Territory monitoring and suggestions on oil filling station arrangement according to ecological standards

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Abstract: The article studies the ecological state of the territory of Novoselki OFS and adjacent territories. The situational analysis of the territory was carried out. Its results will be applied in the section “Ecology and development of an ecological passport of the industrial enterprise”. Practical recommendations on greening and reducing the fire risk were provided.

1. Introduction
The current unfavorable situation is connected with the environment and its protection. Having learned how to mine and use natural resources, human does not care about territories where industrial and capital enterprises are located. The predominant amount of extracted natural resources is directly related to the ecosystems. In addition, qualitative and quantitative characteristics of natural resources (animal and plant life, water, soil, etc.), and anthropogenic resources (buildings, structures, production wastes, etc.), as well as possibilities of their use depend on the characteristics of land plots and their use. Economic development of territories, the construction of industrial infrastructure facilities, in particular, oil and gas complex facilities, can danger the environment [1, 2]. It is necessary to form sanitary and protective zones with a special legal status. Safe operation of the facilities and the state of the environment depend on their efficiency. [3]. In this regard, it is necessary to investigate the ecological state of the territory of industrial enterprises (e.g., an oil loading station) and adjacent sanitary protection zones [4, 5].

2. Research methods
The geobotanical description of the territory and sanitary zones of the enterprise was performed. Soil cuts were described; soil and vegetation samples were taken for chemical analysis. Chemical analysis of soil and vegetation samples for the presence of heavy metals of organic pollutants was carried out using standard techniques.

3. Results and Discussion
Novoselki oil filling station (OFS) of the ring oil pipeline around Moscow is located in Podolsk district. The industrial site is located at a distance of 400 m from Hryvna, on the land plot of the forest fund. There is no hydrographic network with permanent watercourses on the territory surrounding the industrial site, except for a small pond and a boggy stream hydrologically connected with the Rogozhka river. In accordance with technical requirements, the OFS has a protection zone 100 m in width. The soils are sod-podzolic, formed on homogeneous loess-like loams, have an average particle size distribution. Significant areas show degradation of the soil cover [6, 7]. This is plane erosion caused by
light erosion of loess loams widespread in the territory due to the disturbance of vegetation cover during production. Pollution with heavy metals and acidification with sulfur dioxide was observed [8] (Table 1).

**Table 1.** The chemical composition of the soil test site of the southern part of the sanitary protection zone (fragment)

| Horizon designation | Sampling depth, cm | pH | P2O5, mg per 100g of soil | K2O mg per 100g of soil | Humus, % | Oil products mg/kg | Zn mg/kg | Cu mg/kg | Mn mg/kg |
|---------------------|--------------------|----|--------------------------|------------------------|---------|-------------------|---------|---------|---------|
| A₀      | 0-24               | 6  | 15                       | 2.5                    | 1.8     | 22.6±2.3          | 21.2    | 4.8     | 388     |
| B₁      | 30-40              | 4.3| 8.8                      | 0.5                    | -       | 14.3±1.4          | 6.5     | -       | -       |

As a result of geobotanical surveys of the territory, key herbaceous areas were identified, and herbaceous species of ruderal plants, including tall stems capable of accumulating dry plant residues, which can cause fire, were described (Table 2).

On the territory of the oil filling station, samples of the upper soil layer were taken and chemical analysis was carried out [9, 10] (Table 3).

**Table 2.** Characteristics of plants growing on the key plot (fragment)

| Name of plants          | Projective cover, % | Height, cm | Phenophase |
|-------------------------|---------------------|------------|------------|
| Barbarea                | 2.2                 | 60         | Fruits     |
| Taráxacum               | 25                  | 25         | Fruits     |
| Tussilágo               | 10                  | 15         | Vegetates  |
| Tanacétum vulgáre       | 0.2                 | 20         | Vegetates  |
| Plantágo                | 0.2                 | 25         | Vegetates  |
| Atriplex                | 5                   | 70         | Vegetates  |
| Trifolium pratense L.   | 25                  | 20         | Vegetates  |
| Achilléa                | 10                  | 50         | Vegetates  |
| Arctium                 | 24                  | 150        | Vegetates  |

Based on the results of the survey of the OFS territory, it was proposed to cut grass near the underground tanks and within the protected zones in early June, i.e. before insemination of dandelions and other ripening herbs.

The discrepancy in the sanitary and fire regulations of the forests adjacent to the OFS protection zone and the presence of damaged trees and shrubs within the sanitary protection zone were identified.

In the western part of the protection zone at a distance of 10 meters from the enterprise’s border, there is deadwood. In the southern part of the protection zone, in the 10-meter zone from the enterprise, there is a large amount of dead birch, aspen, willow. Technical works have to be performed. To renew protective strips, it is necessary to clean the dead wood and carry out drainage works. Based on the soil and climatic conditions, the most suitable woody plants for the restoration of protective bands will be spruce, pine, larch, or oak. They are well adapted to these conditions.

To the east of the enterprise and beyond its boundary, the tree layer is represented by conifers – pine and spruce providing a sufficient level of soil moistening. On the northern side of the enterprise territory, there is an asphalted parking for cars; the distance to the forest stand corresponds to the standards.

The survey of self-seeding and undergrowth revealed self-seeding oaks in the vicinity of tanks with oil products.

To improve the working space, it is recommended to equip lawns and flower beds near the buildings. Plants were selected. A plan for planting green spaces was developed. Chamomile can be planted on...
lawns to reduce the number of dandelions in the area. Flowers for beds were selected: Bergenia cordifolia - Pulmonalis, Aquilégia, Asteraceae alpinus, etc.

Table 3. List of pollutants emitted into the atmosphere

| Code | Name of pollutants                                      | Quality criteria for the atmospheric air | Hazard Class |
|------|--------------------------------------------------------|------------------------------------------|--------------|
|      |                                                        | MPC m. (mg/m³) | MPC pp (mg/m³) | RSIL (mg/m³) |                |
| 123  | Dioxide Iron trioxide, Iron oxide                      | -             | 0.04000000     | -            | 3              |
| 143  | Manganese and its compounds (IV oxide)                 | 0.01000000    | 0.00100000     | -            | 2              |
| 301  | Nitrogen dioxide; (NO2)                                | 0.20000000    | 0.04000000     | -            | 3              |
| 304  | Nitric oxide (II)                                      | 0.40000000    | 0.06000000     | -            | 3              |
| 328  | Carbon soot                                           | 0.15000000    | 0.05000000     | -            | 3              |
| 330  | Sulfur dioxide and sulfurous nhydride (SO 2)           | 0.50000000    | 0.05000000     | -            | 3              |
| 337  | Carbon oxide (CO)                                      | 5.00000000    | 3.00000000     | -            | 4              |
| 344  | Inorganic Fluorides                                    | 0.20000000    | 0.03000000     | -            | 2              |
| 405  | Hydrocarbons C1-5 (pentane)                            | 100.00000000  | 25.00000000    | -            | 4              |
| 501  | Pentilenes, Amylenes (mixture of isomers)             | 1.50000000    | -              | -            | 3              |
| 602  | Benzene C6H6                                           | 0.30000000    | 0.10000000     | -            | 2              |
| 616  | Dimethylbenzene, Xylene (mixture of isomers o-, m-, p-) | 0.20000000    | -              | -            | 3              |
| 621  | Methylbenzene, Toluene                                 | 0.60000000    | -              | -            | 3              |
| 627  | Ethylbenzene                                           | 0.02000000    | -              | -            | 3              |
| 703  | Benz [a] pyrene; 3, 4-benzpyrene                       | -             | 0.0000010      | -            | 1              |
| 1042 | Butan-1-ol; N-butyl alcohol                            | 0.10000000    | -              | -            | 3              |
| 1061 | Ethanol; Ethanol                                       | 5.00000000    | -              | -            | 4              |
| 1210 | Butyl acetate                                          | 0.10000000    | -              | -            | 4              |
| 1240 | Ethyl acetate                                          | 0.10000000    | -              | -            | 4              |
| 1401 | Propan-2-one; Acetone                                  | 0.35000000    | -              | -            | 4              |
| 2704 | Hydrocarbons (gasoline)                                | 5.00000000    | 1.50000000     | -            | 4              |
| 2732 | Hydrocarbons (kerosene)                                | -             | -              | 1.20000000   | 4              |
| 2735 | Oil mineral e oil (spindle, machine) Oil aerosol       | -             | -              | 0.05000000   | 4              |
| 2750 | Solvent naphtha                                        | -             | -              | 0.20000000   | 4              |
| 2754 | Alkanes C12-C19; Carbonwater limit C12-C19             | 1.00000000    | -              | -            | 4              |
| 2902 | Suspended substances                                   | 0.50000000    | 0.50000000     | -            | 3              |
| 2908 | Inorganic dust                                         | 0.30000000    | 0.10000000     | -            | 3              |
| 342  | Hydrogen fluoride (H2F2)                               | 0.02000000    | 0.00500000     | -            | 2              |

It was recommended to plant trees and shrubs (linden, viburnum, lilac, bird cherry, yellow acacia, barberry, etc.) that will trap dust and create comfort and aesthetics along the paths where the administrative building is located. The collected data and recommendations will be included in the section “Environmental certification of enterprises” that will justify the requirements for the operation of oil filling stations and their territories, buildings, facilities and equipment.

4. Conclusion
The survey revealed an insignificant level of anthropogenic pollution of the territory and sanitary protection zones. Soil trampling has the greatest negative impact. It causes the spread of ruderal plant species. Near the underground oil reservoirs, self-seeding and undergrowing trees were found. They
have to be removed in accordance with sanitary standards. In the ten-meter sanitary zone, there are dead wood and shrub species which have to be cut. It is recommended to perform sanitary cutting, remove self-seeding tree species and mow the territory. It is necessary to conduct environmental monitoring of the territory and develop an environmental passport of the enterprise which have to be updated every five years.

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