FACTSHEET

Arctic

Modeling Oil Spills in the Beaufort, Bering and Barents Seas

An Inuk hunter on a snowmobile observing an icebreaker, Canada.

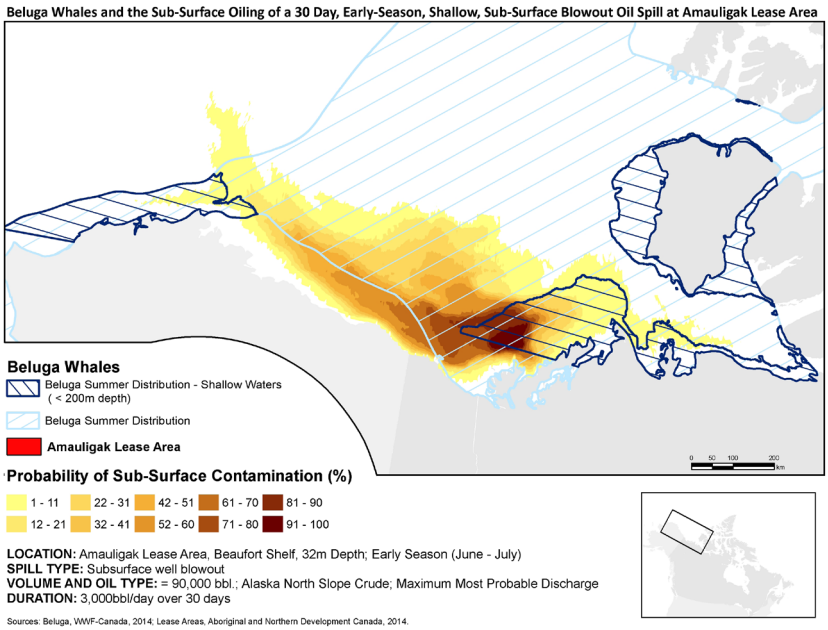
In three separate oil spill modeling exercises, WWF has illustrated the potentially damaging trajectory of oil spills in the Arctic. These modeling exercises prompted the following recommendations. These recommendations cover best practices, protocols, and strategies needed to reduce the risk of oil spills and increase oil spill response capacity across the Arctic Marine and Coastal environments.

Changes in the Arctic sea ice are opening previously inaccessible areas to industrial activity, from natural resources development to increasing shipping. The United States Geological Survey (2008) estimates that up to 22% of the world´s undiscovered technically recoverable oil and gas resources are located in the Arctic, including 13% of the world´s undiscovered oil. More than three-quarters of these resources are to be found offshore in the territories of the five coastal states of the Arctic Sea – namely, the U.S., Canada, Russia, Norway and Greenland. In 2013, 71 ships carried 1.35 million tons of goods through Russia's Northern Sea Route, with oil products making up 67 percent of the cargo. In contrast, 46 vessels with 1.26 million tons of cargo traveled the route the year before.

This expansion in offshore oil and gas and shipping activity is taking place in the absence of proven technologies to clean up a major spill in ice covered waters, putting in jeopardy the livelihoods of people around the Arctic, and jeopardizing already stressed ecosystems.

MODELING OIL SPILLS - LESSONS LEARNT

Beaufort Sea



WWF-Canada's study on oil spill trajectory modeling in the Beaufort Sea modeled a range of spills of different sources and volumes, at different times of year, resulting in a total of 22 spill scenarios mapped. The research was done by RPS Applied Science Associates (ASA), a world leader in modeling the transport, fate, and biological effects of oil and chemical pollutants in marine environments.

RPS-ASA estimated the spread and fate of potential oil spills associated with increased shipping and tanker traffic, and both shallow-water blowouts and deep-water blowouts in the Canadian Beaufort Sea. Spill scenarios were researched and developed to be as realistic as possible, based on proposed and existing developments (shipping traffic, oil & gas lease sites), and determined in consultation with Inuvialuit communities. Worst-case and most-probable scenarios were modeled. Scenarios accounted for seasonal specifics and sea ice conditions. In the blowout option, the effects of dispersant application were also considered in the oil trajectory. The report also mapped the spread of the spills, their potential impact on the water and shoreline, and the potential interaction with the sea ice, wildlife and ecologically significant areas in the region. The results of this study are presented in an interactive website (arcticspills.wwf.ca) and have been presented in person to all six Inuvialuit communities in the Beaufort Sea region.

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FULL RESEARCH RESULTS
panda.org/arctic/spillreport

SUMMARY
panda.org/arctic/spillsummary

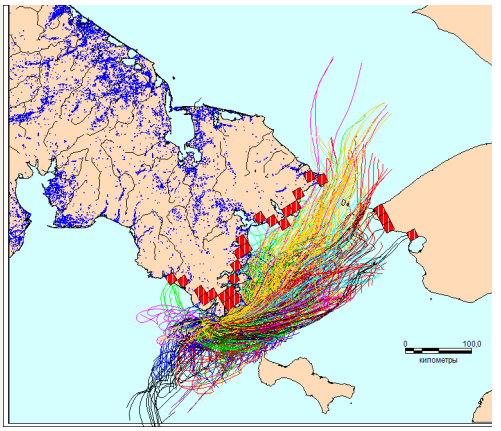
INTERACTIVE MAP
arcticspills.wwf.ca

LESSONS LEARNT FROM BEAUFORT OIL SPILL MODELING STUDIES

- **Oil and ice don't mix: oil is difficult to contain, especially in icy conditions**
  Spilled oil surfaces rapidly and is easily trapped in sea ice, making it difficult to contain or clean up and spreading oil to areas far from the spill site. In particular, spilled oil may travel considerable distances to the west and north of the spill site when trapped and drifting within sea ice, affecting habitat for a wide range of marine species. As a result of this spread of oil, coastal oiling could be international issue – there may be a relatively high chance that oil spilled in Canadian waters could reach U.S. shorelines and affect communities there, as well as those in Canada.

- **When clean isn't clean: spill response measures come with their own risks**
  Use of chemical dispersants at deep water blowout sites may create 'toxic plumes' of chemical residue to concentrate along the Beaufort shelf, an area that is home to a diverse range of species and essential to the health and productivity of Beaufort Sea ecosystem.

- **Local indigenous knowledge provides valuable insight into local and historical environmental and oceanographic conditions**
  Opportunities to include this in modeling and spill response planning should be explored.



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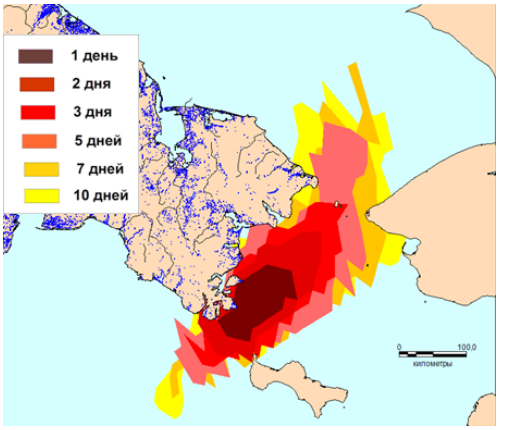
Integrated family of oil spill propagation trajectories after 10 days, for 12 years for the month of August (middle of the navigation period), showing entire northern and western parts of the Chirikov basin as affected by pollution. In some years the oil slick could be transported into the Chukchi Sea. Pollution may impair the whole eastern coast of the natural reserve between Capes Chukotsky and Dezhnev. In individual years the oil slick could reach as far as the Seward Peninsula (Alaska).



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An integrated family of 10-days oil spill propagation trajectories from a specified point in a specified month (August) over 12 years, showing a 50% likelihood of the oil slick crossing the U.S.-Russia border in the central part of the Chirikov basin, within 2-3 days of the spill.

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FULL RESEARCH RESULTS
wwf.ru/about/what_we_do/oil/full_list/arctic/eng

INTERACTIVE MAP AT
projects.scanex.ru/RussianArcticMSP-BStraitEng

Bering Sea

This research, led by WWF-Russia and WWF-US, modeled spills for the Bering Strait region from oil tankers and cargo ships already travelling along Russia's Northern Sea Route and through the Bering Strait, at specified points along the official recommended shipping route during the navigational season (May-November). The research was done by Risk Informatics Research Center, Russian experts in risk assessments, oil spill modeling, design plans and maintenance documentation for oil and gas projects in marine environments, and expert evaluations of safety for such projects.

Risk Informatics Research Center estimated the risk of current and near-future oil spill risk, and the spread and fate of potential oil spills from shipping sources in the Bering Strait, with a total of 36 oil spill scenarios mapped. More than 6,500 calculations of oil spill trajectories were made with real data for a 12-year period. Scenarios considered seasonal specifics, local hydrology, ice conditions, and other environmental conditions that affect oil spill behavior and ship accident incident rates. Discharge volumes were based on a review of vessel types and associated fuel carrying capacities that either currently operate along the Northern Sea Route and in the Bering Strait, or are purposed for future operation in the area. Worst-case scenarios were modeled. The three selected points of oil discharge were intended to take account of the variety of hydrometeorological, hydrological, and ice conditions in the Bering Strait to the largest degree possible. Selected scenarios from this study are presented in an interactive website (projects.scanex.ru/RussianArcticMSP-BStraitEng) and have been presented in person to audiences in Moscow, Washington DC, and Anchorage, Alaska.

LESSONS LEARNT FROM BERING OIL SPILL MODELING STUDIES

- **Increasing transport of oil and gas through the Bering Strait threatens protected territory of the Beringia National Park**
- **An oil spill on the Russian side of the Bering Strait has a high probability of crossing to the US waters, affecting the entire ecosystem**
- **Prevention and response systems in the Bering Strait are either missing or are inadequate**
- **US-Russia transboundary collaboration and knowledge sharing is needed to support planning, preparedness, risk reduction, and incident response**
- **Navigational safety measures are necessary to minimize risks of vessel accidents**

Barents Sea

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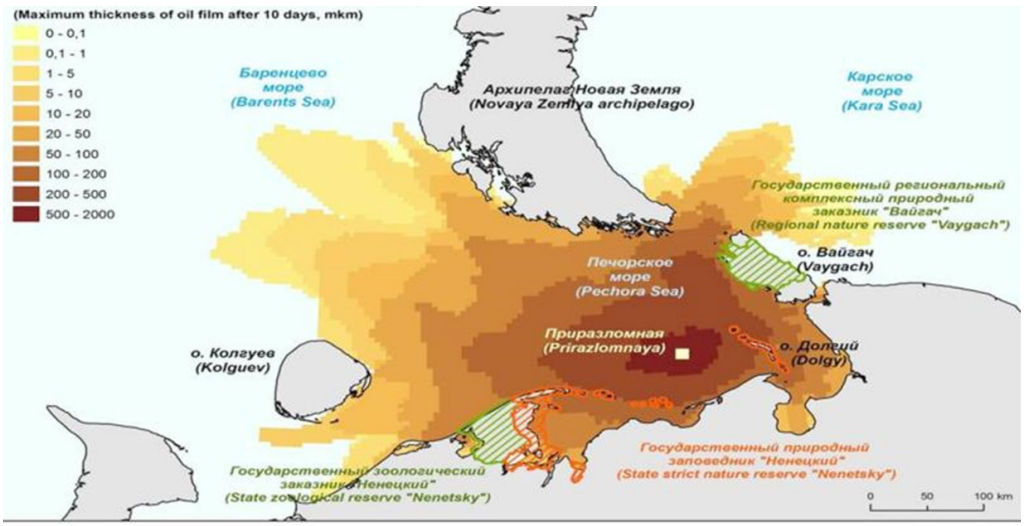
FULL RESEARCH RESULTS
wwf.ru/resources/publ/book/eng/770

The purpose of this WWF-Russia led research (2012) was to assess capabilities and adequacy of emergency response related to the potential oil spills from operation of Gazprom Neft oil platform Prirazlomnaya in the Russian sector of the Barents Sea. The research was also done by Russian experts from the Risk Informatics Research Center (Moscow, Russia).

Scenarios considered the potential volume of spilled oil, hydro-meteorological conditions during the accident (strength and direction of wind, currents, wave height, ice conditions), as well as actions planned by the company to manage the spill. The maximum amount of the spill was calculated according to official regulations, 1,500 tons for wells and 10,000 tons for tankers. The study identified conditions and situations that may hinder oil spill clean-up capability, and took into account official regulations and requirements related to oil spill prevention and response. Research results showed significant shortcomings in Gazprom Neft's oil spill response plan, including inadequate equipment for response in Arctic conditions. The study was shared with the company, which agreed that the pointed-out shortcomings were serious, and was widely shared in Russia. Thereafter the company reported some improvements (including additional response vessel and equipment involvement, establishment of co-operative mutual aid agreement with other operators, and reassessment of oil spill modeling).



Potential oil pollution of seawater and shoreline after oil spill of 10,000 t over 5 days.

LESSONS LEARNT FROM BARENTS OIL SPILL MODELING STUDY

- **Gazprom Neft, operator of the oil platform Prirazlomnaya, needs to strengthen its oil spill response capability in the Arctic**
- **In case of response failure due to harsh environmental conditions, an oil spill could lead to serious pollution of this fragile region**
- **Potential impacts of oil spills in the southeastern Barents Sea will negatively affect endangered species habitat (Atlantic walrus) and important protected areas including shores of the Nenets zapovednik.**

WWF RECOMMENDATIONS

1. Increased investment in knowledge generation and monitoring

The best available environmental and socio-ecological data is needed to model and predict the fate and trajectory of oil spills in the Arctic and support rigorous vulnerability analyses and risk assessments. Arctic states should continue efforts to close the knowledge gap in biodiversity and socio-ecological parameters (i.e. spatial and temporal species distribution, ice-associated habitats, feeding areas, subsistence use areas, and other knowledge gaps identified in the ABA Synthesis 2013); improve real time monitoring of environmental (i.e. weather, sea-ice and oceanography) and ecological conditions; and on-going investments in the improvement of oil-in-ice modeling methodologies and current-ice coupled models.

Furthermore, WWF encourages that CAFF develop actions to close the knowledge gap in biodiversity parameters by further building on the Circumpolar Biodiversity Monitoring Program (CBMP) and the Arctic Biodiversity Data Service (ABDS) as providing a source of data for modeling and ecosystem-based management. Data collection should include community-based monitoring and local and traditional knowledge, which provide valuable insight into the local and historical environmental and ecological conditions.

2. Implementing an ecosystem approach at national and eco-region scales

Transboundary collaboration and knowledge sharing is essential to support planning, preparedness, and risk reduction prior to increased development. As entire ecosystems would be affected by marine oil spills, implementation of an ecosystem approach (as under-development by the PAME Expert Working Group), in collaboration and cooperation from nations across eco-regions, is necessary to prepare and plan for oil spill impacts. As one step to advance an ecosystem approach, WWF recommends that Arctic countries establish and enhance eco-region specific databases to actively share relevant data on environmental, ecological and human activity, and prioritize and fund research to further collect and compile such data at an ecosystem scale.

3. Mandatory oil spill modeling

Oil spill modeling should be mandatory for regions of existing and new oil development and for waterways where oil is currently being transported or where such transport is being planned. Implementation of such models is especially important in transboundary regions. WWF recommends that all applications for oil and gas exploratory drilling and proposed shipping corridors be accompanied by 3rd party oil spill trajectory modeling in a range of scenarios (most probable spills, worst case spills and other important scenarios). Models should include spill scenarios that may occur both during and beyond operating seasons. These scenarios should also include vulnerability analyses, and identification of critical habitats and subsistence use areas. Relevant ministries should mandate and/or support the modeling at a national level, to be performed by the most-qualified third parties. Results should be shared with neighboring countries in order to inform effective joint prevention and response measures.

WWF recommends that EPPR encourage rigorous oil spill trajectory modeling exercises in areas of proposed and existing shipping and oil and gas activities, and use the results of regional and trans-boundary oil spill modeling to define further prevention and response projects and actions involving Permanent Participants and Observers.

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Belugas, Chukchi Sea.

4. Environmental risk assessments

The Arctic countries should require comprehensive environmental risk assessments prior to issuing new exploratory drilling licenses in the Arctic and in consideration of the full life-cycle risks of these developments (including exploration, production, and transportation). Such risk assessments should be conducted in a transparent manner with participation by all relevant stakeholders. WWF recommends that in upcoming projects, including the Circumpolar Oil Spill Response Gap Analysis and the Circumpolar Marine Environmental Risk Assessment, EPPR should assess response gaps and environmental risks on a Circum-Arctic basis to inform spatial and temporal measures to reduce disturbance to significant areas from oil and gas and shipping activities.

5. Implementing appropriate spatial and temporal measures to reduce disturbance to significant areas

Arctic States should continue the on-going identification and mapping of ecologically and culturally significant areas and pursue further work to determine the vulnerability of areas to oil spills under different scenarios. Ecosystem features, habitats, and subsistence use areas that are deemed too valuable and vulnerable to oil spills should be identified and agreed upon by national agencies, industry and regional communities. Special measures for response (i.e. response infrastructure nearby, seasonal considerations in response options), and development limitations (such as safeguarding, zoning, shipping lane designations, or deferral areas) should be implemented in oceans planning and leasing decisions at national and ecosystem scales.

6. Improving oil spill response capacity and coordination

As the AMSA (2009) emphasized, there is a lack of emergency response capacity for saving lives and for pollution mitigation in the Arctic, except in limited areas, which makes emergency response significantly more difficult. The report on Responding to Oil Spills in U.S. Marine Environments (2014) by the U.S. National Research Council confirmed that the lack of infrastructure and oil spill response equipment in the U.S. Arctic is a significant liability in the event of a large oil spill. This report also noted that many aspects of the Arctic environment which are still poorly understood, including the presence of sea ice, can influence the behavior of spilled oil, yet most spill response technologies were designed for and tested in temperate regions.

For regions where risk assessments and oil spill modeling forecasts show a high risk and likelihood of transboundary oil spills, transboundary cooperation on oil spill preparedness and response, pursuant to the recent Agreement on Cooperation on Marine Oil Pollution, Preparedness and Response in the Arctic (2013), needs to be strengthened. WWF recommends that Arctic countries immediately begin to implement this Agreement and strengthen the implementation by developing joint oil spill models for transboundary regions, and by conducting joint preparedness and response exercises and drills, especially in the Bering, Beaufort, and Chukchi Seas shared by Arctic Council states.

Prior to increased exploration, production, and transportation of oil in the Arctic, claims that adequate oil spill response technologies exist for Arctic conditions (across seasons, in both open and ice-infested waters) must be verified. Adequacy and effectiveness should be assessed by a committee of regulators and community stakeholder representatives. WWF recommends that the Arctic Council Ministers task EPPR with enhancing Arctic oil spill response capability, by coordinating and conducting simulation and training exercises in cooperation with national governments, including an after-action report with recommendations improving oil spill response coordination in the Arctic. WWF specifically recommends that the U.S. lead such an exercise to test technology to combat oil spill in ice conditions including mechanical recovery, in-situ burning and use of dispersants or other countermeasures, including information on the operational benefits and limits associated with the use of these tactics to enhance implementation of the 2013 Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic. The joint exercises should also address the practical challenges of transporting and deploying response equipment and responders to spill locations.

Furthermore, WWF supports efforts to provide guidance to small communities on best practices related to prevention, preparedness and response to oil spills in the Arctic and increased capacity-building of regional and local of communities to respond to oil spills.

CONCLUDING RECOMMENDATIONS

During its two-year chairmanship of the Arctic Council, the United States should lead a process to ensure that agreed recommendations are implemented at a national (and where necessary, international) level, and that the level of implementation is monitored by each state, and reported back to the Council every two years.

Such a process should include the development of plans for all policy recommendations that outline specific methodologies, processes, timelines, milestones and approaches for implementation of the many working group recommendations. It should also include not just commitments to research, but concrete actions on some of the already well-researched recommendations of the CAFF Arctic Biodiversity Assessment.

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WWF

Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

panda.org/arctic

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