# General Introduction of the Hungarian Air Quality Monitoring Network and the Air Quality Reference Centre

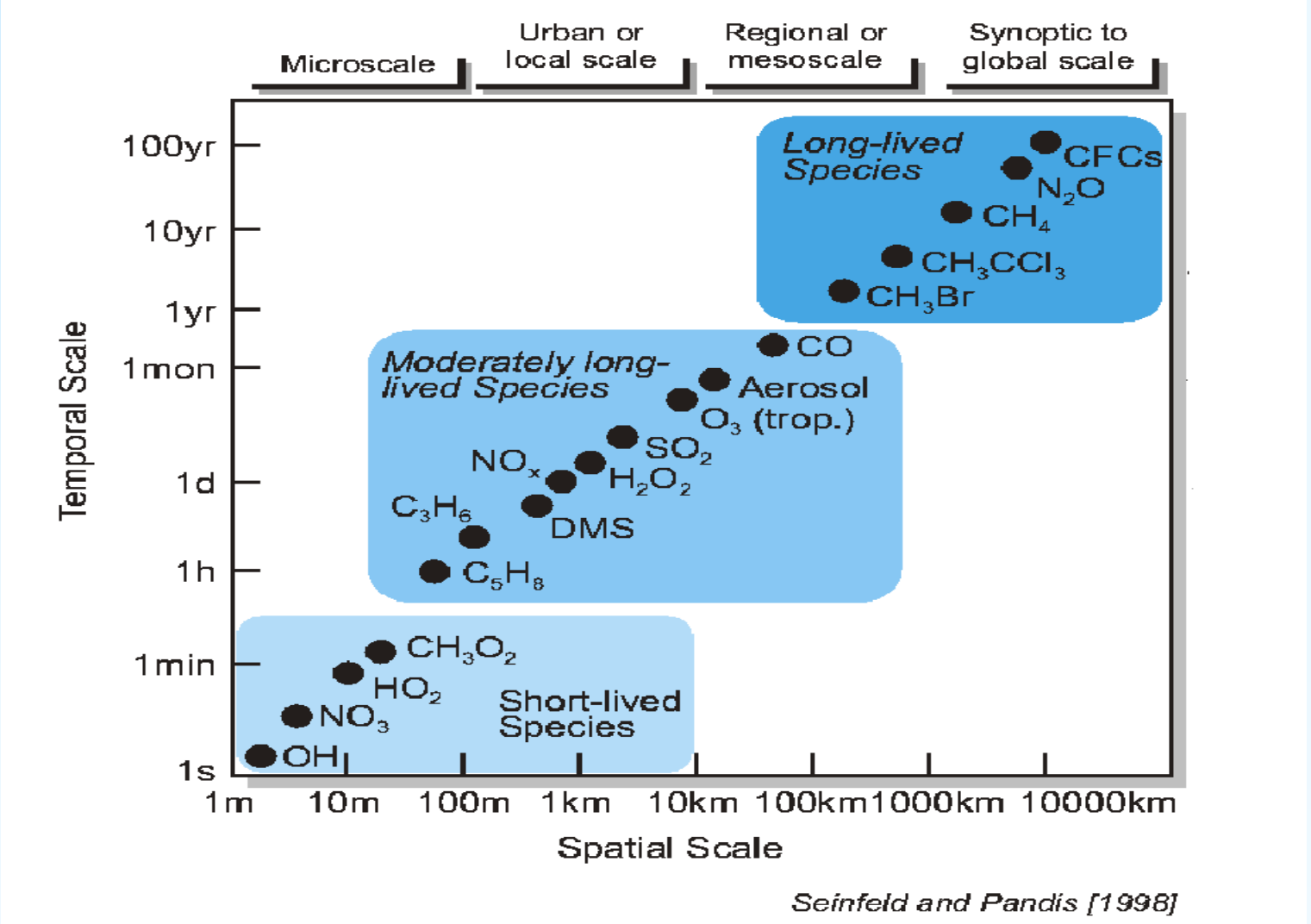
Attila Machon

OMSZ ORSZÁGOS METEOROLÓGIAI SZOLGÁLAT

# Program

| | English groups | A, B, C csoport | D, E, F csoport |
|---|---|---|---|
| 8:30 - 9:00 | Machon: Introduction of Air Quality Reference Center and the Hungarian Air Quality Monitoring Network (kistárgyaló) | Dézsi V.: Az OLM és az LRK bemutatása (nagytárgyaló) | |
| 9:00-10:00 | Machon A.: Introduction of the lab, pressure regulator assembly, calibration, calculation with gases etc. | Labancz K.: Háttér mérőállomások bemutatása Ferenczi Z.: Szennyezettség modellezése, Gyarmatiné Zsike: Adatközpont bemutatása (nagytárgyaló) | |
| 10:00-11:00 | Labancz K.: Introduction of the Hungarian background measurements network Ferenczi Z.: Modelling of air pollution, Gyarmatiné Zsike: intrduction of the data center (kistárgyaló) | Machon A.: Referencia labor: kalibrálás, palackok és számolás | Dézsi V., Farkas G.: Mérőbusz, mérlegszoba és az analitikai labor bemutatása |
| 11:00- 12:00 | Dézsi V. or Farkas G.: intoduction of the mobile measurement station, balance room and the analytical lab | Dézsi V., Farkas G.: Mérőbusz, mérlegszoba és az analitikai labor bemutatása | Machon A.: Referencia labor: kalibrálás, palackok és számolás |
| 12:00 - 12:20 | Facultative: meteorological ballon installation | Fakultatív: Meteorológiai ballon felereszt ése | |

# Atmospheric lifetime and spatial scale of the pollutant




*Seinfeld and Pandis [1998]*

# According to the Hungarian laws:

- In Hungary, compliance of the air quality levels and air pollution limits are officialy investigated by only the Hungarian Air Quality Monitoring Network *(306/2010. (XII. 23.) Goverment regulation 9§ (1)*

- The tasks of the Air Quality Reference Centre (Department of the Hungarian Meteorological Service) is also regulated by the *306/2010 Goverment regulation 9§ (2) and other legislation*

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

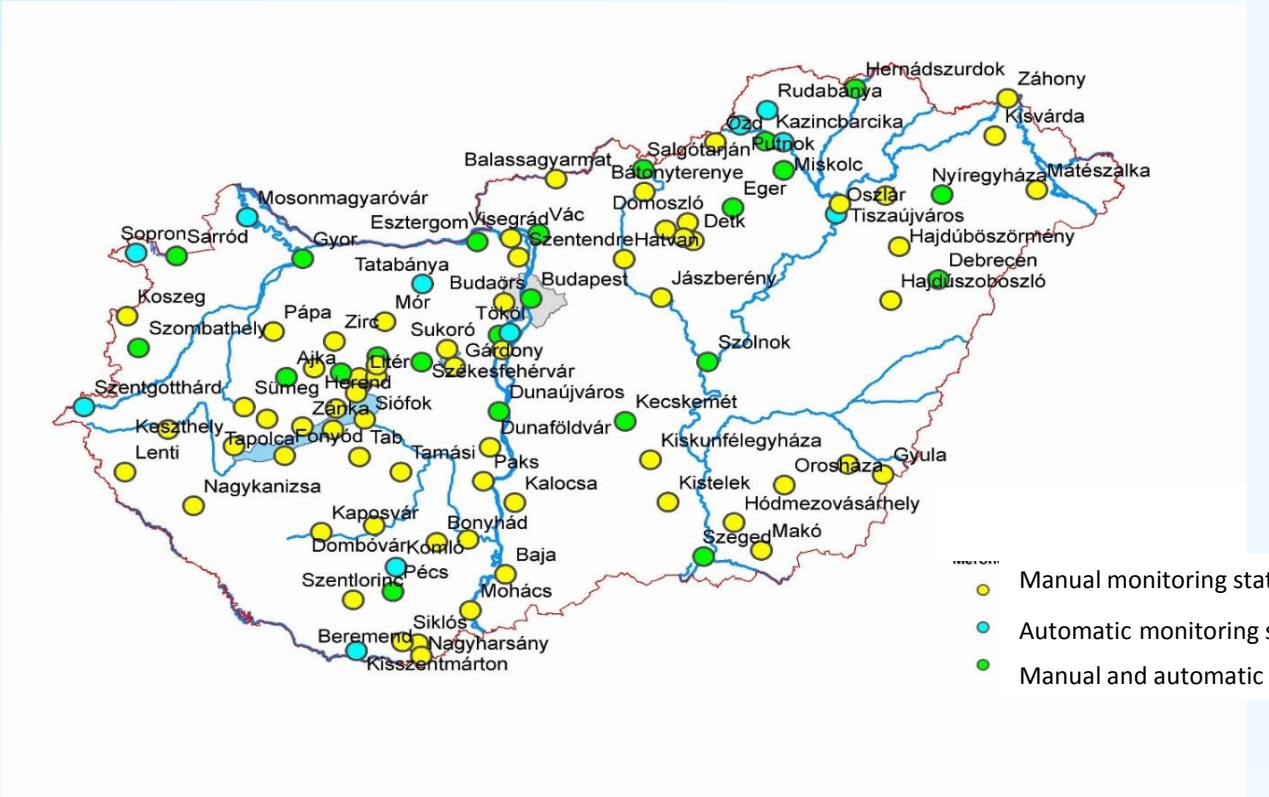
# The main tasks of the National Air Quality Reference Centre and Laboratory

- **Management of the Hungarian Air Quality Monitoring Network (HAQM) operation according to the requirements of the Ministry of Agriculture.**
- **Coordination and regulation of the used methods and procedures in the HAQM according to the EU legislation.**
- **Determing the QA/QC aims for the HAQM and checking these.**
- **Ensure the traceability of the measurements with operating an accredited Calibration Laboratory.**
- Participation in the national and international standardisation.
- Participation in the work of the international organisation of the National Reference Centers (AQUILA).
- **Collection, validation and evaluation of the data from the HAQM.**
- Operation of the National Public Information System for air quality.
- Coordination of the central public procurements for the HAQM.
- Data transmission for the European Environment Agency (EEA-AirBase).
- Organisation of workshops to solve actual problems and answering questions coming up during the operation, especially according to the new legislations, programs and methods.
- **Organisation of the intercalibrations for the analytical laboratories**.

# 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 (CO, O3, NOx, SO2, PM10, PM2,5) and manual system with sampling points and consecutive laboratory analysis.

There are also annual assessment reports for both systems as well as for particulate matter (PM10) components.



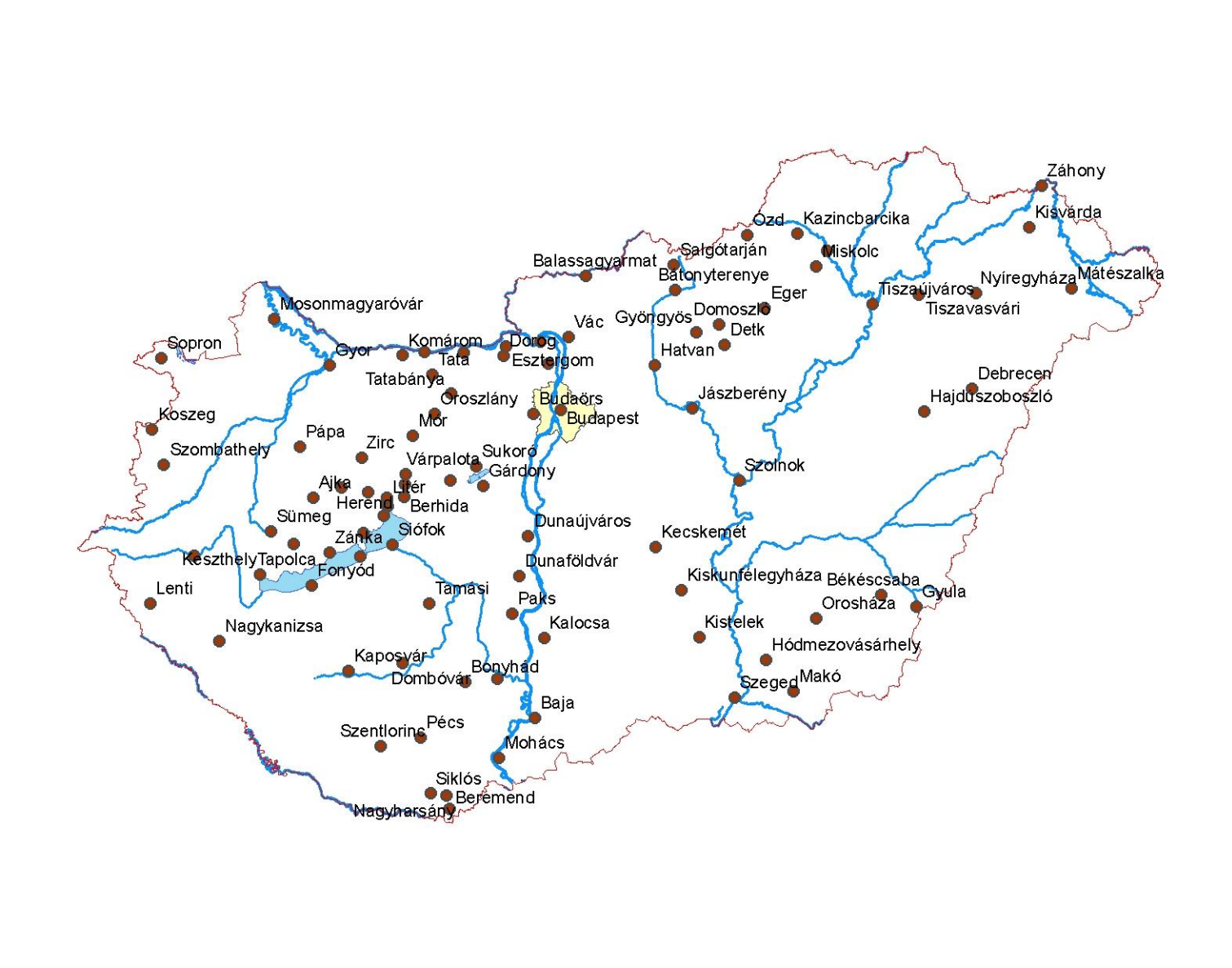
# Type of the monitoring stations:

- Traffic
- Industrial
- Background

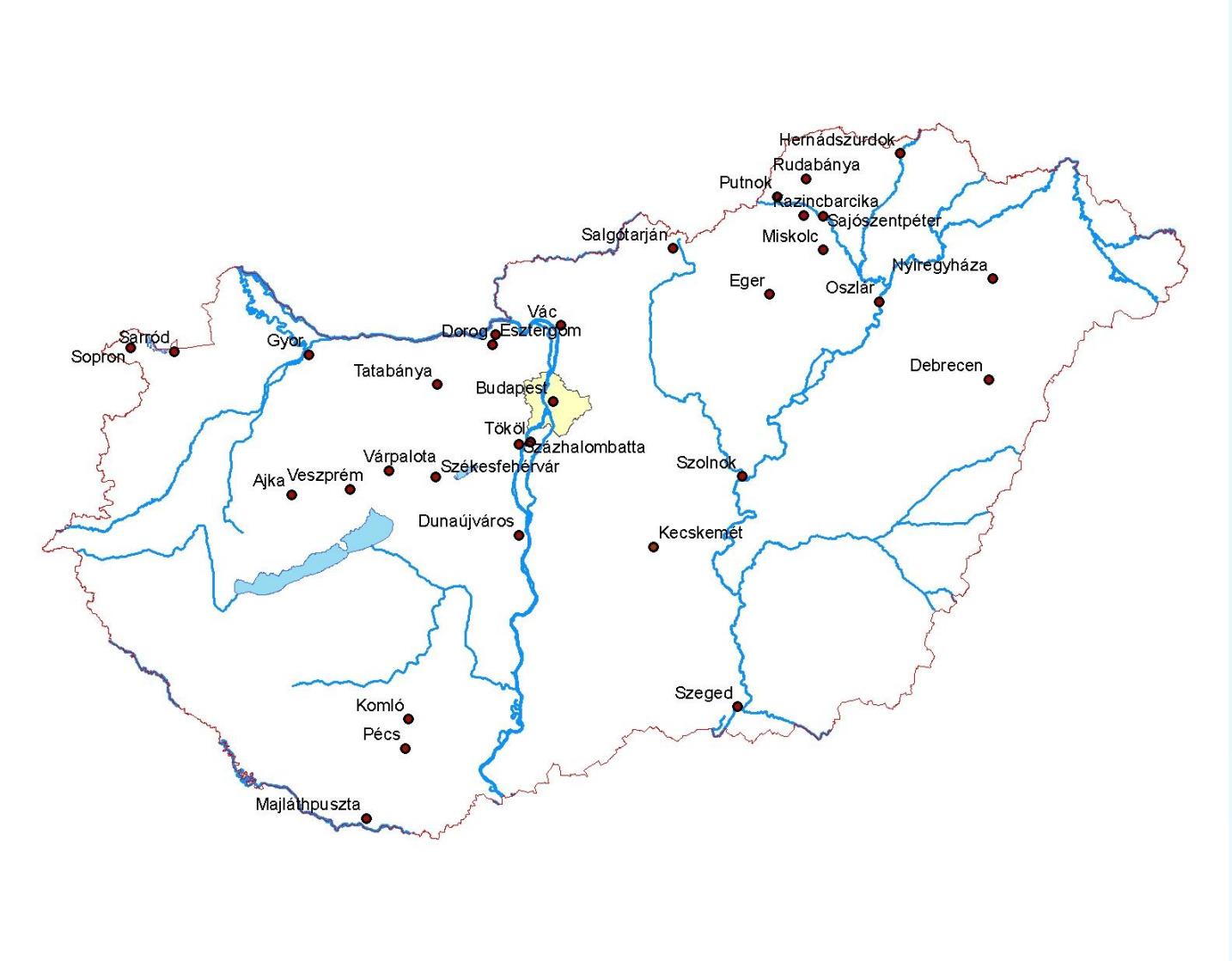
## Type of the environment:

- Downtown
- Suburban
- Rural

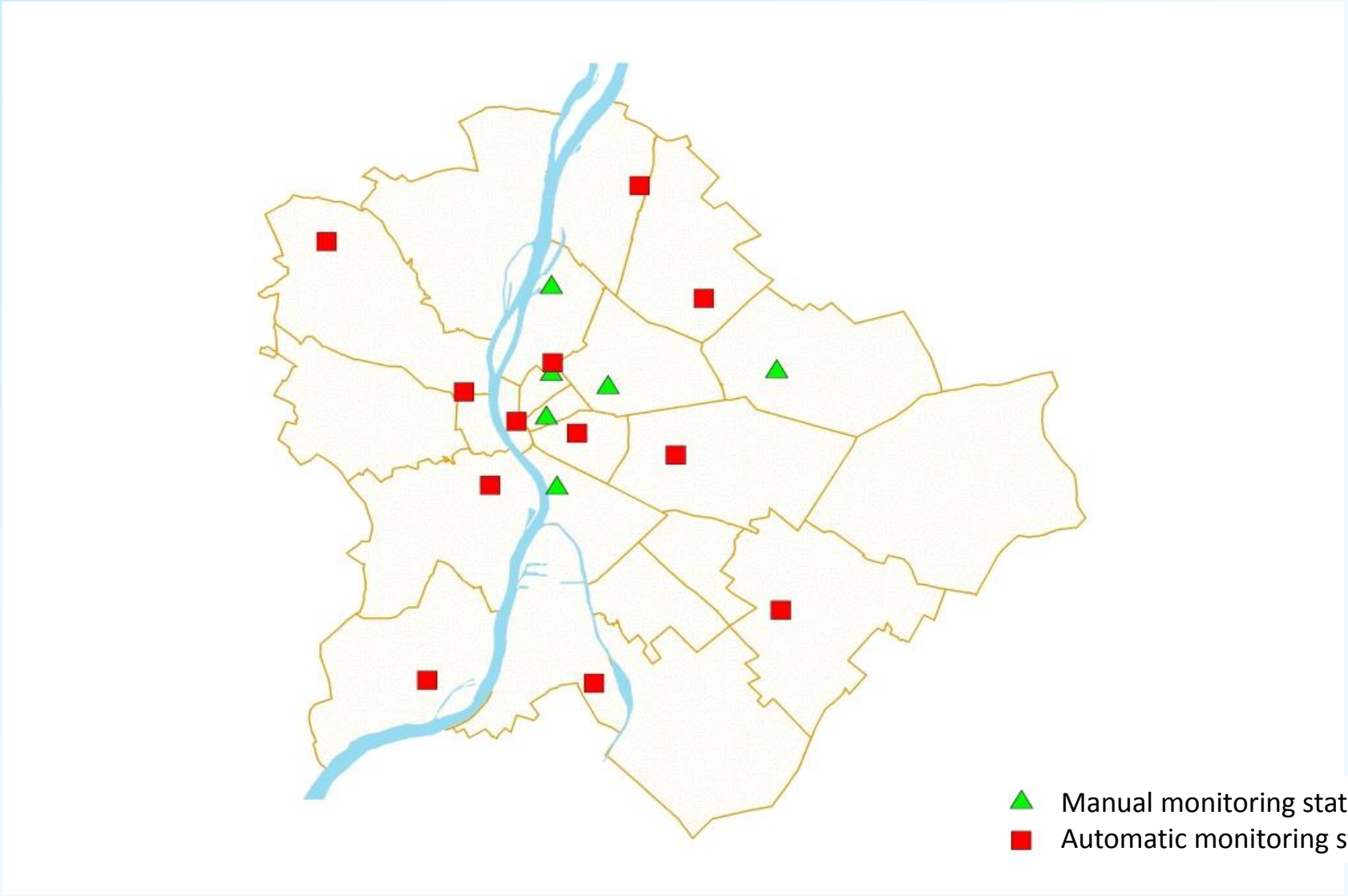
# Manual monitoring stations (91 places)



# Automatic monitoring stations (55+7 places)



# Monitoring stations in Budapest



# All instruments are complianced (or equivalent with) the EU reference measurement methods in the Hungarian Air Quality Monitoring Network:

- **MSZ EN 12341:2014** Ambient air. Standard gravimetric measurement method for the determination of the $PM_{10}$ or $PM_{2,5}$ mass concentration of suspended particulate matter
- **MSZ ISO 12884:2003** Ambient air. Determination of total (gas and particle-phase) polycyclic aromatic hydrocarbons. Collection on sorbent-backed filters with gas chromatographic/mass spectrometric analyses
- **MSZ EN 14211:2013** Ambient air. Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence
- **MSZ EN 14212:2013** Ambient air. Standard method for the measurement of the concentration of sulphur dioxide by ultraviolet fluorescence Ambient air. Standard method for the measurement of the concentration of sulphur dioxide by ultraviolet fluorescence
- **MSZ EN 14625:2013** Ambient air. Standard method for the measurement of the concentration of ozone by ultraviolet photometry
- **MSZ EN 14626:2013** Ambient air. Standard method for the measurement of the concentration of carbonmonoxide by non-dispersive infrared spectroscopy
- **MSZ EN 14662-3:2005** Ambient air. Standard method for the measurement of benzene concentrations. Part3: Automated pumped sampling with in situ gas chromatography
- **MSZ EN 14902:2006** Ambient air quality. Standard method for the measurement of Pb, Cd, As and Ni in the PM10 fraction of suspended particulate matter

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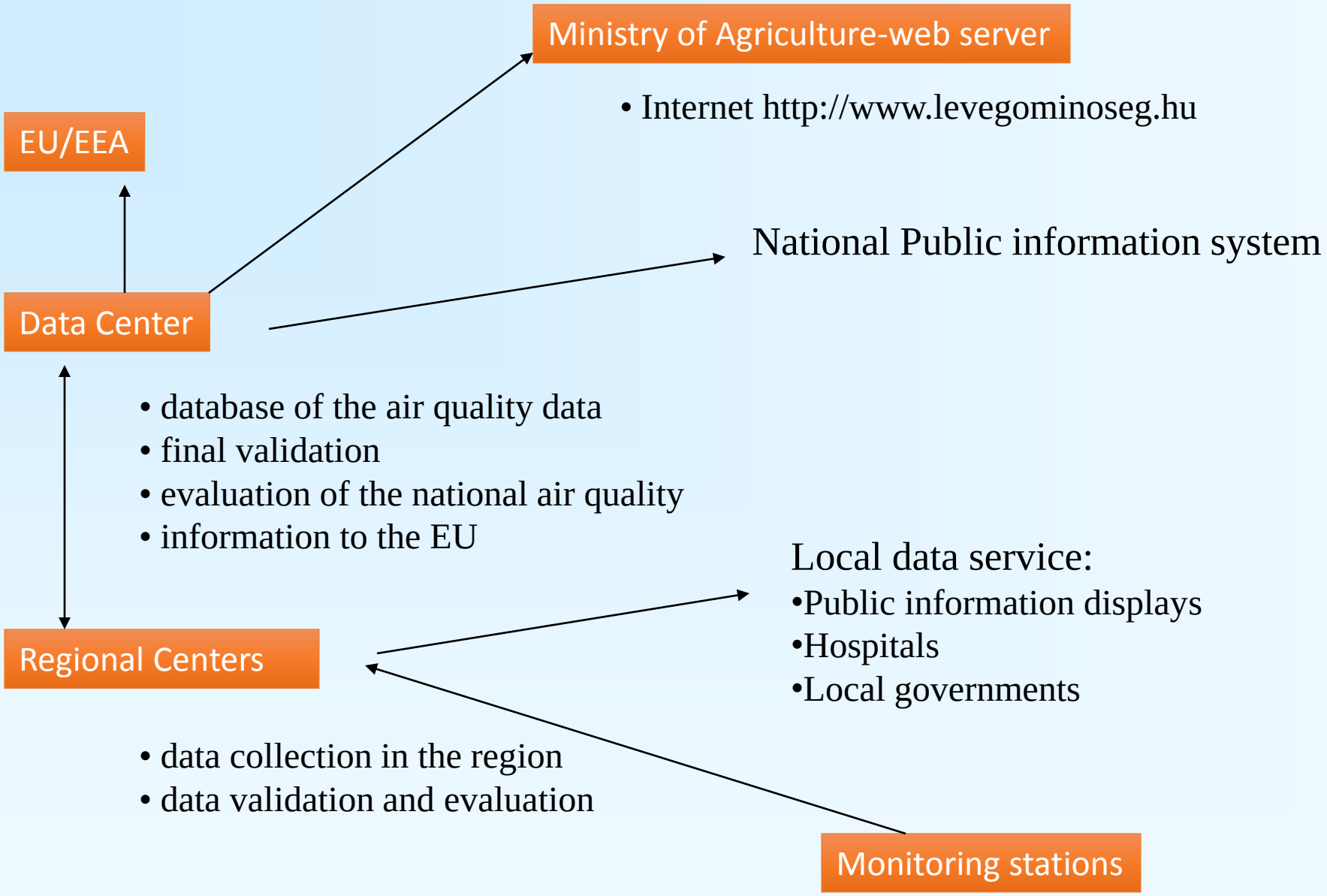
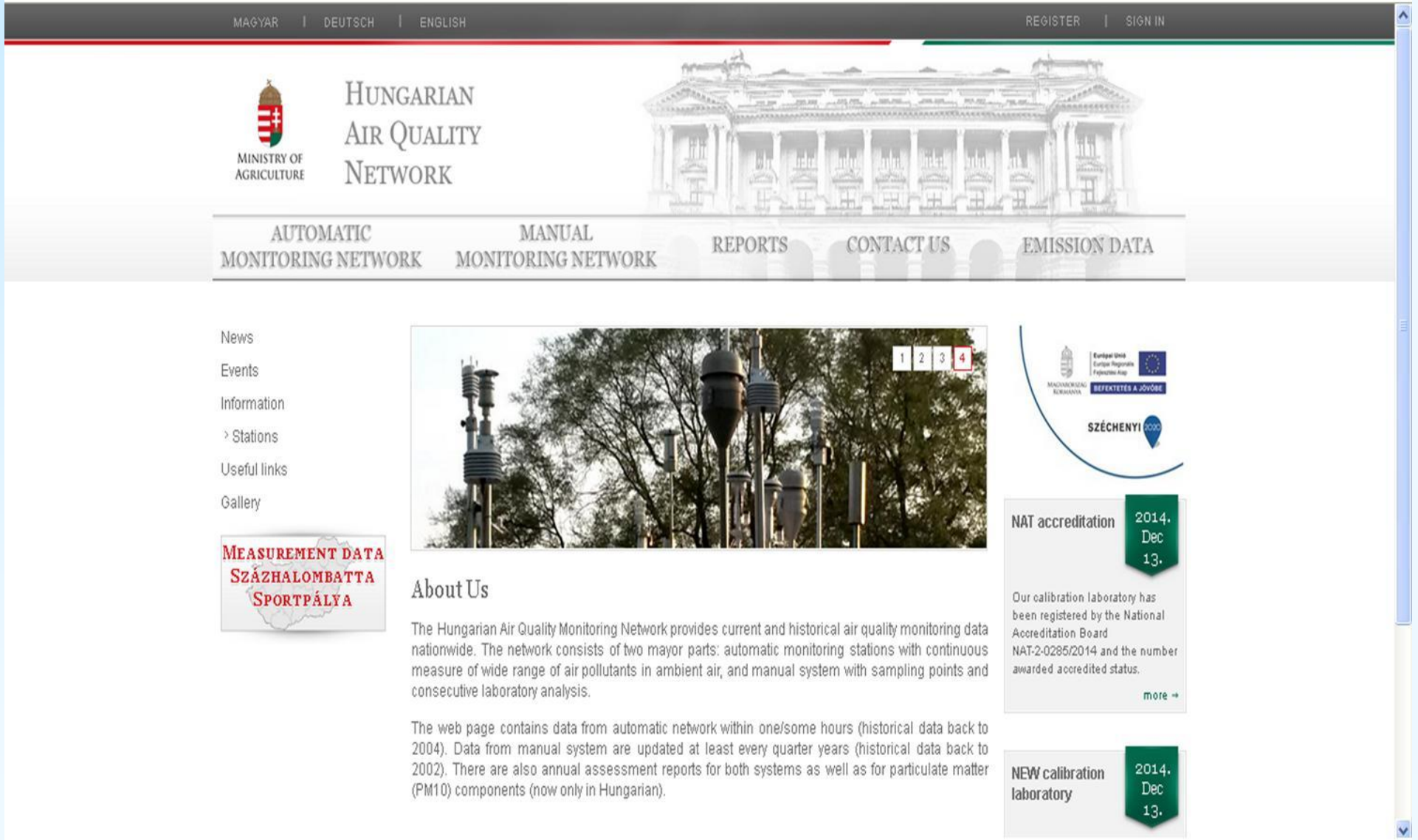
# Data flow, data processing



# www.levegominoseg.hu

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# Calibration Laboratory

# Gases using for calibration (emission level)

- **$C_3H_8$ / $N_2$ 918,9 ppm** ± 5 ppm
- **$C_3H_8$ / $N_2$ 4981 ppm** ± 18 ppm
- **$CH_4$ / $N_2$ 1,808 %** ± 0,010 %
- **CO 100 %** (4,7)
- **CO / $N_2$ 1,328 %** ± 0,008 %
- **CO / $N_2$ 1199,2 ppm** ± 2,0 ppm
- **CO / $N_2$ 3141 ppm** ± 40 ppm
- **CO / $N_2$ 8154 ppm ±** 77 ppm
- **CO / $N_2$[PRM] 9982 ppm** ± 20 ppm
- **$CO_2$ / $N_2$ 30,63 %** ± 0,5 %
- **$CO_2$ 100 %** (4.8)folyékony
- **NO / $N_2$[PRM] 100,03 ppm** ± 0,40 ppm
- **NO / $N_2$ 102 ppm** ± 1 %
- **NO / $N_2$ 199,5 ppm** ± 2 %
- **NO / $N_2$ 2020,3 ppm** ± 1 %
- **NO / $N_2$ 2992 ppm** ± 0,6 %
- **$SO_2$ / $N_2$ 4996 ppm** ± 37 ppm
- **$SO_2$ / $N_2$[PRM] 60,06 ppm** ± 0,36 ppm

- **$O_2$ / $N_2$ (szint. lev.) 19,7 %(5,0)** ± 0,4 %
- **$O_2$ / $N_2$ (szint. lev.) 20,5 %** (5,0)
- **$O_2$ / $N_2$ (szint. lev.) 20,5 %** (5,0)

# Gases using for calibration (imission level)

- **CO / $N_2$ 1,328 %** ± 0,008 %
- **CO / $N_2$ 2,173 %** ± 0,014 %
- **CO / $N_2$ 556 ppm** ± 2 %
- **CO / $N_2$[PRM] 9982 ppm** ± 20 ppm
- **NO / $N_2$[PRM] 100,03 ppm** ± 0,40 ppm
- **NO / $N_2$ 102 ppm** ± 1 %
- **NO / $N_2$ 199,5 ppm** ± 2 %
- **$SO_2$ / $N_2$ 25,02 ppm** ± 0,28 %
- **$SO_2$ / $N_2$[PRM] 60,06 ppm** ± 0,36 ppm
- **$SO_2$ / $N_2$ 79,8 ppm** ± 2,0 %
- **$SO_2$ / $N_2$ 79,9 ppm** ± 0,5 %

**VOC / $N_2$**

| **[PRM]** | **ppm** | ppm |
|---|---|---|
| 1,2,4-trimethylbenzene | **1,007** | 0,050 |
| 1,3,5-trimethylbenzene | **0,996** | 0,050 |
| 1,3 butadiene | **1,002** | 0,030 |
| 1-butene | **1,002** | 0,030 |
| 1-butene | **1,010** | 0,030 |
| 1-pentene | **0,995** | 0,030 |
| 2-methyl-1,3-butadiene | **0,994** | 0,030 |
| 2-methyl-pentane | **0,994** | 0,030 |
| benzene | **0,986** | 0,029 |
| cis-2-butene | **1,001** | 0,030 |
| ethane | **1,004** | 0,030 |
| ethene | **1,032** | 0,030 |
| ethylbenzene | **0,995** | 0,030 |
| ethyne | **1,017** | 0,030 |
| iso-butane | **0,998** | 0,030 |
| iso-butene | **0,989** | 0,029 |
| iso-pentane | **0,984** | 0,029 |
| m-xylene | **0,983** | 0,029 |
| n-butane | **0,997** | 0,030 |
| n-heptane | **0,983** | 0,029 |
| n-hexane | **0,974** | 0,029 |
| n-octane | **1,000** | 0,030 |
| n-pentane | **1,013** | 0,030 |
| o-xylene | **1,014** | 0,030 |
| propane | **0,982** | 0,030 |
| propene | **1,003** | 0,030 |
| p-xylene | **0,982** | 0,029 |
| toluene | **0,985** | 0,029 |
| trans-2-butene | **1,009** | 0,030 |
| trans-2-pentene | **1,005** | 0,030 |

# Calibration point (according to the standards)

| | EN 14626:2013 | EN 14212:2013 | EN 14211:2013 | EN 14211:2013 | EN 14625:2013 | EN 14662-3:2013 |
|---|---|---|---|---|---|---|
| | CO | $SO_2$ | NO | $NO_2$ | $O_3$ | BTEX / VOC |
| Range | 86 ppm | 376 ppb | 962 ppb | 261 ppb | 250 ppb | 15,4 ppb |
| Cal.point | 0,20,60,***75***,95% | 0,20,60,***75***,95% | 0,20,60,***75***,95% | | 0,20,60,***75***,95% | 70-90% |
| lack of fit | 0,20,40,60,80,95 % | 0,20,40,60,80,95 % | 0,20,40,60,80,95 % | 0,50,95% | 0,20,40,60,80,95% | 0,10,50,90% |
| cal. point 20% | **17,2** | **75,2** | **192,4** | **130,5** | **50** | **1,54** |
| cal. point 60% | **51,6** | **225,6** | **577,2** | **247,95** | **150** | **7,7** |
| cal. point 95% | **81,7** | **357,2** | **913,9** | | **237,5** | **13,86** |
| cal. point 75% | **64,5** | **282** | **721,5** | | **187,5** | **11,55** |

# QC/QA and the traceability

- Primary Refernce Material
- Calibrated instruments
- Accreditation


- z’-score és En-number: ISO 13528
- Grubbs test:körmérés jósága MSZ ISO 5725-1 és-2

# Traceability chain:

**Metrological traceability chain:** sequence of **measurement standards** and **calibrations** that is used to relate a **measurement result** to a reference

- Note 1: A metrological traceability chain is defined through a **calibration hierarchy**.
- Note 2: A metrological traceability chain is used to establish **metrological traceability** of a measurement result.

**Calibration hierarchy:** sequence of **calibrations** from a reference to the final **measuring system**, where the outcome of each calibration depends on the outcome of the previous calibration

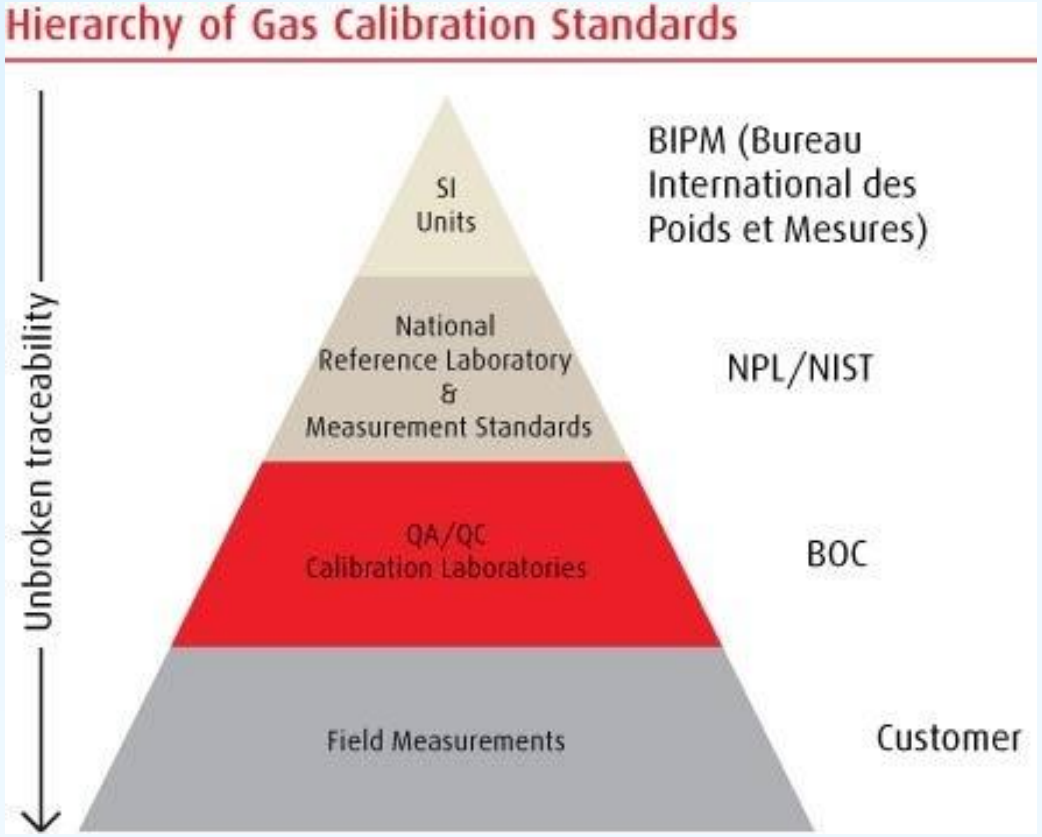
- Note 1: **Measurement uncertainty** necessarily increases along the sequence of calibrations.
- Note 2: The elements of a calibration hierarchy are one or more **measurement standards** and measuring systems operated according to **measurement procedures**.

**International measurement standard:** **measurement standard** recognized by signatories to an international agreement and intended to serve worldwide

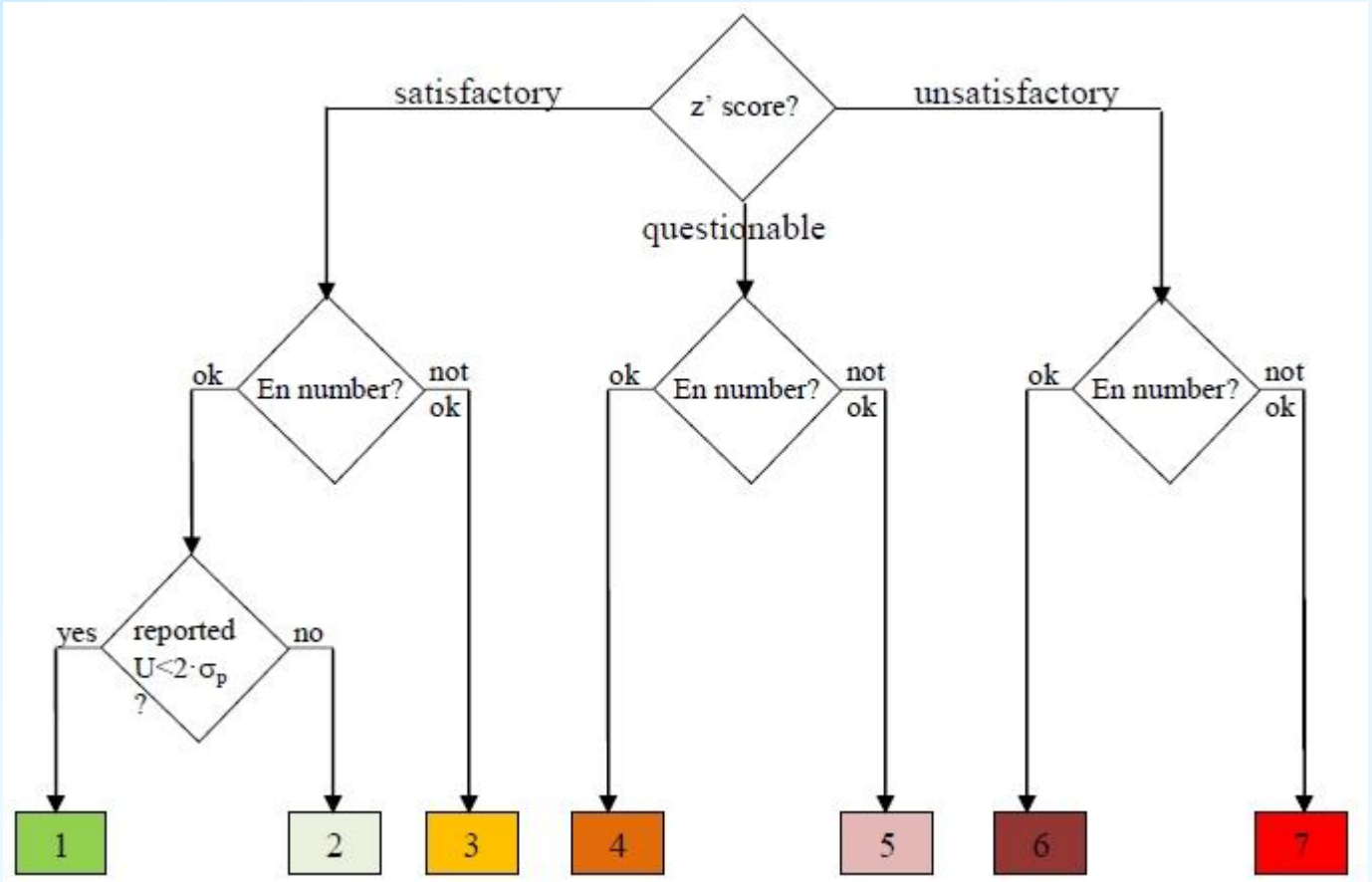
Example 1: The international prototype of the kilogram.

**National measurement standard:** **measurement standard** recognized by national authority to serve in a state or economy as the basis for assigning **quantity values** to other measurement standards for the **kind of quantity** concerned

**Primary measurement standard:** **measurement standard** established using a **primary reference measurement procedure**, or created as an artifact, chosen by convention



# Rating scale



JRC Scientific and Technical Reports

EC Harmonization Programme for Air Quality Measurements:

# The evaluation of the Interlaboratory comparison Exercise for $SO_2$, CO, $O_3$, NO and $NO_2$ 14.- 17. June 2010

Maurizio Barbiere, Claudio A. Belis, Matej Kapus Dukarić, Friedrich Lagler and Federico Karagulian

EUR

JRC EUROPEAN COMMISSION ies

| Country | Laboratory | Code |
|---|---|---|
| Finland | Finnish Meteorological Institute | A |
| Austria | Umweltbundesamt | B |
| Ireland | Environmental Protection Agency | C |
| European Commission | European Reference Laboratory for Air Pollution | D |
| Austria | Oberösterreichische Landesregierung | E |
| Bulgaria | Executive Environmental Agency | F |
| United Kingdom | National Physics Laboratory | G |
| Netherland | National Institute for Public Health and the Environment | H |
| Hungary | Hungarian Meteorological Service | I |
| Spain | Instituto de salud CARLOS III | L |

| | run number | conc. level | IE code A | B | C | E | F | G | H | I | L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO (µmol/mol) | 0 | 0.014 | a1 | a1 | a3 | a1 | a3 | a1 | a1 | a1 | a1 |
| | 5 | 1.003 | a1 | a1 | a3 | a1 | a1 | a1 | a2 | a1 | a1 |
| | 4 | 1.976 | a1 | a1 | a3 | a1 | a1 | a1 | a1 | a1 | a1 |
| | 3 | 4.272 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 |
| | 2 | 5.959 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 |
| | 1 | 8.547 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 |
| NO (nmol/mol) | 0 | 0.3 | a1 | a1 | a1 | a1 | a1 | ND | a1 | a1 | a1 |
| | 10 | 3.4 | a1 | a1 | a1 | a1 | a1 | ND | a1 | a1 | a1 |
| | 9 | 17.1 | a1 | a1 | a3 | a1 | a1 | ND | a1 | a1 | a1 |
| | 8 | 31.8 | a1 | a1 | a1 | a1 | a1 | ND | a1 | a1 | a1 |
| | 7 | 52.5 | a3 | a1 | a1 | a1 | a2 | ND | a5 | a1 | a2 |
| | 6 | 94.9 | a1 | a1 | a1 | a1 | a1 | ND | a1 | a1 | a1 |
| | 5 | 154.5 | a1 | a1 | a1 | a1 | a1 | ND | a5 | a1 | a1 |
| | 4 | 154.0 | a1 | a1 | a1 | a1 | a1 | ND | a1 | a1 | a1 |
| | 3 | 253.8 | a1 | a1 | a1 | a1 | a1 | ND | a1 | a1 | a1 |
| | 2 | 383.2 | a1 | a1 | a1 | a1 | a2 | ND | a2 | a1 | a2 |
| | 1 | 502.0 | a1 | a1 | a2 | a1 | a2 | ND | a4 | a1 | a2 |
| $NO_2$ (nmol/mol) | 0 | -0.2 | a1 | a1 | a3 | a1 | a1 | ND | a1 | a1 | a1 |
| | 10 | 13.5 | a1 | a1 | a2 | a1 | a3 | ND | a1 | a1 | a1 |
| | 8 | 20.6 | a1 | a1 | a2 | a1 | a1 | ND | a5 | a1 | a2 |
| | 6 | 59.9 | a1 | a1 | a2 | a1 | a1 | ND | a5 | a1 | a2 |
| | 4 | 101.3 | a1 | a1 | a2 | a1 | a3 | ND | a1 | a3 | a1 |
| | 2 | 121.9 | a1 | a1 | a2 | a1 | a2 | ND | a5 | a1 | a2 |
| $O_3$ (nmol/mol) | 0 | 0.4 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 |
| | 5 | 13.9 | a1 | a1 | a1 | a1 | a1 | a1 | a2 | a1 | a1 |
| | 4 | 20.8 | a1 | a1 | a5 | a1 | a1 | a1 | a1 | a1 | a1 |
| | 3 | 59.2 | a1 | a1 | a2 | a1 | a1 | a1 | a1 | a1 | a1 |
| | 2 | 98.7 | a1 | a1 | a1 | a1 | a1 | a1 | a2 | a1 | a1 |
| | 1 | 117.0 | a1 | a1 | a4 | a1 | a2 | a1 | a1 | a1 | a1 |
| $SO_2$ (nmol/mol) | 0 | 0.1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 |
| | 5 | 3.0 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 |
| | 4 | 7.4 | a1 | a1 | a1 | a3 | a1 | a5 | a2 | a1 | a2 |
| | 3 | 18.8 | a1 | a1 | a1 | a1 | a1 | a3 | a1 | a1 | a1 |
| | 2 | 47.9 | a1 | a1 | a1 | a1 | a1 | a3 | a1 | a1 | a1 |
| | 1 | 134.9 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 | a1 |

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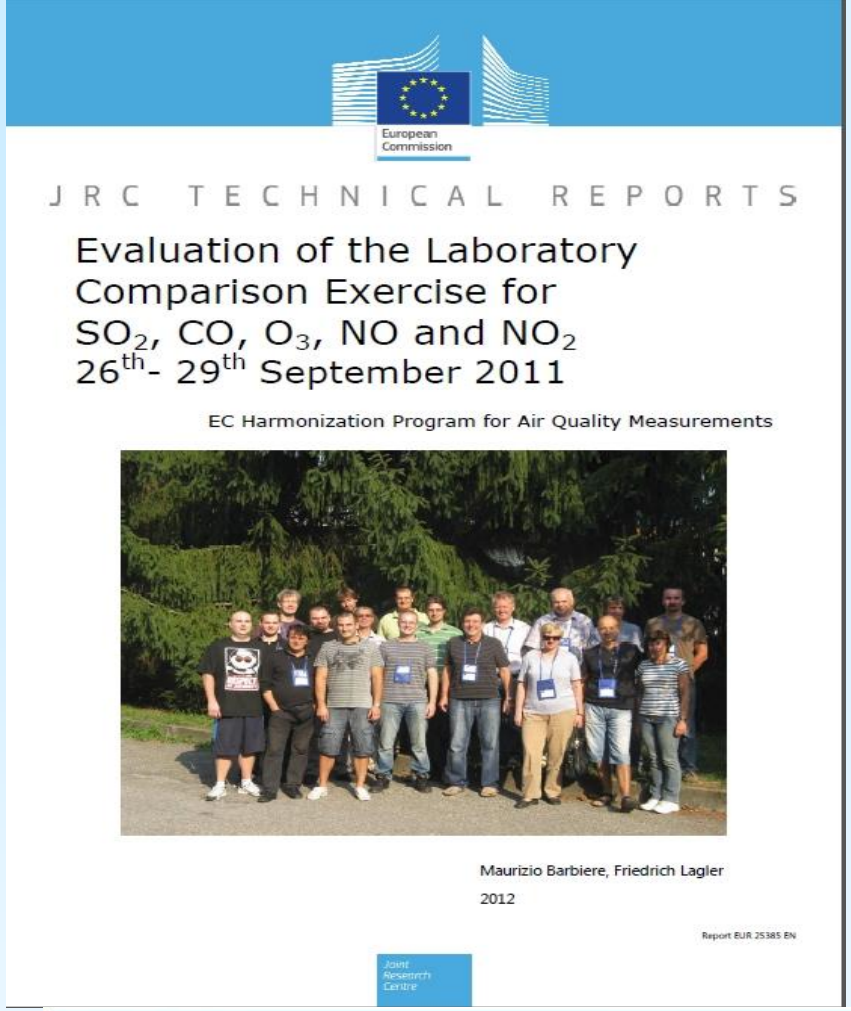



| Country | Laboratory | Code |
|---|---|---|
| Czech Republic | Czech Hydrometereological Institute (CHMI) | A |
| United Kingdom | AEA Technology | B |
| Denmark | National Environmental Research Institute (NERI) | C |
| Croatia | Energy and Environmental Protection Institute (EKONERG) | D |
| Netherland | National Institute for Public Health and the Environment (RIVM) | E |
| Bulgaria | Executive Environmental Agency (EEA) | F |
| European Commission | European Reference Laboratory for Air Pollution (ERLAP) | G |
| Slovak Republic | Slovak Hydrometeorological Institute (SHMU) | H |
| Belgium | Belgian Interregional Environment Agency (IRCEL-CELINE) | I |
| Hungary | Hungarian Meteorological Service (HMS) | L |

| | run number | Ref. conc. level | IE code A | B | C | D | E | F | H | I | L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO (µmol/mol) | 0 | -0.001 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 1 | 1 |
| | 1 | 8.050 | 1 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 1 |
| | 2 | 4.549 | 1 | 1 | 1 | 3 | 2 | 1 | 3 | 1 | 1 |
| | 3 | 6.050 | 1 | 1 | 1 | 3 | 1 | 3 | 3 | 1 | 1 |
| | 4 | 3.039 | 1 | 1 | 3 | 3 | 2 | 3 | 3 | 1 | 1 |
| | 5 | 1.025 | 1 | 1 | 1 | 1 | 2 | 1 | 5 | 1 | 1 |
| NO (nmol/mol) | 0 | 0.0 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 |
| | 1 | 513.8 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| | 2 | 393.8 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| | 3 | 61.7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 4 | 39.1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 5 | 171.0 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| | 6 | 120.8 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 7 | 257.0 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| | 8 | 170.5 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| | 9 | 20.7 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| | 10 | 10.2 | 1 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| NO2 (nmol/mo | 0 | -0.05 | 1 | 2 | 2 | 1 | 7 | 1 | 2 | 1 | 1 |
| | 2 | 121.847 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| | 4 | 22.947 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 6 | 52.537 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 8 | 88.21 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| | 10 | 11.08 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| O3 (nmol/mol) | 0 | 0.0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 1 | 117.0 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| | 2 | 22.5 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| | 3 | 51.0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 4 | 85.1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 5 | 11.1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| SO2 (nmol/mo | 0 | 0.0 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 1 | 8.7 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 51.1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| | 3 | 19.9 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 4 | 123.1 | 1 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |
| | 5 | 3.5 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

European Commission

JRC TECHNICAL REPORTS

# Evaluation of the Laboratory Comparison Exercise for $SO_2$, CO, $O_3$, NO and $NO_2$ 11th-14th June 2012 Ispra

EC Harmonization Program for Air Quality Measurements

Maurizio Barbiere, Friedrich Lagler

2012

Report EUR 25536 EN

| Country | Laboratory | Code |
|---|---|---|
| Austria | Upper Austria Regional Government (OOE) | A |
| Estonia | Estonian Environmental Research Centre (EERC) | B |
| Spain | Instituto De Salud Carlos III (ISCIII) | C |
| Poland | Chief Inspectorate of Environmental Protection (GIOS) | D |
| Bulgaria | Executive Environment Agency (EEA) | E |
| Hungary | Hungarian Meteorological Service (HMS) | F |
| European Commission | European Reference Laboratory of Air Pollution (ERLAP) | G |

| | run number | Ref. conc. level | IE code A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|
| CO (µmol/mol) | 0 | 0.000 | 1 | 1 | 2 | 1 | 3 | 1 |
| | 1 | 2.536 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 8.293 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 3 | 5.583 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 4 | 4.063 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 5 | 0.821 | 1 | 1 | 1 | 1 | 1 | 1 |
| NO (nmol/mol) | 0 | 0.04 | 1 | 1 | 1 | n.s. | 1 | 1 |
| | 1 | 651.36 | 1 | 1 | 1 | n.s. | 1 | 1 |
| | 2 | 500.53 | 1 | 1 | 3 | n.s. | 1 | 1 |
| | 3 | 190.29 | 1 | 1 | 1 | n.s. | 1 | 1 |
| | 4 | 129.69 | 1 | 1 | 1 | n.s. | 1 | 1 |
| | 5 | 342.86 | 1 | 1 | 1 | n.s. | 1 | 1 |
| | 6 | 241.61 | 1 | 1 | 1 | n.s. | 1 | 1 |
| | 7 | 19.38 | 1 | 1 | 1 | n.s. | 1 | 1 |
| | 8 | 8.53 | 1 | 1 | 1 | n.s. | 1 | 1 |
| | 9 | 67.72 | 1 | 1 | 1 | n.s. | 1 | 3 |
| | 10 | 43.03 | 1 | 1 | 1 | n.s. | 1 | 1 |
| NO2 (nmol/mol) | 0 | 0.14 | 1 | 1 | 1 | n.s. | 1 | 1 |
| | 2 | 153.23 | 1 | 1 | 3 | n.s. | 1 | 1 |
| | 4 | 61.33 | 1 | 1 | 3 | n.s. | 1 | 1 |
| | 6 | 102.82 | 1 | 1 | 3 | n.s. | 1 | 1 |
| | 8 | 11.06 | 1 | 1 | 3 | n.s. | 3 | 3 |
| | 10 | 25.09 | 1 | 1 | 3 | n.s. | 3 | 3 |
| O3 (nmol/mol) | 0 | 0.09 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 1 | 121.13 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 2 | 58.20 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 3 | 92.62 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 4 | 8.26 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 5 | 23.82 | 1 | 1 | 1 | 1 | 1 | 1 |
| SO2 (nmol/mol) | 0 | 0.03 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 1 | 103.61 | 3 | 1 | 3 | 1 | 1 | 1 |
| | 2 | 4.40 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 3 | 15.96 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 4 | 46.28 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 5 | 8.63 | 1 | 1 | 1 | 1 | 1 | 1 |

# Challenges / incompleteness

- Renewal of the accredited status
- Continuous development:
  - Continuous maintenance or change of the instruments (some of them older than 10 years)
  - Fulfil the requirements of the directives of EU or Standards
    1. stricter quality requirements
    2. Measurement of „new” components as VOC, Mercury PM2.5 etc. according to the directive of EU
    3. Install new measurement stations
  - standardization of IT systems (not homogeneous)

# Recent trends

All Directives on great combustion are followed in Hungary, and no derogation has been required.

*Resource: background paper to BATUMI EfE Conference*

# Recent trends

Based on our measures, inventories and scientific knowledge, one of the major source of air pollution is **residential heating** (not only the traffic).

It becomes a decisive source of **particulate matter** and **EC/OC emissions**, which poses the most adverse effects on human health.

…technical, financial and social aspects have to be considered at the same time, as well as public awareness needs to be elevated.

*Resource: background paper to BATUMI EfE Conference*

# Recent developments

In the year of 2015 the Air Quality Monitoring Network and the Air Quality Reference Centre were developped by the the Swiss-Hungarian Cooperation Programme and KEOP Programme. All together about 8.5 million EUR.

New instruments: gas monitors (100 pcs), mobile measurement stations, analitical balances, ICP-OES, GC-MS, ASE, EC/OC lab instrument, automated discrete photometry analyzer etc.

# Future developments (by Ministry) - 1

## $PM_{10}$ program

**The multisectoral program assesses all resources of emissions including industry, energy, agriculture, transport, household heating. Awareness raising and horizontal action will have roles in the package.**

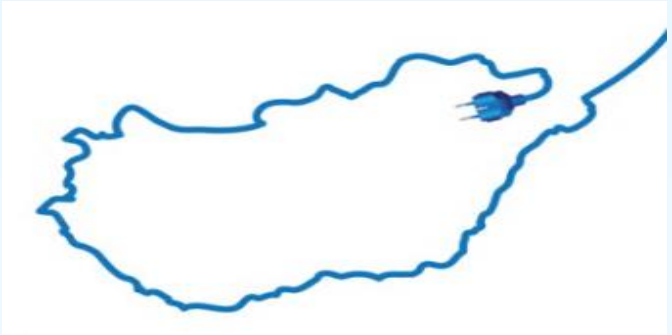
**It is estimated that by the help of the action the $PM_{10}$ emission may be decreased by 10-15%, which may result 10-20 % concentration decrease.**

*Resource: background paper to BATUMI EfE Conference*

# Future developments (by Ministry) - 2

## Jedlik Ányos Plan

The plan (named after the inventor of electric engine) aims the propagation of electro mobility, electric cars will support purchasing of these vehicles, will give advantage for electric vehicles (at parking, tax exemption, etc.). Measures encompass personal vehicles, commercial vehicles and buses too. Deployment of recharge infrastructure is also included.



*Resource: background paper to BATUMI EfE Conference*

# Future developments (by Ministry) - 3

## Heat wisely!


The campaign (homepage, posters, leaflets, films etc.) shares information on more effective and less polluting ways of heating, especially on wood combustion. The possible emission's effects on health are also introduced.

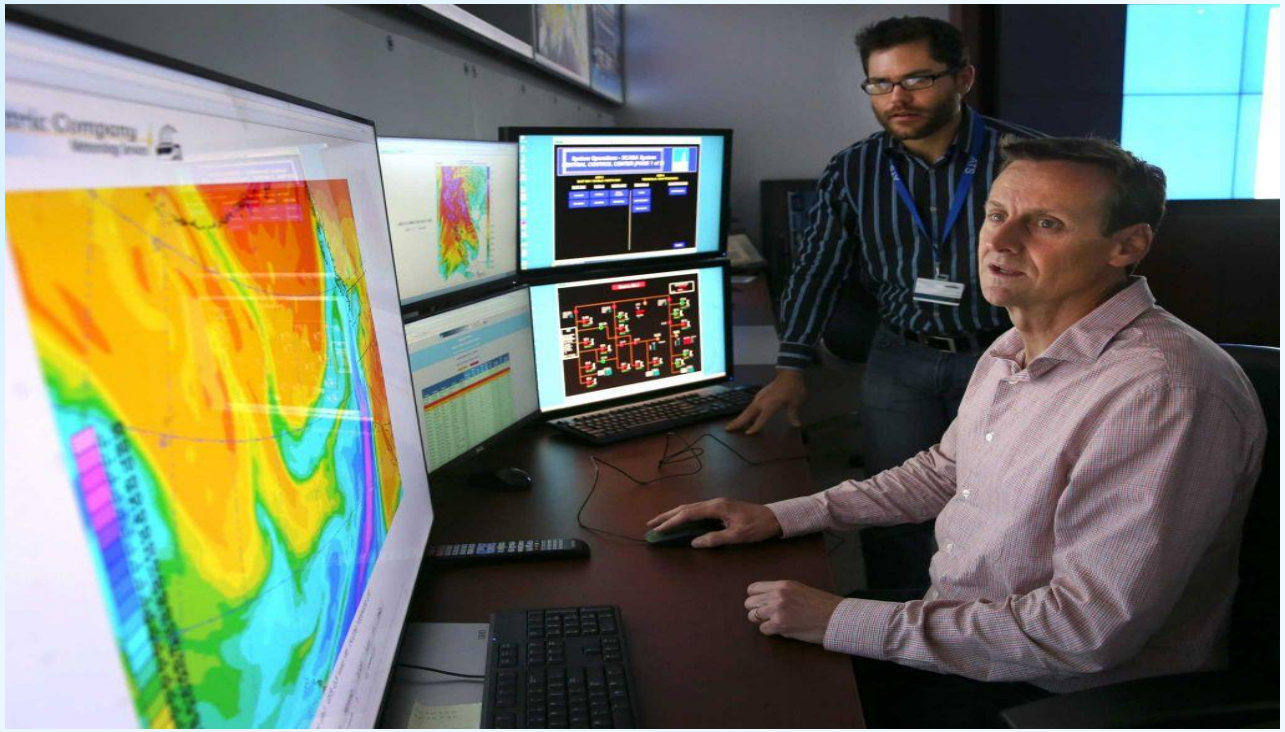
*Resource: background paper to BATUMI EfE Conference*

# Future developments - 4

## Air quality model

The model will help

- Those area that now has no monitoring station;
- Air quality forecasting;
- Easy access to air quality data;
- Assessing effects of possible alternative measurements for decision makers.



*Resource: background paper to BATUMI EfE Conference*


Thank you for your attention!