



**European Network on New Sensing Technologies for Air Pollution  
Control and Environmental Sustainability - *EuNetAir***  
**COST Action TD1105**

**WG3-WG4 JOINT SCIENTIFIC MEETING**

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Republic of Macedonia**



# Air Quality Monitoring in the Republic of Macedonia

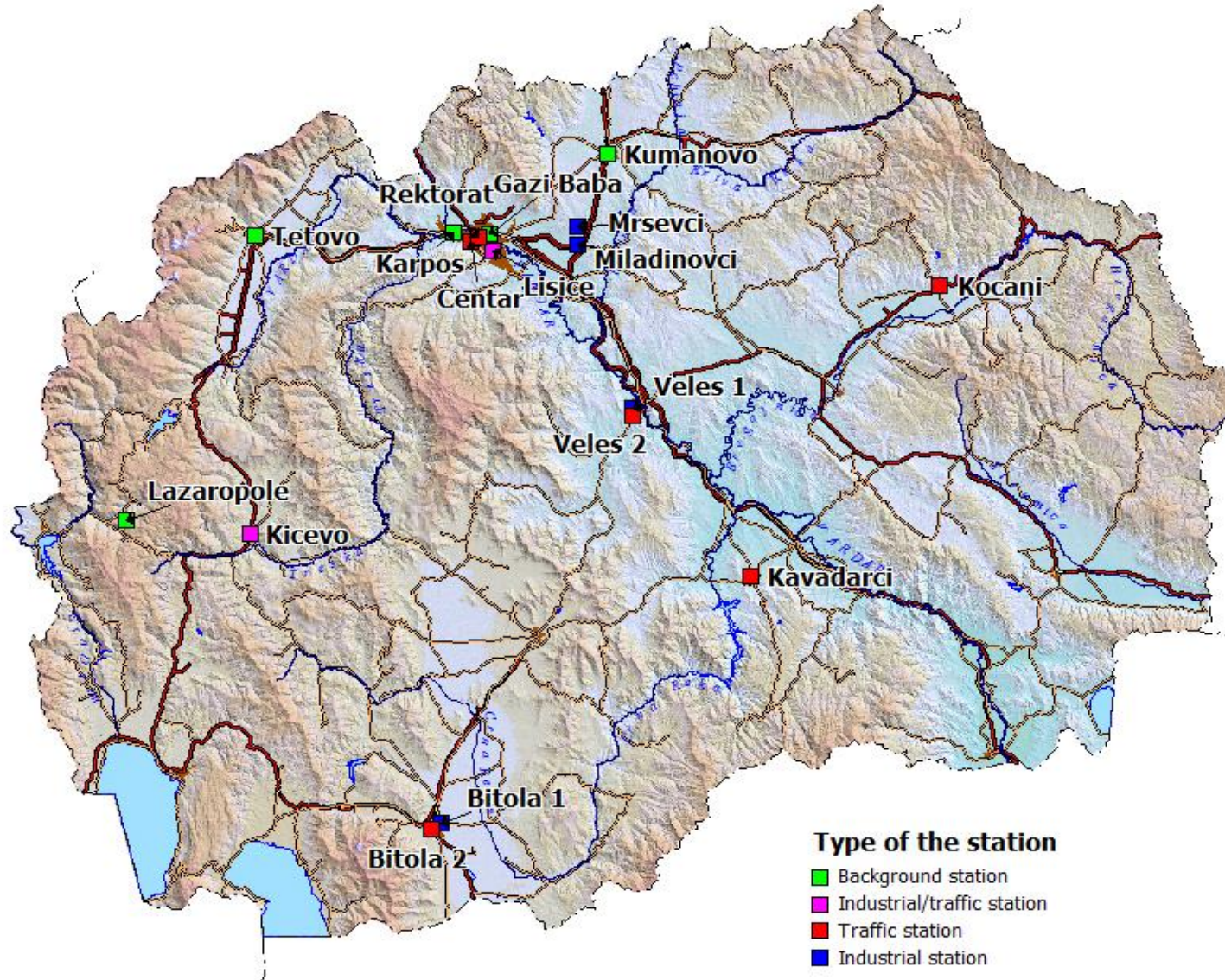


# Establishment of State Ambient Air Quality Automated Monitoring System (SAQAMS)

From 1998 till 2011:

- 17 automatic monitoring stations for air quality
- Calibration laboratory
- Balance room
- Procurement of new air quality data management/collection system

# Location of the stations from the SAQAMS



# Monitoring stations

## Environmental parameters

- CO-carbon monoxide
- SO<sub>2</sub>-sulphur dioxide
- Nitrogen oxides
- O<sub>3</sub> - ozone
- PM<sub>10</sub> - suspended particulate matters in air with size below 10 microns
- PM<sub>2.5</sub> - suspended particulate matters in air with size below 2.5 microns
- BTX

## Meteorological parameters

- Wind velocity
- Wind direction
- Temperature
- Humidity
- Pressure
- Global radiation





# Measuring methods

Substance	Measurement method
SO <sub>2</sub>	MKC EN 14212:2005 Air quality - Standard method for the measurement of the concentration of sulfur dioxide by ultraviolet fluorescence
NO, NO <sub>2</sub> , NO <sub>x</sub>	MKC EN 14211:2005 Air quality - Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence
PM <sub>10</sub>	B attenuation: x-ray absorption of substance compared with MKC EN 12341:1998 Determining PM <sub>10</sub> particulate matter - Reference method and procedure for demonstrating the reference equivalence of measurement methods
CO	MKC EN 14626:2005 Air quality - Standard method for the measurement of the concentration of carbon monoxide by non-dispersive infrared spectroscopy
O <sub>3</sub>	MKC EN 14625:2005 Air quality - Standard method for the measurement of the concentration of ozone by ultraviolet photometry
Benzene	EN 14662:2005, parts 1, 2 and 3 - Air quality - Standard method for measurement of benzene concentrations ???



# Low and High volume samplers

6 LVS PM10 (low volume samplers) were installed in April 2005:

Karpos (Skopje); Lisice (Skopje); Veles; Kicevo; Jegunovce; Kavadarci

4 HVS PM10 (high volume samplers) were installed in April 2005 in  
Kumanovo; Bitola; Kocani; and Lazaropole





# PM10 and HM measurement procedures

- Collected Samples (24h) are transported in Central Laboratory
- PM10 is measured gravimetrically
- Filters are prepared by EN14902:2005 standard
- Samples are analyzed by ICP
- In 2006 indicative measurements were carried on for: PM10; As; Cd; Hg; Ni; Cr; Fe; V; Mn; Pb; Cu; Zn and Mg.



# Calibration Laboratory

- Established in May 2004
- Calibration of the referent analyzers with primary static volumetric injection system
- Determine the correlation between primary calibration method and other methods used
  - secondary dynamic dilution system
  - gas transfer standard
  - field calibrator



# Service and maintenance of SAQAMS

- Operational Program for working of the SAQAMS
- Annual plan for service and maintenance
  - 2/4 week service
  - 3 month service
  - 6 month service
  - 1 year spare parts replacing

# Data processing from the SAQAMS

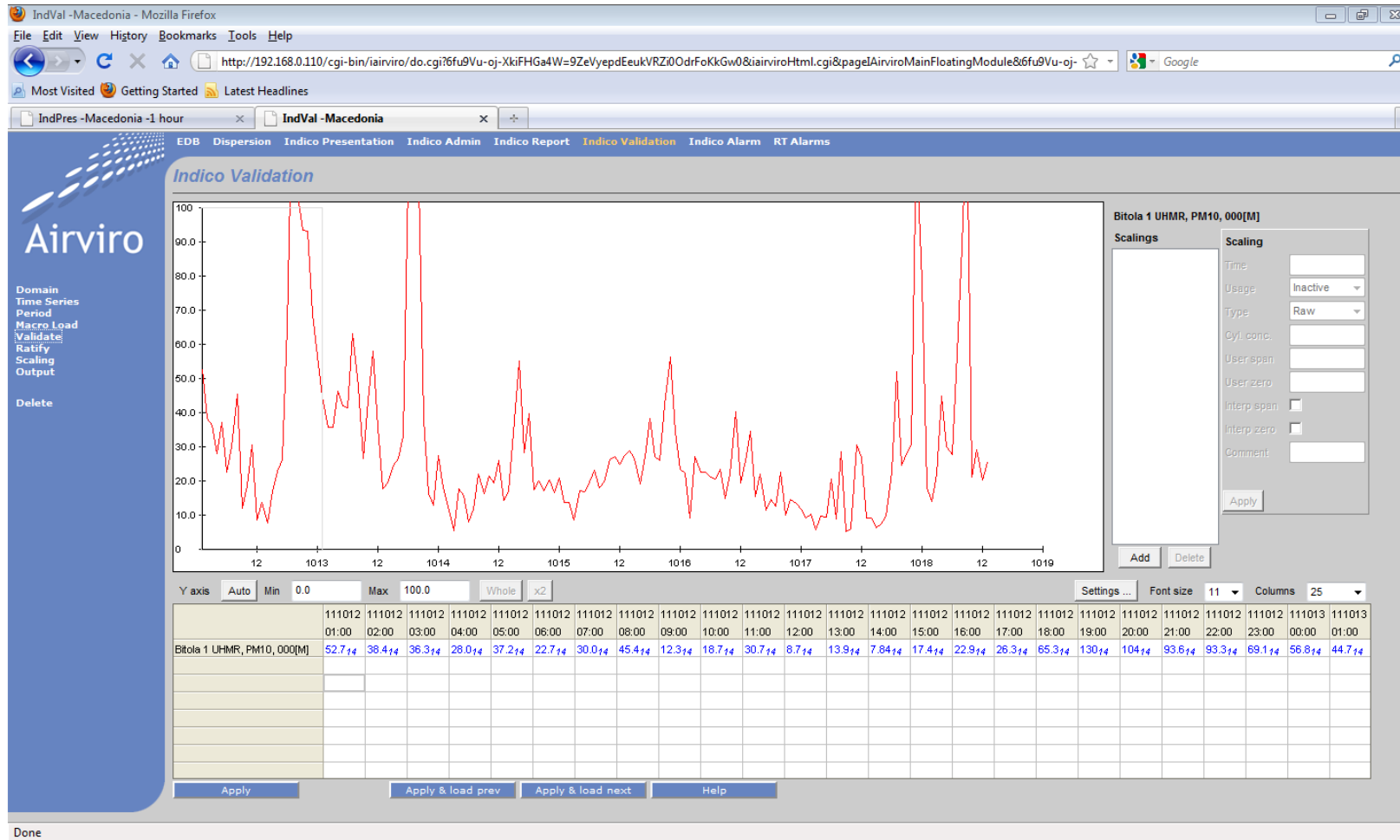
- Gathering hourly data from each station through a GPRS connection
- Storing data in the air quality data base

## AIRVIRO - web based system for

- Management of air quality different time interval data
- Integrated emission data base
- Dispersion modeling

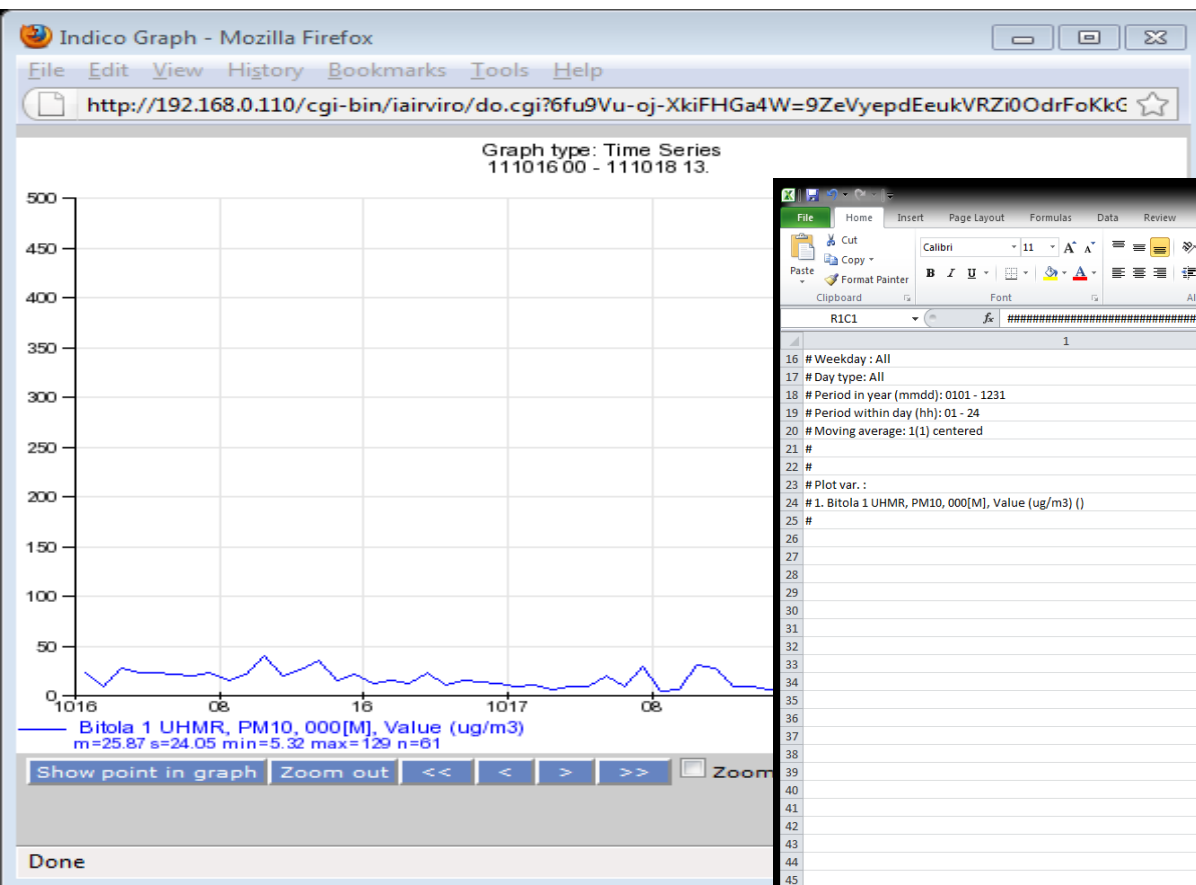


# Data processing



## Data validation

# Data processing

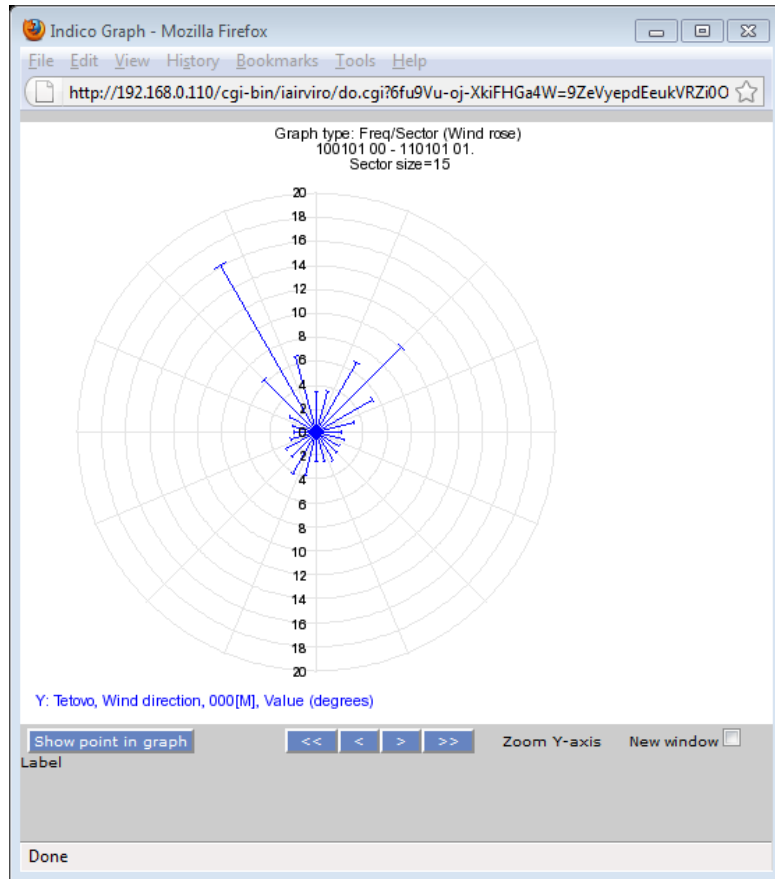


do.cgi-1.xls [Read-Only] - Microsoft Excel

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
16	# Weekday : All													
17	# Day type: All													
18	# Period in year (mddd): 0101 - 1231													
19	# Period within day (hh): 01 - 24													
20	# Moving average: 1(1) centered													
21	#													
22	#													
23	# Plot var. :													
24	# 1. Bitola 1 UHMR, PM10, 000[M], Value (ug/m3) ()													
25	#													
26		10/16/2011 1:00	22.5											
27		10/16/2011 2:00	9.4											
28		10/16/2011 3:00	27.16											
29		10/16/2011 4:00	22.83											
30		10/16/2011 5:00	22.75											
31		10/16/2011 6:00	21.29											
32		10/16/2011 7:00	20.65											
33		10/16/2011 8:00	23.49											
34		10/16/2011 9:00	14.9											
35		10/16/2011 10:00	22.07											
36		10/16/2011 11:00	40.31											
37		10/16/2011 12:00	19.54											
38		10/16/2011 13:00	26.24											
39		10/16/2011 14:00	34.64											
40		10/16/2011 15:00	15.56											
41		10/16/2011 16:00	22.2											
42		10/16/2011 17:00	11.55											
43		10/16/2011 18:00	14.82											
44		10/16/2011 19:00	12.74											
45		10/16/2011 20:00	22.84											
46		10/16/2011 21:00	10.21											
47		10/16/2011 22:00	14.75											

Possibility to extract data in graphic (PDF and GIF) and tabular format (EXCEL)

# Data processing



Possibility to display wind rose.

# Public Information

## Daily information

- State Inspectorate of Environment
- City of Skopje (capital city)
- Crisis management Centre

## Monthly report

- Hydro meteorological administration
- Institute for Public Health
- Public Health Centers
- Municipalities

## Annual report

## Assessment report (2005-2010)



# Monthly report

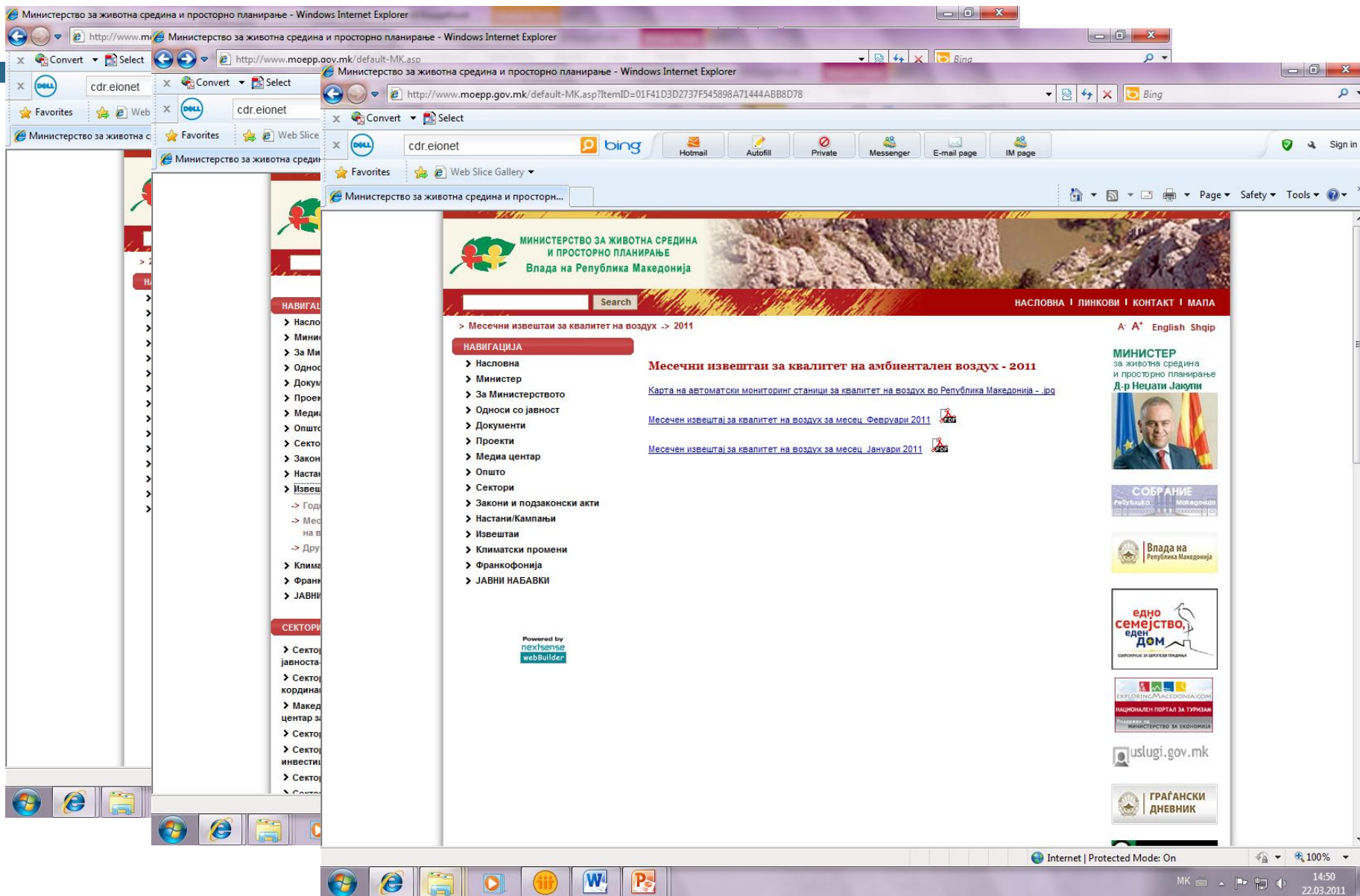
Табеларен и графички приказ на среднодневните концентрации на суспендирани честички со големина до 10 микрометри (PM10) од Кавадарци, за месец Февруари 2011 година

PM <sub>10</sub> / $\mu\text{g}/\text{m}^3$	Кавадарци
01.02.2011	203,7
02.02.2011	252,9
03.02.2011	128,8
04.02.2011	154,8
05.02.2011	154,9
06.02.2011	220,4
07.02.2011	199,7
08.02.2011	265,6
09.02.2011	178,1
10.02.2011	137,8
11.02.2011	199,4
12.02.2011	165,0
13.02.2011	176,8
14.02.2011	172,8
15.02.2011	119,7
16.02.2011	71,3
17.02.2011	78,5
18.02.2011	109,9
19.02.2011	27,5
20.02.2011	71,0
21.02.2011	83,1
22.02.2011	42,7
23.02.2011	28,0
24.02.2011	45,8
25.02.2011	68,9
26.02.2011	100,9
27.02.2011	140,5
28.02.2011	204,5

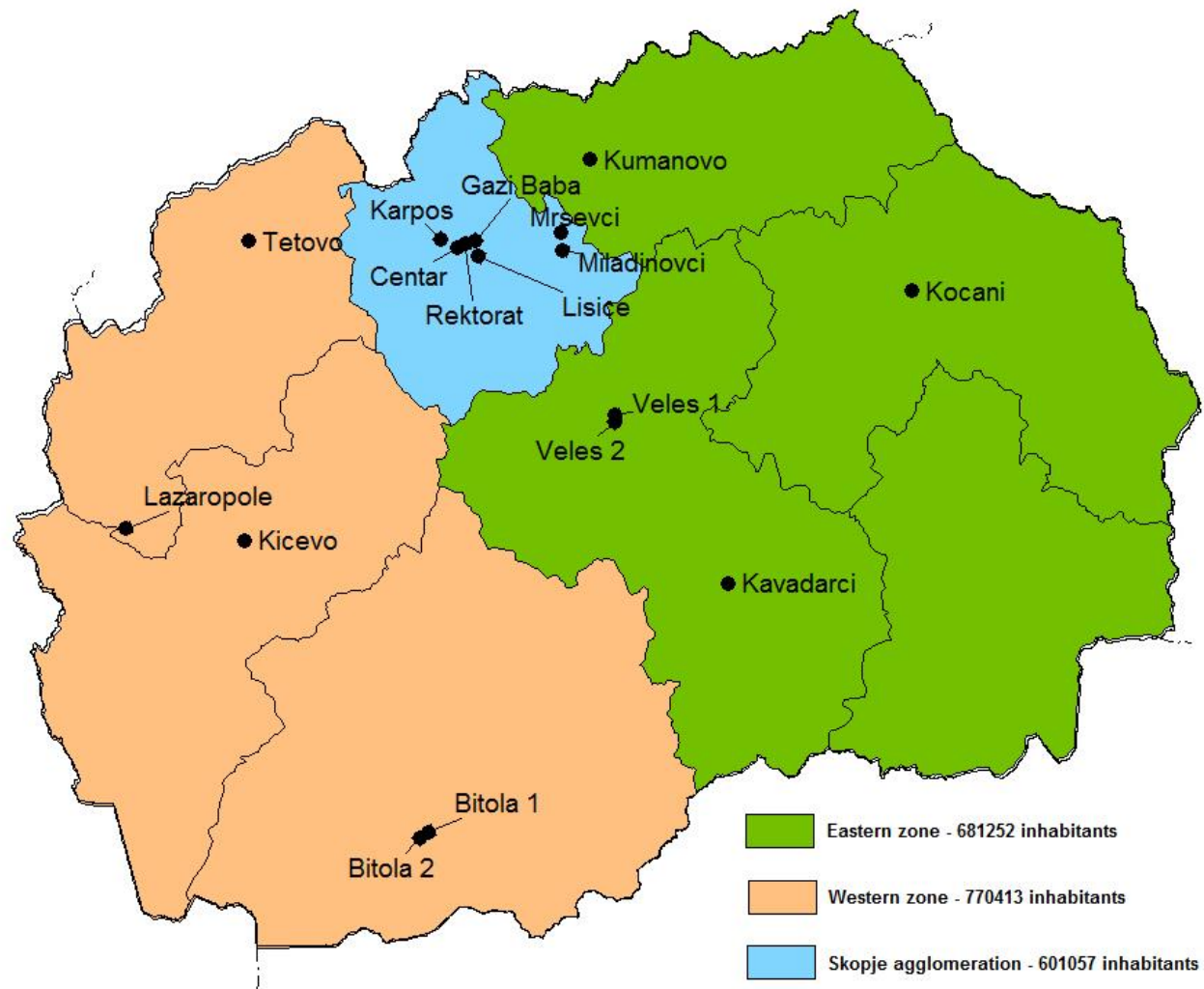
PM <sub>10</sub> / $\mu\text{g}/\text{m}^3$	Кавадарци
Гранична 24h вредност за заштита на човековото здравје	50
Колку пати е надмината 24h гр. вредност во тековниот месец	24
Колку пати е надмината 24h гр. вредност во 2011	53



Среднодневни концентрации на суспендирани честички со големина до 10 микрометри (PM10)



# Zones and agglomerations in Republic of Macedonia



# Assessment report (2005-2010 data)

**Table 1: Assessment regime in zones and agglomerations**

Agglomeration/Zone	SO <sub>2</sub>	NO <sub>2</sub>	PM10	CO	O <sub>3</sub>
<i>Agglomeration</i>					
Skopje	1	1	1	1	1
<i>Zone</i>					
Eastern	1	1	1	2	1
Western	2	2	1	1	1

## Main problem PM10



# Daily concentrations of PM10 in background station Karposh (14.09.2011 - 18.11.2012)- winter episodes

11 days exceedances	
29.10.2011	106.9
30.10.2011	100.8
31.10.2011	141.5
01.11.2011	173.5
02.11.2011	171.1
03.11.2011	173.1
04.11.2011	148.3
05.11.2011	169.5
06.11.2011	191.7
07.11.2011	167
08.11.2011	116.7
9 days exceedances	
15.11.2011	132.6
16.11.2011	208.3
17.11.2011	204.1
18.11.2011	234.6
19.11.2011	301
20.11.2011	284.9
21.11.2011	354.9
22.11.2011	421.4
23.11.2011	573.4

9 days exceedances	
27.11.2011	129.7
28.11.2011	245.5
29.11.2011	151.5
30.11.2011	251.7
01.12.2011	313.6
02.12.2011	269.2
03.12.2011	350.1
04.12.2011	312
05.12.2011	220.7

7 days exceedances	
18.02.2012	186.6
19.02.2012	106.1
20.02.2012	164.4
21.02.2012	201.6
22.02.2012	155.5
23.02.2012	166.5
24.02.2012	117.6

5 days exceedances	
09.11.2012	109.8
10.11.2012	129.8
11.11.2012	103.1
12.11.2012	122.3
13.11.2012	182.4

# Proposed thresholds by IG for air

## **NO thresholds in the EU regulative**

Information threshold

50  $\mu\text{g}/\text{m}^3/5$  days

Alarm threshold

100  $\mu\text{g}/\text{m}^3/10$  days

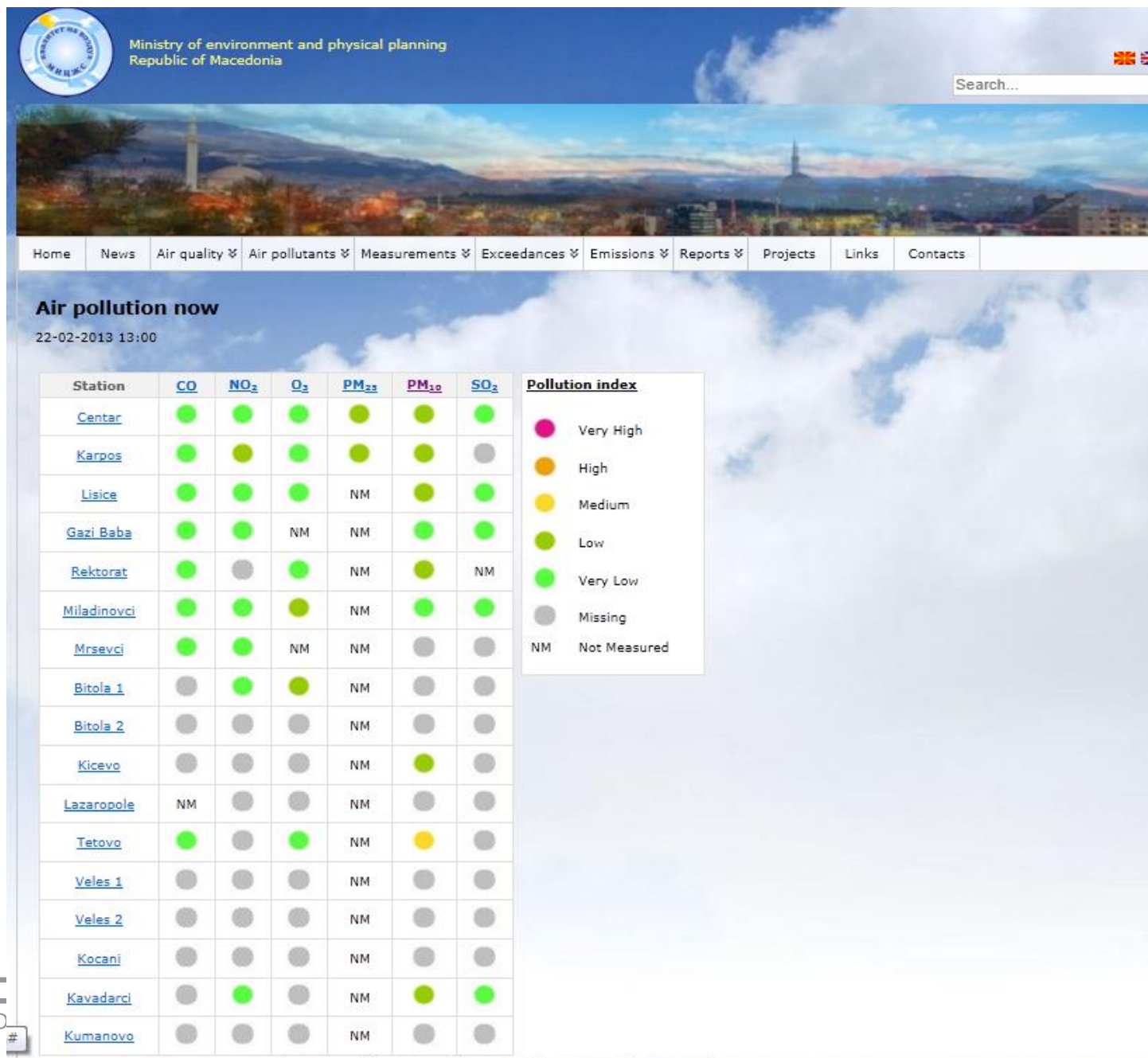
Period for Informing

recommendations

Period for Alarming

measures

# New air quality web portal



# Air Quality Reporting towards EEA

- Air quality data processing and using the DEM (Data Exchange Module) software, proposed by EEA, for inclusion in the EEA central air quality data base
- Ozone data processing in accordance with the 2002/3/EC Directive and reporting toward EEA
- Reporting according to EMEP protocol requirements



# Projects

- CARDS 2005 PROGRAMME

## I TWINNING PROJECT: *AIR QUALITY IMPROVEMENT*

Component 4 - Air quality measurements and laboratory work

- Training technical staff on servicing , maintenance and calibration of instruments
- Training for preparation of SOP's
- Draft version of QA/QC plan has been prepared
- Training for implementation of the QA/QC procedures

# Projects

- **IPA 2008 PROGRAMME, II TWINNING PROJECT:**  
*STRENGTHENING THE CENTRAL AND LOCAL LEVEL CAPACITIES FOR ENVIRONMENTAL MANAGEMENT IN THE AREA OF AIR QUALITY*

- Improvement of air quality assessment
- Introduction of dispersion modeling
- Preparation for accreditation of calibration laboratory
- Establishment of air quality information system
- Preparation of pilot action plan and program for air quality protection for city of Bitola

**FMI, Finish Meteorological Institute**

# Future activities

## Future reporting toward EEA and EC

- Annual air quality report (2004/461/EC questionnaire )
- Reporting of real-time ozone data

IPA 2012-2013, III TWINNING PROJECT (Future implementation of CAFÉ directive)

# Future activities

Accreditation of the calibration laboratory

Expanding the SAQAMS

- Procurement of 2 new monitoring stations and reorganization of the stations according to the Assessment report
- Procurement of mobile station for air quality indicative measurements in smaller urban environments
- Measurements of HM and PAHs (according 2004/107/EC)

Improvement of public awareness



Official web page:

[www.moepp.gov.mk](http://www.moepp.gov.mk)

[www.airquality.moepp.gov.mk](http://www.airquality.moepp.gov.mk)





Thank you for your attention