



ARCTIC CONTAMINANTS  
ACTION PROGRAM

# DIESEL BLACK CARBON

## EMISSIONS IN MURMANSK



ARCTIC COUNCIL



[acap.arctic-council.org](http://acap.arctic-council.org)



@ACAP\_Arctic

### Black carbon: Why does it matter?

Black carbon is the sooty black material emitted from diesel engines, coal-fired power plants, and other sources that burn fossil fuel. It comprises a significant portion of particulate matter (PM), which is an air pollutant.

Black carbon emissions have powerful effects on air quality and visibility, ecosystems, and the climate. In humans, black carbon can adversely affect cardiovascular and respiratory systems and contribute to premature death.

Reducing black carbon emissions can slow climate change, particularly in the Arctic. Black carbon reduces the reflectivity of snow and ice, and increases rates of snow and ice melting. The Intergovernmental Panel on Climate Change lists black carbon as the third largest warming agent globally. The reduction of black carbon emissions and impacts in the Arctic is a priority for the Arctic Council.

### Murmansk: The right setting for quick action

Murmansk is the largest city above the Arctic Circle, with a population of over 300,000 residents. The Arctic Council's Arctic Contaminants Action Program (ACAP) Working Group chose this important city to implement its first black carbon project because of its abundance of relevant statistics and data, widespread use of diesel-powered vehicles, and motivated local government support for taking practical action to address black carbon emissions.

### ACAP project partners

U.S. Environmental Protection Agency (EPA) | Battelle Memorial Institute  
World Wildlife Fund - Russia | Murmansk State Technical University

## Arctic Contaminants Action Program (ACAP) develops initial inventory

After initial consultations, the ACAP project partners decided the first step to reducing emissions of black carbon was a solid, bottom-up inventory of sources within the region. This could then be compared to the available data sets.

Experts from the United States and Russia enlisted the help of graduate students at Murmansk State Technical University, who took air quality samples at key locations around the city, monitored traffic flows, and estimated emissions from on-road vehicles in the city to better-characterize the type of black carbon emissions in the city. The research team found that roughly 400 tonnes of black carbon are emitted from diesel sources each year in the Murmansk Region.

Emission-causing activity	Estimated emissions (kg)
On-road transport	54,000
Mines	280,000
Locomotives	20,000
Construction	10,000
Agricultural	3,000
Diesel generators	35,000
Ships	4,000

The largest source in the region, responsible for 69% of emissions, was the mining industry, a significant part of the Murmansk economy. On-road vehicles, like cars, trucks, and buses, were the second largest source, responsible for 13% of emissions. The full results of this data collection and analysis were published in July 2015 in the peer-reviewed journal *Atmospheric Chemistry and Physics*. (see <http://bit.ly/2cyc8WI>)

### Murmansk bus company pilot

A pilot mitigation project to upgrade part of the bus fleet at a local bus company reduced emissions by 90 percent, lowered the fuel consumption, reduced operations and maintenance costs, and improved service reliability. This was such a success that a competing bus company decided to undertake the same measures. For more information on the bus company project, see: <https://oaarchive.arctic-council.org/handle/11374/389>

### Emissions from mining operations

Murmansk is home to a large mining industry that conducts operations across the region. Four large, open-pit mines in the Murmansk region provided valuable data to the study and represented the bulk of diesel fuel consumption in regional mining operations in 2012. The sources of black carbon in mining operations in Murmansk included large mining trucks, shovels, bulldozers, excavators, drilling equipment, and supplementary vehicles. Mining trucks consume the highest percentage of the total diesel fuel consumed, using 85% of the diesel used in open-pit mines. Best practices for the mining industry developed through this project can be found at <http://bit.ly/2cWBGeK>. For an associated article, in Russian, see <http://bit.ly/2dmcuOT>.

### Next steps: more effective reductions

This black carbon inventory effort (the first of its kind in the Russian Arctic) and ongoing black carbon reduction pilot projects will enable decision-makers, universities, and others to make more accurate assessments of black carbon sources in other cities and regions and will help guide Murmansk as it takes action and puts in place more effective reduction strategies.

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### Contacts

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