INNOVATIVE METHODOLOGY FOR ASSESSING THE CONDITION, CERTIFICATION, SYSTEMATIZATION AND ACCOUNTING OF OIL-CONTAMINATED SITES

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Abstract. The article describes an innovative method for assessing the condition, certification, systematization and accounting of oil-contaminated sites. The paper offers three-dimensional models, tables on the volume content of petroleum products, tables of the distribution of plots into reclamation groups, QR codes and parcel codes necessary for targeted elimination of the consequences of oil and petroleum products spills in the soil. This technique involves the construction of three-dimensional models of oil-contaminated sites, necessary to reflect the volume of soil contamination, numerical visualization of oil pollution volumes using various data tables, as well as the creation of QR codes and parcel codes, which are necessary to improve the system of accounting, storage and certification of oil-contaminated land.

1. Introduction
The problem of eliminating the consequences of oil and oil products spills is still quite relevant at oil-producing enterprises. Difficulties in carrying out effective remediation measures are associated with the lack of spatial and temporal parameters of the volume of oil pollution in the soil, which leads to an irrational waste of finances.

To solve this problem, we propose three-dimensional models of oil-contaminated sites, tables on the volume content of petroleum products, tables of the distribution of sites into reclamation groups, QR codes and parcel codes necessary for targeted elimination of the consequences of oil and petroleum products spills in the soil. This technique involves the construction of three-dimensional models of oil-contaminated sites, necessary to reflect the volume of soil contamination, numerical visualization of oil pollution volumes using various data tables, as well as the creation of QR codes and parcel codes, which are necessary to improve the system of accounting, storage and certification of oil-contaminated land [1]. To test the proposed methodology, the oil-contaminated land plot of the Samotlor field under the conditional registration number X-Y-ZZZZ was analyzed.

2. Materials and methods
The study was conducted in two stages. At the first stage, the survey site was photographed, a map map of the required scale was created for the site under consideration, soil samples were taken from certain depths (parcels) and quantitative chemical analysis of soil was carried out. At the second stage, color scales of the content of petroleum products, chlorides and soil acidity were developed, then 3D models of oil-contaminated sites were built and tables were compiled for the volume content of petroleum products, chlorides and pH concentration in the soil of the studied land plot. At the end, QR codes and
parcel codes were created to improve the objectivity of certification of oil-contaminated land plots, convenience, efficiency and reliability of accounting, data transmission and storage.

Maps of the study area were created using the Mapinfo Professional geoinformation system, and 3D models were built using the three-dimensional computer-aided design and drawing system AutoCAD 2016.

3. Results
The result of our research can be used in the oil industry of our country for effective reclamation.

✓ The 3D model in color reflects the pH, chlorides, and petroleum products in each layer of soil and allows you to visually demonstrate the spatial parameters of the site.

✓ The tables developed by us help to determine the exact amount of contamination with petroleum products, chlorides and the pH concentration in the soil of the studied land plots.

✓ QR codes and parcel codes help to increase the efficiency and objectivity of certification of oil-contaminated sites, the reliability of accounting and data storage, and eliminate duplication of data entry.

4. Discussion.

4.1. Adjustment of the location, boundaries, and description of oil-contaminated sites.
Their topographic survey and photographing were carried out. Division of plots into parts: allotments and parcels. Formation of a hierarchical system of 3 levels for each site. level 1 – the smallest level-a parcel, as one of the four layers within the boundaries of the allotment; level 2-an allotment with a set of four parcels; level 3 – the entire plot in the aggregate of allotments and parcels.

4.2. Sampling of soil and soil at the sites.
Conducting quantitative chemical analysis. Presentation of the analysis results in tabular form (table 1).

| Select | The parcel / sampling depth, см | Petroleum products Content | Defined indicator | Chlorides Content | Acidity Content |
|--------|--------------------------------|-----------------------------|-------------------|--------------------|-----------------|
| 83     | a 0-10                          | 60661                       | 6,1               | 3378 (0,34)        | 5,5             |
|        | b 20-30                         | 118130                      | 11,8              | 2549 (0,25)        | 5,6             |
|        | c 40-60                         | 50700                       | 5,1               | 7345 (0,73)        | 4,8             |
|        | d 90-110                        | 46667                       | 4,7               | 8590 (0,86)        | 5,4             |
| 84     | a 0-10                          | 780176                      | 78,0              | 1228 (0,12)        | 4,9             |
|        | b 20-30                         | 116316                      | 11,6              | 1775 (0,18)        | 3,4             |
|        | c 40-60                         | 109206                      | 10,9              | 3900 (0,39)        | 3,3             |
|        | d 90-110                        | 20563                       | 2,1               | 2577 (0,27)        | 3,1             |
| 85     | a 0-10                          | 720100                      | 72,0              | -                  | -               |
|        | b 20-30                         | 357100                      | 35,7              | 3187 (0,32)        | 4,6             |
|        | c 40-60                         | 65810                      | 6,6               | 4650 (0,46)        | 3,8             |
|        | d 90-110                        | 27550                       | 2,8               | 10066 (1,01)       | 3,5             |
| 86     | a 0-10                          | 776700                      | 77,7              | -                  | -               |
|        | b 20-30                         | 186100                      | 18,6              | 9570 (0,96)        | 4,7             |
|        | c 40-60                         | 18190                       | 1,8               | 24800 (2,48)       | 3,7             |
|        | d 90-110                        | 15120                       | 1,5               | 22500 (2,25)       | 3,3             |

4.3. Scaling and coloring of the values of limiting factors.
Calculation of the volume of allotments, deep layers and pollution (table 2).
4.4. Creating tables that reflect data on the volume content of limiting factors in soils.
In the course of the study, tables were also created that contain data on the volume content of limiting factors in the soil-soils of the studied area (table 3).

Table 3. The volume of the concentration of chlorides in the soil of the land plot X-Y-ZZZZ

| Select | Volume of chloride content, m³ | Total |
|--------|-------------------------------|-------|
|        | a            | b    | c      | d |       |
| 83     | -            | -    | -      | - | -    |
| 84     | -            | -    | -      | - | -    |
| 85     | -            | -    | -      | - | -    |
| 86     | -            | -    | 1,049 (2,48) | 1,586 (2,25) | 2,609 |
| Total  | -            | -    | 1,049 (2,48) | 1,586 (2,25) | 2,609 |

This tables are necessary in order to know the exact data on the volume of upcoming remediation works.

4.5. Creation of three-dimensional models of an oil-polluted area based on the limiting factor for their volumetric reflection.
Three-dimensional models consist of allotments and parcels. Parcel-this is the smallest component of the site, the interlayer. A selection is a collection of parcels united by common characteristics. As a rule, the land plot is divided into 4 allotments, allotments, in turn, are divided into 4 parcels each (figure 1).

Figure 1. Three-dimensional model of the concentration of chlorides in the soil of the land plot X-Y-ZZZZ

Similar three-dimensional models and tables presented in the paragraphs above were created for indicators such as oil pollution and soil acidity.
4.6. Distribution of parcels of the site into reclamation groups.
Land reclamation, depending on the degree of initial pollution and the purposes of further use of soil-soils, can be as follows:
-technical, including planning, creating slopes, removing and updating land with the help of heat, hydrotechnical and chemical influences;
- biological, which implies agrotechnical and phytomeliorative manipulations aimed at improving the biochemical, agrochemical, agrophysical and other similar indicators of soil fertility. This type of reclamation allows you to remove the most severe violations of the composition and capabilities of the soil. Especially when it is necessary to restore the soil flora and fauna completely.

The parcels of the land plot were divided into reclamation groups:
1) parcels on which it is necessary to carry out a biological type of reclamation;
2) parcels that do not need to carry out a biological type of reclamation;
3) parcels on which it is currently impossible to achieve the required results during biological reclamation due to the lack of necessary or insufficient existing technologies;
4) parcels on which biological remediation is temporarily impractical due to the high probability of their re-contamination.

4.7. Creation of QR Codes and parcel codes to improve the process of accounting, systematization and certification of oil-contaminated land plots.
QR codes will help improve the process of accounting and systematization of oil-contaminated land plots (figure 2).

As mentioned earlier, the parcel is the smallest part of the oil-contaminated area, which has its own number of characteristics and properties. This data can be used to encode the plot. For example, X-Y-ZZZZ/84b/350/g. in this case, the cipher indicates: the number of the site; the parcel in the area of the point 84 of layer b; the volume is 350 m3; the excess of the content of petroleum products over the permissible level in the range from 31 to 40%. Options of forms and types of coding you can choose many, the main thing is to be consistent. Parcel coding precedes QR coding [2].

5. Conclusions.
The result of our research can be used in the oil industry of our country for effective reclamation. The 3D model in color reflects the pH, chlorides, and petroleum products in each layer of soil and allows you to visually demonstrate the spatial parameters of the site. The tables developed by us help to determine the exact amount of contamination with petroleum products, chlorides and the pH concentration in the soil of the studied land plots. QR codes and parcel codes help to increase the efficiency and objectivity of certification of oil-contaminated sites, the reliability of accounting and data storage, and eliminate duplication of data entry.

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