the table of water quality classification (according to NIVA), we can state that for Gjanica station, waters in this river section are of a quality beyond any standards, where their average values are within the interval 2-4mg/l O₂, while for water stations, waters are of a good quality, hence, with values within the interval 6.4-9mg/l O₂. (Definition of the Ministry of Environment). There is also other waste which includes: semi-solid sludge mixed with oil, which have been collected from atmospheric conditions which have acted for a long period of time, liquid waste with oil, sludge and oil, waste of heavy hydrocarbons which are found all over the resource premises. Liquid and semi-liquid waste localized in the channel present in the resource spot are assessed to be 30,000m³. From our continuous inspections, it has been observed that the water which is used for the irrigation of agricultural cultures is saturated with chemicals, which are harmful for agricultural cultures, by devastating the flora and fauna in the area.

Table 3: Physical-chemical parameters of the discharging waters on decanting oil Plants

| Chemical indicators | Usoja | Visoka | Marinës | Gorisht | Albanian limit |
|----------------------------|--------------|---------------|----------------|----------------|-----------------------|
| pH | 6.75 | 6.20 | 6.40 | 6.35 | 6-9 |
| Suspended matter (mg/l) | 62.50 | 74.00 | 52.50 | 67.00 | 50 |
| Oil products (mg/l) | 198.00 | 488.00 | 166.00 | 137.00 | 20 |
| H ₂ S (mg/l) | 6.15 | 5.80 | 6.60 | 6.10 | 1 |
| Nitrites (mg/l) | 1.74 | 0.32 | 0.23 | 0.27 | 0.005 |
| Nitrates (mg/l) | 2.80 | 3.10 | 2.25 | 2.35 | 10 |
| Phenols (mg/l) | 94.00 | 43.50 | 27.00 | 114.00 | 1 |
| Phosphates (mg/l) | 1.55 | 1.05 | 0.40 | 1.45 | 0.7 |

Source: Dr. Beqiraj I. Environmental problems in Albanian fields of production & processing of the petroleum, 2006

3.3 Contamination from hydrocarbon spillage in the ground

Soil contamination is another severe problem for the area under study, where more than 200km² is contaminated from oil industry. Patos-Marinza oil field and Gjanica River bank are two well-known examples. The deterioration of pipes' technology used in oil extraction, processing, etc., has caused an immeasurable damage in the past years and in the present. Following preliminary intensive research and consulting with the Environmental Program of United Nations (UNEP) have stipulated nine areas of Albania, considered as "hot environmental spot" due to pollution incurred by industrial installations. Three out of these hot areas are located in the district of Fier: the oil field of Patos-Marinza, the oil Refinery in Ballsh and the Plant of Oil Processing in Fier, TEC and the Plant of Agricultural Fertilizers (Arsenic). The total contaminated surface, only in the oil field in Patos-Marinëz is assessed to be 600,000m². Contaminated soils are obvious in the whole source place; the quantity of soil is assessed to be 180,000m³ (taking into account the surface and the depth of pollution). Oil and layering water in many cases flow into channels outside the territory of wells and groups, since in general, the pits are overfilled.

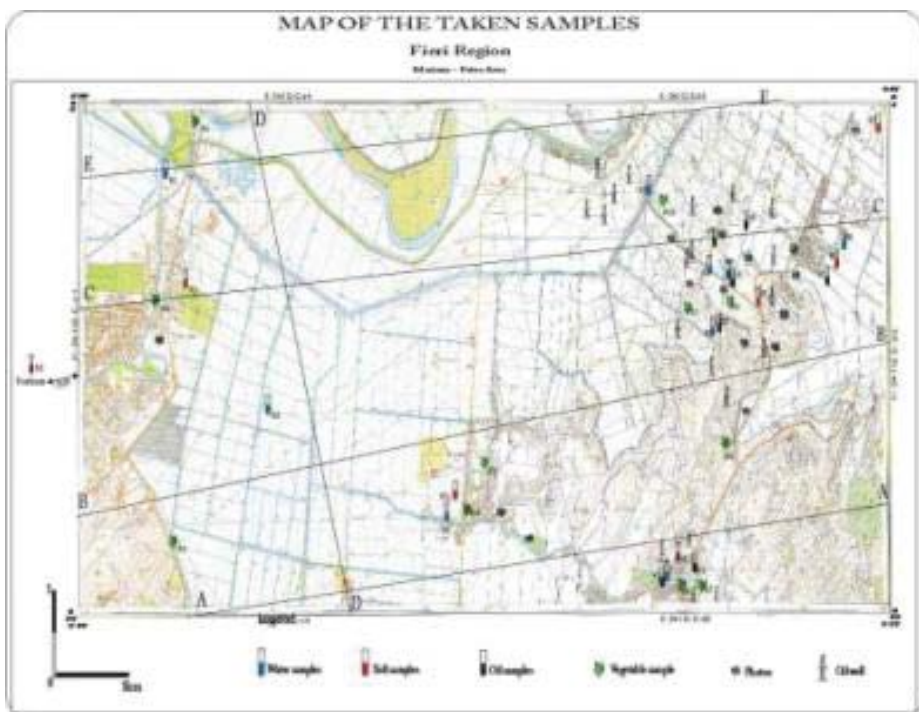
3.4 Quantities and types of hazardous waste

Every day, from the oil source place in Patos-Marinz there are discharged as a leakage form re than 4-8 tons of gross oil, by contaminating natural environment (ground, water and air), for which the concrete plan for the recovery of this technology, as well as for the mitigation of its impact on environment have not put into practice, yet. From the Ballsh Refinery, it has been evaluated a loss of 7% in production or 22,000 tons of production a year. It is being anticipated a project from the European Committee for the recovery and implementation of a clean technology. In all cases, whatever

technology is used, inevitably it shall be formed a small quantity of hazardous waste. Such waste shall require a safe storage place and this includes a geo-environmental study. The construction of a storage place constitutes one of the main requirements, whose execution takes the city of Fier to another situation, a more favorable one. This means that the Authorities of the district shall work by guaranteeing that hazardous waste should have a special treatment.



Foto 2. A view from the oil contaminated soil (A. Guri, 2012)



Source: Prof. Asc. S. Guri, Environmental Impact from hydrocarbon activity in Fieri areas, 2008

4. Identification of Risks on Environmental and Human Health

Paracelsus stated that "it is the dosage that makes the poison", because dangerous substances cannot reach the food chain (poulties and flocks are usually fed in the area) through contaminated surface waters. The method for risk assessment is called the "non threshold linear model".

4.1 Risk assessment

The procedure for risk assessment constitutes in the identification and definition of risks and their potential effects. It makes the assessment of effects which are produced from risks identified as qualitative and quantitative in the aspect of probability that an event can happen⁵. It also defines the level of consequences, as well as the assessment of risk tolerance for the personnel, environment, assets and public, comparing the risk level with the relevant criteria of project acceptance. It is based on the principals accepted internationally, taking into consideration other factors, such as health benefits, social-economic factors, ethical issues and environmental considerations. Hence, we have made efforts to determine clearly the objective of risk assessment, or which pollutants present risks up to the assessment of the risk level as the result of food consumption or the effect on people or the relation between touchable dosage and the damage caused, and ultimately the general risk for a particular population.

4.2 Chemical causatives of health consequences

As the result of surface waters, air and agricultural land, the families who live in oil fields are exposed to serious health risks. But, not only. Another reason, the same influential in their health is also the fact that underground waters are much polluted from the oil of wells, pumps, pipelines and pre-treatment equipments. Ways of oil hydrocarbon introduction into human body are mainly through air, as well as food and water. Their metabolism follows the common scheme of xenobiotic metabolism. Hydrocarbons, are initially oxidized in order to form the metabolites of the first phase, including primary metabolites, such as the epoxy, phenols and dihidrodol and then secondary metabolites, such as diol-epoxy, tetrahidrotretol and phenol-epoxy⁶. The metabolites of the first stage are then joined, either with glutathione, sulfate or glucuronic acid in order to form the metabolites of the second phase, which are more polar and soluble in water than previous hydrocarbons. In the composition of petroleum oils are also included the aromatic polycyclic hydrocarbons, several components of which are carcinogenic substances. Acute toxicity from aromatic polycyclic hydrocarbons varies from moderated to low.

4.3 Clinical characteristics of chronic intoxications

The employees of oil extraction sector, starting from the most unskilled worker to the engineering – technician personnel are under the influence of pollution and the negative effects on their health are rather sensible. Such effects incur numerous and various organic and functional disorders, which influence in the decrease of the ability for work and in many cases from negligence or underestimation to undergo time after time a medical check up, may aggravate the condition up to death⁷. Polluting components enter to the organism in small quantities and for a relatively long period of time, causing chronic intoxications as the form which is encountered more often at the employees, who exercise their activity in this sector. In the contingent of employees, where the medical check up has been performed, the most pronounced complaints have been observed in the central and peripheral nervous system, which belong to such disorders of the activity in this system with functional character. The clinical characteristics of such disorders are classified in the syndrome of visceral vegetative asthenia, with headaches (*Cefalea*), often continued with a moderate intensity, aggravating sense in the back area of the head, fatigue, loss of attention, lack of concentration, often sleepy condition, disorders in the mood, reduction of memory, sweating palms and soles. *Cefalea* has been present in 86% of cases. This condition is subject to seniority (years) at work, level of pollution, as well as profession. More pronounced it is at cleaning and sludge workers than at other professions, as well as those who have more than 10 years of work experience, and less at workers with a work experience of up to 5 years. *Cefalea* constitutes the periodic symptom of asthenias and has a different character from *cefalea* and other pathologic nature. It becomes more pronounced with the increase of physical and mental pressure, particularly during the night shift. In most cases, it is fixed the sense of general apathy; as a consequence, headache becomes more pronounced and continuous, reduction of attention and sight, both near and far away, photophobia and redness on eye. Such a syndrome constitutes a toxic encephalopathy or the so-

⁵ Nicholas K.COCH, Geohazards Natural and Human, 1995;

⁶ WHO, reducing risks, promoting healthy life. The world health report 2002

⁷ Corensen I., Covello, Risk analysis: A guide to principles and methods for analyzing health and environmental risks, 1989. UNEP/IPCS Training Module No. 3, Human Risk Assessment;

called "*Toxic Cerebroasthenia of Oil*" and it is followed by organic alterations in the central nervous system. Oil hydrocarbons also give sharp functional disorders in the liver, which is expressed with fat deposits, with *hiperalbuminemia* and *hipergamaglobulinemia*. Furthermore, in the cases which have been examined, it has been encountered reduction of glycogen in the liver, as well as the reduction of anti-toxic function, glyco-regulating of albumins. Sick employees complain for the dry sensation in the throat, as well as bitterness in the mouth, especially in the morning, thirsty for water at night, etc. Moreover, along the study of several cases, dyspeptic disorders have been encountered as well. From the complaints which are related to the disorders in the functions of food digestion, predominant are the following: lack of appetite, pain in epigastria area, heartburn, etc.

Respiratory injuries occupy an important place at workers of the oil system. They manifest themselves in a number of subjective complaints such as cough, runny and dry nose, toracoalgia, laeringite, etc. The diseases that predominate are: chronic bronchitis, chronic bronco pneumopatites associated with a considerable amount of respiratory, ventilator, restrictive insufficiency, obstructive and mixed which make up 66% of the cases checked. The patients, who were presented in a severe health condition, were hospitalized and they were treated and then they recovered or improved. This constitutes 34.6 % of the cases checked. In the contingent of checked people, there were also observed professional sickness of skin, such as dermatitis, skin burn. Dermatitis and professional acne constitute 2.7% of examined cases. Acne, which is otherwise called *the acne of oilmen*, appears in the form of a red pimple, in forearm, thigh, bones, etc. Such pimples block fat glands, closing the pores and they do not allow the extraction outside of their production. In this way, the skin in certain areas seems to be as sprinkled with black spots. If not treated in time, the illness may be complicated causing infections in the skin. Oil components incur injuries even to sexual virility. In the contingent taken for this study, it resulted that this phenomenon was present in 17.8% of cases. It appeared over the age of 40 years old, but even some cases under this age are not excluded.

4.4 Statistical analysis of health data

Oil field Patos-Zharréz-Marinéz-Sheqisht, has always been and still remains a serious and threatening risk for the health of employees and residents of the area. From the analyses performed and from the medical check up, it resulted that 6.000 residents who live in this oil field result with a high percentage of toxic in blood (carbon), as well as affected by various professional and chronic illnesses, such as the diseases of respiratory tract, chronic bronchitis, asthma, pulmonary cancer, anaemia, ischemia, cardio-vascular diseases, as well as arterial hyper tension (HTA) (Dr. K. Stoja 2009). Data according to age-groups.

Tab. 4. Hospitalized residents in Fieri hospital

| Years | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|------------------------|------|------|------|------|------|------|------|------|------|------|
| Hospitalized residents | 6 | 11 | 28 | 15 | 16 | 2 | 16 | 15 | 21 | 30 |

Allowed norm for fenolurina is > 50 mg/l. In cases when it is more than 50mb/l, pathologies appear in organism.

5. Policies Which Lead to a Consistent Development

5.1 Overcoming the situation

The group of authors proposes that, in this region, be implemented the action plan for the sensibilization of public opinion, residents, private activities, or an action plan for the management and administration of dangerous waste, industrial waters. On the other side, it is required a plan for training the employees in oil sector for the elimination of oil waste discharge. It shall facilitate the development of agro business, tourism and ecotourism, which takes the region towards a consistent development.

5.2 Policies which lead to a consistent development

Since our territory is considered the most polluted due to a series of drainage and irrigation channels, there are still many sources which contaminate the environment, such as oil wells, oil pits, accumulation groups, oil sludge plants, stations of oil transport, leakage from the cracks of oil pipelines and the plant of oil processing would require that the technology and

equipment be used nowadays, in the industry of oil extraction and processing comply, with the requirements for environment protection.

Except for surface spillage in the region, there is 85-90% of gas produced as emission in atmosphere (in the source place called Sheqisht, i.e., it is produced approximately 170,000Nm³/month gas and in the source place Patos approximately 130,000 Nm³/month), which should be necessarily used as combustibles, and gas separators be put into operation.

An ecologic and engineering control requires that emissions of other gases, in particular days and times, such as that of H₂S, or emissions of dissolved gas in oil waste deposited in the so-called ecological pits, which in the presence of humidity form respective acids. These one have considerably damaged the olive plant or vineyard in this area. For the first case, it is required the systematization of gases collected in pipelines and then can be used for village home utilities and for the second case, it should be considered the form of recycling for waste oil or the final closure of such pits.

Supplying with potable water is made from the network of utilities. On the other side, approximately 80% or more of the wells which produce oil have *kezinge* (ring spaces) out of function. It increases the possibility of underground water pollution. So, the village people would be better to use the potable water from the network of utilities and not from the use of underground waters, which the residents acquire from the wells drilled in their gardens.

6. Reduction of Negative Impacts and the Need for Monitoring

6.1 Measures for the reduction of negative impacts

Since the pollution in the waters of Gjanica River is rather concerning, it should not be allowed their discharge into surface waters, without bringing them to a permitted level. Negative impacts may be reduced by reconstructing equipment, machineries, as well as the pipelines and reinforcements for the elimination of oil and gas spillage. It may continue to be further reduced, if maintenance services are regularly carried out at the wells for oil extraction, which include the change of reinforcements, valves and pipelines. Or, if it is not achieved the disciplining of discharged waters from oil and gas through proper canalizations (drainage and culverts with plastic pipes). A mitigate of negative impacts on environment is also the way of separation for oil, gas and water, by means of separators in various constructions. After this phase is over, it could be made the substitution of contaminated soil with a clean one, and then after it is made the levelling of territories, the forestation and the rehabilitation with decorative trees.

6.2 Requirements for self-monitoring

Monitoring is a continuous function which uses systematic data collection on a certain number of indicators, in order to provide with them the environment parameters management. It also gives to the actors, interested on the development of a program, the level of achievement for objectives and the progress made in using certain funds. Hence, monitoring includes regular follow-up of activities, inputs, results and products, as well as impacts of a program or project. Improvement of information availability and analyses on air, water and soil would provide the basis for the whole further environmental planning relating this sector. One of the greatest challenges for air improvement in the region is the construction of the required technical and institutional capacities for air monitoring. There is no available and complete information for air emissions, air concentrations, pollution sources, exposure and effects on health and their connections. This would also require the installation of a control stations in Ballsh in the top of Gjanica River, as well as after the discharges of the industrial complex in Fier, in the exit from the city. On the other side, these would require that a central environmental laboratory be established in Fier in order to perform controls on polluting parameters.

7. Conclusions and recommendations

7.1 Conclusions

Oil industry has been and still is an activity which has had a direct impact on air, ground, water and, as a consequence, on human health. It has been long times since in the Ballsh-Fier region, there have been revealed considerable contaminations in the environment, with severe impacts in the health of the community.

Waters discharged by the oil industry have hydrocarbon components in their composition, such as: aromatics, tension-active substances, etc., which has damaged living plants and animals in aquatic environments, where they are discharged.

Analysis of environmental data and indicators makes it possible for us to give a correct assessment of the actual environmental situation based and substantiated on the comparison of these indicators with those in national and international level.

Observing in the light of environmental and social environment, which this community deals with, it is difficult to speak about a sustainable economic development, where, on one side, this region has modest benefits from petroleum industry and on the other side, the cost of environmental contamination they are obliged to deal with is many times greater.

Professional illnesses have turned into anxiety for the residents of oil areas. More than 90% of them have been affected from phenols in blood. Hundreds of residents in these areas suffer from health problems. Life expectancy has been reduced sensibly and living in this region has been reduced sensibly and living in this region is becoming more difficult each passing day.

7.2 Opinions to be taken into account

- To be established an isolated location for the collection of bituminous sand, (oil sand) in order to store and preserve it, so as to use it for the adjustment of infrastructure, where pits shall be covered.
- To be made possible that the territory be fenced and wooded.
- To be established an isolated location for the collection of contaminated ground, then to be stipulated where they shall be relocated, processed and destroyed.
- To be established a small commune sector in order to carry out the works for planting and maintaining the infrastructure, which shall also involve a specialist for plant agriculture.
- To be established a modern healthcare centre for the check up of service personnel, as well as for the residents in the surrounding area.
- To be kept under control the presence of hydrocarbons of the series: benzene, toluene in aquatic environment, as these substances are carcinogenic.

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