Introduction of the Air Quality Monitoring Network

In Hungary, compliance of the air quality levels and air pollution limits are officialy investigated by only the Hungarian Air Quality Monitoring Network.

The Hungarian Air Quality Monitoring Network provides current and historical air quality monitoring data nationwide. The network consists of two mayor parts: automatic monitoring stations with continuous measure of wide range of air pollutants in ambient air, and manual system with sampling points and consecutive laboratory analysis.

The Air Quality Reference Centre as a calibration laboratory has been registered by the National Accreditation Board.

The main tasks of the National Air Quality Reference Centre and Laboratory:

1.Management of the Hungarian Air Quality Monitoring Network (HAQM) operation according to the requirements of the Ministry of Agriculture.

2.Coordination and regulation of the used methods and procedures in the HAQM according to the EU legislation.

3.Determining the QA/QC aims for the HAQM and checking these.

4.Ensure the traceability of the measurements with operating an accredited Calibration Laboratory.

5.Participation in the national and international standardization.

They purchased an ICP-OES spectrometer, a gas chromatograph mass spectrometer (GC-MS) and a discrete photometric analyser to newly created analytical laboratory within the framework of the tender. Calibration laboratory instruments fleet expanded a CO analyser, a PM_{10} / $PM_{2.5}$ monitors, a calibration tower, and a mass flow meter calibration system within the framework of the tender.

Characterization of BTEX and VOC

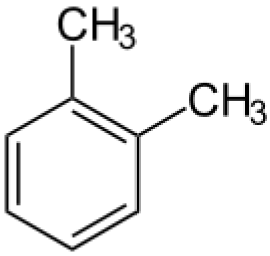
Benzene is an important organic chemical compound with the chemical formula C_6H_6. The benzene molecule is composed of 6 carbon atoms joined in a ring with 1 hydrogen atom attached to each.

Benzene is a natural constituent of crude oil and is one of the elementary petrochemicals. It can make reactions with Sulfonate , chlorinate, nitrate compounds.

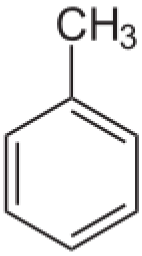
Because benzene is ubiquitous in gasoline and hydrocarbon fuels are in use everywhere, human exposure to benzene is a global health problem. Benzene targets liver, kidney, lung, heart and the brain and can cause DNA strand breaks, chromosomal damage, etc. Benzene causes cancer in animals including humans. Benzene has been shown to cause cancer in both sexes of multiple species of laboratory animals exposed via various routes.The maximum allowable amount of benzene in workroom air during an 8-hour workday, 40-hour workweek is 1 ppm. Because benzene can cause cancer, NIOSH recommends that all workers wear special breathing equipment when they are likely to be exposed to benzene at levels exceeding the recommended (8-hour) exposure limit of 0.1 ppm.

The other compounds are similar to bezene, they have similar physical or chemical characteristics and are all harmful to human health.

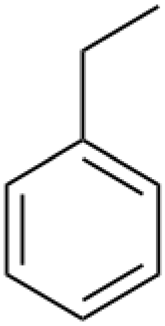
The chemical compositions are as follows:



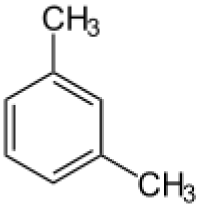
m-Xylene



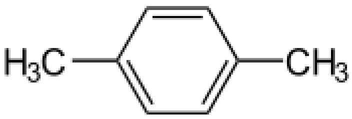
Toluene



Ethylbenzene



o-xylene



p-xylene

The standard measurement of BTEX and VOC

VOCs are organic molecules (C2 - C12) (based on carbon chemistry) present in ambient outdoor air at low concentration (typically in the low ppb range).In accordance with EN14662-3 standard for benzene measurement, is based on gas chromatography (GC) for the separation of the measured compounds coupled with a Flame Ionization Detector (FID) or photo-ionization detector (PID). The compact and fully automated analyser provides equal performance to the laboratory chromatographs and is particularly well-suited for fixed or mobile ambient air quality monitoring stations. The BTEX (Benzene, Toulyne, Etil-Benzene and m-p-o-Xylene) use to measured separately because of the highly risk of health (toxic, carcinogenic, mutagenic).
The Instrument is a high performance gas chromatograph with flame ionisation detection(FID) and an on-line sample preparation. It is designed for the analysis of volatile organic compounds: VOC in gaseous samples, in ambient (100 ppt) to emission (ppm) concentration ranges. The miniaturisation, the inertia to chemical compounds, the mobility and flexibility of this analyser have been optimised.

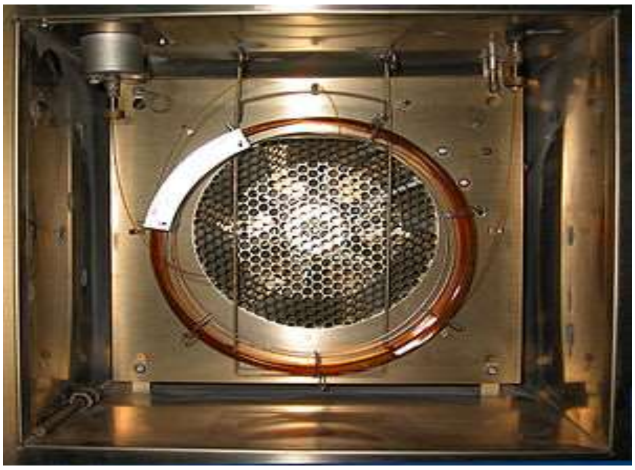
Comparative data analyses based on a given place and time scale dataset of Hungarian Air Quality Monitoring Network

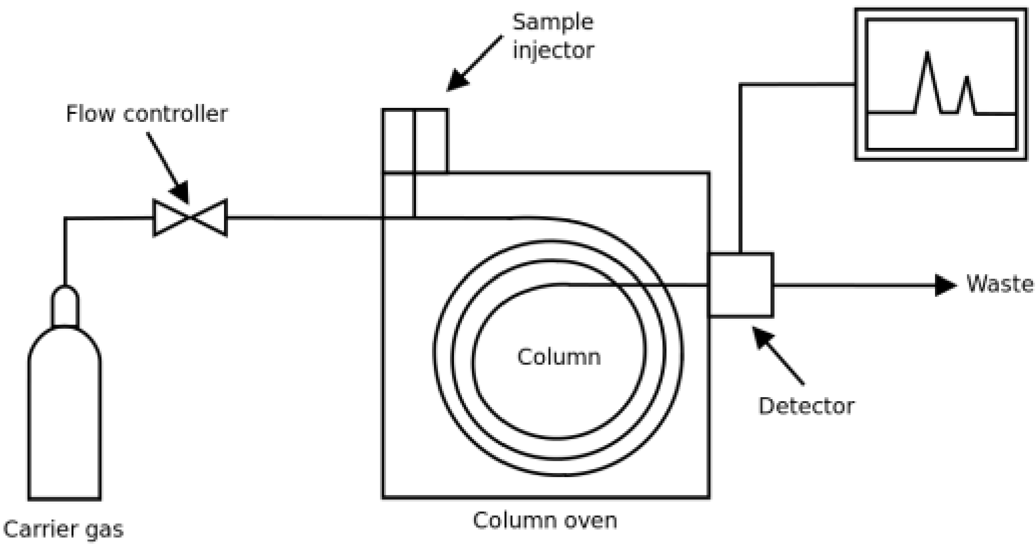
The Hungarian Air Quality Monitoring Network shows us the concentration of Benzene in three different places situated in Hungary during the 2015 and 2016. The time period was from Jan.1st of 2015 to Dec.31th of 2016. The limitation of daily health limit is 10 ug/m^3 The data shows that several of these days are highly risky. Especially for the Szentgotthɑ́rd town, from 15.03.2015 to 21.03.2015, the concentration of Benzene was continually over 10 ug/m^3 as well as from 24.10.2015 to 06.02.2016. It lasted a long time period.
When Comparing the data of the three different towns, the town called Sopron is of good air quality. Just a few days' Benzene concentration was over five from this period. Whereas the town called Szentgotthɑ́rd is of bad air quality. A lot of days' Benzene concentration was over ten from this period. Maybe it is because of some oil related refined factory.
Another conclusion is that even in the same day, the concentration of Benzene in different places is totally different. For some places, the concentration is safe but for other places, the concentration may be dangerous as it depends on the location where the measure takes place.
My suggestion is that the government should pay much more attention the air quality problem, especially in Szentgotthɑ́rd town. A lot of actions should be taken to make the town suitable for local people to stay. Since air quality is highly related to human life, every effort should be taken into action when it comes to this problem which is cared about by every human being.

Analyses of a chromatogram

In gas chromatography, the *mobile phase* (or "moving phase") is a carrier gas, usually an inert gas such as helium or an unreactive gas such as nitrogen. Helium remains the most commonly used carrier gas in about 90% of instruments although hydrogen is preferred for improved separations.[3] The *stationary phase* is a microscopic layer of liquid or polymer on an inert solid support, inside a piece of glass or metal tubing called a column (an homage to the fractionating column used in distillation). The instrument used to perform gas chromatography is called a *gas chromatograph* (or "aerograph", "gas separator").

The gaseous compounds being analyzed interact with the walls of the column, which is coated with a stationary phase. This causes each compound to elute at a different time, known as the *retention time* of the compound. The comparison of retention times is what gives GC its analytical usefulness.




Sample
injector
Flow controller
Waste
Column
Detector
Carrier gas
Column oven

Analyser :MSZ ISO 12884:2003

Serial Nr : #2020100

Owner : OMSZ ELFO LRK

Location : HUNGARY

Operating conditions :

Description : Sampling 10 mins- 515hPa

Method Name : AMB-30MN **SubstanceTableName :** VOC#202

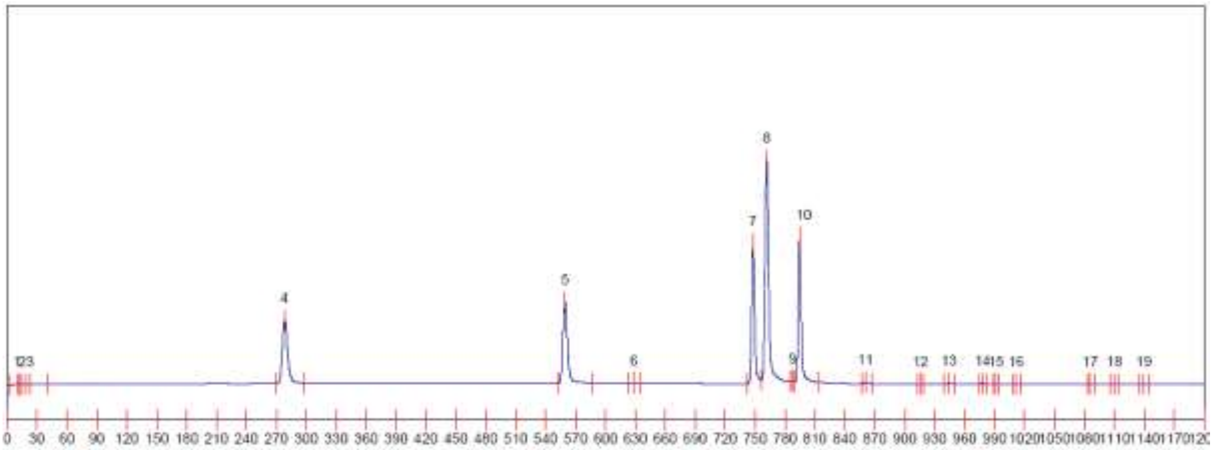
Detector :

Amplification : 3-High **Sampling Rate :** 20 per second

Sensitivity :

Base sensitivity : 5308.0

Volume: 417,7 ml



Guide to the evaluation of the chromatogram:

$BS = [Area/(c \times V)] \times 10^{-3} \times CF$

Where: BS = Base sensitivity (BS_{BTEX} = 5308 and BS_{VOC} = 4043)

Area = Peak area

c = measured concentration ($\mu g/m^3$)

V = sample volume (m^3)

CF = Correction Factor (compared to the standard)

From the retention time, we know that the point 4 stands for benzene, the point 5 stands for toluene(the CF is 1.05), the point 7 stands for ethylbenzene(the CF is 1.1), the point 8 stands for m&p-xylenes(the CF is 1.1), the point 10 stands for o-xylene(the CF is 1.1).

We calculate the concentration of these compounds.

C(benzene)= 62236/5308/417.7*10^3=28.1ppb

C(toluene)=69692/5308/417.7*10^3*1.05=33ppb

C(ethylbenzene)=78336/5308/417.7*10^3*1.1=38.9ppb

C(m&p-xylenes)=162108/5308/417.7*10^3*1.1=80.4ppb

C(o-xylene)=79772/5308/417.7*10^3*1.1=39ppb

Their concentration is all under 1ppm. It can be regarded as a safe air quality.