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Monitoring pollution level in railroad right-of-way

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Abstract

The paper describes environmental pollution in railroad right-of-way. The authors set a goal of collecting systematic data about concentration of pollutants in soils and surface run-off, which are close to railroad tracks and railway service enterprises. They also justified the choice of their research sites and described pollution forms typical for areas, which are close to railroad tracks. Petroleum products and iron were considered as main pollutants. The authors carried out a set of field-tested experiments to measure the level of railroad right-of-way pollution. The results are summarized in graphs showing how the level of pollutant concentration in surface run-off depends on the level of the same pollutant in soil sample. Theoretical and experimental research made it possible to calculate surface waste water and soils pollution concentration in railroad track right-of-way. The paper considers the Russian Legislation regulatory documents requiring enforcement of environmental protection measures to decrease dirty discharge into water bodies.

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Keywords: surface run-off; railroad track; railroad right-of-way; waterbody; petroleum products; iron (general)

1. Introduction

Surface run-off has a great influence on organic soils and waterbodies. Traditionally, the main research tasks in this field used to be diagnosing environmental pollution by surface run-offs, which are formed on industrial enterprises territories and near motorways. The influence of surface run-offs formed in railroad track right-of-way on the environment is also crucial. That is why it is extremely important to investigate the problems of surface run-offs (those formed on the territories of railway enterprises) collecting, disposing and purifying [1, 2, 3, 4, 5].

The authors set a goal of collecting systematic data about concentration of pollutants in soils and surface run-off, which are close to railroad tracks and railway service enterprises. They also justified the choice of their research sites and described pollution forms typical for areas, which are close to railroad tracks. Petroleum products and iron (general) were investigated as main pollutants.

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Theoretical and experimental research made it possible to calculate surface waste water and soils pollution concentration in railroad track right-of-way. As the requirements for environment protection are being toughened it is extremely important to reduce contaminants disposal into waterbodies. The main problem concerning railroad constructions in the city of Samara is that surface waste water here are never collected, disposed or purified. It means that surface waste water formed in railway bed follows surface relief and runs into the nearest water reservoirs, rivers, lakes and subsurface water basins.

Papers [6, 7] describe a related problem and analyze city and country landscape in Romania. Extraction of minerals (oil resources mostly) and transport infrastructure development here result in soil and vegetation cover exhaustion. Paper [8] introduces the results of a similar research and shows the level of land contamination by heavy metals which take a heavy toll on organic soils condition. The paper proves that the increase of heavy metals concentration in organic soils detrimentally affects soil ferments able to prevent soil degeneration [8].

2. The object of the research

The object of the research is surface waste water running from railroad tracks and soils in railroad track right-of-way. The researchers investigate a process of surface waste water purification and operation schedules of surface waste water collecting, disposal and purification.

Chemical (petroleum products and metals) and physical (suspended materials) pollution have a great adverse effect on nature and artificial waterbodies. These pollutants run into waterbodies through surface run-off coming from railroad tracks. Surface run-off coming from railroad tracks contain metals (for example, iron) because railroad tracks (also referred to as railings or metals) are made of alligation (the main component here being iron, up to 97%). Iron (general) enters surface run-off as a result of railings friction and abrasion, and also due to electrochemical corrosion. Chemical pollution is known as the most harmful pollution which affects large territories and afflicts damage to soil water, surface water and soils themselves. Harmful chemicals are absorbed by soils particles, become a part of oxidation-reduction process and later settle down in soils. As a rule, there is no contaminated water self-purification. Mechanical pollution involves mechanical admixtures (such as sand, raw sludge, dust, etc) which also run into water. They substantially impair water organoleptic parameters [9, 10].

3. Materials and method

3.1 Research

Railway facilities are usually defined as stationary engineering structures that constantly influence environment. The authors analyzed railroad negative influence on the nearby territories and waterbodies while taking transport infrastructure as an example [11, 12, 13, 14, 15]. To provide accurate information on the level of pollution they chose relevant research sites which were situated in railroad right-of-ways and which were close to motorway bridges. These were the sites situated near Samarskiy state owned farm, Volzhskiy district of Samara region. Soils point samples were taken on these sites. The research sites were also situated at about 100-metres distance from surface waterbodies. Soils samples from these sites were collected by "semi-ellipse method" [16, 17, 18, 19, 20, 21]. Soils sampling was done according to regulatory documents. Figure 1 shows that one-kilogram soils samples were collected with the help of a special gauge. The researches took 15 soils samples from the both sides of railroad tracks. These research sites and railroad tracks location can be seen in Figure 1.

3.2 Analysis

The results of quantitative chemical analysis were summarized in the tables below (see Tables 1-6). These results were obtained in the certified hydrochemical laboratory of the Water Supply and Sewerage Department, Samara State University of Architecture and Civil Engineering.