

POSTERS

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Potential changes of environmental contamination in permafrost regions caused by the anthropogenic global warming

O.A. Anisimov

State Hydrological Institute, 2-nd Line V.O., 23, St.Petersburg, 199053, Russia

Accidental hydrocarbon spills from pipelines may be caused by landslides or uneven settlement of pile foundations. Stability of slopes and bearing capacity of the foundations decrease with permafrost temperature rise, thus, the anthropogenic global warming may enhance the potential contamination in the Arctic.

Scenarios of climate change derived from general circulation models predict approximately 1°C increase of the global-mean air temperature by the middle of the 21st century, with much greater increase (2-3°C) over the high latitudes. Permafrost models may be used to evaluate the effects of climate change on the ground surface temperature and the depth of seasonal thawing. Results of calculations suggest 1.5 - 2.5°C temperature increase and 30%-50% increase of seasonal thaw depth in the next 50 years. Such changes will enhance the landslide activity and may cause 30% to 60% loss of the bearing capacity of permafrost, which can exceed the safety factor incorporated in the design of existing constructions and provoke abrupt hydrocarbon spills from the pipelines.

A hazard index was constructed using data on the seasonal thaw depth, ground temperature and ice content, to regionalize the permafrost with respect to potential contamination caused by instability of pile foundations and slopes. Maps, calculated for the conditions of the future climate, show that the pipelines in West Siberian oil and gas fields located in the ice-rich permafrost, are of particular concern. The Trans-Alaska pipeline spans two areas of high hazard potential, and special efforts are needed to prevent pipeline destruction caused by warmer climate.