

Pipeline intended for transportation of liquid hydrocarbons by sea is referred to pipeline engineering; precisely, it is referred to main pipeline which is laid at the sea bottom.

This type of pipeline is very prone to mechanical damage which can happen for many reasons. It can be mechanical damage caused by ship anchors and trawl-fishing vessels. Besides, waves and currents can cause the erosion of soil under pipeline, which, in its turn, results in distortion or sag of pipe sections, pipeline vibrations and endurance failure, corrosion damage. To prevent such damage, offshore pipelines are usually submerged into the ground. The burial depth depends on the specific geological conditions of the construction area.

To protect offshore pipelines from damage in the coastal zone or approach area, technology of rock placement, also termed as rock dumping, is most commonly used. Stone dumping is carried out from barges with fall pipes and vibrators. The ships are often used with rigid deck where the bulldozer resets stones. The accuracy of such dumping is rather low.

Another technology is so-called pipe-in-pipe solution [2] which is used for arresting the propagation of a buckle. In addition, such a solution ensures that the temperature of the oil remains as constant as possible.

In conclusion, it can be stated that despite all the safety precautions, new engineering solutions and environmental standards and regulations, accidents still happen. Therefore, the question of the environmental problems related to marine oil transport remains open.

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#### THE PROCESS OF SUFFUSION ON TOMSK ROADS

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It is a common place to come across with unexpected potholes on the roads of Tomsk, even on the central streets such as Lenin Street and Frunze Street. There are some cases when cars and trucks may even fall down into these holes. These days such events are not extraordinary for local people. People are used to blaming road workers and the authorities claiming that they do not follow the rules and regulations of road building. They also criticize the local councils for doing nothing to keep under control the conditions of city roads. However, it should be stated that potholes on the roads are not always caused by negligence. Sometimes, it is suffusion that becomes the main reason. The suffusion is a widespread exogenous geological phenomenon. Therefore, the formation of suffusion potholes presents an urgent problem not only for people living in Tomsk but also in other regions of the Russian Federation. That's why, it is necessary to

find appropriate solutions to this problem in order to avoid financial damage and threat to human lives.

The aim of the present study is to identify their influence of the suffusion processes on the road covering in Tomsk. Achieving the above aim it is need to reach the following objectives:

1. to examine the data on suffusion;
2. to find out in which districts of Tomsk the suffusion phenomenon is more common
3. to propose the ways to reduce the impact of this process

It has been revealed that potholes on the roads of Tomsk are basically formed due to suffusion. Suffusion is a geological hazard caused by groundwater flow. Suffusional failures (leaching, piping, underground erosion) of soils or rocks cemented by soluble material are well known throughout the world. The process results in a range of phenomena: weakened zones, caves and voids, subsidence hollows, collapse sinks, swallow holes, landslides, and sand volcanoes. In extreme cases, buildings and structures may be damaged. [3]. Removing the layers of clay and sand gradually reduces the volume of the hard layers, which in its turn, leads to the collapse of the Earth's crust. Water which penetrates from the sandy and sandy-clay strata in the underlying limestone karst carries out a lot of sand and clay into the karst cavities. Such a removal is especially intensive in the breakout of the aquifer saturating sand in the underlying limestone karst cavities [1]. At the same time, the aqueous sand is sucked down, and a pothole forms on the surface of the ground. Undulating water flow through the rock may cause its erosion. It means that water moves through sufficiently large cavities and channels leading to a backwash formation, which in its turn, often results in breakdown of weakly bound particles of the rock. The most intensive processes of suffusion occur in thin and fine-grained sand, loess and loam soils. In more dense clay rocks, suffusion processes are more rare case, with cutout beginning in cracks. The problem is also complicated further by the fact that the asphalt coat hides the effects of suffusion as long as it fails. There were cases when cars and even trucks fell into formed sink holes.

The main conditions for the formation of mechanical suffusion are as follows:

- 1) The heterogeneity of soil grading estimated by the proposed by L.V. Peredelsky heterogeneity factor and is not considered suffusion.
- 2) The critical value of the hydraulic gradient of the water flow under which slow filtering without elution of fine particles occurs.
- 3) The presence of the conditions for the removal of fine particles to the surface at the base of the slopes and various sinks [2].

In natural environment, mechanical suffusion processes usually develop very slowly. However, due to some man-made factors, such as breakthrough canalization, suffusion process develops much faster, thereby reducing the resistance of the road surface, which leads to the formation of craters and pits [5].

Suffusion processes are particularly common in the city of Tomsk. Tomsk is a city that is located in the south-east of Western Siberia Plain where flat and highly swamp areas prevail. The following basic suffusion-prone areas were identified in Tomsk: Kirovskii district, as well as the Leninskii district along Lenin Street.

The numerous attempts of road workers to solve the problem on their own result in new forms of suffusion processes. The fact is that builders often try to eliminate only the external displays of the destructive processes - suffusion funnels. In most cases, they try to deal with the consequences of suffusion by means of the so-called "patching". Suffusion funnels are filled with gravel and bricks, and then they are concreted and closed with the

"patches" of newly made asphalt. However, new holes inevitably developing place of the recently laid patches. This is due to the fact that the road surface destruction originates not on the surface, but much deeper - under the ground. Suffusion drawdowns are often observed near the storm water drains as there is a significant increase in the speed of groundwater flow filtration, which in its turn, corresponds to silt removal intensification.

To prevent the consequences of suffusion, it is required to conduct activities aimed at reducing or stopping the flow of water in the soil, as well as decreasing the flow rate. For these purposes, a great variety of methods are used. The analysis of Tomsk flooding areas is one of these methods which can allow identifying the most dangerous areas of possible pothole and failure formation.

#### References

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#### INDUSTRIAL POLLUTION

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At all stages of its development man was closely connected with the outside world. But with an advent of industrial society dangerous human interference in nature has increased dramatically. Nowadays, industrial pollution threatens to become a global threat to humanity. Earlier factories were small and didn't produce so much smoke and pollution, but with the increase of human needs their number and size began to grow causing significant environmental pollution. With the development of technologically-developed factories into full-scale industries and manufacturing units, the problem of industrial pollution started to be of great importance.

There are a lot of different factors which cause industrial pollution. The most important are the following:

1. Unplanned industrial growth – in most industrial townships unplanned growth took place due to the fact that companies violated the rules and regulations, and polluted both water and air.