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THE WASTE OIL INFLUENCE AND RISKS ON ENVIRONMENT IN REFER TO BOSNIA AND HERZEGOVINA

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ABSTRACT
The main impurities usually present in used oil are various organic acid, polymer residua, metal particles arisen by wear and tear parts of lubricated equipment like: lead, chromium, nickel, cadmium, aluminum, polycyclic aromatic hydrocarbons (PAH), mercaptans, various halogenated compounds, soot, sand, dust and microbes. In addition, but with less frequency, waste oils may contain high-harmful polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCT) or polybrominated biphenyls (PBB). Waste oil can have a number of significant, short-term and long-term impacts on the environment if they are treated or managed in an uncontrolled manner. Oil prevents the penetration of oxygen into the water, thereby makes violation the conditions of life of many species. Taking into account that Bosnia and Herzegovina interspersed with a large number of surface and groundwater, and paying attention to the fact that water contains only 1-2 mg per liter of lubricating oils are not suitable for drinking, it is obvious that the risks short-and long-term impact for the entire huge living world are present. An existing initial database of oil distributors, importers, manufacturers and users in Bosnia and Herzegovina has been analyzed, on the base of the lubricants related practice waste oil generation.
Key words: waste oil, risks, environmental impact assessment, PCBs .

1. CHEMICAL COMPOSITION OF LUBRICATING OILS AND WASTE OILS
Lubricating oils and greases, base oils contain *component of based oil or additives*, which are used for the optimization of lubricants for various applications. Greases besides this contain a component called a thickener, usually metallic (calcium, aluminum) soap. The most commonly used base oils are mineral base oils paraffin's type, whose initial characteristics of the processes used to further improve the catalytic hydrogen treatment (hydro-treatment), but in some cases, are also used synthetic base oils, especially synthetic esters, poly-α-olefins, poly-glycols, and Butyl, and sometimes bio-degradable vegetable oil base. All of these types of base oils are mostly made of carbon (C) and hydrogen (H), and to a lesser extent oxygen (O) [3].
Additives are used to give the properties of the lubricant base oil, which just does not have, but with the aim of reinforcing the existing desirable properties or to reduce undesirable properties of base oil. They are based on different organic and organ metallic compounds, like zinc-dialkyl-ditiophosphates, sulphonates, phonates and salicylates (typically calcium, magnesium), olefin copolymers, polymath-acrylates, copolymers of styrene and butadiene, copolymers of styrene and isoprene, succinimide borats…

Of all the lubricants, the highest rate of use are those that are used for vehicles, ie. motor oil and gear trains, hydraulic oils, turbine and compressor oil. Fresh lubricants contain "hetero"- elements, primarily oxygen (O), sulfur (S), nitrogen (N), calcium (Ca), zinc (Zn), phosphorus (P), boron (B) and chlorine (Cl) in different concentrations, while the base oil previously contained very harmful polycyclic aromatic hydrocarbons (PAH). The most manufacturers of lubricants use today only the base oils which do not contain harmful substances (like lead and barium) in significant quantities.
In recent years the growing number of users requires lubricants that are compatible with the environment, especially in the case of applications where lubricant regularly comes into contact with water, soil or living organisms. Such lubricants may be based on the plant, and synthetic base oils, mostly from rapeseed oil. Base oils of plant origin are biodegradable and do not have toxic properties, and their sources are renewable. Of synthetic base oils by the biodegradability the synthetic esters and polyethylene glycol should be emphasized. The industry has adopted the criterion that the lubricants which biological degradation during the standard 21-day test exceeds 80% are indicated as fast biologically degradable. Unlike these lubricants, conventional mineral based lubricants only during one year period may reach 90% biodegradation, but the complete destruction in some cases lasts much longer. The biodegradation of lubricants itself, which accelerates the presence of moisture and heat occurs due to microorganism's activity, where as the final products resulting CO_2 and water.
In contrast to fresh or unused lubricants, the term oils means waste product after the application of lubricating oils, whose original features have changed over the use to the extent that it deems unsuitable for further use. Chemical composition of waste oil, along with the original ingredients of the components of base oils and additives, includes the products of oxidation and degradation of base oils and additives, as well as outer pollutants that have arisen during implementation. (Figure 1). Waste oils are considered to be irritating, carcinogenic, and one category of potentially harmful pollutants, with much more serious impact on the environment compared to the effect that they have unused lubricating oils.

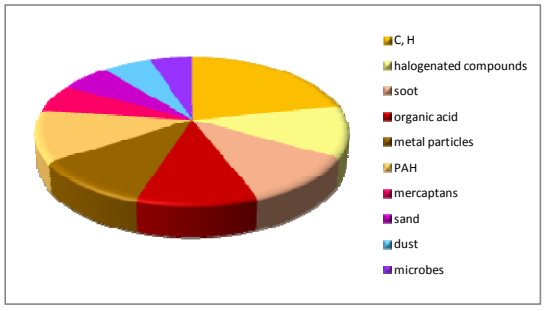

Figure 1. Chemical composition of used oil

2. IMPACT ASSESSMENT AND RISKS RELATED TO USED LUBRICANTS

Waste oil can have a number of significant, short-term and long-term impacts on the environment if disposed of in an uncontrolled manner [1]. For example, water containing 1-2 mg per liter of lubricating oil is not suitable for drinking and is considered dangerous. The oil prevents the penetration of oxygen into the water, thereby violating the conditions of life of many species. According to some estimates, one ton of waste oil released into the waterways resulting in pollution equivalent to that caused by waste water per day town of 40,000 inhabitants. Contamination of soil and water used oils affects the overall flora and fauna. After discharge, sometimes it takes several years to reach its natural degradation. Even though the hydrocarbon components of oil can be easily degraded by biological processes within the natural environment, the degree of degradation depends on many factors, such as temperature, medium with which the oil is in contact, environmental pH, other physical and chemical parameters, as well as the amount discharged oil itself. However, it is important to note that, regardless of what the basic

components of a hydrocarbon oil can be completely degraded by biological way, many other pollutants such as heavy metals, remain permanently in the soil or end up in surface or groundwater.
As for the improper or uncontrolled burning of waste oil, it should be noted that their thermal degradation at temperatures below 1100°C, can lead to the formation of highly toxic gaseous substances such as dioxins and furans. In addition, emissions that are released during the burning of oil include carbon monoxide (CO), sulfur oxides (SOx), nitrogen oxides (NOx), particulate matter, metals, HCl, gases that contribute to global warming (carbon dioxide - CO2 and methane - CH4), and other environmentally harmful or toxic organic substances.

3. CURRENT CONDITIONS IN BOSNIA AND HERZEGOVINA

In the case where no treatment facilities exist, as is often the case in the current conditions of Bosnia & Herzegovina, oils are going in the surface waters, which further pollute the entire aquatic life and coastal biodiversity. In many cases, surface water is used for drinking, recreation and irrigation, thus further endangering human life.
Taking into account the level of oil consumption and possible percentage of collection (Table 1), it can be assumed that between 10.200 and 11.875 tons of lubricants dominant categories unavoidable lost every year (50% of all oil for vehicles, hydraulic and compressor oil, which together have a combined share of between 85% to 95% of all lubricants, which are currently being used). Unavoidable losses can be estimated at about 11000-13000 t/yr. (More precisely, 10950-12835 t/yr, under the same assumptions[1]). This is attributed to losses due to evaporation (VOC-volatile organic compounds) or worn parts and improperly maintained facilities and equipment, resulting in unintentionally leakage and shedding. Even the waste oil to be collected individually - with the amount based on the above considerations roughly estimated at a maximum of 10,000 t / yr (10 440 to 14.875t) - mostly burned in furnaces home heating systems, as well as industrial boilers, under inappropriate conditions (as explained earlier, 90% or even more when using certain types of waste oil). Table 1 shows the cumulative quantity lubricant flows considered in this paper, in the context of environmental impact.

Table 1 - Volume flow lubricants in the context of the environmental impact in B&H

Oil to be for sale [t/g]	Consumption [t/yr]	Possible Collected used oils [t/yr]	Current individual collecting -estimation [t/yr]	Direct losses to environment [t/yr]
27.000	24.000-25.000	12.000-12.500	≤ 10.000 (90% is not legally burning and polluting environment)	11.000-13.000 (evaporation, leaks or spills)

Because the waste oil containing PCBs sometimes burned in boilers central heating systems (where there is an additional risk of high toxic polychlorinated dibenzo-furanes - PCDF, whether alone or mixed with other types of oil, and as occasionally comes to oil leaks from transformers, it is obvious that the devastating effects are often not comprehend seriously.
During the war in B&H from 1992-1995, [1] about 500 electrical transformers and capacitors have been damaged or destroyed (the precise locations are generally not known, and there are no records on the characteristics of the original oil used in this equipment). The results of measuring the total concentration of PCBs in soil are much more varied and range from 50 to over 100 million ng / g or 0.050 to 100,000 ppm. The concentrations found in most samples were below 10.000 ng / g. However, a particularly high level of total PCB concentrations recorded in the following areas are illustrating on the Table 2.
Especially high concentrations of PCBs were found in sediments of some streams in the area of Sarajevo (rivers Miljacka and Zujevina, with measured concentrations of 929 and 2691 ng/g), the Bihac area (pond

[1] if for all types of grease / oil simplified assuming an average level of the possible collection of 50%, leads to somewhat different amounts, about 12000-12500 t / yr

Klokot, with 361 ng/g, - In the tissue of six examined fish from the ponds was determined PCB concentration in the range of 12-73 ng/g), as well as in the Tuzla region (rivers Gostilja and Spreca, with the record set of 377 and 483 ng/g).

Table 2. PCB concentrations at defined regions

Region	The highest measured amounts of concentration PCB, ng/g
Tuzla	**96.178.000**
Tešanj (Jelah)	**178.954.000**
Banja Luka	**400.000**

While the pollution of soil PCBs in most cases can be attributed to leakage from damaged electro installations (transformers and capacitors), is not a reliable to make conclusion without further detailed study about the origin of PCBs in streams, having on mind the possibility of different migration paths. Such studies would have to include an analysis of the hydro geological characteristics of each micro location, filtration and hydraulic characteristics concerning the movement of groundwater and surface water, sediment characteristics and bed covers rivers, etc., with laboratory analysis of samples of surface water, soil and groundwater from a series of holes.

4. CONCLUSIONS

Total losses amounted to 11000-13000 tons per year which ends within the soil, waterways or the atmosphere where it is still breathing humans and animals, and eventually becomes carried by water away in soil and water. One part of this amount going through the process of natural degradation, while a certain amount, which is practically impossible to determine, ends within the plants, animals and humans, causing acute or cumulative and chronic health problems. Biodegradable lubricants in B&H are currently used in negligible amounts.

On the individual basis about 10.000 t/yr is collected, which are improperly burned where thousands of tons of organic substances and dozens of tons of metals are released into the atmosphere each year across the Country. Taking into account that Bosnia and Herzegovina interspersed with a large number of surface and groundwater, and once again paying attention to the fact that water contains only 1-2 mg per liter of lubricating oils is not suitable for drinking and that is dangerous, it is obvious that the risks short- and long-term impact for the entire huge living world. When the PCB, as well as persistent organic pollutants (POP), one reaches the animal or human tissue, the health implications are very negative. Animals and people are becoming less fertile, less immune, and develop a higher degree of susceptibility to cancerous diseases. It is also believed that PCBs act as endocrine blockers. Not available data on the health situation in some locations on the basis of which it would be possible to make reliable conclusions and to establish a correlation between the presence of PCBs in soil or water currents and the emergence of diseases that could be caused by the action of PCBs.

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