

THE ECOLOGICAL ASPECTS OF GROUND-LEVEL MONITORING IN THE KOLA PENINSULA

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Abstract

Results of surface ozone concentration measurements in the Kola Peninsula (Lovozero, since 1999; Apatity, since 2002) are discussed. For all periods of measurements and for all monitoring points the cases of the exceeding of the critical levels are not found. Signatures of photochemical smog during summer periods in Apatity city are not detected. In Apatity city the lower ozone concentrations take place more often, than in Lovozero. This is caused by the additional ozone destruction in reactions with nitric oxide and other anthropogenic pollutions. During winter, conditions of the surface inversion and wind velocity are less 2 ms^{-1} in Apatity city in daily hours unfavourable ecological situations may occur.

Introduction

According to ecological requirements, the ground-level ozone is included in the substance group, which is subjected to the unremitting control. There is given the priority list of pollutants (Table 1). The experts of the First intergovernmental conference on monitoring made this list according to the monitoring in Nairobi in 1974 (the less classes number, the higher priority).

Table 1. Priority classes of the environment pollutants /1/.

Priority classes	Pollution	Surroundings
I	Sulphur dioxide, suspended part	Air
	Radio nuclides	Air, food
II	Ozone	Air
	DDT and chlorine-organic compounds	Biota, human
	Cadmium	Food, human, water
III	Nitrate, nitrite	Water, food
	Nitric oxide, nitrogen peroxide	Air
IV	Mercury and its compounds	Food, water
	Lead	Air, food
	Carbon dioxide	Air
V	Carbon monoxide	Air
	Fluorides	Water
VI	Asbestos, arsenic	Air
VII	Micro toxins	Food
	Reactive hydrocarbon	Air

In Russia the background ozone belongs to the class of substances of the first dangerous category, too. The list of the main ozone critical levels and standards that apply to European countries is presented in Table 2.

Discussion

The monitoring of the background ozone in the Kola Peninsula has been done since 1999 (Lovozero). In additions, since 2002, the monitoring has been done in Apatity city and its suburbs (2 km from city). For all periods of measurements and for all monitoring points the cases of the exceeding of the critical levels are not found. The maximal concentrations of the background ozone are far from reaching the maximum allowed (Fig.1) and their absolute values never exceed concentrations of ozone at the upper edge of the boundary layer. Signatures of photochemical smog during summer periods in Apatity city are not detected.

Note, that in Apatity city the lower ozone concentrations take place more often, than in Lovozero. This is caused by the additional ozone destruction in reactions with nitric oxide and other man-made pollutions. The lower concentrations are not dangerous, but they testified about the presence of other dangerous air compounds in great quantity in the city air (NO, hydrocarbon and etc.) and about total decrease of the oxidizer quality of the city atmosphere.

Table 2. Ozone critical levels and guideline values that apply in the European region.

Set by	Criteria	Value
European Council Directive 92/72/EEC	Population information threshold	1 hour average 180 $\mu\text{g m}^{-3}$ = 90 ppb
	Population warning threshold	1 hour average 360 $\mu\text{g m}^{-3}$ = 180 ppb
	health protection threshold	fixed 8 hour means 110 $\mu\text{g m}^{-3}$ = 55 ppb
UNECE-CLRTAP	Critical level for crops and semi-natural vegetation	AOT40* daylight hours May to July 3,000 ppb h
	critical levels for forests	AOT40 daylight hours April to September 10,000 ppb h
WHO	Guideline for the protection of human health	Running 8 hour maximum 120 $\mu\text{g m}^{-3}$ = 60 ppb
	Critical levels for agricultural crops	AOT40 daylight hours over 3 months 5,300 ppb h
	Critical level for forest	AOT40 all hours over 6 months 10,000 ppb h
Russia		1 hour average 80 ppb

- AOT40 is the accumulated concentration over a threshold of 40 ppb.

As rule, the lower ozone concentrations in Apatity city take place during the cold half-year, when the man-made pollutions accumulated in the boundary layer in conditions of the surface inversion. During winter, conditions of the surface inversion and wind velocity are less 2 ms^{-1} in Apatity city in dally hours unfavourable ecological situations may occur. During summer months this situations do not arise, as there exists an unstable stratification during the most part of the day and there are no conditions for accumulation of ozone-destruction substances.

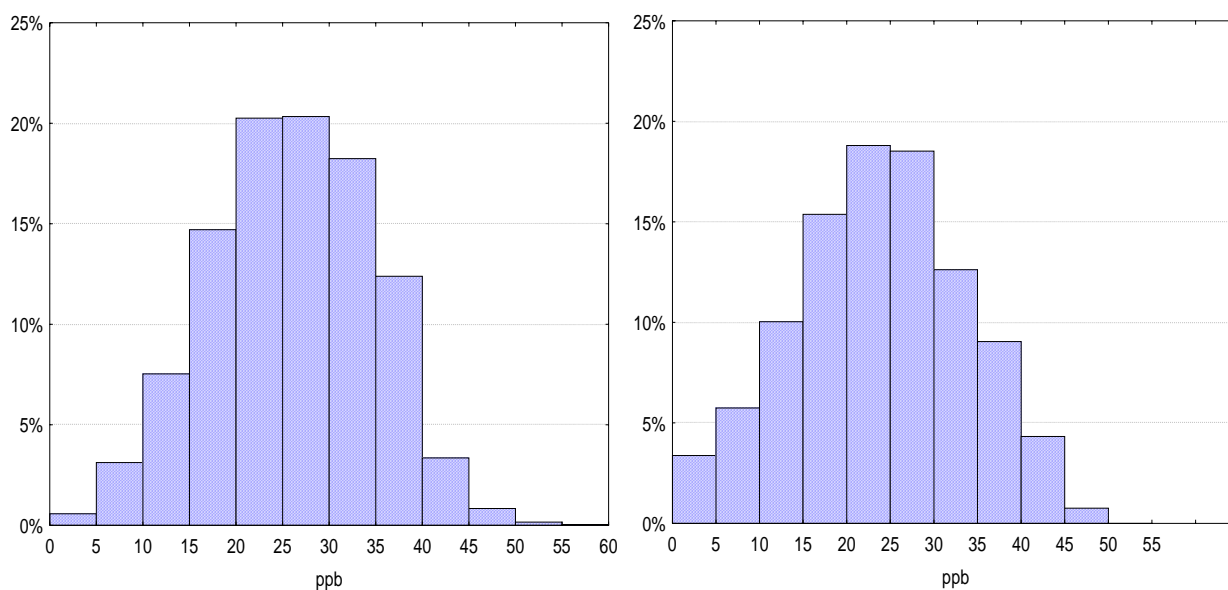


Fig.1. Frequency distributions of the ground-level ozone in Lovozero (rural side) and Apatity city.

Since the measurements periods in the Kola Peninsula is short, we can say nothing about the ozone trend, which is detected by the number of European stations. But it is known, that the background ozone trend is absent in northern Finland (according to data of Sodankjula observatory) and in northern Sweden (Esrangle), where the measurements periods are over 10 year. This circumstance may suggest that the abnormally high background ozone concentrations during summer periods do not represent an actual problem in the near future.

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References

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