

Air quality report

Lithuania

2003



Environmental Protection Agency

Abstract

Lithuania is one of the states on the eastern shore of the Baltic Sea. In the north, Lithuania is bordered by Latvia; in the south-east – by Belarus; and in the south-west – by Poland and Kaliningrad Region (Russia). The territory of Lithuania occupies an area of 65,300 km². Approximately 30% of the country is covered by woods. Relief plains with small hills prevail; climate is transitional between maritime and continental. The largest river, the Nemunas, gathers and carries the waters of many tributaries to the Baltic Sea wherein lies Lithuania's famous "amber coast".

The population is about 3.5 million (2004): 80% are Lithuanian, 11% - Polish and 7% - Russians. The territorial administrative units of the Republic of Lithuania are the counties and the municipalities. Counties implement state policies in the fields of social maintenance, education, culture, health care, territorial planning, monument protection, land use and protection as well as agriculture, environmental protection and other fields. Counties implement state and inter-regional programmes.

The most important spheres controlled by the Ministry of Environment are: environmental protection, forestry and consumption of natural resources and territorial planning. The ministry controls and regulates the impact on the environment and directs economic entities and state institutions towards the prevention of negative impact on the environment. One of its most important objectives is to consistently implement the directives of the EU and national laws, regulating the impact on the environment and human health as well as to increase manufacturers' responsibility for environmental pollution.

One of the subordinate institutions, which practically implement the Ministry's tasks, is Environmental Protection Agency (EPA) – sufficiently autonomous to be able to flexibly and efficiently perform its functions. Among the many issues, EPA's functions are: to investigate, evaluate and forecast environmental quality; to organize, coordinate and perform state environmental monitoring of air quality; to exchange of information, reporting and etc.

Air monitoring activity has been initiated in Lithuania since 1967 and basically was orientated to a local level. The system was expanded, optimized and in 1999 it consisted of 23 stationary air quality control stations located in major cities and industrial centres and based on wet chemistry methods (sampling of the pollutants conducted on a discrete basis, within 30 minutes three times a day: at 7 a.m., 1 p.m. and 7 p.m., thereafter samples were analysed in laboratories. New air monitoring network corresponding EU requirements was established at the end 2002. It consists of 16 stations located in two agglomerations and one zone. Three of them are rural stations and are carried out in remote sites from industrial enterprises and centers, where human activity is very low. These stations are considered for ecosystem's protection, all other stations represent the air quality mainly in the cities and appointed for human health protection.

First ambient air quality for Lithuania report is prepared on the basis of measuring equipment only. There are 13 continuously measurement stations in current ambient air monitoring network. In five of them for SO₂, NO₂ and O₃ is used Differential Optical Absorption Spectrometry method (DOAS) and validated data for these components are able since October 2003. It should be mentioned, that there is no complete data coverage for DOAS measurements for 2003, also we expect that data coverage from air monitoring network next year will be better. In 3 rural stations measuring is carried out manually, only ozone here is measuring continuously as well as in other stations.

After the preliminary assessment Lithuania was divided into two agglomerations and one zone. It is approved by the order No 470/581 of the ministers of Environment and Health Protection on 30 October 2000.

With the aim to optimise air monitoring network, there is a plan to pursue passive samplers' campaign in Lithuania 2004-2005 and to make other needful supplementary measures. Probably the location of some monitoring sites may be changed as well as number of zones as a result of passive samplers' campaign.

Concentrations of pollutants, which are controlled in ambient air, usually are lower than limit values with exception of PM10. High concentrations of PM10 are established in the cities and mostly depend on winter sanding, emission of traffic and small scale stoves. The urban emissions and unfavourable meteorological conditions motivated the PM10 exceedences. According to Framework Directive requirements it should be draw up an action plans in order to reduce the risk for human health of high particulate matter concentrations. The action plans are on the preparation and concentrate on:

- Improving the emissions from traffic;
- Improving the emission regulations of small scale stoves;
- Reducing the precursors of secondary aerosols (NO_x and SO₂).

Ambient air quality assessment by modelling is getting started and will be used in reporting next year.

1. Introduction

The first annual report of ambient air quality in Lithuania is made pursuant to the requirements set in the Directives 1999/30/EC (the first Daughter Directive, AQDD1), 2000/69/EC (the second Daughter Directive, AQDD2), 2002/3/EC (the third Daughter Directive, AQDD3) and, of course, 96/62/EC (the Framework Directive).

The report consists of two parts: questionnaire and main report. A questionnaire has been completed for submission to the EU containing the results of air quality assessment for 2003. The report will discuss the SO₂, NO₂, PM₁₀, lead, benzene, CO and ozone concentrations.

This document first discusses the zones and agglomerates (chapter 2); the monitoring network (chapter 3), the results (chapter 4) and an outlook for the reporting over 2004 (chapter 5).

For this year the measured data are reported according to the procedures that are described in the Lithuanian regulation of 2 July 2004 No D1-364 “due to annual ambient air quality reporting to the European Commission”.

2. Zones and agglomerations

Taking into account current air pollution level, administrative structure and density of population in the biggest cities, Lithuanian territory was divided into two agglomerations and one zone. One of the agglomerations is the capital of Lithuania – Vilnius city, which covers 400 km² and has about 553 thousand inhabitants.

Second agglomeration is a territory of Kaunas city, which occupies 157 km² with 369 thousand inhabitants. The remaining territory of Lithuania – 64743 km² and population around 2.5 mln - is nominated as one zone.

On the basis of the results of passive samplers' campaign, the number of zones and agglomerations may be optimised in the future. Growing centres in north of country, such as Siauliai, with specific pollution sources and industrial area in the surroundings, may be detected as third agglomeration. Decision on this issue will be taken at the beginning of 2006.



3. The monitoring network

Description of the monitoring network

Lithuanian ambient air monitoring network consists of 13 automatic measurement stations located in urbanized territories and 3 background stations in the rural sites and allow assessment of ambient air quality according to EU directive's requirements.

There are 4 stations in Vilnius city: one urban-background, two traffic-orientated and a commercial-residential, which represent air quality in the agglomeration. One station is in Kaunas agglomeration and it is established near the most intensive traffic road.

In zone there are installed 8 continuous measuring stations in comparable big cities and industrial centers. The three background stations are in operation in separate regions of Lithuania. They are designed for the protection of ecosystems and are considered as a part of integrated monitoring. These stations are located in National Parks of Aukstaitija, Zemaitija and Neringa (Preila) and are in distance from motorways, industrial installations or urban areas.

Lithuanian air monitoring system was modernised and developed in line with the requirements of the relevant EU legislation at the end 2002. With PHARE Twinning and others projects contribution there were installed new automatic equipment and put into operation including training in data processing.

At 8 stations in the network reference measuring methods are used for SO₂, NO₂, NO_x, NO, CO, benzene, lead, ozone and at 5 - Differential Optical Absorption Spectrometric method for NO₂, SO₂ and ozone. Sampling of the total suspended particles (TSP) with the aim to analyse lead is performed semi-automatic. In the background stations there are continuous measurements according to reference method for ozone, but for SO₂ and NO₂ concentrations allow only weekly data with exception of the Preila station, where daily data is obtained.

In all stations where are perform PM10 measurements are used β -Absorption method, for compliance with reference method, we use correction factor 1.3.

Methods used for measurement of concentrations in automatic stations:

| | |
|---------------------------------------|----------------------------------|
| NO ₂ , NO, NO _x | - Chemluminescence |
| SO ₂ | - UV-Fluorescent |
| CO (mg/m ³) | - IR-Absorption |
| O ₃ | - UV-Absorption |
| Benzene | - Chromatography |
| PM ₁₀ | - β ray-Absorption |
| Pb | - Atomic Absorption Spectrometry |

The sites and pollutants measurements operating during 2003 for purpose of reporting are listed in Table 1 below.

Table 1

| STATION, code | POLLUTANTS | | | | | | | | |
|-------------------------------------|------------------|-----------------|-----------------|----|-----------------|----|----------------|---------|------|
| | PM ₁₀ | SO ₂ | NO ₂ | NO | NO _x | CO | O ₃ | Benzene | Lead |
| Vilnius agglomeration LT0100 | | | | | | | | | |
| Senamiestis LT0037A | | + | + | + | + | + | | | |
| Lazdynai LT0038A | + | + | + | + | + | | + | + | + |
| Žirmūnai LT0039A | + | + | + | + | + | + | + | | |
| Žvėrynas LT0040A | + | + | + | + | + | + | | + | |
| Kaunas agglomeration LT0200 | | | | | | | | | |
| Petrašiūnai LT0041A | + | + | + | | | | + | | + |
| Zone LT0300 | | | | | | | | | |
| Klaipėda C LT0042A | + | + | + | | | + | + | | + |
| Klaipėda W LT0046A | + | + | + | + | + | + | | + | |
| Šiauliai LT0044A | + | + | + | | | + | + | | + |
| N.Akmenė LT0047A | + | + | + | + | + | | | | |
| Mažeikiai LT0043A | + | + | + | | | | + | | |
| Panevėžys LT0045A | + | + | + | | | + | + | | + |
| Jonava LT0048A | + | + | + | + | + | | + | + | |
| Kėdainiai LT0036A | + | + | + | + | + | | + | + | |
| Preila LT0015R | | + | + | | | | + | | |
| Žemaitija LT0026A | | + | + | | | | + | | |
| Aukštaitija LT0023A | | + | + | | | | + | | |

Maintenance, calibration and validation

The EPA is responsible for programming and co-ordinating environmental monitoring activities and is charged with advisory tasks on the accuracy of air measurement (systems) and air quality data and provides technical support and guidance to the whole of the ambient air monitoring network in the country.

Methods of quality control are used after starting the process of production when it is performed according to the demands of quality assurance. These methods are divided in control during the process and control on finalised products (data). The need for improving these quality assurance and quality control has been recognised by EPA. Therefore in the framework of the bilateral contacts between Lithuania and The Netherlands projects have been started to improve the monitoring system. Assistance of the Dutch project¹ will deliver technical support in order to improve the calibration laboratory and calibration procedures to make them more efficient and effective in air quality data processing.

The calibration will be expected to be in accordance to the requirements in the course of 2005.

Data capture

¹ Strengthening capabilities in implementing the requirements of Air Quality Directives for data assessment and exchange of information, Lithuania, PPA03/LT/7/4

More than half of the monitoring sites produce data with a data capture more than 90%. However, not all the stations' data coverage is in compliance with EU requirements. Especially the data capture for measurements made by DOAS method, have in the year 2003 ranging from 8 to 30%. This is due to the fact that the equipment came in full operation for the first time in 2003, but quality controlled and assured data from DOAS stations is able only from September 2003.

City background station of Vilnius agglomeration didn't collect required amount of data, because at summer time due to technical reasons this station wasn't in operation. Data capture for different components range from 54 to 66%.

4. Measuring Results

General remarks

The main sources of pollutant emissions in Lithuania, as in many other countries, are mobile pollution sources, industry and energy sector. Stationary pollution sources total emitted 88,2 thousand tons (~21 thousand t SO₂; 11,5 thousand t NO_x; 21,5 thousand t CO; 4,7 thousand t suspended particles and other) into the atmosphere in 2003 and mobile pollution sources additional emitted around 75-80% of total emission amount. Comparable with previous year, sulphur dioxide emission was reduced by 29%, but nitrogen oxides, carbon monoxides and volatile organic compounds emission from industry and energetic sector increased with 2-6% while particulate matter remained constant.

In 2003 Vilnius agglomeration stationary sources emitted 5,3 thousand tons pollutants, which consist of 1035 t NO_x, 861 t SO₂, 858 t CO, 299 t suspended particles and other; in Kaunas agglomeration - 5,6 thousand tons which consist of 1305 t NO_x, 675 t SO₂, 1223 t CO, 402 t suspended particles and other. The biggest amount of pollutants came into atmosphere in zone from Mazeikiai region, where the Oil Refinery Company "Nafta" is located and makes up about 38% (77,3 thousand tons) of total.

SO₂:

The concentrations of sulphur dioxide in ambient air, like in previous years, meet the limit values indicated in the DD1. The results of measurement data on SO₂ did not exceed the lower and upper assessment threshold levels of the limit value for the daily mean and for the winter and yearly means. Only in Klaipeda (city in zone) at a very local scale maximum daily mean concentration was 52 µg/m³, e.a. exceeded lower assessment threshold (LAT) value. However in winter time SO₂ concentrations were little bit higher, but no the exceedances of the limit values or the alert thresholds level are reported.

NO₂:

An hourly mean nitrogen dioxide concentration - 200µg/m³ is given as one of the limit values for the protection for human health in the DD1 and this hourly value may not be exceeded more than 18 times a year. At no one monitoring site the 200 µg/m³ limit value is exceeded more than 18 times per year. In 12 hours during 2003 this limit value was exceeded in Vilnius at the location near the road with heavy traffic and limit value plus margins of tolerance 278 µg/m³ (LV+MOT) - only 2 hours. The maximum concentration here reached 338µg/m³. Also there were three hours, when NO₂ concentration was higher than LV, but below LV+MOT in industrial centre of zone, where a big fertilizer plant is located. The maximum value was 235µg/m³. The yearly mean concentration of nitrogen dioxide in Vilnius agglomeration varied from 15µg/m³ at urban background station to 43 µg/m³ at traffic station, in Kaunas agglomeration - 37µg/m³ and in zone it was lower than 40µg/m³ with exception of Siauliai city with 41µg/m³. The reason of comparably high concentrations of NO₂ is intensive traffic in the cities.

The NO₂ alert threshold level – 400µg/m³ in Lithuania during 2003 was not detected.

Preliminary assessment of NO₂ concentrations by dispersion modelling tools has started in Vilnius. Rough number of inhabitants that are living in the areas with exceedings of annual mean nitrogen dioxide concentration (40µg/m³) is 114.5 thousand.

PM10

There is evidence of quite high concentrations of particulate matter (PM10) over the whole monitoring network in Lithuania. The limit values combined with margin of tolerance for daily average were exceeded in 2003 only in Vilnius agglomeration. Annual mean concentration in traffic stations in Vilnius reached 41-47 $\mu\text{g}/\text{m}^3$ but in Kaunas agglomeration or in zone varied from 23 to 37 $\mu\text{g}/\text{m}^3$. Exceedence of the upper assessment thresholds level take place at all measurements stations.

The high PM10 concentrations depend on emission of mobile sources, winter sanding and house heating issues. The contribution of winter sanding is not clear at the moment. This will be analysed in the forthcoming period. If winter sanding is important for the higher PM10 concentrations, then Lithuania will consider practical measures to reduce the impact of winter sanding (better quality control of the sand and salts used; street sweeping programme after sanding etcetera). This is a long term process, compliance with the EU limits for 2010 is questionable, new limit (20 $\mu\text{g}/\text{m}^3$) is very likely not to be achieved in 2010.

There is no measuring results are available for PM_{2.5}, also in 2005 no monitoring equipment for measuring fine particulates will be able.

Lead

No exceedings of annual average lead concentrations were detected in Lithuania in 2003. The maximum value in agglomerations reached 0,007 $\mu\text{g}/\text{m}^3$ and in zone – from 0,002 to 0,010 $\mu\text{g}/\text{m}^3$. There are no local sources of lead that cause local higher concentrations. Since January 1998 lead is no longer a component of gasoline (not more than 0,013 g/liter) used in our country. It is approved by order No 303 of the minister of Economy on 22 October 1997.

Carbon monoxide

The concentrations of carbon monoxide are very low in all areas of the territory of Lithuania and meet the requirements of DD2. Maximum 8 hour moving average CO value was reported in Vilnius agglomeration and reached 5 mg/m^3 . Usually CO concentrations are much lower in the cities of zone.

Benzene

No exceedings of benzene concentrations were measured. The maximum annual average value of benzene was detected in Vilnius – 1.7 $\mu\text{g}/\text{m}^3$ and in other areas it varied from 0.2 to 0.7 $\mu\text{g}/\text{m}^3$.

Ozone

The limit values of ozone are given in the DD3 for the protection for human health. These limit values were not exceeded in Lithuania in 2003. Only the 8 hour moving average target value (120 $\mu\text{g}/\text{m}^3$), which will be in force since 2010, was exceeded up to 5 days per year. Maximum ozone concentration (8 hour moving average) was established at urban background station in Vilnius and reached 138 $\mu\text{g}/\text{m}^3$. Target value for protection of vegetation (AOT), examined at rural stations not exceeded 18000 $\mu\text{g}/\text{m}^3 \text{ h}$ and varied from 4961 to 7148.

There were no alert and information thresholds for ozone in 2003, the maximum 1 hour average value reached 151 $\mu\text{g}/\text{m}^3$.

Summer exceedences were not detected in rural stations as well as in urbanized territories.

Conclusions

The ambient air quality in Lithuania for substances mentioned in the DD1, DD2 and DD3 are assessed in compliance with the requirements. In the context of the limit values or alert thresholds there were no exceedences with exception of PM10. This problem is not only local, but observed in many other European countries.

Forthcoming tasks are to develop and improve monitoring network as well as the quality of measurements. Modelling tools will be used in the future for assessing ambient air quality and hot spots for 2004 with probably support from PHARE project, which is underway.

5. Outlook for 2005

In 2005 the ambient air monitoring activities will be intensified: all stations are operational, data capture is sufficient. The quality control of the measurements will be improved due to support of the Dutch project, the monitoring maintenance and calibration practice will be improved that will allow to collect QA/QC data.

Report for 2004 will be done not only on the basis of measurements, but also with modelling tools. The effect of hot spots on ambient air quality will be assessed by modelling in addition to measurements. In the end of 2004 it will be decided what local scale models should be used best and introductions of the models will start in 2005. Probably the first results will be presented in the report over the year 2004.

In 2004 measurements for ozone precursors have been started. A set of precursors is measured at all the DOAS monitoring sites. These measurements are still in the research phase; quality control and quality assurance has not been completed until now. It is the aim of the ministry to set up this QC and QA system in the forthcoming years.