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SANATION TECHNOLOGIES LEADING TO REGENERATION AND REVITALIZATION OF ENVIRONMENT COMPONENTS**

1. INTRODUCTION

Sanation technologies are technologies that are leading to regeneration and revitalization of objective environment component (soil, water, air) at a level approaching to natural situation. The aim of works is elimination of hygienic and eco-toxic risks resulting from existence of contamination ground or underground water [1].

Fruitfulness of sanation depends on different factories:

- type, concentration, distribution, physical status of pollution;
- chemical and physical properties, biodegradation, toxicants, mobility, radioactivity, explosiveness of pollution;
- geological properties, particularly type of earth and their hydrogeology properties [2];
- an area and period of the contamination creation;
- a physical status (buildings and others building objects, stones, surface water and etc.), required time for solution of sanation [3].

2. MOVEMENT OF CRUD OIL POLLUTION AT GROUND SURROUNDINGS

Crud oil can occur at ground surroundings basically in four basic matrixes:

1) gas,
2) water,
3) emulsion in water,
4) solution in water.

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A leaking of crud oil into surroundings is possible at contact with ground surroundings in four main phases [4]:

1) an infiltration (local, small leakages);
2) an extension over surface and infiltration (face, large accidents);
3) an extension over surface of groundwater- table;
4) an transfer with moving underground water.

At appraisal of crud oil leaking into ground surroundings we separate two basic cases:

1) The infiltration capacity of crude oil to a certain period do not crippling a capacity of ground at the area, a level of underground water is deep.

   Water remains fixed at ground. Configuration of matter depends on:
   - granulometric and mineralogical composition of measures,
   - percent of saturation of water pits,
   - viscosity and chemical composition of filter fluid (Fig. 1).

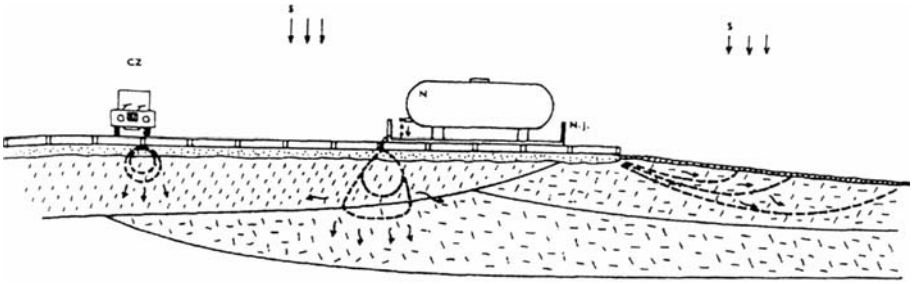

Fig. 1. Infiltration of crude oil at ground surroundings

   Gravitational moisture though will be possible to be washed of contaminated ground and transport matters solute in it by-either at deep measures or into wider surroundings in the future.

2) Quantity of infiltration crude oil overreach absorbing capacity of pervious matters and contamination achieve impermeable floor or surface of underground water (Fig. 2).

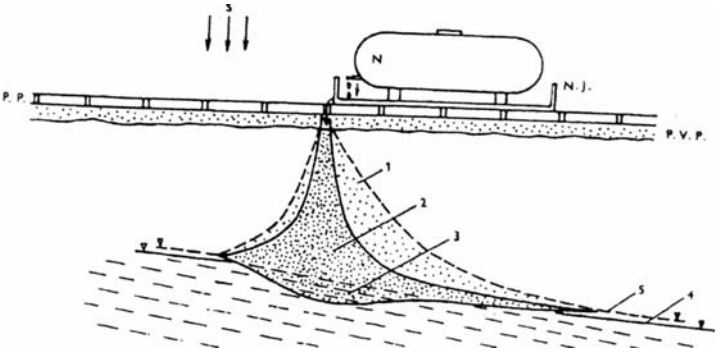

Fig. 2. Extension of crude oil with gas aureola: 1 – aureola of gas phase, 2 – oil matter, 3 – penetration into water area, 4 – surface of underground water, 5 – zone of capillary elevation

At first there is seepage of aeration area after emptying of oil product on terrain surface. There is an active extension (migration) on border between surroundings waterlogged and surroundings do not waterlogged. On underground water surface at good permeability ground can give out at so called inactive migration. Oil matter is drift with inrushing underground water. If oil matters stay at ground surroundings for long time, its moving is more complicated because there is swinging of underground water here. Oil matters follow water more depth at decrease surface of water. Part of oil matters stay under surface of underground water when it is increasing- there is more speed than decrease.

Moving of oil matters is interested in two phases. For the first it is a question of moving at beginning of pollution. For the second it is manners of oil matters during its removal from water and ground surroundings.

Crude oil and oil products are so-called heavy degrade matters; consequently pollution at ground surroundings is take long time. It is necessary to prevent pollution extension of ground surroundings. For example it is the construction of underground walls, primarily under industrial firms and after possible accident convenient sanation method is chosen [5].

3. SANATION TECHNIQUES

We consider those works of sanation, which are more closely to regeneration and revitalization of environment (ground, water, air) on level which nears at original condition. Goal of sanation works is decontamination. There is a process, which abstracts or lowers to an acceptable level of decontamination matter.

In between most frequently using sanation technics belongs for example cleaning of ground, isolation, barrier, cleaning of water.

Cleaning of ground can be made for example by removal and consistent cleaning by methods *ex situ*:

- thermal modification,
- extraction and separation,
- biological degradation,
- unloading of ground,
- alternative technologies.

Next methods are cleaning methods *in situ*:

- cleaning with underground water, washing- out;
- biosanation (bioventing, stripping by air);
- extraction of gas phase (venting);
- alternative technology.

Isolation [6]:

- physical barriers- leak proof walls,
- hydraulic screen,
- isolation *in situ*.

Sanation technologies utilise differences between characteristics of contaminant and underground water, or ground.

For examples there are:

- volatility,
- solubility,
- chemical and temperature stability,
- biological dissolubility,
- magnetic and electric characteristics,
- ability of sorption and desorption,
- dimension, form, density, hardness.

These aspects have to make provision for explorer works so that aspects consider carefully for optimal sanation technology.

It is necessary so that first from basic spot of explorer works will be documented qualitatively and quantitatively audit of contaminant according to individual chemicals [7].

Methods using at sanation works

There are lots of sorptive resources for fixation of oil matters. For examples: natural sorptive materials, chemical and synthetic sorptive materials and sorptive resources. Majority of these materials is used on surface of water. Prevention of escape of oil matters on surface of water of course prevents seepage (let us say consecutive seepage) of oil matters.

Separation of some sorptive materials:

- Natural sorptive materials:
  - sawdusts,
  - parings and wooden hair,
  - hammer-milled bar and dry peat,
  - peat and straw.
- Chemicals and synthetic sorptic materials:
  - VAPEX (expanded perlit- experlit),
  - non-woven textile FIBROIL,
  - non-woven textile ARABEVA.
- Next sorptive resources:
  - charcoal,
  - slack,
  - coke dust,
  - ash,
  - fly ash,
  - cinder.

Biodegradation *in situ*

There is a technology for removal of organics pollutants from fluid and solid materials.

For removal organics pollutants are using microbes. Microbes in this form use pollutant to produce new biomass and at the same time like power source. There are waste of metabolism usually allied substances – water and carbon oxide.

Before beginning of application of biodegradation technology it is necessary make the first entrance analysis of materials contains chemical, soil, microbiological and eco-toxicological analysis.

Biodegradation of present contaminants, status of present organism, structure of material, in which phase materials is present and alike valuation based on acquired results.

Biodegradation *ex situ*

It is mostly made on special adjusted areas. Material is cascaded at approximately 30–50 cm. After adding the nutrients and application of bio-preparation material is aerated mostly through the medium of agricultural engineering or building engineering.

Contamination material is invaded into wide filling 2–5 m, height 1, 5–3 m.

Thermal methods of ground decontamination

This method is following from possibility removal of organic and inorganic pollutants in the way that burning and meltdown and it depends from point of boil typical chemical compounds or elements.

Pollutants are unlocked from ground into air when the temperature achieves the point of boil. There is a change of chemical reactions. Attended by oxygen is a change of oxidation.

In the case, when delivery energy is without oxygen, there is a change of evaporation of pollutants, which can be next burning or can condense.

Thermal methods of modifications are very effective, their use do not depended from facilities of ground and characteristic of ground, but this is financially seriousness.

Such as at other technologies of decontamination of ground exist thermal methods by variant of *in situ* and *ex situ*.

The main advantage *in situ* is, that ground for purposes of modification need not transport. There are two main technologies for this method:

1) thermal nourishment extraction of stream from ground,
2) vitrification.

From the first there is extraction technology, which uses temperature for increasing liquid pollutants in the ground.

Vitrification *in situ* uses heat for meltdown of ground, decomposition of chosen organic pollutants.

Methods *ex situ* are divided as follows:

- cryogenic thermal desorption,
- high-temperature thermal desorption,
- burning,
- vitrification.

Cryogenic thermal desorption

There is a process of physical separation, whereat there is change of only release of organic pollutants to the carrying air.

There is a release of vapour and organic pollutants during heating of ground at temperature 90 to 320 degree of Celsius scale. Temperature and heating time is assigned so rich to heating of pollutants and there is not oxidation.

Released gas and vapour are transport by carrying gas or effect of vacuum to unit of additive burning.

Decontamination ground observant its physical modifications and they are able support biological activity.

High-temperature thermal desorption

There is a method of physical separation when there is not decomposition of pollutants. The process is made at temperature interval from 320 to 560 degree of Celsius scale, when is during burning vapour and organic pollutants are released. They are led by carrying gas or through the medium of vacuum to the modification of gas.

Temperature and time of heat are assigned to get only burning of pollutants and there is not its oxidation.

Burning

Technology of burning includes three main processes: modification of material, the own thermal modification and cleaning of exhaust gas.

Temperature of burning process depends on the character of pollutants, for removal of oil are temperature higher (about 860 degree of Celsius scale). Pollutants can be removed by two thermal ways: burning and pyrolysis.

During burning process there is straight heating of ground at oxidation atmosphere using open fire and products of burning at temperature range from 870 to 1200 degree of Celsius scale.

We definite of pyrolysis like chemical decomposition of organic part by temperature, without oxygen. In a matter of fact such environs we can not achieve.

Vitrification *ex situ*

The principle of method is skeleton type of waste. This is finance relatively precious technology was using the main for disposal radioactive waste until recently.

There is a thermal processing of waste, when technology is like using in glassmaking. There are useful wastes which are able to make glass, for examples oxide of metals, silicates and so on.

The main step is progress meltdown at temperature till 1700 degree of Celsius scale and consecutive drop of temperature without making crystal grate. The resultant product is glass, which with its properties do not pollutant environment and can be put on dump.

4. INSULATING TECHNIQUES

We can achieve insulation by:

- realisation of vertical impermeable barrier (bentonit, polyethylene walls), permanent, temporal;
- realisation of horizontal barrier (by grouting);
- combination with two antecedent;
- with hydraulic screen;
- sorptive and bisorption screen and finishing screen (barriers);
- oxidation sorptive screens, scumboards for arrestment of oil matters.

5. CONCLUSION

Speed of contamination spread of ground with oil matters depends on the character of ground, permeability and degree of jointing of depth and hydraulic inclination of surface underground water and of properties of oil matters (viscosity, density, solubility etc.) [8].

At vapour phase oil matters can appear under surface of underground water. Oil matters at fluid phase representative more danger, because they can speed like every fluid of permeability environs influence gravity.

Analysis of contaminated non-selective progresses is necessary, but not satisfactory condition for proposal of range and manner of sanation technology.

There is necessary identification and quantitative determination of individual contaminants [9].

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