Annals of DAAAM for 2012 & Proceedings of the 23rd International DAAAM Symposium, Volume 23, No.1, ISSN 2304-1382
ISBN 978-3-901509-91-9, CDROM version, Ed. B. Katalinic, Published by DAAAM International, Vienna, Austria, EU, 2012
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Annals & Proceedings of DAAAM International 2012

DIAGNOSTIC ANALYSIS OF SOILS CONTAMINATED WITH OIL AND SALT WATER, STRANDS FOR THEIR REMEDIATION

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Abstract: *The article presents a number of issues related to soil pollution with oil and salted water. There are presented analyzes that have to be made to determine if a piece of land is affected by oil pollution and salt water and how it affects soil and agricultural production . Also, laboratory results are shown for two polluted areas which were analyzed and for the four soil profiles in the area.B.Finally are presented the improvement works to be executed for the remediation (decontamination) of the two areas.*
Keywords: *pollution, soil, oil, salted water, diagnosis, improvement works*

1. INTRODUCTION

The quality of the natural environment is one of the most pressing global problems of mankind, because it is not only the preservation of the natural environment, but questioned the very survival of the human species.

In spatial terms, the impact of human activity on the environment can have a planetary impact, regional or local, without identifying through it, the intensity or ecological imbalances, more or less dangerous.

Although signals warning of the effects of particularly serious pollution of air, soil, surface water and groundwater populate oil on health were publicized, demonstrating the danger and the risk of pollution, human memory is selective, subjective and is often used because the claim "the earth shall bear any".

The study was carried out on the surfaces A and B, places where large areas were affected by the phenomenon of pollution with oil and salted water.

The aim of the diagnostic analysis was to specify if these areas are or not affected by oil and salted water pollution, how it negatively affects the soil and agricultural production, but also the necessary ameliorative works to be done for decontamination of the analyzed areas [5].

2. DIAGNOSTIC ANALISIS OF SOILS CONTAMINATED WITH OIL AND SALTED WATER

The beam section A, was a failure (breaking) in the pipeline pumping oil. The objective of the experiments was to clarify whether the pipe adjacent land has been affected by oil pollution and salt water and how it influences soil and agricultural production [2, 3].

From the polluted area three samples were collected at depths agrochemical average between 0-20 cm, each sample totaling 10 soil samples collected with the agrochemical probe. The soil samples were dried and conditioned in the laboratory, after which the following analyzes were performed [2, 4]:

- Soil reaction(pH) - Potentiometric method;
- Soluble salts - method in water extract 1:5;
- Cl anion content - Mohr method;
- Na ion content - Mohr method;
- Oil residue.

Results of laboratory analyses are shown in Tab. 1:

Sample name	**Depht, cm**	**pH**	**Cl^- mg/100g**	**Na^+mg/ 100g**	**Solu-ble salts %**	**Oil residue %**
Sample 1	0 - 20	6,01	148,8	45,6	0,43	1,19
Sample 2	0 - 20	6,63	111,6	35,2	0,24	1,46
Sample 3	0 - 20	6,81	834,8	73,5	1,25	2,16

Tab. 1. Laboratory analysis results done for surface A

At B locality it was studied an area of 3361 m² agricultural land affected by salt water pollution and petroleum products. This area is located in two different surfaces. First with an area of 2000 m², situated near a disused well and the second with a surface area of 1361 m², located near highway and railroad.

The objective of the experiments was to clarify whether the 3361 m2 land has been affected by oil pollution and salt water and how it influences soil and agricultural production [2].

From two contaminated sites were collected 8 agrochemical samples with depth average in the range from 0 to 20 cm (5 of the first zone and 3 from the second zone), each area meaning a total of 20 soil samples collected as AGROCHIM-type small probe.

Medium texture		Fine texture	
Soluble salts pollution intensity	Limits mg/100g sol	Soluble salts pollution intensity	Limits mg/100g sol
Not salted	< 18	Not salted	< 20
Weak salted	19 - 60	Weak salted	21- 69
Medium salted	61 - 175	Medium salted	70 - 200
Strong salted	176 - 360	Strong salted	201- 400
Very strong salted	> 361	Very strong salted	> 401

Tab. 2. Soil Cl ions content

Soluble salts pollution intensity	Limits (mg/100g sol)
Not salted	< 5
Weak salted	5 - 10
Medium salted	11 - 15
Strong salted	> 16
Very strong salted	> 25

Tab. 3. Soil Na ions content.

Soluble salts pollution intensity	Limits
Not salted	< 0.100
Slab salted	0.100 - 0.250
Moderate salted	0.260 - 0.600
Strong salted	0.600 - 1.000
Very strong salted	1.000 - 1.500

Tab. 3. Soluble salts soil content (%).

Oil residue pollution intensity	limits
Not polluted	0
Extremely weak polluted	0 - 0.1
Very weak polluted	0.1 - 0.2
Weak polluted	0.2 - 0.4
Weak-moderate polluted	0.4 - 0.5
Moderate polluted	0.5 - 1.0
Strong polluted	1.0 - 5.0
Very strong polluted	5.0 - 10.0
Extremely strong polluted	> 10

Tab. 4. Oil residue soil content (%)

In areas bordering the two polluted areas were collected 2 samples under agrochemical control (sample 6 in the first sample area and 10 in the second area). Also, each area was performed by pedological profile of which were collected six soil samples, corresponding depths: 0-10 cm, 10 to 20 cm, 20-40 cm, 40-60 cm , 60-80 cm.

From the area bordering the two locations were collected six soil control samples (control profile for each area) on the same depths.

Sample nr.	Soil name	Na, mg/100g sol.	Soluble salts, %	Oil residue, %
1	sample	11,0	0,039	0,17
2	sample	6,8	0,028	0,09
3	sample	5,2	0,023	0,06
4	sample	3,3	0,021	0,06
5	sample	1,3	0,023	0,05
6	Blank	2,9	0,028	0,00
7	sample	92,1	1,56	0,28
8	sample	66,0	0,74	0,17
9	sample	47,5	0,42	0,11
10	Blank	10,5	0,086	0,00

Tab. 7. Results of laboratory tests performed for the two areas

Sample nr.	Denumire sol	Profile nr.	Depht, cm	Solble salts, %	Oil residue, %
1	Polluted soil evidence	1	0 - 10	0,96	0,18
2	Polluted soil evidence	1	10 - 20	0,21	0,11
3	Polluted soil evidence	1	20 - 40	0,11	0,08
4	Polluted soil evidence	1	40 - 60	0,10	0,05
5	Polluted soil evidence	1	60 - 80	0,08	0,05
6	Polluted soil evedence	1	80 - 100	0,08	0,02
1	Blank	2	0 - 10	0,023	0,0
2	Blank	2	10 - 20	0,026	0,0
3	Blank	2	20 - 40	0,023	0,0
4	Blank	2	40 - 60	0,026	0,0
5	Blank	2	60 - 80	0,018	0,0
6	Blank	2	80 - 100	0,023	0,0
1	Polluted soil evidence	3	0 - 10	0,94	0,01
2	Polluted soil evidence	3	10 - 20	1,15	0,09
3	Polluted soil evidence	3	20 - 40	1,72	0,34
4	Polluted soil evidence	3	40 - 60	2,21	0,25
5	Polluted soil evedence	3	60 - 80	2,83	0,18
6	Polluted soil evidence	3	80 - 100	2,89	0,1
1	Blank	4	0 - 10	0,125	0,0
2	Blank	4	10 - 20	0,112	0,0
3	Blank	4	20 - 40	0,260	0,0
4	Blank	4	40 - 60	0,068	0,0
5	Blank	4	60 - 80	0,039	0,0
6	Blank	4	80 - 100	0,039	0,0

Tab. 5. The results of laboratory tests performed for the two contaminated sites and four soil profiles

3. DIAGNOSIS RESULTS

For A zone, comparing the data presented in Tab, with the interpretation of chemical values in Tabs 2 – 6, we can go to the following conclusions:

Agrochemical sample number 1

- Reaction is slightly acid soil (pH = 6.01);
- Cl ion content - moderate soil salted (148.8 mg/100g soil);
- The content of Na ions - strong ground salted (45.6 mg/100g soil);
- The content of soluble salts - soil moderately salted (0.43%);
- Oil residue-soil heavily polluted (1.19%).

Agrochemical sample number 2

- Reaction is slightly acid soil (pH = 6.55);
- Cl ion content - moderate soil salted (111.6 mg/100g soil);
- The content of Na ions - strong ground salted (35.2 mg/100g soil);
- The content of soluble salts - soil salted low (0.24%);
- Dry oil - heavily polluted soil (1.46%).

Agrochemical sample number 3

- Reaction is slightly acid soil (pH = 6.83);
- Cl ion content - very strong ground salted (834.8 mg/100g soil);
- The content of Na ions - strong ground salted (73.5 mg/100g soil);
- soluble salt content - very strong ground salted (1.26%);
- Dry oil - heavily polluted soil (2.16%).

From the analysis and interpretation of results for A zone, we can see that the entire area is fully affected by salt water and oil pollution.

Agrochemical sample number 1 is moderately saline soluble salts and chloride ions very strongly saline with sod-Soluble salts content – not salted (0.039%); Na ions and heavily polluted with oil residue.

Agrochemical sample number 2 is poorly soluble salt saline, moderately saline with chloride ions very strongly

saline with sodium ions, pollution from oil residue being, as in the previous proof, strong.

Agrochemical sample number 3 is very strong saline soluble salts, sodium ions and chloride ions; waste oil pollution is still strong.

Study results, show a high degree of pollution and salt water residue of oil pipeline pumping nearby area, high exceeding recorded for indicators analyzed, the most restrictive factors as sodium ions and residual oil.

Due to the presence of soluble salts and oil residue, soil changes its natural qualities. Their presence causes the extracellular osmotic pressure of the soil, the intracellular going beyond the plant, so plants cannot absorb water from the soil.

For B zone, comparing the data presented in Tab. 7 limits the interpretation of chemical values in Tab. 2. - 6. the following conclusions:

Polluted area number 1 - area 2000 m².

Agrochemical sample number 1 has the following characteristics:

- Content of sodium ions (Na +) - medium (11.0 mg/100g soil);
- Residue oil - very low polluted (0.17%).

Agrochemical sample considered polluted from area number 2(1381m²) has the following features:

- Soluble salts content – not salted (0.028%);
- Ion content (Na +) - small (6.8 mg/100g soil);
- Residue oil - polluted very weak (0.09%).

Agrochemical sample number 3 considered polluted area has the following characteristics:

- Soluble salts content – not salted (0.023%);
- Ion content (Na +) - small (5.2 mg/100g soil);
- Residue oil - polluted very weak (0.06%).

Agrochemical sample number 4 considered polluted area has following features:

- Soluble salts content – not salted (0.02%);
- Ion content (Na +) - not salted (3.3 mg/100g soil);
- Residue oil - polluted very weak (0.06%).

Agrochemical sample considered polluted area number 5 has the following characteristics:

- Soluble salts content - not salted (0.023%);
- Ion content (Na +) - not salted (1.3 mg/100g soil);
- Residue oil - polluted very weak (0.05%).

Agrochemical sample number 6 (blank) considered polluted area adjacent area has the following characteristics:

- Soluble salts content - not salted (0.028%);
- Ion content (Na +) - not salted (2.9 mg/100g soil);
- Residue oil - absent.

Pedological profile considered polluted area number 1 has the following characteristics:

- The content of soluble salts - great for the first 10 cm (0.96%), than not salted between 10-60 cm.
- Residue oil - very low polluted up to 20 cm (0.11-0.18%) and very low pollution below (0.02 to 0.08%).

Pedological profile number 2 (profile blank) considered polluted area adjacent area has the following characteristics:

- Soluble salts content - all profiles not salted (0.018 to 0.026%);
- Residue oil - absent throughout the profile.
- Polluted area number 2 - area 1361m ².

Agrochemical sample number 7 considered polluted area has the following characteristics:

- Soluble salts content - very large (1.56%);
- Ion content (Na +) - very high (92.1 mg/100g soil);
- Residue oil - polluted low (0.28%).

Agrochemical sample number 8 considered polluted area has the following characteristics:

- Soluble salts content - large (0.74%);
- Ion content (Na +) - very high (66.0 mg/100g soil);
- Residue oil - very low polluted (0.17%).

Agrochemical sample considered polluted area number 9 has the following characteristics:

- Soluble salts content - medium (0.42%);
- Ion content (Na +) - very high (47.5 mg/100g soil);
- Residue oil - very low polluted (0.11%).

Agrochemical sample number 10 (blank) considered polluted area adjacent area has the following characteristics:

- Soluble salts content - not salted (0.086%);
- Ion content (Na +) - small-moderate (10.5 mg/100g soil);
- Residue oil - absent.

Pedological profile considered polluted area number 3 has the following features:

- Soluble salts content - great for the first 10 cm (0.94%) and very high below (1.15 to 2.89%);
- Residue oil - polluted very weak in the first 20 cm (0.01 to 0.09%), slightly polluted between 20 - 60 cm (0.25 - 0.34%) and weakly polluted below (0.10 to 0, 18%).

Pedological profile number 4 (witness profile) from adjacent area considered polluted area has the following characteristics:

- Soluble salts content - than the first 20cm (0.112 to 0.125%), average between 20 - 40cm (0.260%) and not salted below (0.039 to 0.068%);
- Residue oil - absent throughout the profile.

From the analysis and interpretation of results can be observed that the presence of salt water soil attributes were modified, productive capacity is very much decreased.

Zone 1 - area 2000m ².

If soluble salts, pedological profile location number 1 of 2000m ² in area considered polluted values are above

the 0.100%, which indicates that the soil is polluted. More precisely, the pollution is high in the first 10 cm, slightly between 10-60 cm and at depths greater than 60 cm soil is not salted. We note that the soil profile" salts are not in place "; they go up and down depending on the ground-water and rainfall. Presence of soluble salts causes the extracellular osmotic pressure of soil, surpassed the intracellular the plant, so plants cannot absorb water from the soil.

At the same profile, pedological number 1 have a very low pollution with waste oil to a depth of 20 cm and very low at depths greater than 20 cm. Pedological profile 2, considered a witness for location 1 is not polluted with salt water, or with oil residue.

All 5 samples taken from the middle agro-chemical considered polluted location soluble salts, have values below 0.100%, which indicates that we have not salt pollution. There are, however, very low oil pollution from agrochemical sample 1 and very weak in samples 2, 3, 4, and 5. Results show, one sodium ion content is moderate in samples 2 and 3 is small, samples 4 and 5 being polluted with sodium ions. Six agro- chemical sample taken from polluted area adjacent area in one location has not exceeded normal values in any of the analyzes and thus uninfected salt water or oil.

Zone 2 - area 1361m ².

Pedological profile number 3 made in the area considered polluted site 2, has exceeded normal values both soluble salts and the oil residue. If salt concentration is high in the first 10 cm, making it very depths of over 10 cm. Residual oil content is extremely low up to 20 cm, low between 20-60 cm and very low at depths greater than 60 cm.

Pedological profile number 4, considered a witness for location 2, also shows pollution soluble salts to a depth of 40 cm. Samples agrochemical environments polluted area location 2 are moderate to very heavily polluted with salt water, the sodium ion content is also very high in all 3 samples. Proven oil residue is weak and very weak in samples 8 and 9.

Agrochemical sample 10, considered a witness for location 2 has a low pollution - moderate sodium ions. The high percentage of sodium in the soil produces unfavorable plant growth following features:

- Wet soil mass into a muddy, sticky, impervious to water and air;
- Dry soil forms a hard crust and crack, forming large lumps established;
- Reduced hydraulic conductivity, thereby preventing water infiltration into the soil;
- Water is retained by powerful forces changing the root system of plants;
- Plants have low growth may even lead to its shutdown;
- Reduced microbiological activity in the soil;
- They cause decalcification and loss of soil organic matter.

Values obtained from analyzes conducted and that the surface of 3361m ² is totally polluted with oil residue soluble salts and values content of soluble salts and sodium ions greatly exceed the maximum allowed levels.

4. CONCLUSION

The most suiTab. method for A zone is stripping zone is affected by pollution layer, preferably over 0.7 m deep, followed by installing a filter layer to prevent capillary rise of salts and cover with a layer of fertile soil, good for growth and crop development [1].

For B zone, decontamination of the analyzed areas, following developments and improvement works are proposed [1]:

- Overburden layer as a high salt content up to depths of 100 120cm if groundwater permits, and installing a filter layer to prevent capillary rise of salts followed binding fertile land.
- Deep cleaning of soluble salts with large amounts of water, depending on soil texture (1000 1200 m3 for medium texture).
- Artificial drainage works to collect wash water rich in salts and their disposal.

Of the three solutions mentioned above, the only solution that can be applied when the ground is affected by pollution, scraping salt layer cover lying fertile land [1]. Even this work is quite difficult to implement, especially for location 2, soluble salts pollution down to the deep sea, the content is very high at a depth of 100 cm (2.89%).

High concentration of salts in the profile is due to the vertical infiltration of salt water, which could reach the groundwater.

Not recommended, due to lack of drainage, works artificial channel, to take large quantities of water needed money salts, there is a danger salt water pollution and land surrounding the lateral infiltration.

Also, deep cleaning of soluble salts with large amounts of water is not recommended, especially since the land is considered very close to a probe oil extraction.

A method that also could be applied is decontamination of soil through bioremediation techniques. It can be a subject for a new study.

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