DE GRUYTER OPEN

DOI 10.2478/pesd-2018-0009 PESD, VOL. 12, no. 1, 2018

THE CHARACTERISTICS OF THE PROCESS OF ”HISTORICAL POLLUTION” WITH BLACK OIL AT S.C. ”MODERN CALOR” S. A. BOTOŞANI

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Key words: historical pollution, black oil ramp

Abstract: The work shows historical pollution aspects of the soil on a range of approximately 2000 m^2 located in the east of Botosani city at the loading platform/discharge heavy fuel oil in the enclosure thermal power company S.C. Modern Calor found S.A. This study was based on a series of works based on projects of soil and groundwater investigation in the area of the heating company S.C. Modern Audit Office found S.A. Soil contamination is the result of pollution over time, which is due primarily to faulty-urilor occurring during operation of the pipes or the sewage system in the territory of society of heating, to the lines of transport heavy fuel oil.At present, industrial pollution control, requirements imposed by Community acquis on environment, shall be carried out on the basis of directive (IPPC Directive, Directive LCP) and other techniques of the medium (BAT-s corresponding BREF, in the industrial sector). By these tools are prevents and controls in full pollution, thereby reducing industrial pollution.

Introduction

In Botosani municipality, the soil pollution with mineral oils is due especially to technological processes developed in those 3 fuel depots, the trading activity of end mineral oils in more than 20 fuel distribution stations but in most pollution is due to the activity developed by the district heating company S.C. Modern Calor S.A.

The particular aspect of soil pollution with black oil and mineral oils for the studied area (black oil discharge ramp inside S.C. Modern Calor S.A.) is that there is a phenomenon with a history of over 30 years, which began in the same time with the emplacement of district heating industry in the north-west part of Botosani town. Analysing the history we can conclude that the black oil ramp was designed

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in 1977, built in the period 1978-1980 and brought into service probably in 1980. In the archive of CET Botosani, there was found only a situation plan realised by ISPE in 1977. Down the ages, the black oil ramp was used for discharging black oil from wagons and its transport to the storage tanks nearby. Initially, the collector pipe for black oil and the steam pipe for fluidization were placed in a concrete, underground, waterproof (covered) channel. Shortly after bringing into service, there were detected black oil infiltrations in this channel, come from the leakage during handling. The infiltrations were significant, because in 1983 was decided the re-location of the steam overground pipe, on a metallic supporting srtucture.

Since the first functioning period (1980-1990) there were found failures in the black oil ramp functioning, because, mainly, to the difficulty to manage the black oil leakages, and also to the underground water situated at small depth.

The surface of the black oil ramp was initially lost, so the black oil leakages were very hard to be captured. Thereby, there was decided integral concreting (slabbing) of the ramp and realizing a concrete collecting channel, from where the black oil leakage could be collected and pumped over. Taking into account that the impermeability of the concrete channel was no longer ensured, there have been realized contact slots between the collecting channel and the concrete channel. The problems still continued because the pluvial waters (and the impurities involved in this) came in the channel of the black oil pipe polluting the black oil come from the leakages.

The underground water being at small depth gets into contact with the black oil leakages through the concrete channel, through the collecting channel and through the CF line. In time, there were found irizations in the underground waters down the river. In order to stop the contamination of pluvial waters, there have been proposed several solutions, including the development of a drainage channel in the left part of the railway, in order to lower the underground water level. This channel was realized but it didn't work at the designed parameters, and the problem of underground water contamination persisted. At present, the drainage channel is integrally clogged.

Along with comming into force of the Environmental Protection Law (1995), the pollution problems at the black oil ramp became stringent. In order to conform to the environmental legislation, there have been realized different measures for reducing the impact over the soil and underground water. Among these we remember: metallic separator, with the volume V=1,5 m^3, steel concrete separator for the organic substances in the contaminated waters, fats separator for waters come from the drainage of the area of the black oil depots has the volume V=7,8 m^3. The resulted water is directed to Luizoaia rivulet.

Materials and methods In order to collect the data, there have been used both secondary information sources and primary sources. Specifically, to the preparation of the paper we used the data fund in Modern Calor archive, documents and authorizations issued by the Environmental Protection Agency, Botosani and documents in the archive of Botosani Town Hall. There have been difficult collaborations, especially when this supposed providing data or syntheses on fields of activity.

Observation on site was used in order to inventorize and locate as accurately as possible of the factors that have led to soil pollution in the studied area. So, there have been executed a number of 7 drillings from which there have been taken samples of soil and water.

The arrangement of drillings was established according to the spacial extension of the area to analyze, and to the flowing direction of the underground waters. There has been observed data collection concerning black oil contamination of soil upstream and downstream the ramp, and also of soil under the black oil ramp.

Drilling (D1):Is located in the right side of the railway, at about 30 m of its end, in the green area between the black oil ramp and tanks. The drilling was conducted till 3 m depth. There hasn’t been intercepted ground water. Soil stratification was: 40 cm sooty, loose vegetable soil; 190 cm yellowish powdery clay – reddish, consistent, 70 cm fawn powdery clay – brownish – black, consistent. From this drilling there have been extracted 4 soil samples, from 10, 100, 220 and 300 cm. There haven’t been detected traces (visual or olfactory) of mineral oil in the collected samples.

Drilling (D2): Is located in the left side of the railway, at about 30 m of its end, near the Drilling F1. The drilling was conducted till 4.3 m depth. There has been intercepted ground water at -3.30 m. Soil stratification was: 40 cm sooty, loose vegetable, humid soil; 240 cm yellowish powdery clay – reddish, consistent, 80 cm yellowish whitish, pressed loess; 70 cm loamy yellowish consistent hard (waterproof) clay. From this drilling there have been extracted 5 soil samples, from 20, 120, 210, 300 and 430 cm. After a rest period of 2 hours, there has been extracted water acumulated in the drilling and after refill and rest, there has been sampled a groundwater sample, using a hand pump. There haven’t been detected traces (visual or olfactory) of mineral oil in the collected samples.

Drilling (D3): It is located in the north extremity of the ramp, near the hydrocarbon separator, between the trak rails. For the drilling, the concrete slabs have been extracted with a machine. In order to reach at the soil layer there has been manually removed the gravel layer. Under the concrete slabs the presence of black oil was visually found. The gravel layer under the slabs is also heavily contaminated with black oil. The ground water has been intercepted at -1.1 m, in the gravel layer. The drilling was conducted till 2.5 m depth. Immediately after the gravel layer, there has been intercepted a layer of loamy yellowish consistent hard (waterproof) clay. Sampling was difficult because of the drilling flood with ground water contaminated with black oil in the gravel layer and implicitly of the contamination risk of the sample. There still have been sampled 2 soil samples from 150 and 250 cm depth. After the drill extraction, the soil samples were washed with water and the superficial soil layer was removed, minifying this way the samples contamination. The ground water sampling was considered irrelevant because the black oil presence was obvious.

Drilling (D4): It is located in the southern part of the ramp, near the first tank of 5000 m^3 in the black oil establishment, between the trak rails. For the drilling, the concrete slabs have been extracted with a machine. In order to reach at the soil layer there has been manually removed the gravel layer. Under the concrete slabs the presence of black oil was visually found. The gravel layer under the slabs is also heavily contaminated with black oil. The ground water has been intercepted at -1,6 m, in the gravel layer. The drilling was conducted till 3 m depth. Immediately after the gravel layer, there has been intercepted a layer of powdery yellowish consistent clay which continues till – 2 m depth. There follows a layer of loamy yellowish consistent hard (waterproof) clay. As in case of Drilling F3, the sampling was difficult because of the drilling flood with ground water contaminated with black oil in the gravel layer and implicitly of the contamination risk of the sample. There have been sampled 4 soil samples from 150 and 200, 250 and 300 cm depth. After the drill extraction, the soil samples were washed with water and the superficial soil layer was removed, minifying this way the samples contamination. The ground water sampling was considered irrelevant because the black oil presence was obvious.

Drilling (D5): It is located in the central area of the ramp, on the right part of the railway, near the second black oil tank of 10000 m^3. The drilling was conducted till 4,3 m depth. The ground water has been intercepted at -4,2 m. After a vegetable soil layer of 40 cm, there has been intercepted only powdery yellowish reddish soft consistent clay. The most probably this clay layer is not native, but it was artificially installed in order to realize the black oil establishment. From this drilling there have been extracted 5 soil samples, from 40, 120, 210, 300 and 430 cm depth. After a rest period of 2 hours, there has been extracted water acumulated in the drilling and after refill and rest, there has been sampled a groundwater sample, using a hand pump. There haven't been detected traces (visual or olfactory) of mineral oil in the collected samples.

Drilling (D6): It is located in the north extremity of the ramp, on the left side of the railway, near the hydrocarbon separator. The drilling was conducted till 2 m depth. The ground water has been intercepted at -1,1 m. After removing the 20 cm gravel layer, there has been intercepted a powdery yellowish reddish consistent (till -1,1m) clay, after which it continued with a loamy yellowish clay with interlayers of yellowish grey sand, consistent hard (waterproof). From this drilling there have been extracted 3 soil samples, from 50, 120, 160 cm depth. After a rest period of 2 hours, there has been extracted water acumulated in the drilling and after refill and rest, there has been sampled a groundwater sample, using a hand pump. There haven't been detected traces (visual or olfactory) of mineral oil in the collected samples.

Drilling (D7): It is located at 50 m in the north extremity of the ramp, in the green area between the 2 railways. The drilling was conducted till 1.4 m depth. The ground water hasn't been intercepted. The drilling intercepted only a vegetable soil layer mixed with ballast and yellowish, crumbly gravel (most likely, non-indigenous stuffing for realization of railway foundation). From this drilling there have been extracted 2 soil samples, from 50 and 140cm depth. There haven't been detected traces (visual or olfactory) of mineral oil in the collected samples.

Table 1. Types of soil samples analyses .

1	pH analyses in potentiometer extract
2	$CaCO_3$ analyses by Scheibler method
3	humus analyses, by Walkey-Black method in Gogoaşă (Sinker) modification
4	N total analyses, by Kyeldahl method
5	P mobil analyses, by Egner-Riehm-Domingo method
6	K mobil analyses, by Egner-Riehm-Domingo method
7	Granulometric analyses by Kacinski method
8	soluble salts analyses
9	SO42- content
10	Heavy metals (total forms)

For comparison, the data obtained compared with soils unaffected by the impact of the steam power plants in order to evaluate the contamination degree.

The analyses were performed within O.S.P.A. Botosani laboratory.

For the water samples there has been used the „SPECTROPHOTOMETRY IR" method. As heavy oil products, greases, heavy residual fuels, asphalt etc. are less volatile, the IR spectrum of the unknown samples can be compared with the reference spectrum. If the unknown sample was exposed to the environment factors, such as air, sunlight or temperature, there must be taken into account the peroxidative modifications which took place. There can't be obtained useful information from the IR spectrum of volatile products, such as naphtha and gasolines, only sampling is made „in the spot" immediately after the evacuation. Sampling and preparing the sample is realized identically with the one for the gravimetric method.

The principle of the method - From the sample brought at pH<5 the oil products together with some organic substances are extracted. After retaining polar substances, on a chromatographic column with silica-gel the oil products are dosed from the carbon tetrachloride by spectrophotometry in infrared, measuring the absorbance at 2930 cm-1. The equipment necessary is similar to that used at the gravimetric method, besides, being necessary a spectrometer with double beam in the infrared field [(4000 ... 400) cm^{-1}] fitted with a pair of vats with optical length of 3 mm or 5 mm.

The analyses were performed in S.G.A. Iaşi laboratory.

Results and discutions

The areal studied is placed on a quasi-horizontal plane, situated in the NW part of the CET Botosani. The field is not affected by any instability and it doesn't have ups or downs not being crossed by any kind of water flowing at the surface. Till the date of the present researches on the researched area there was emplaced the industrial railway for transports and liquid fuel (black oil) supply of CET Botosani. In order to establish the geological characteristics of the emplacement there was performed a geotechnical study, which established that there is a covering of quaternary deposits litological represented by powdery clays, clay powders, sands, loesses etc which cover the whole surface of the area, and on the occasion of the execution of the geological hand drillings of study Ø 2", for establishing the field nature, there have been underlined the following formations:

- black, brown, dry, crumbly vegetable soil (virgin soil); powdery yellowish reddish consistent clay; the yellowish whitish loess with pressed $CaCo_3$ concretions; loamy yellowish consistent-hard clay; gravel with dried and humid sand.

The stratification is uniform, simple and horizontal with graded crossings without net separations between the layers. The layers met in drillings have variable thickness excepting the vegetable soil horizon which has around 0,40 m thickness and the gravel layer on the CF line of about 1,50 m thickness.

From the HYDROLOGIC point of view the underground water was put in evidence through the implementation of the research drillings, at depths ranging between -1,10 m and 3,30 m.

From the CLIMATIC point of view, the Climate: is temperate-continental, strongly influenced by the air masses from the East of the continent, which determines the yearly medium temperature to be more reduced than the rest of the country (8-9°C), with variable rainfalls, with summers that have a low moisture regime, with winds predominant from North-West and South-West. The vicinity of the great Eurasian plain makes the climate of Botosani county to be characterized by a regime of the air temperature and rainfalls with values characteristic for the continental-excessive climate.

The emplacement studied has assured general and local stability, not being reported instability phenomena, active or stabilized landslides.The total legth of the black oil ramp (sewer and industrial railway) in the studied premises is about 280,00 m. In plane, the black oil ramp (channel and LFI), has 3 curves with radii of R=160 m; R=200 m and R=775 m. In longitudinal profile, LFI is in plateau on approximately 100 m (starting from the edge Shed) and with declivity of 0,45% on the rest of the line to the gate, approximately 180 m.

The present components of the black oil ramp are (according to the figure and transversal profile below): **1. Separation fence** from concrete slabs between the 2 rail lines. The fence is formed of 5 reinforced concrete slabs of 400x2000mm. It has 2 m height and it is pre-exalted with 3 rows of barbed wire, on metal bases. The support pillars are from reinforced concrete. **2. Reinforced concrete slabs** of 550x800x100mm. They are emplaced along the ramp, adjacent to the concrete fence. **3. Reinforced concrete slabs** of 550x800x100mm. They are emplaced along the ramp, adjacent to the railway. **4. Railways** emplaced with a 1,435m gauge with superstructure type 40.

5. Reinforced concrete slabs of 550x800x100mm. They are emplaced along the ramp, adjacent to the collector channel. **6. Concrete collector channel**. It is 500x250mm. The thickness of the concrete layer is 150mm. It contains waste consisting of earth, gravel, water and black oil in a viscous mixture and solid here and there. **7.Concrete channel** which contains the black oil collector pipe (15) and the metallic supports connected. It is 1000x2000mm, 1200 mm underground, and 800 mm overground. The concrete thickness is 100 – 150 mm. It is covered with concrete slabs with 100 mm thickness. Initially, this channel was drafted as being waterproof, but down the ages, this one cracked allowing the underground water, rain water and black oil leakings to leak into the channel. At present it contains waste (16) consisting of earth, gravel, vegetable material, water and black oil in a liquid mixture (in the South), viscous (to the centre of the ramp) and solid (in the North). The thickness of the waste layer range from North to South between 800 and 1200 mm. The waste is not homogeneous along the channel. In the Southern part the 2 phases of water / black oil are clearly differentiated. **8. Steam metallic pipe**, thermal insulated with coat of mineral wool and zinc coated sheet, with 150mm diameter. **9.Reinforced concrete slabs** of 550x800x100mm. They are emplaced along the ramp, adjacent to the concrete channel. **10. Concrete rain waters drain channel**, of 300+300mm and 50mm thickness. **11. Metal bases for the steam pipe** of 1500mm high. **12. Soil** (verge). **13.Coarse gravel** for sustaining the railway (railway bed). **14. Concrete sleepers** for sustaining the railway. **15. Black oil collector pipe** with different sidings and dimensions, from Dn377 (main pipe) till Dn50 (dewatering connection).Waste formed of earth, gravel, vegetable material, water and black oil in a liquid mixture (in the South), viscous (to the centre of the ramp) and solid (in the North). The thickness of the waste layer range from North to South between 800 and 1200 mm. The waste is not homogeneous along the channel. In the Southern part the 2 phases of water / black oil are clearly differentiated. **16. Separation fence** of concrete slabs between the black oil ramp and the black oil establishment. The fence is formed of 5 reinforced concrete slabs of 400x2000mm. It is 2 m height. The supporting pillars are from reinforced concrete. The fence is disassembled on large portions, remaining only the supporting pillars. **17.Reinforced concrete slabs** between the railways. They are 1350x550x150mm. **18**.**Reinforced concrete slabs** of 550x800x100mm. They are emplaced along the ramp, adjacent to the railway. **19.Reinforced concrete slabs** of 550x800x100mm. They are emplaced along the ramp, adjacent to the rain water drainage channel. **Other elements on the emplacement** : *Drainage channel* – it collects the rain waters from the drain channel (10) in a drain pipe chimAAney emplaced at the middle of the ramp, from where, through a channel it undercrosses the railway the rain water is directed in the left side of the railway, in a collector channel, after the fence. From here, through a concrete trench, the rain water drains freely to the ground. Presently, this channel is completely mudded off and it doesn't perform the projected function; Hydrocarbons separator for waters come from the drainage of the black oil depot has the volume V=7,8 mc and the dimensions 2m x 1,5 m x 2,6 m, with two divisions, which take the rain and technological waters in order to separate the water of black oil. The water resulted is directed to Luizoaia rivulet. This separator is handcrafted realised, without technological foundation or technical project. *Metallic separator*, with volume V=1,5 mc, which is emplaced at the end of the black oil unloading ramp. The black oil is manually taken and it is reintroduced in the storage tanks. In this separator there are pomped the rain waters and also the condensation water and the black oil drained from the concrete channel.

Fig. 1. Overview of the black oil ramp (correlation with figure 2)

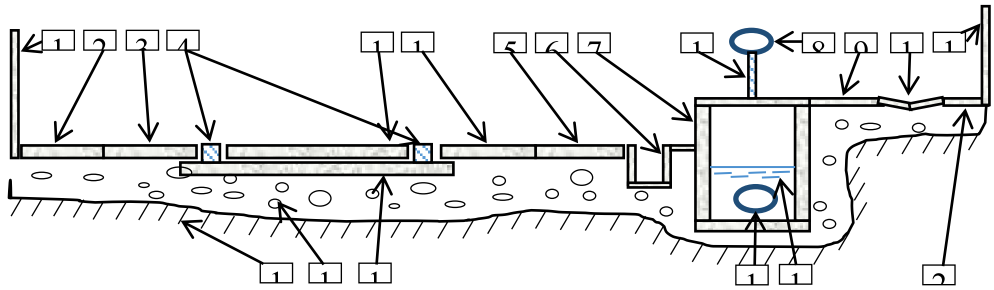

Fig. 2. Transversal section through the black oil ramp

A synthesis of the soil analyses results and their comparison with the maximum admitted limit is presented in table 2.

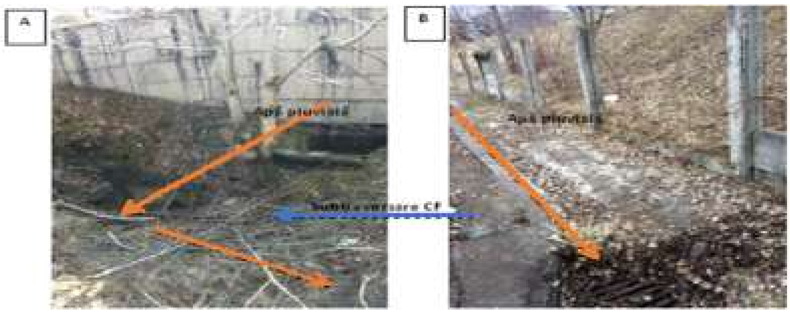

Fig. 3. Drainage channel A: in the right side of the ramp (drain pipe and chimney) and B: in the left side of the ramp, after undercrossing CF (chimney and collector ditch)

Fig. 4. Hydrocarbons separator (A) and metallic separator (B)

In table 2 we observe that: the samples PS2, PS3 and PS4 from F1 drilling; PS5 from F2 drilling; PS4, PS5 from F5 drilling; PS1, PS2, PS3 from F6 and PS2 from F7 drilling are into the normal value for the Total Hydrocarbons indicator from Petroleum (<100 mg/kg S.U.). PS1 samples from F1 drilling; PS3, PS4 from F2 drilling; PS1, PS2 from F3 drilling; PS1 from F4 drilling; PS1 and PS3 from F5 drilling and PS1 from F7 drilling are into the normal value and the intervention threshold for soils with sensible use (100 - 200 mg/kg SU). PS1 and PS2 samples from F2 drilling; PS2, PS3 and PS4 from F4 drilling and sample PS2 from F5 drilling are into the normal value and the alert threshold for less sensible soils (100 - 1000 mg/kg SU), and also into the normal values and the intervention threshold for sensible soils (100 - 500 mg/kg SU). The result of the under ground water samples analysis is synthetically presented in table 3.

Table 2.

Sampling points (drilling no.)	No. Soil sample / sampling depth		Concentrated in THP (IR method), mg/kg SU	Normal values	Alert threshold		Intervention threshold	
					Sensible use	Less sensible use	Sensible use	Less sensible use
F1	PS1	5-10 cm	110	<100	200	1000	500	2000
	PS2	80-100 cm	70.6					
	PS3	200-220 cm	51.8					
	PS4	280-300 cm	53.5					
F2	PS1	20-40 cm	250					
	PS2	100-120 cm	452					
	PS3	190-210 cm	152					
	PS4	280-300 cm	132					
	PS5	410-430 cm	87.1					
F3	PS1	150 cm	192					
	PS2	250 cm	112					
F4	PS1	150 cm	187					
	PS2	200 cm	312					
	PS3	250 cm	327					
	PS4	300 cm	556					
F5	PS1	20-40 cm	200					
	PS2	100-120 cm	422					
	PS3	190-210 cm	191					
	PS4	280-300 cm	73.5					
	PS5	410-430 cm	67.5					
F6	PS1	50 cm	71.8					
	PS2	120 cm	67.1					
	PS3	160 cm	65.3					
F7	PS1	50 cm	109					
	PS2	120-140 cm	68.2					

The ground water quality is usually evaluated by comparing the values of specific indicators with the limits imposed by the Law 363/2004 for modification and completion of the Law no. 458/2002 concerning the drinkable water quality. THP indicator is not under regulation of this law. The purpose of the present study is not to establish if the ground waters are drinkable, but to identify and quantify their pollution with petroleum products. Taking into account that the ground waters are intercepted at a small depth, their quality is dependent on the quality of the rain waters infiltrated in the soil and on the soil washed by them. After the drillings, there was observed that the ground water here and there intercepts the soil layer strongly polluted with mineral oil, which is why there was installed a hydrocarbons separator on the route of the ground and rain waters.

Taking into account all the above mentioned considerations, there was considered that the ground water on the analysed emplacement, and the drained rain waters on it, to be considered used waters discharged in natural receptor (Luizoaia rivulet). So, the quality of these waters is appreciated according to the maximum limits imposed by the Decision no. 352 from 21/04/2005 concerning the modification and completion of the Governmental Decision no. 188/2002 for approving some normatives concerning the discharge conditions in the aquatic environment of the used waters (NTPA001). The limit concentration for the indicator Mineral Oils (analysed by IR method), in the used waters discharged in natural receptors is 5 mg/l (without irizations at the surface).

Table 3.

F2	PAS1	0,62
F5	PAS2	0,58
F6	PAS3	0,l51
Hydrocarbons separator	PAS4	0,56

After the investigations and analyses performed for quantification the pollution with mineral oil of the black oil ramp aferent to CET Botosani, we may give the following conclusions:

- The area of the black oil ramp is polluted with mineral oil (black oil) come especially from the flowings during the handling (unloading, liquefying, transport). The pollution is noticeable after removing the concrete slabs at the surface.
- According to the results of the analyses performed at the soil samples from the black oil ramp emplacement, there was found out a prejudice against to the environment by soil contamination, with significant risk over the human health as a result of the black oil direct leaking in the soil.
- Immediately under the railway bed there is a compacted clay layer, waterproofed. The black oil leaked down the ages accumulated in the most part

over this clay layer, forming along with verge gravel and with rain or underground water a heterogeneous mixture – dangerous waste.

- The gravel layer (railway bed) is washed by rain and underground waters, existing the risk that the petroleum product existing in this layer to be trained and transported down the river. In order to stop this phenomenon, a hydrocarbons separator was built down the river (the Northern part of the black oil ramp), which pre-purges the drained waters on the surface of the black oil ramp. Then the pre-purged waters are overflowed in Luizoaia rivulet. The efficiency of this separator is good, taking into account the result of the analyses performed at samples from the pre-purged waters.
- The reinforced concrete channel intended for transport pipes is strongly clogged with a mixture of black oil, soil, gravel, water, vegetable material and other impurities – dangerous waste. This mixture is fluid (in the South), viscous (to the centre of the ramp) and solid (in the North). The thickness of the waste layer varies from North to South between 800 and 1200 mm. The waste is not homogeneous along the channel. In the South part the 2 phases water / black oil differentiates themselves.
- The extension of black oil pollution, according to the analyses and investigations performed, is limitted at the surface of the black oil ramp (surface covered with concrete slabs or concrete structures). As depth, the extension of pollution is limited at the surface layer (concrete slabs) and the railway bed (gravel), respectively about 80-140 cm from the level 0 (surface), till the compacted clay layer. The surface of the cross section of the area contaminated with black oil is 14,75 sm (10m width x 1,475 m depth) and it is the same on the entire length of the ramp of 270 ml.
- The risk that the black oil existent in the soil in this moment to infiltrate at greater depths than is increased, even if the compacted clay layer under the verge is waterproof. There is an increased risk of training the black oil by rain or underground waters and of its transporting down the river. The probability of extension the pollution increases drastically with any intervention on the field in the area of the ramp. So, the decontamination and greening of the area becomes imminent.
- The pollution identified on the emplacement of the black oil ramp presents a potential risk for human and environment health.
- According to OUG 68/2007 concerning the environment responsability referring to the prevention and reparation of the prejudice on the environment, with further modifications and completions, the operator is obliged to act immediately in order to control, isolate, eliminate or, if not, to manage those pollutants, in order to limit or prevent the extension of the prejudice on the environment and the negative effects on human health or further aggravation of services deterioration.

• According to the *Decision 1403/ 2007 concerning the recovery of the areas in which the soil, subsoil and terrestrial ecosystems have been affected*, it is compulsory the geological environment restoration and the terrestrial ecosystems affected by bringing them as close to the natural state.The polluted area behaves like a semi-closed system – the only important flow of matter being the water (rain or ground water) which washes „the bubble of polluted soil”, being able to train mineral oil which it transports down the river. Training of mineral oil depends on more factors, such as:

• **Water flow** which transits „the bubble of polluted soil”. The level of phreatic level and flow depends very much on the rainfall regime. In the absence of rainfall, the ground water flow is relatively low. The mineral oil trained by these waters is filtrated in the soil layers which it crosses. During rainfalls, the rain waters flow rises significantly, increasing the total flow of waters which transit the polluted soil. The natural filtration mechanism unbalances itself and, in this situation, there can be trained mineral oils outside the system. A part of them are retained by the hydrocarbons separator, but other part can pollute the neighboring areas. It is mentioned that the drillings and samples were realised on dry time, when the ground waters flow was low.

• **Air temperature**. At high temperatures, the black oil melts down and releases many light compounds, which can be trained by water. At low temperatures, the black oil has the tendency to solidify, and training pollutants by rain waters is low. So, it is expected that the risk of pollution with mineral oil of the areas down the river to be maximum during summer, during and immediately after rainfalls. Generally, the risk of destabilization of semi-closed system is increased. The pollution potential of neighbourhoods is also increased. Any intervention on the field in the area of the black oil ramp, can destabilize the system, leading to the modification of the present parameters that maintain pollution exclusively in the black oil ramp. So, the interventions type: modernization of the black oil ramp, changing its destination or decommissioning without prior purification, and also exploitation of the ramp in the same conditions, can lead to significant pollutions of the soil and ground waters, with seriuos repecussions down the river. The superstructure, railway bed and the filling layer under the concrete structures (concrete channel) are heavily contaminated with black oil. The concrete channel also contains large quantities of black oil. The metallic pipes which ensured the black oil and steam transport are heavily corroded and contaminated with black oil.

Conclusions

The „hystorical pollution" phenomenon of the black oil ramp, according to the analyses and investigations performed, is limited only to the surface of the black oil ramp (the surface covered with concrete slabs or concrete structures). As depth, the extension of the pollution is limited at the surface layer (concrete slabs) and the railway bed (gravel), respectively 80-140 cm from the level 0 (surface). The surface of the transversal section of the black oil contamination area is 14,75 sm (10m width x 1,475 m depth) and it is the same on the entire length of the ramp 270 ml. Total waste volume resulted after decontamination is approximately 3280mc. As a remedial solution we think there is necessary an ample decontamination action and then the area monitorization.

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