GREEN DANUBE

Integrated transnational policies and practical solutions for an environmentally-friendly Inland Water Transport system in the Danube region

Work Package 3 – Air emission assessment

(1.01.2017 – 30.08.2018)

Partners involved: CER, DDNI, DCC, ACTEDJ, BDCA, BMA,CRUP, DC, DDBRA, DDNI, DST, MT, OVF, PDM, PLOVPUT, REC

Constanta *23-24 February 2017*

Project co-funded by European Union Funds (ERDF, IPA)

Interreg
EUROPEAN UNION
Danube Transnational Programme
GREEN DANUBE

Act. 3.1 Set up assessment criteria

D.3.1.1 List of the assessment criteria for the selection of critical environmental areas on the Danube river

D 3.1.2 Working methodology for performing the measurements in the selected areas with procedures, required equipment, parameters, data types, existing standards, emission factors etc. for performance the measurements in selected Danube areas

Act. 3.2: Performance measurements of air pollutant emissions in the selected critical environmental areas

D 3.2.1 Report on the results of measurements performed in the selected Danube areas

Act. 3.3: Analyzing, interpreting and reporting of the measurements results

D 3.3.1 Consolidated report summarizing the interpretation of the measurements results and the information regarding the data on the vessel traffic and the pollution caused by the industry and by the other sources from each area.

In order to make improvements in the air quality, the amount of pollutant emissions in the air must be measured, what will be done in Danube selected areas based on a working methodology which will be jointly developed with the involved partners.

The pollutant emissions monitoring will be performed in this WP by collecting samples and measuring air emission main factors in the selected Danube areas in order to determine the level of pollutant emissions generated, mainly, by the operation of inland vessels.

The results of measurements performed will be included in a consolidated report.

The final database will be compared with existing data statistics in the other transport sectors and in the conclusions of the report will be underlined the most vulnerable area with highest level of air pollution and it will be proposed solutions for reduction of air pollutant emissions to be used in subsequent ultimate emission reduction Strategy.

Involved Target Groups and other Stakeholders

- Ministries of Environment and Waters,
- National public authorities and administrations in charge with monitoring environment pollution and water management,
- Danube port administrations,
- National environment guards,
- International organizations as policy decision makers,
- International associations for research and protection of Danube ecosystem.
- (others?)

Project co-funded by European Union Funds (ERDF, IPA)

Act. 3.1 Set up assessment criteria

D.3.1.1 List of the assessment criteria for the selection of critical environmental areas on the Danube river:

- Location(national or border area);
- Intensity of inland navigation vessels traffic;
- Urban or rural crowded areas in the proximity;
- Existence of navigation infrastructure (locks, bridges, port terminals, berthing areas, etc.);
- Designation of the areas as protected/ natural park/national park/natural setting etc.
- Existence of a strong industrial developments and other pollution sources (road transport, railways, etc.) in the proximity and their impact on pollution measurements;

Act. 3.1 Set up assessment criteria (continued)

D.3.1.1 List of the assessment criteria for the selection of critical environmental areas on the Danube river:

- Existence of an intensive agriculture development in the proximity;
- Existence of available statistics according to which human health is in danger;

If tourism is developed in that area

- An inherent ecological, geological or hydrological sensitivity to change that may be adversely affected by any change
- Need for preservation of biodiversity and landscapes

Selection of critical environmental areas

PDM (Austria) partner - proposed to look at areas where vessels movements are more intense, e.g. ports located near to cities, locks etc. and to consider the Clean Power for Transport Package and its objectives on the selection of critical environmental areas. This was also suggested by **DDNI** in the early stages of the development of criteria. A map of traffic intensity along the study area will help the consortium in choosing the right (representative) location for measurements, especially due to the (very) limited number of points.

ACTEDJ (Romania) **and CRUP** (Croatia) agrees with the suggested criteria.

Selection of critical environmental areas - continuation

BDCA (Bulgaria), agrees with suggested criteria and the proposals consist on a draft table with some example of areas places along Bulgarian Sector of the Danube, for common analysis on the selection of critical environmental areas.

REC (Hungary) has the following remarks:
Because the measurements will be performed only at 4 selected locations along the Danube, **we need to be very careful with the development of the selection criteria** and also with the selection, as we will have only these four 'shots';
Measurements make sense basically in two different types of areas:

- **natural, environmentally/ecologically sensitive areas;**
- **urban / industrial areas;**

Selection of critical environmental areas - continuation

REC (continuation)

Based on the previous point it is logical that for the two different types of areas we cannot have the same selection criteria. Instead we **will need two customized sets of criteria.** For instance, in case of urban areas ecological sensitivity is not a relevant criterion. In contrast, in case of a natural area, navigation infrastructure and the level of industrial activity is irrelevant;

It needs to be determined which criteria to be used in which case and how. Are the criteria weighted and if yes how, do we use a point system or a matrix, etc.;

Selection of critical environmental areas - continuation

REC (continuation)

The developed database (under Activity 3.3) will include data on vessel traffic, data on background pollution sources, etc. This means that availability of relevant data will be a key criterion for selection, particularly in case of urban areas, as here the data measured by the project will not mean a lot in the absence of data on emission from other sources (e.g. source apportionment including urban and regional background). In addition, we should take into consideration that data availability will be different in urban and in natural areas;

Given the small number of planned measurement points and the fact that data availability can be a problem, as a first step **REC** propose **to select at least 6-8 locations**, perform an initial analysis of data availability and based on this, reduce the number to the final four locations

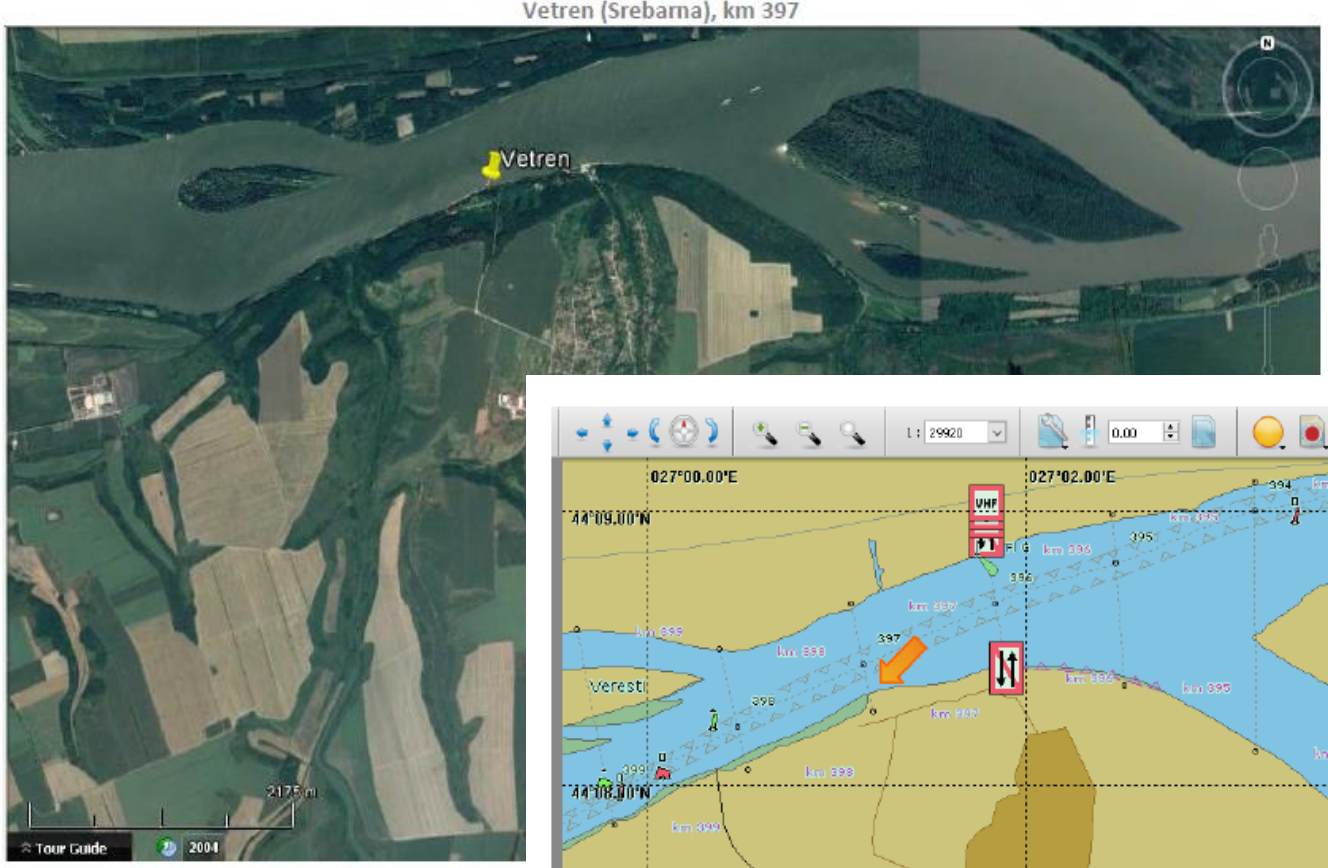
Selection of critical environmental areas - continuation

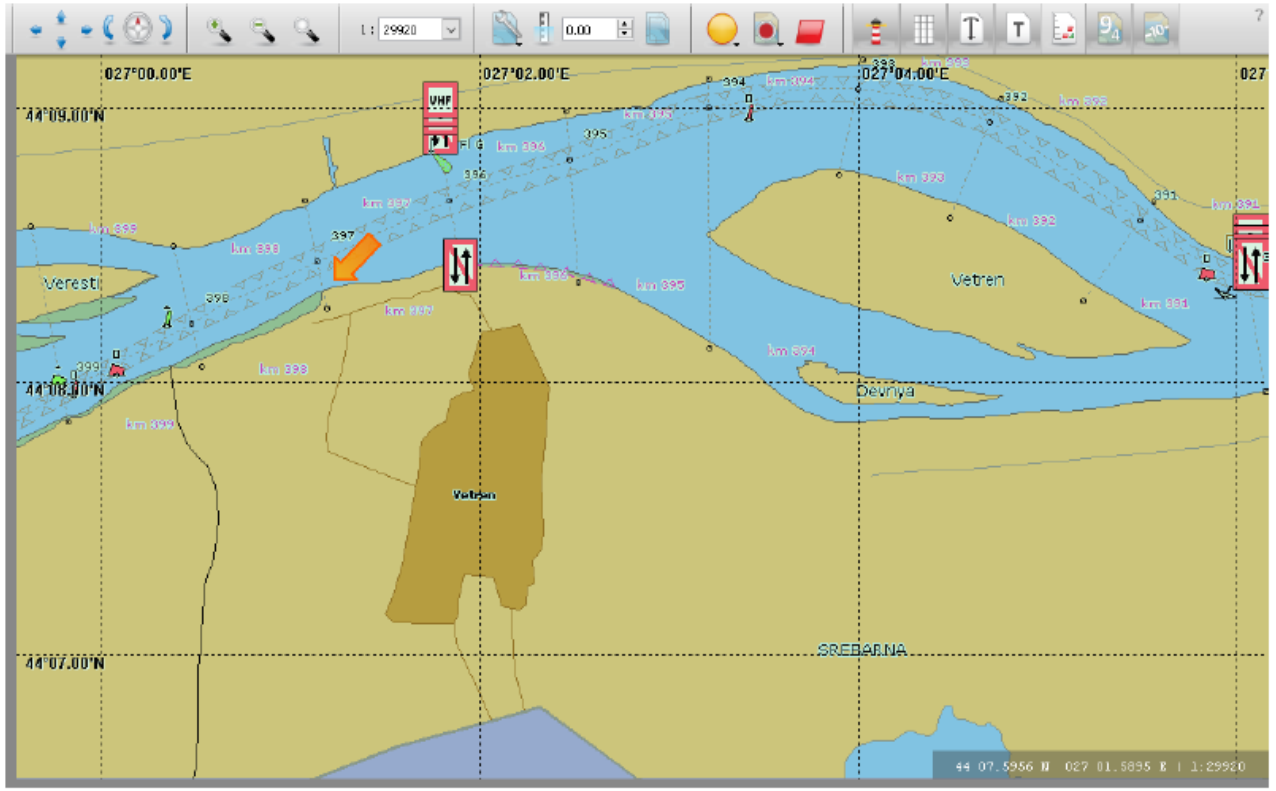
DCC partner (Serbia) considered that 'the natural sensitive area and the criterion for tourism has two sides – one is pollution caused by tourism activities (which is not quite substantive since tourism is not hugely developed) and the other one is that you can better promote destination with clean air especially when we already speak about national parks (IWT pollution there can have not so huge health problem but aesthetically it is not good to see pollution coming from ships when enjoying in the nature.)'

In order to set up the criteria for critical environmental areas along the Danube River, it should be considered, at least one or more of the following reasons:

Example Areas along Bulgarian part of Lower Danube (of which to select one, where to execute air emission survey within Green Danube project)

	Name	Vetren (close to Srebarna Protected Area (Bulgaria)	Kalimok-Brushlen	Persin Island	Nikopol Ferryboat Terminal	River Port of Lom
	Location (km)	km 397	km 454	km 565	km 599	km 741
	General description	In the neighborhood of Srebarna Protected Area (Bulgaria	Protected Area	Part of Persina National Park (Bulgaria), protected area wetland	Ferryboat Terminal	River Port
1.	**Location (national or border area);**	Border area BG-RO	Border area BG-RO	Border area BG-RO	Border area BG-RO	Border area BG-RO
2.	**Intensity of inland navigation vessels traffic;**	High	High	High	High	High
3.	**Urban or rural crowded areas in the proximity;**	village of Vetren, 500 m, Srebarna – 5 km town of Silistra- 16 km	No	town of Belene, 6 km town of Svishtov, 10 km	Yes, town of Nikopol, 1-2 km away	Yes, town of Lom adjacent
4.	**Existence of navigation infrastructure (locks, bridges, port terminals, berthing areas, etc.);**	16 km from port of Silistra	Berths in Tutrakan, 6 km away	Pontone bridge, 20 km from a port	Ferry slip structure	River port
5.	**Designation of the areas as protected/ natural park/national park/natural setting etc.**	In the Neighborhood of a Nature Reserve	Nature Park	Nature Park	No	No
6.	**Existence of a strong industrial developments and other pollution sources (road transport, railways, etc.) in the proximity and their impact on pollution measurements;**	Some roads, low impact on measurements expected	No, low to none impact on measurements	Nuclear Power Plant Belene Project (suspended), low to none impact on measurements	Yes, roads, urban area at 2-3 km, expected medium impact on measurements	Yes, roads, urban area at 2-3 km, expected medium impact on measurements
7.	**Existence of an intensive agriculture development in the proximity;**	Yes, surrounded by arable land	Yes, surrounded by arable land	Yes, partly surrounded by arable lands	Yes	None
8.	**Existence of available statistics, if any, according to which human health is in danger;**	No	No	No	No	No
9.	**If tourism is developed in that area**	No	No (however good potential available)	Partly, good potential available	No	No
10.	**An inherent ecological, geological or hydrological sensitivity to change that may be adversely affected by any change**	Protected species, birds				
11.	**Need for preservation of biodiversity and landscapes**	Yes	Yes	Yes	No extra needs	No extra needs
12.	Access condition (by car, by boat ...), permit required to dispose measurement equipment	Free access, gravel road No permission needed	Free access, gravel road, No permission needed	Free access, gravel road No permission needed	Asphalt road, Permission needed (but easy to get one),	Asphalt road, Permission needed (but easy to get one)



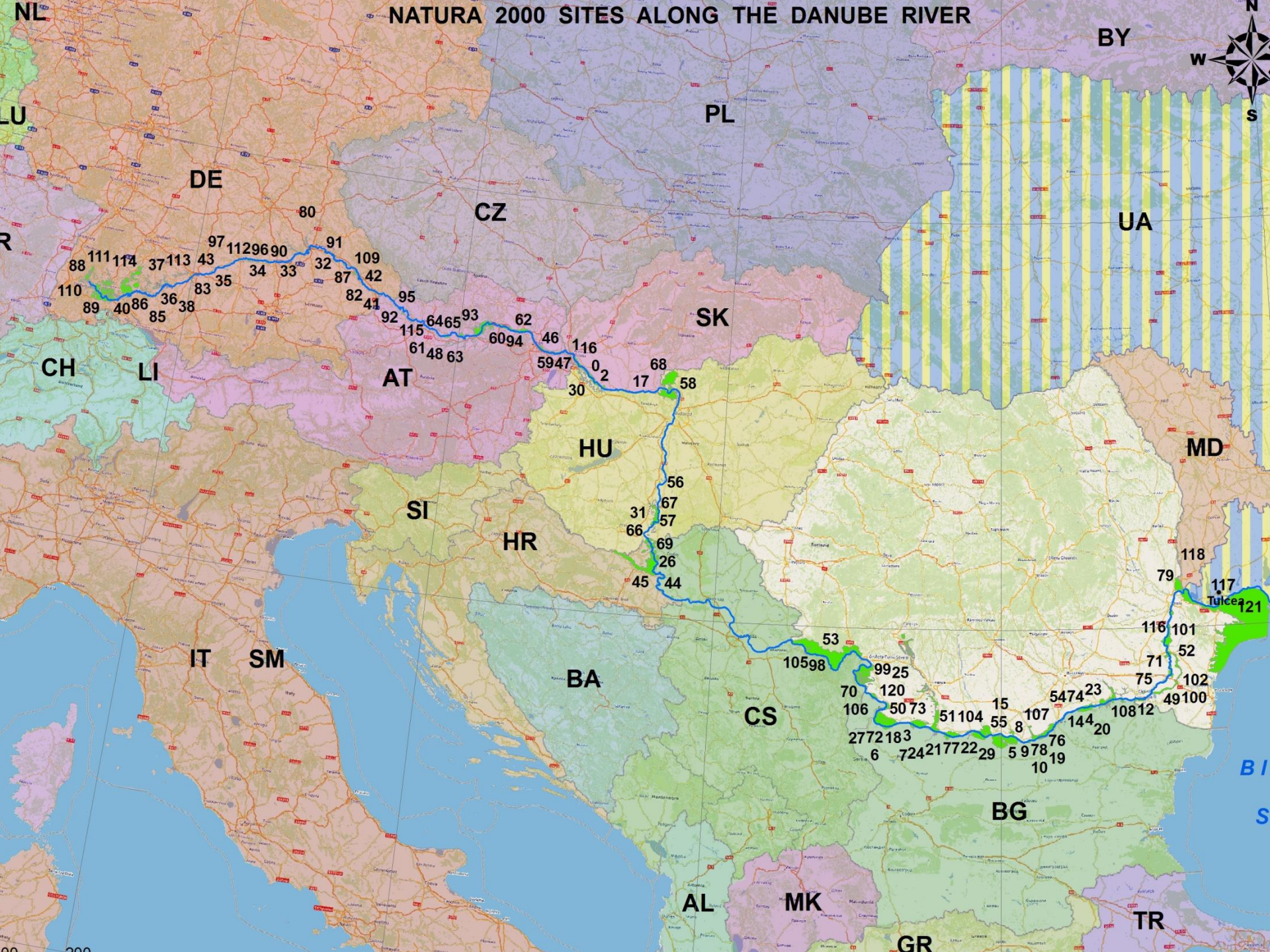


Interreg
Danube Transnational Programme
GREEN DANUBE

Project co-funded by European Union Funds (ERDF, IPA)

Interreg
EUROPEAN UNION
Danube Transnational Programme
GREEN DANUBE

Project co-funded by European Union Funds (ERDF, IPA)


NATURA 2000 SITES ALONG THE DANUBE RIVER
NL
LU
DE
CZ
PL
BY
UA
SK
AT
CH
LI
HU
MD
SI
HR
IT
SM
BA
CS
AL
MK
BG
GR
TR
Tulcea
N
W
S


MAIN PORTS ALONG THE DANUBE RIVER
AND TONS TRANSPORTED
N
W
E
S
15°0'0"E
20°0'0"E
25°0'0"E
30°0'0"E
50°0'0"N
45°0'0"N
Regensburg
Linz
Vienna
Bratislava
Budapest
Dunaújváros
Novi Sad
Pančevo
Belgrade
Smederevo
Prahovo
Vidin
Oriahovo
Svishtov
Ruse
Reni
Kilia
Galati
Izmail
Braila
Tulcea
Sulina
Black
Sea
Legend
Thousands tons / year
>1
1 - 1372
1373 - 1793
1794 - 3021
3022 - 4335
Danube River
0
100
200
Km
Source: Catchment Characterisation and Modelling 2 (CCM2) (Environment European Agency)
Background source: Open Street Map
OSM-WMS Univ. Heidelberg
Geographical coordinates system

A preliminary list of areas might be:

•Maritime Danube (and this would need to consider two routes of entry of ships, namely the Sulina channel and Bastroe and agglomeration of ships in major ports for loading and unloading), including a potential reference area, with very low pollution such as St. Gheorghe;

•One of the islands in the lower Danube area, perhaps islands near Danube-Black Sea Chanel to capture the contribution of traffic on this channel;

•Oriahovo-Vidin area;

•A particular area, perhaps that one suggested by CERONAV upstream, on the border with Serbia (National park).

•The Regensburg-Linz region, with the largest volume trafficked.

Other areas that will arise from consultations between partners taking into account the measurements duration and budget.

CONCLUSIONS and DISCUTION

This exercise is extremely useful for two reasons: first for testing the proposed criteria in practice and second for giving preliminary results (locations) to be considered in the decision making process. The exercise may result in overlapping sampling points proposed by different partners, giving the indication that specific point meets the criteria from more than one partner's point of view.

Act. 3.1 Set up assessment criteria for selection the critical environmental areas on the Danube River

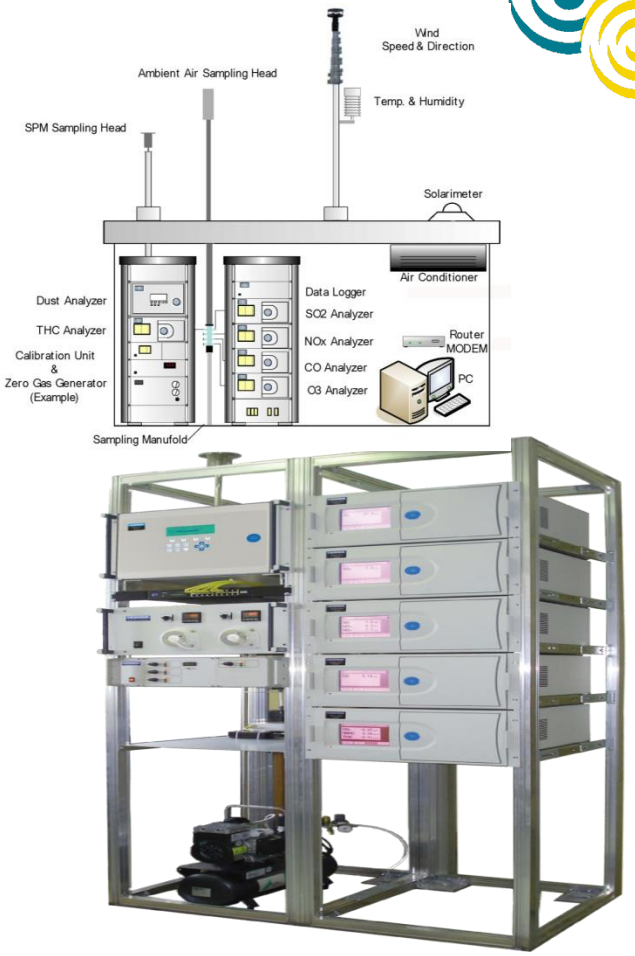
D.3.1.1 List of the assessment criteria for the selection of critical environmental areas on the Danube river

D 3.1.2 Working methodology for performing the measurements in the selected areas with procedures, required equipment, parameters, data types, existing standards, emission factors etc. for performance the measurements in selected Danube areas.

EQUIPMENT and DATA TYPES

Main Air Pollution Parameters: according to ISO 17025 standard

- CO (Carbon monoxide)
- NOx (Oxides of nitrogen)
- PM (Particulate matter, PM10, PM2.5)
- SO_2 (Sulphur dioxide)
- CO_2 (Dioxide carbon).
- Others (?)
- Sensors for Meteorology



Project co-funded by European Union Funds (ERDF, IPA)

Main Air Pollution Parameters: according to ISO 17025 standard

- CO (Carbon monoxide) limit detection 2 ppb
- NOx (Oxides of nitrogen) limit detection 0,5 ppb
- PM (Particulate matter, PM10, PM2.5) limit detection 0,001 mg/m^3
- SO_2 (Sulphur dioxide) limit detection 1 ppb
- CO_2 (Dioxide carbon)
- Others (?)
- Sensors for Meteorology

Interreg
EUROPEAN UNION
Danube Transnational Programme
GREEN DANUBE

Project co-funded by European Union Funds (ERDF, IPA)

Existing standards

Analyzer	European Norm	US-EPA Designation
APNA-370 NO_x	EN14211 August 2006	RFNA-0506-157 May 2006
APSA-370 SO_2	EN14212 August 2006	EQSA-0506-159 May 2006
APMA-370 CO	EN14626 February 2006	RFCA-0506-158 May 2006
APDA-371/372	EN12341 for PM10 EN14907 for PM2,5	

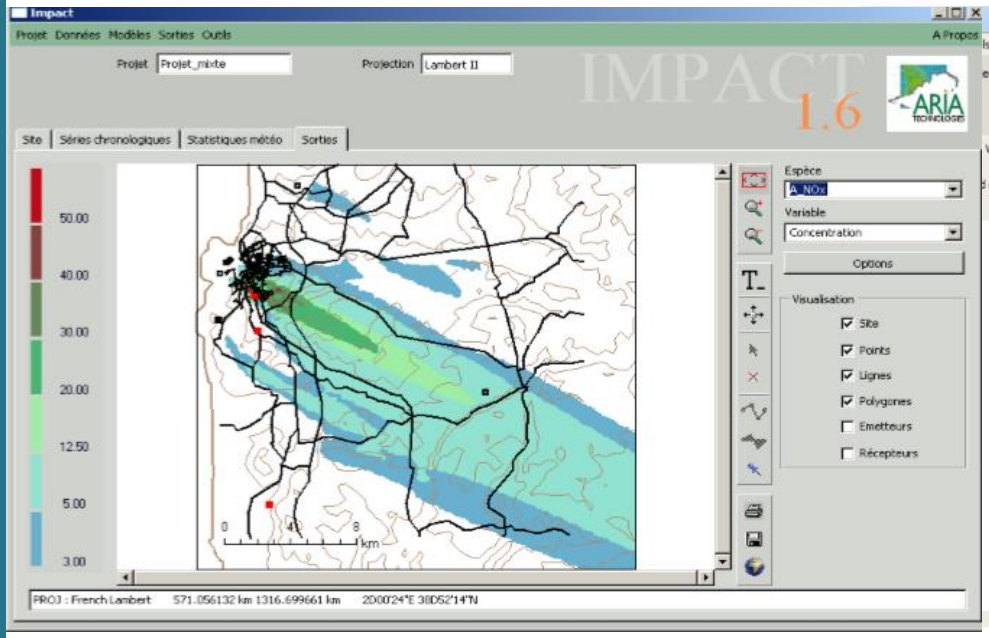
AP-370 Series are in compliance with European and US Regulations

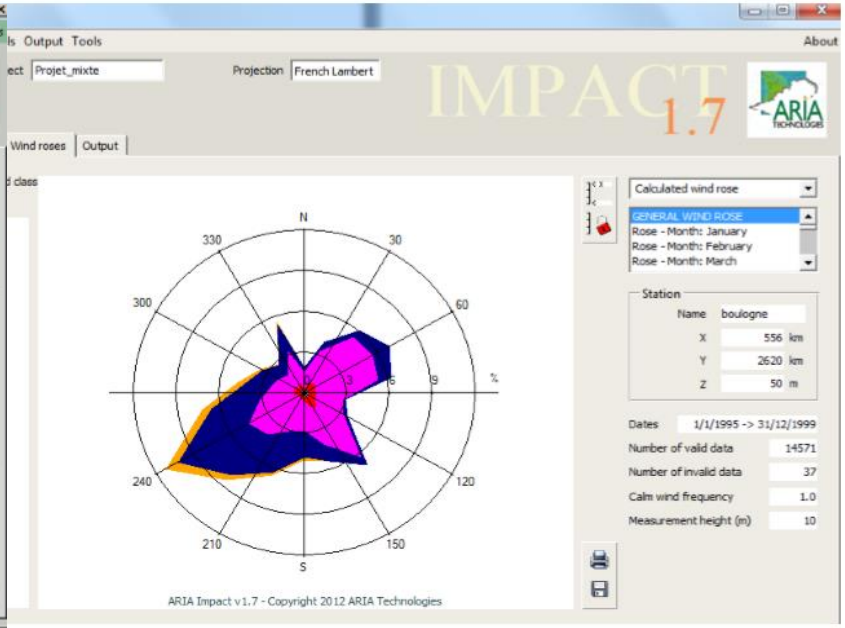
Interreg
Danube Transnational Programme
GREEN DANUBE
Project co-funded by European Union Funds (ERDF, IPA)

Data transfer

A data acquisition system stores data, calculates defined averages, controls the quality assurance and prepares alarm messages. Data transfer itself happens via modem or network

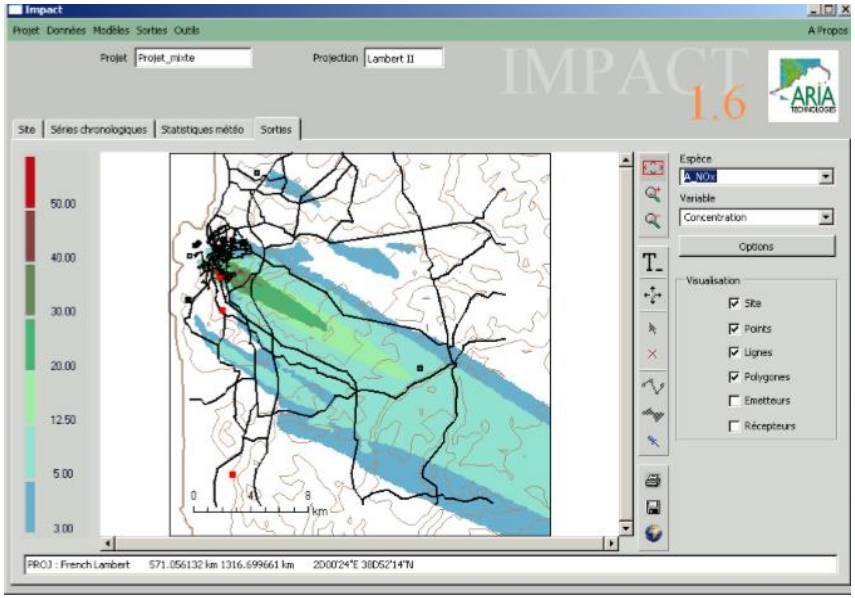
Modeling data using data soft

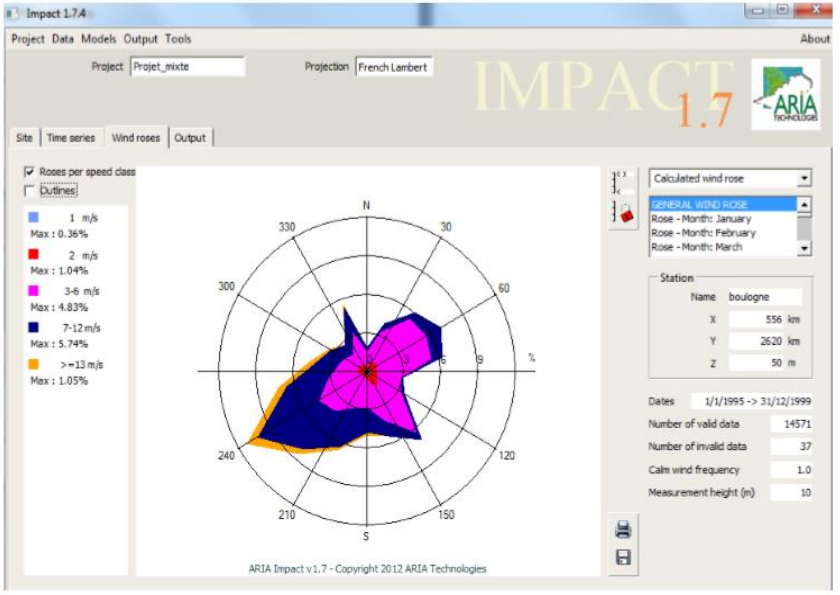




Project co-funded by European Union Funds (ERDF, IPA)

Modelling data





Version 1.6	Version 1.6

AP-370 Series Features (1)

- Approval according new EN standards + Approval acc. EN 15267
- Optimized components for low maintenance costs and long service intervals
- Low weight for easy handling, sample pump included
- Compensation of ambient temperature and pressure
- Optional modules for built-in zero/span check
- Automatic calibration sequence

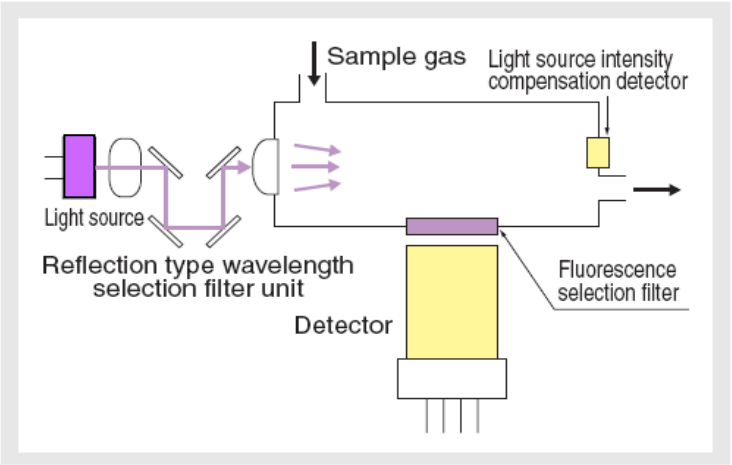
Interreg
Danube Transnational Programme
GREEN DANUBE

Project co-funded by European Union Funds (ERDF, IPA)

AP-370 Series Features (2)

- Easy to use Touch Screen Display
- User access password protected
- High connectivity (Ethernet, serial or analog)
- Storage of different average values, calibration history and alarm history
- CF data card slot for data back-up and memory extension
- Remote diagnostics and operation with included software

APSA-370 SO2 (Sulphur dioxide) Analyser



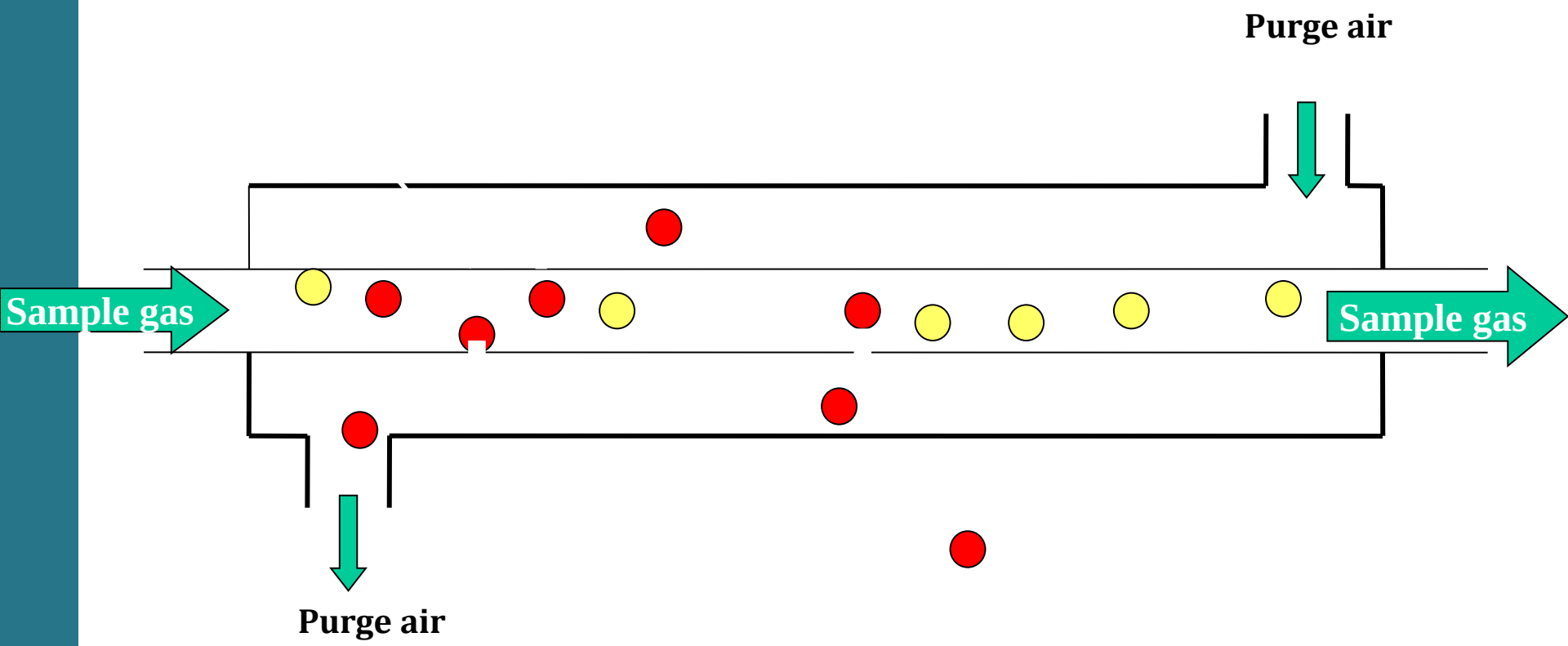
Method: ultraviolet flourescence

- Xenon flash light ➔ no moving parts
- Mirror unit instead of optical filter better optical transmittance
- HC cutter to reduce background noise
- Critical orifice

Project co-funded by European Union Funds (ERDF, IPA)

APSA-370 HC Cutter

Avoids interference of HC in sample gas



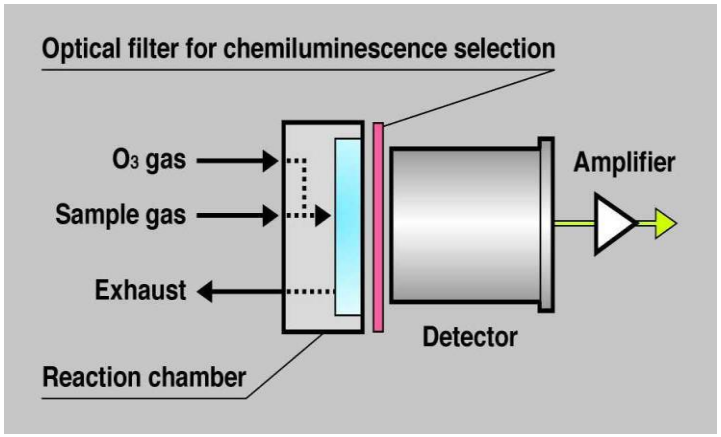
Interreg
Danube Transnational Programme
GREEN DANUBE
Project co-funded by European Union Funds (ERDF, IPA)

APSA 370 Specifications

Range	**0-0.05/0.1/0.2/0.5 ppm (Optional ranges available)**
Principle	**UV fluorescence method**
L.D.L	**0.5 ppb (3 sigma)**
Input/output	**momentary value, integrated or moving average value, contact for input/output, RS-232C,TCP/IP, CF**

* ***Low background realized with unique optical system. Achieved long-term stability and high sensitivity***
* ***Possible to remove interference of toluene in air by utilization of a HC cutter***

APNA-370 NOx Analyser



Method: chemiluminescence

- Cross flow modulation ➔ no drift
- Continous measurement of NO, NO2 and NOx
- Automatic regeneration of silicagel with 2 drying coloumns
- Photodiode instead of Photomultiplier

$$NO + O_3 \rightarrow NO_2^* + O_2$$

$$NO_2^* \rightarrow NO_2 + hv$$

Interreg
Danube Transnational Programme
GREEN DANUBE

Project co-funded by European Union Funds (ERDF, IPA)

APNA-370 NOx Analyser

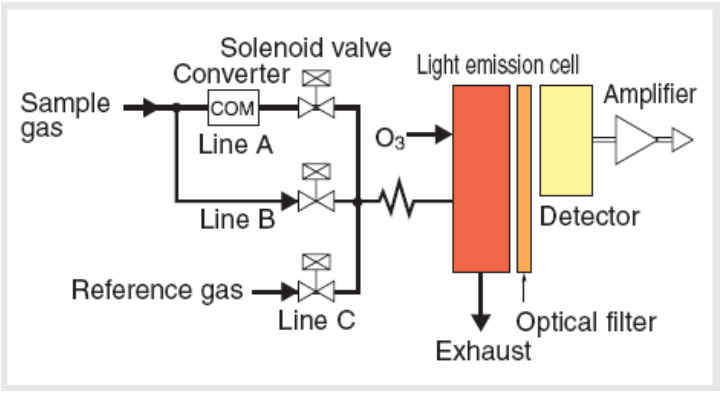
APNA 370 Sample lines

Line A : NO2 converts into NO
measured value : NOx (NO + NO2)

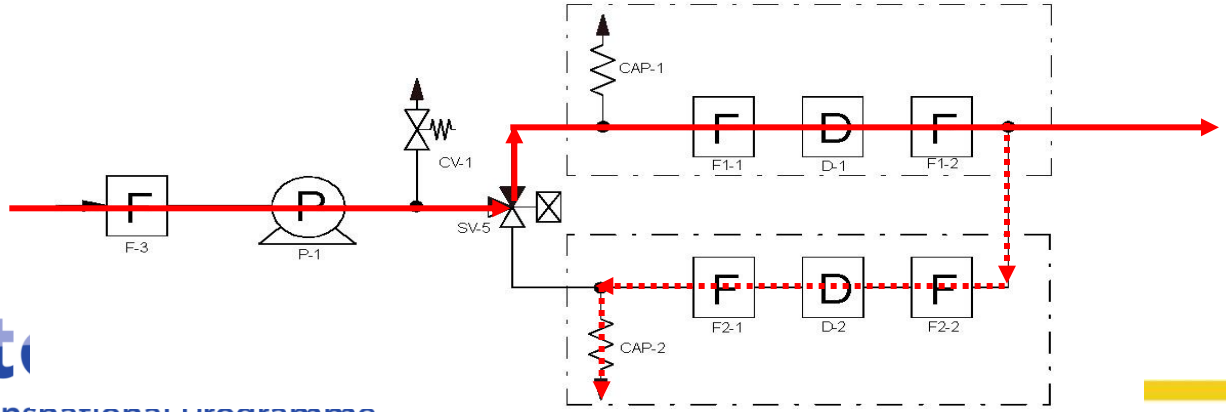
Line B : NO

Line C : Reference Line

(NO2 = NOx – NO .....calculated value)



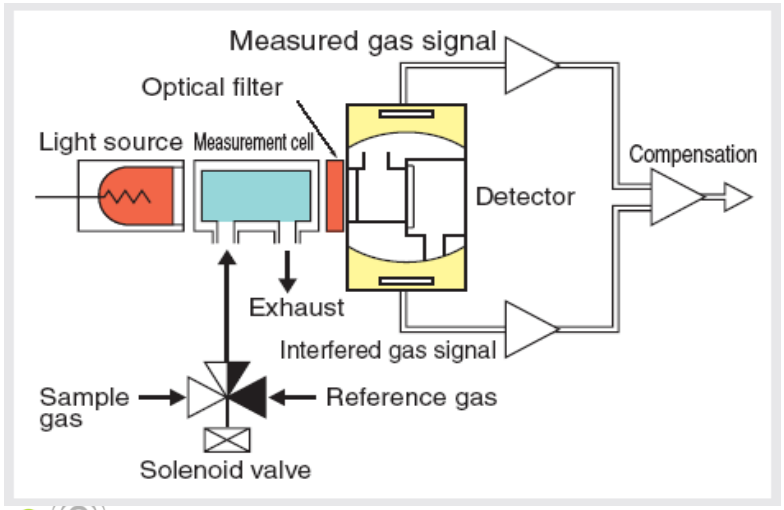
Automatic regeneration of silicagel



APNA-370 NOx Specifications

- **Range** **0-0.1/0.2/0.5/1 ppm (Optional ranges available)**
- **Principle** **Cross flow modulation type, reduced pressure chemiluminescence**
- **L.D.L** **0.5ppb (3 sigma)**
- **Input/output** **Momentary value, integrated or moving average value, contact input/output, RS-232C TCP/IP, CF**
- **Long-term stability with unique cross flow modulation method**

APMA-370 CO Analyser



Method: non-dispersive infrared absorption

- **Cross flow modulation ➔ no drift**
- **Critical orifice**
- **Interference compensation detector ➔ no influence of moisture**

Interreg
Danube Transnational Programme
GREEN DANUBE
EUROPEAN UNION

Project co-funded by European Union Funds (ERDF, IPA)

Complete Integrated Systems include:

Analysers

Air Conditioned Shelter or Mobile Trailer

Sampling Systems for gas and dust

Function Control Unit or

Multipoint Calibration Unit for Laboratory

Zero Gas Generator

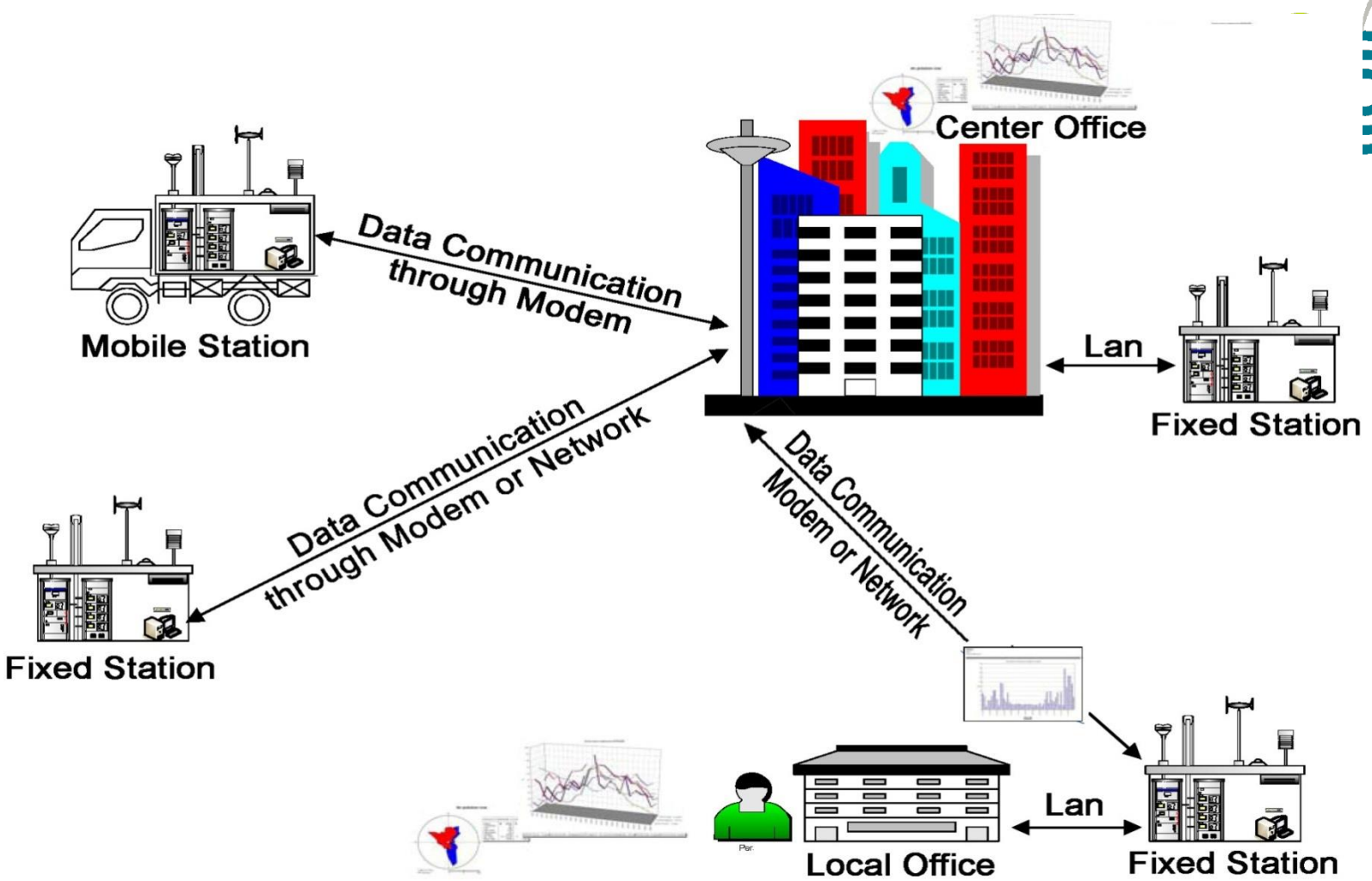
Data Acquisition and Data Transfer

Meteorology Equipment…

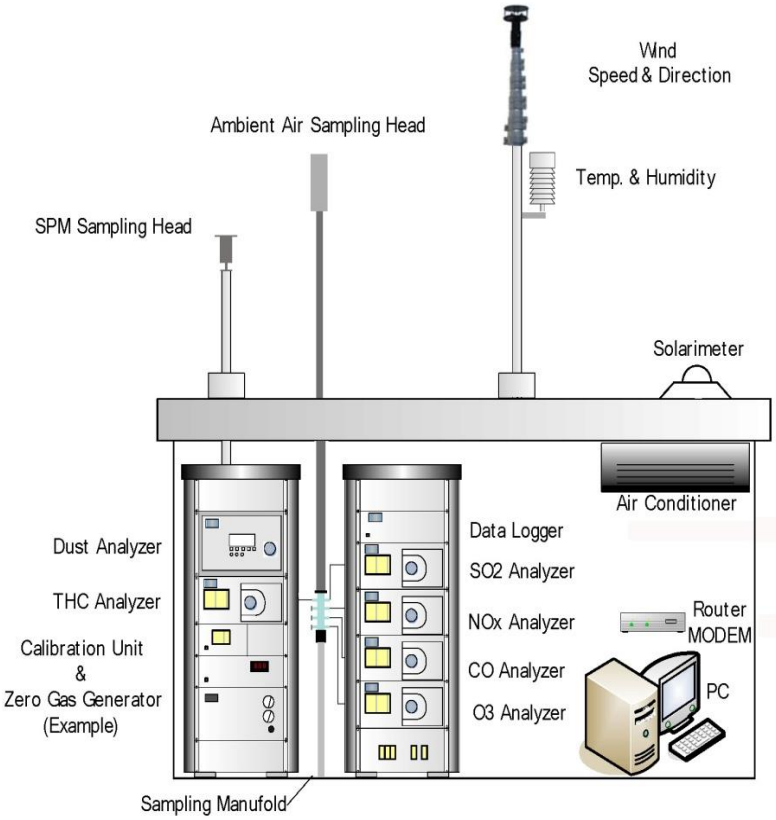
Interreg
EUROPEAN UNION
Danube Transnational Programme
GREEN DANUBE

Project co-funded by European Union Funds (ERDF, IPA)

Total Solution



Application examples



Interreg
EUROPEAN UNION
Danube Transnational Programme
GREEN DANUBE

Project co-funded by European Union Funds (ERDF, IPA)

APDA-371 PM Monitor

- Frequent filter changes (1h) to avoid Memory effects from Humidity
- Frequent filter changes (1h) to avoid Memory effects from volatiles
- Reduced gap between detector and source
- Intelligent heated sampling system
- Flow control acc. real ambient conditions
- Automatic Zero and Span check - not necessary to calibrate the unit in the field

Meteorological Sensors

Wind Sensors



Humidity and Temperature Measurement

Pressure Sensor

Star Pyranometer
for global radiation

UV-AB Sensor
UV-B Sensor


Mast
for fixed or mobile installation


Rain Rauge

Radiometer
Measurement of Radiation Balance

Interreg
Danube Transnational Programme
GREEN DANUBE

Project co-funded by European Union Funds (ERDF, IPA)

Procedures/protocols

1. Location(where)
2. Timing(when) – Campaign 1, 2, 3
3. Team(who will participate)
4. Transport(on the ground and on the water)
5. Protocols
6. Budget

Interreg

EUROPEAN UNION

Danube Transnational Programme

GREEN DANUBE

Iuliana-Mihaela Tudor, Adrian Burada
DDNI
Email mihaela.tudor@ddni.ro
Phone +40741084991

Project co-funded by the European Union Funds (ERDF, IPA)