

DIRECT AA MERCURY DETERMINATION IN AIR

(DETECTION OF POLLUTION SOURCES USING CONTINUOUS MERCURY AUTOMOBILE SURVEY)

INTRODUCTION

The overall picture of regional ecological situation shows that mercury is one of the most hazardous toxic elements in urban soils and sediments. The origins of mercury pollution at industrial and urban areas have been determined by exposure of many types of sources. A high proportion of mercury is transferred to deponent media through the atmosphere. Therefore, active sources of Hg emission can be found by mercury determination in ambient air. A portable Zeeman AAS **RA-915+** mercury analyzer of proprietary LUMEX Ltd. design has been used for continuous automobile and helicopter surveys of mercury distribution in ambient air. Car-borne mercury surveys were carried out during 1990–2002 in cities and industrial areas in Russia, Ukraine, Kyrgyzstan, Slovenia, Croatia and Czech Republic.



EXPERIMENTAL AND SURVEY TECHNIQUES

The multifunctional mercury spectrometer is based on a new kind of the Zeeman atomic absorption spectrometry using high frequency modulated light polarization (ZAAS-HFM). The portable spectrometer is available for continuous mercury determination in air and for rapid analysis of soils, rocks, and waters. The use of the ZAAS-HFM and a multipath cell allows direct measuring of mercury at the background level, i. e., around 2 ng/m³ with a response time of 1 sec.

In the case of the automobile survey, the analyzer is placed in a car, and ambient air is continuously pumped through the analytical cell at a rate of 20 L/min. The car's speed (from 5 to 60 km/h and more) depends on the current task. Data are recorded on the portable computer with the response time of 1 sec. The baseline is controlled by software or manually. The vehicle location is determined using a topographic map or GPS connected with the same computer. Data processing is provided by special software.

CONCLUSION

New Zeeman mercury analyzer RA-915+ provides direct measurements of mercury concentration in ambient air and can be used for continuous vehicle survey. Experiment with serial instruments shows that their real detection limit values are 0.3 ng/m³ – during car stop, and 2.0 ng/m³ on the way with the speed of 30–60 km/h. Our wide experience in automobile mercury surveys in ambient air shows that it is the most rapid and effective method of detection and identification of active sources of mercury emission into atmosphere.

EXAMPLES OF CONTINUOUS MERCURY AUTOMOBILE SURVEY

Concurrent measurements using 2 analyzers RA-915+

A: Continuous measurements in anomaly zone: during car stop (**a**), and on the run (**b**), speed 40 km/h, (07.06.2001, St. Petersburg, Russia).

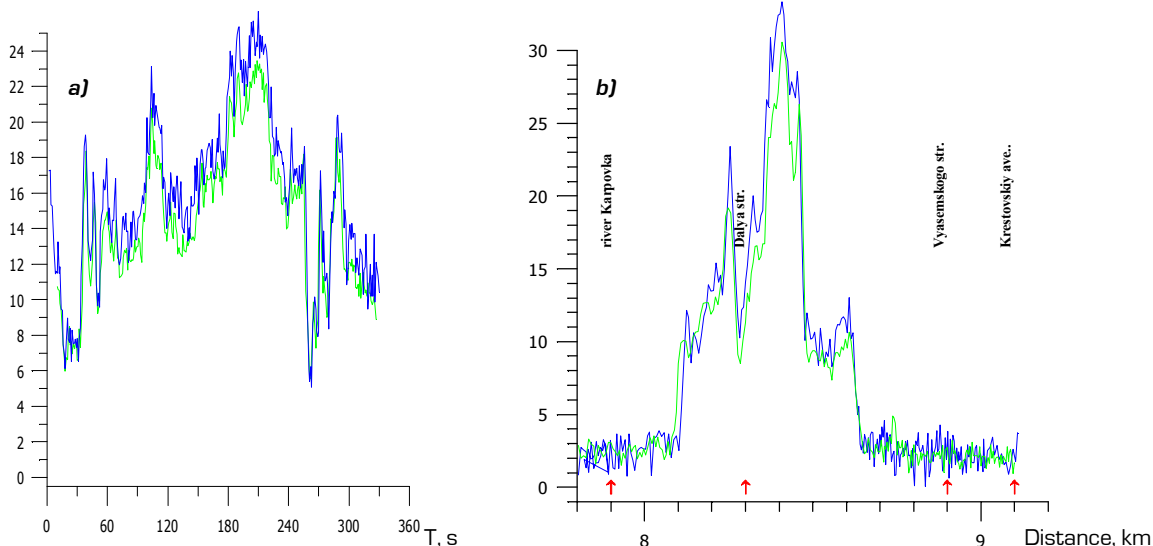
Two random serial instruments were used for concurrent operation during car survey.

Statistical data manipulation showed:

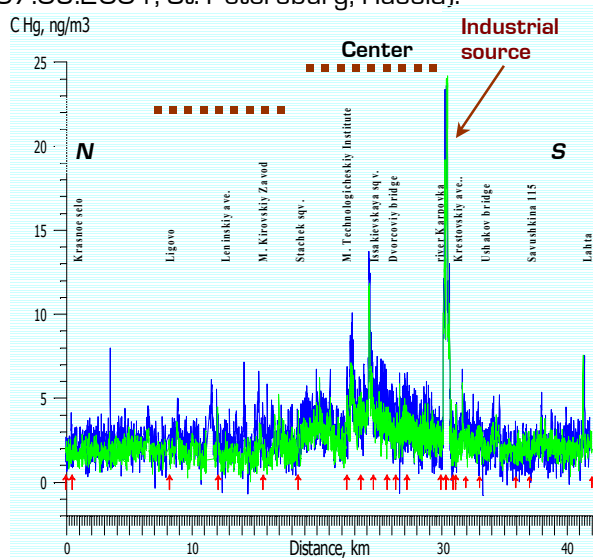
Difference between **calibration factors** of the instruments is 1.2 %;

Detection limit according threefold standard deviation criteria (3σ) is:

0.3 ng/m³ (during car stop), 2 ng/m³ (during 30–60 km/h driving).



B: Mercury distribution in ambient air. Continuous car survey at a speed of 40–60 km/h, (07.06.2001, St. Petersburg, Russia).



A slight increase of the Hg content in ambient air of industrial and central areas compared to suburbs, is typical for urban areas without powerful industrial sources of mercury (St. Petersburg, Pskov, Ljubljana, Prague, Zagreb, et al.). The signal dispersion in the city is five times greater than in suburbs. Against this background some local haloes, up to 150–300 ng/m³ and more, have been recorded around plants that use this metal in technological processes, over soils contaminated with metal mercury, and around dumpsites.