Environmental Impact of Oil Refining Industry in Albania
Case of Ballsh Oil Refinery Plant

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Abstract

Oil and Gas Processing Industry in Albania is installed near major crude oil resources of the country. Mallakastra region (Ballesh) occupies an important place in this national asset, in which are present not only limestone deposits of oil but also Oil Refinery Plant and Lubricant Plant in Ballsh. Oil Refinery Plant, with a processing capacity of 1.25 million t v-1 crude oil, it has been in use since 1978. Development of Oil Processing Industry except irreplaceable benefits to the national economy has had and has a significant environmental risk to soil, water, air and habitat areas where the industry is installed. Object of study has been taken Mallakastra region, as a region in which coexist and generate environmental negativity as extraction industry and oil processing.

Keywords: crude oil, habitats, environmental impact, refining industry, sources of pollution.

Aim: The purpose of this study was to identify the resources, factors and effects of current environmental pollution by the oil processing industry and the their impact in the environment.

Background

Oil refining industry and gas in Albania has been installed in four refineries in oil-bearing areas:
Oil Processing Plant (UPN) in Kucova, Cërrik, Fier and Oil Refinery Plant (KPTHN) Lubricant oil Plant in Ballsh. Oil Refinery Plant was designed with Chinese technologies of years 70s -'75 and bring into use in 1978, it has a processing capacity of up to 1 million tons / year crude oil.
Oil Processing Plant in Kuçova with procesing activity since 1940 and Oil Processing Plant in Cërrik since 1956, currently have discontinued production activity since November 1993, but they left behind contamination consequences in the respective regions where they where installed. But, Oil Processing Plant in Fier and Ballsh are active in production and they are contaminating habitat of the premises where they are installed.[4,7,10] Convulsive development of oil processing industry in Albania was accompanied by the relevant environmental impact, for many reasons, such as:

- Lack of legislation and lack of National Strategy for Development and Environmental Protection;
- Poor technical infrastructure and amortized in oil processing industry;
- Waste treatment technologies of oil industrial refineries and gas, exceeded in time;
- High sulfur content (3.2-6.2%) in the crude oil of the country and it's byproducts;

- The high level of losses (5-11%) in the stocking process, refining, storage and distribution of oil, gas and it's byproducts;
- Lack of seriousness on the supply of raw and auxiliary materials of this industry, especially with crude oil and electricity;
- Interruption of the production process due to technical failures and frequent interruptions of power supply (over 30 times a year);
- Lack of control instruments according to contemporary standards for the quality of production and the quality of the fluid discharged into the environment;
- Lack of technologies for the treatment of waste gases, liquid and solid of oil and gas refining industry.

Environmental pollution from the oil refinery industry include pollution of soil, water and air, but this paper will concentrate more on liquid effluents. Sources and main factors of this pollution are:

- Units and the relevant technological processes necessary for the refining of oil and gas in Oil Refinery Plant,
- Reservoirs of raw material (crude oil), semi-products and products,
- Decantation oil plants, as part of the technological processes before refining it,
- Oil pumping stations, semi-products and products,
- Pipelines transporting oil, semi-products and products,
- Gas stations supplying gas in Oil Refinery Plant and in all technological unit.
- Dysfunctional Plant for water treatment and solid waste
- High technological losses
- Great corrosion of devices and equipments, due to higher depreciation and lack of care for the preservation and maintenance
- Lack of recycling plants for catalysts and chemicals
- Supply of raw material (crude oil), out of standards (high % of sulfur, water, salt, sand and clay)
- Evaporation of hydrocarbons and chemicals from surface waters and relative water body (River Gjanica)
- Accidental Pollution (breakdown, fire, leakage) crack lines, defects in equipment and devices,
- Subjective pollution with effects such as fire and gas leak and liquid due to the interruption of electricity, technology and fire-fighting evaporation, technological water and air. [1-12]

Oil Refinery Plant are closed technological systems, however they emit pollutants which contaminate soil, liquid and water in the regions where they are installed. Liquid pollutants most often caused by the refinery are:

- Oil-water mixture caused during decantation in reservoirs of raw materials and electro-desalination plant before atmospheric distillation of crude oil;
- Mixing semi-products-water and products -water discharged during decantation in their respective conservation reservoirs;
- Liquid waste discharged during the washing process required of technological lines and technological equipment before their release and after their detention;
- Acids and basic water generated during chemical technological processing of refining of oil and oil derivatives (byproducts);
- Accidental discharges of crude oil and it's liquid derivatives.

In the pictures and table below are provided the main sources of wastewater in K.P.TH.N, Ballsh and corresponding emissions and discharges in water body and specifically on the Gjanica River:

Figure 1: Direct discharged in Gjanica River of polluted water without passing through wastewater treatment plant of refinery, Ballsh.

Figure 2. The discharges in Gjanica River from Balshi Oil Refinery.

Materials and Methods

To have a clear idea about the environmental impact caused by Oil Refining Industry in Albania, referring to data sources of studies conducted in this area over the last decade, this study will present monitoring of emission in the environment of liquid pollutant, coused by the Oil refinery Ballsh and with consequences in respective habitats. The methodologies used to determine the qualitative indicators above are as follows: 33 EN159: 2010 PH, 1584 STASH nitrates (NO_3-N); STASH 1584 phosphates (P-PO_4); STASH 1584 - chlorides; 1584 STASH – sulphates and Smee; 5520. B - oil (grease). More specifically, in the table below, we present the summary identifying sites of pollution by chemical ingredients discharged by Oil Refinery Industry, Ballesh:

Tabela 1: Identified contaminated places by chemical components of discharges in Oil Refinery Industry, Ballesh.

Nr.	Unit	Product
1	Distillation Unit	- Oil products - Acidic waters (H_2S, HCl, etc.) - Alkaline water
2	Coke Unit	Oil products - Acidic waters (H_2S, HCl, etc.) - Alkaline water
3	Hydrogen Unit	- Acidic waters (H_2S) - Alkaline waters (MEA) - Oil products - Acidic waters (H_2S, HCl, etc.) - Alkaline waters (NaOH, MEA, etc.)
4	Sulfur production Unit	- Oil products - Acidic waters (H_2S, HCl, etc.) - Alkaline water (NaOH, MEA, etc.)
5	Transport Unit	Oil products - Acidic waters - Alkaline waters
6	WWTP	Oil products - Acidic waters (H_2S, HCl, etc.) - Alkaline waters (NaOH, MEA, etc.)

In Gjanica River valley are installed both refineries that are today in function in Albania, Oil refinery Ballesh & UPN Fier, also along the coast of this river are extended two major sources of crud oil, Ballesh and Visoka. Gjanica River has a longitudinal extection of 70 km with a water catchment basin area of 234.07 km^2. The main source that supplies Gjanicës flow is Shpiragu Mountain.

At a length of 41 km, starting from Ballesh until it joins with the Seman river are concentrated all discharges that influence in river pollution where every 7-8 km occures waters descharges, which are changing the nature of the river to the full destruction of it's fauna and flora.

Results and Discussion

In the Gjanica River, water is discharged as technological waste of Oil Refinery Ballesh and Fier and layer waters deriving after decantation process of Usojë and Visokë oil extraction plants and urban cities of Fier and Ballsh citys. It is estimated that every month about 13000-18000 m^3 liquid waste are discharged in Gjanicë river containing hydrocarbons, chemicals, oil and industrial oils. In the Oil Refinery in Ballesh, currently are useing a series of chemicals necessary for technological process, such as:

- Monoethanolamine 9-9.5 tonnes / year (hydrogen production)
- Sulfolane from 8.5 to 9 tonnes / year (hydrogen production)
- Caustic calcined 9.5 to 10 ton / year (atmospheric distillation)
- Caustic soda 105-115 tons / year (Hidropastrimi & gas cleaning).
- As well as servo, an inhibitor, acid and laboratory chemical for analysis and production schedule sales.

These chemicals during their use contaminate the land that is part of the refinery, and after their use they are discharged into the Gjanica River, causing a very negative effect on river contamination. Only from the units and tanks park of Oil Refinery Ballesh are generated a large amount of groundwater containing oil and its byproducts. The type and quantity of water generated per hour (m^3/h) from various technological processes in Oil Refinery, referring to the current production capacity is as in the chart below:
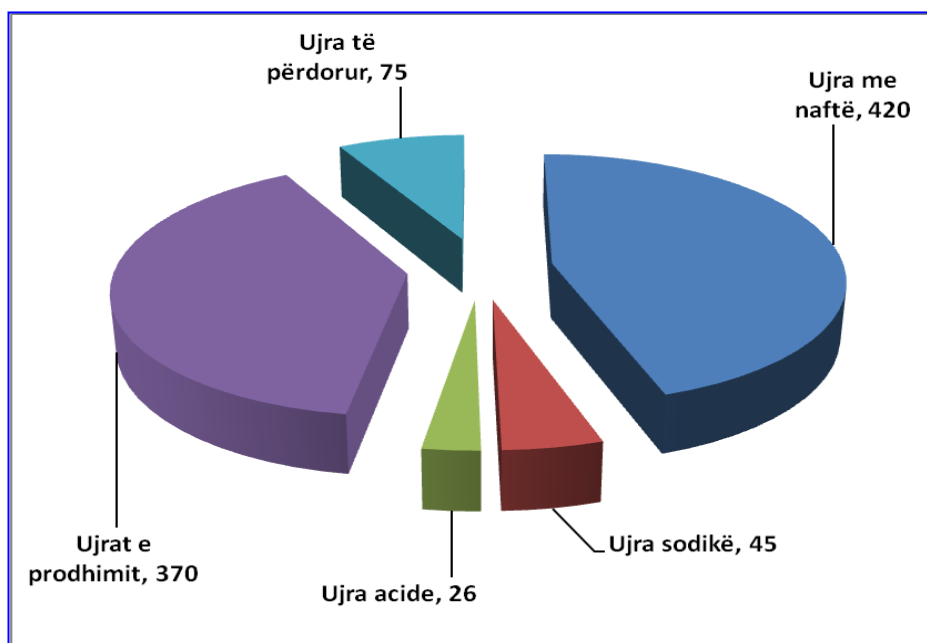

Chart 1: The inventory of technological water discharged from Oil Refinery, Ballsh.

Oil Waters - the largest amount of oil water is produced from, transport unit, laboratory unit, remont unit with 3120 m^3/day, the circulating water with 2424 m^3/day and hydrogen unit with 552 m^3/day. *Alkaline Waters* - the largest quantity of alkaline water is produced from hidropastrimi with about 1080 m^3/day. *Maximum daily load* - is produced from transport unit, laboratory unit, remont unit and desalting unit, with 2064 m3/day. The quality monitoring situation of technological water discharged before the entrance in WWTP and the quality of water discharged in Gjanica is presented as follows:

Table 2: Water analysis of Gjanica River before the Oil Refining Industry

Analysis	Water of Gjanica River before the Oil Refinery
pH	6.5
Acidity content mgek/l	4.2
COD, mg/l	30
The content of dissolved O_2 mg/l	35
The content of phenol mg/l	missing
The content of chlorides mg/l	26
Contents of oil and it's byproducts	missing
The content of calcium and magnesium amount mgek/l	6
Contents of Ammonia mg/l	missing
The content of sulfates mg/l	60
TSS mg / l	490

Table 3: The quality situation of industrial water Oil Refinery Ballsh, and the quality of discharges into the Gjanica River

Parameters	Oil Water	Alkaline Water	Acid Water	Desalter	Discharge in Gjanica river	Standarts	
						VKM nr.170, 31.03.05	BB/IFC 1995
pH	7.6	10	5.7	8.5	8	6 - 9	6 - 9
BOD_5 (mg/l)	> 50000	8500	6900	5400	750	50	50
TSS (mg/l)	700	< 30	< 30	<30	< 30	50	50
Oil and grease	>10000	270	175	656	2800	10	10
Phenols (mg/l)	8.5	2.5	40	600	38	1	0.5
Sulfide (mg/l)	-	4.9	4	5.4	6.1	1	
Total nitrogen (mg/l)	-	58	340	308	-		
Chrome (mg/l)	< 0.1	< 0.1	< 0.1	<0.1	< 0.1	5	0.1
Lead (mg/l)	< 0.1	< 0.1	< 0.1	-	< 0.1	5	0.1
Sulphur (mg/l)	-	-	-	-	240		300
Chloride(mg/l)	-	-	-	-	50		1

Environmental pollution in the areas where the oil industry is installed has brought these consequences:

❖ It severely damaged the health of workers and residents of urban and rural respective areas:
- A large number of employees are affected by professional diseases, cardiovascular, diabetes, blood phenols; they have concerns and damage to the central nervous system and pulmonary, respiratory system, digestive etc.
- From a survey conducted in Ballsh Oil Refinery on tests conducted on 163 employees working over 15 years is found that:
  - 51%   have high blood phenols.
  - 22.8% have to high Bilirubin.
  - 11:38% have with diabetes.
  - There are employees who suffer from more than one disease
- High mortality and short life especially for the employee of the Oil extraction and Refinery area.

❖ It caused an environmental negative effect damaging:
- Air quality and concretely:
  - In all regions of the extraction e refining of oil you can smell the strong odor of oil vapor hydrocarbons and H_2S.
  - Areas near the oil processing industry are exposed to the effects of acid rains with consequences in the respiratory system of people, crops and environmental corrosion.

❖ It has harmed water quality relevant regional hydro system bringing these consequences:
- Gjanica River in its geographical segment (about 41 km) from Ballesh Oil Refinery - joining the Seman River, has become a "dead" river for its traditional fauna and flora, without any benefit to agriculture (irrigation) or livestock.
- Effect is great and forwarded to the Adriatic Sea affected negatively in:
  - Fisheries
  - Damage to the marine flora and fauna,
  - Sandstone pollution generation,
  - Favors corrosion of metal surfaces of ships, etc.

❖ In the water basins is jeopardizing the existence of microorganisms, being injured and poisoned them.
❖ Impairment of land near technological systems of the Industry of oil processing consists of:
- The degradation (poisoning) of agricultural land in the area around the perimeter of Oil Refinery.
- In creating their erosion phenomena due to its organic damage,
- The reduction of agricultural productivity of etc.

Flora & Fauna:
- Fauna of the oil-bearing region is impoverished in the number of species, but also in the number of individuals within a species, as a result of deterioration of the environment where they live, whether in water and soil environments.
- Has damaged tourist and recreational activities for the residents and the regions where the oil industry has developed.

Finally environmental contamination from oil processing industry is a problem which is not sufficiently taken into consideration so far, but should be evaluated more not only by institutions and researchers, but also by political and opinion makers.

Conclusion

In conclusion of this work, which includes monitoring of the environmental impact of the Oil Refining Industry, specifically in hydro system and precisely Gjanica River, come up with following conclusions:
- The development of the oil industry is not associated with environmental management strategies and policies of the companies and the relevant state structures.
- The technical and technological condition of Oil refining, in general, does not comply with the environmental laws,
- Technological water, polluted by oil and chemicals is discharge in river without complete treatment until the right value required by standards.

- River Gjanica in its full length on 40 km from Ballsh Oil Refinery, and until they are reunited with the River Seman, is a "Dead river", with a negative impact on the fauna and flora and ususable for drinking and irrigation,
- Fauna is continuously reduced as a result of damage to the vegetative cover of the concentration hydrocarbons, as in the air and surface waters.
- The large amount of discharged liquid in the hydrological body and physico-chemical characteristics of their above admissible, have impacted negatively on the development of flora and fauna, which is threatened by contamination of their habitats.
- All areas where the Oil Industry is installed represents a degradation stage of native vegetation (degradation that continues even today)
- Fertility of agricultural lands and fruit growing of all around oil-bearing area is in continuos regresivity
- Pollution in air, water and earth has consequences on the health of the inhabitants of these regions.

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