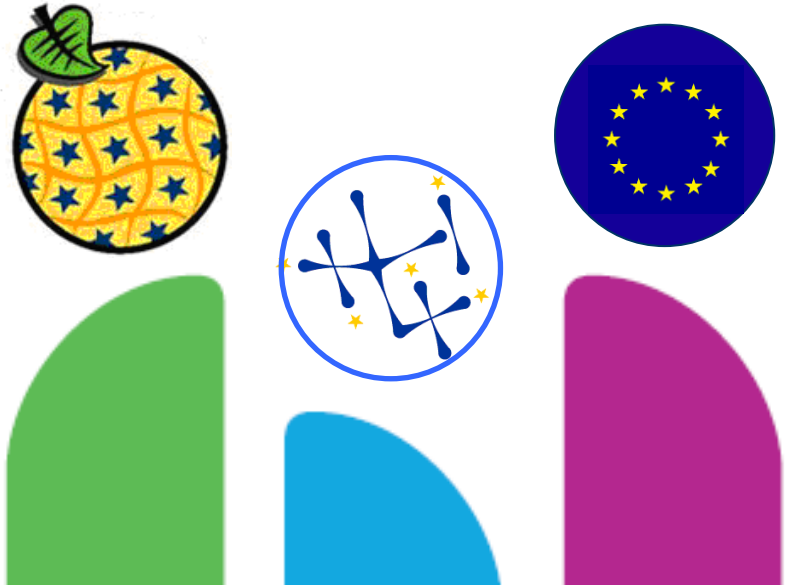
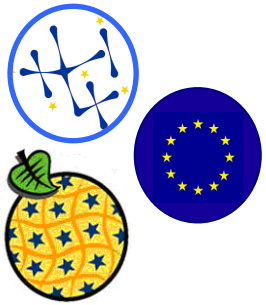
# *BENEFITS* OF AN EUROPEAN AIR QUALITY DATA MODEL FOR CAFE REPORTING AND DATA EXCHANGE (Directives 2008/50/EC and 2007/02/EC)

*ana.grossinho@mouchel.com*



25th June 2010
INSPIRE CONFERENCE 2010
Krakow, Poland



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Snowflake software

NovaTel Systems

Intelligent Application Solutions

SHMU

**AIR QUALITY/INSPIRE/SEIS EXPERTISE**

Team Leader

Ana Grossinho

**INSPIRE/SEIS**

Tools & Applications

Debbie Wilson

**SOFTWARE DEVELOPMENT/INSPIRE**

Project Manager

Ian Gray

**LMO**

Reporting & Data Exchange

Lubor Kozakovic

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Road Map

1

2

3

4

5

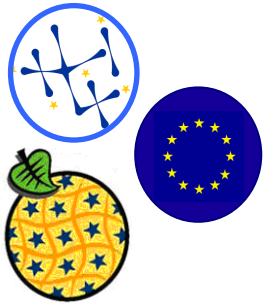
6

7

8

9

- What for Who – the project & stakeholders
- Why – CAFE and INSPIRE Directives
- How – Work Packages and Deliverables
- Evaluation and benefits identified
- Conclusions
- Recommendations



JRC
EUROPEAN COMMISSION

"Development and demonstration of technical IT solutions linking INSPIRE services to the reporting and data exchange requirements of the proposed CAFE Directive"

Slovakia

Poland

UK

Austria

EEA

Environment
EUROPA > European Commission > Environment

EU27

**DIRECTIVE 2008/50/EC on ambient air quality and cleaner air for Europe**

**EC DGENV Data Exchange Group** → **Drafting Implementing Provisions**

- **Art 26 Public Information**
- **Art 27 Reporting**
- **Streamlines Decision 97/101/EC Exchange of Information**

**Need to prototype and share experiences of 4 Member States**

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Road Map

The Project & Stakeholders

CAFE and INSPIRE

3

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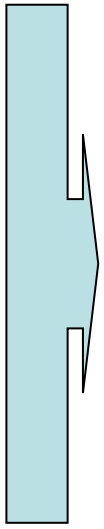
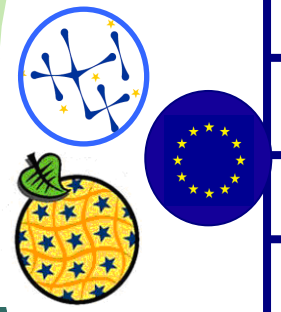
IPs



## Art. 26 Public Information

*Member States shall ensure that the public as well as appropriate organisations such as environmental organisations, consumer organisations, organisations representing the interests of sensitive populations, other relevant health-care bodies and the relevant industrial federations are informed, adequately and in good time, of ambient air quality in accordance with Annex XVI.*

*The information shall be made available free of charge by means of any easily accessible media including the Internet or any other appropriate means of telecommunication, and shall take into account the provisions laid down in Directive 2007/2/EC.*



| WP | Deliverable |
|---|---|
| M.1 | Kick-off meeting |
| D.2.1.1.1 | INSPIRE compliant metadata for air quality |
| D.1.1 | Report on the implementation of reporting & data exchange |
| D.2.1 | Report on the architecture of the prototype |
| D.2.1.2.1 | Technical specifications of the CAFE/European data model for air quality data |
| ITR.1 | Interim Technical Report |
| D.2.1.2.2 | Transformed data for viewing through the INSPIRE geoportal |
| D.2.1.2.3 | Technical report on the methodology of the transformation |
| D.2.1.3.1 | Download Service |
| D.2.2 | Fully functional and accessible prototype |
| D.2.3 | Demonstration Report |
| D.2.4 | Report on the conformity of the reporting |
| D.1.2 | Report on the integration of INSPIRE services |
| WSP.1 | Workshop |
| FTR.1 | Final Technical Report |

# D.2.1.1.1

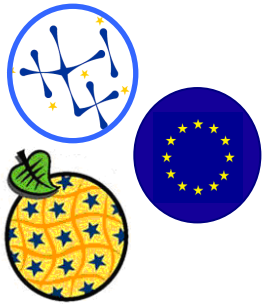
## Defining common CAFE metadata across the 4 LOTS

## USE CASE Definition

### USE CASE 1
**Reporting purposes assessing compliance Q461**

### USE CASE 2
**Exchange of Information (EoI) and wider data sharing**

### USE CASE 3
**Development of AQ policies**



**USE CASE 1** – Reporting purposes – assessing compliance. User Requirements:

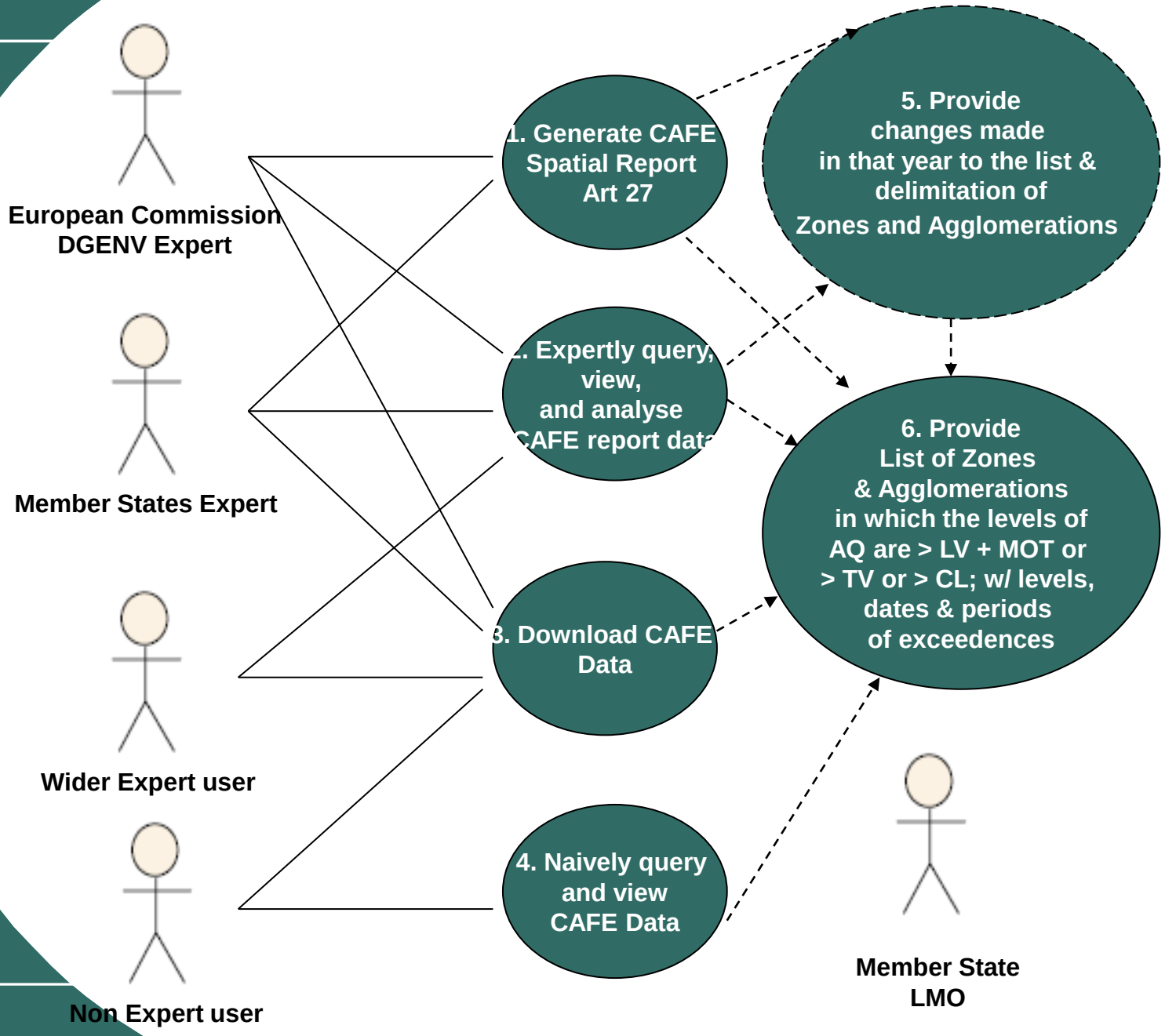
i. Questionnaire contents;

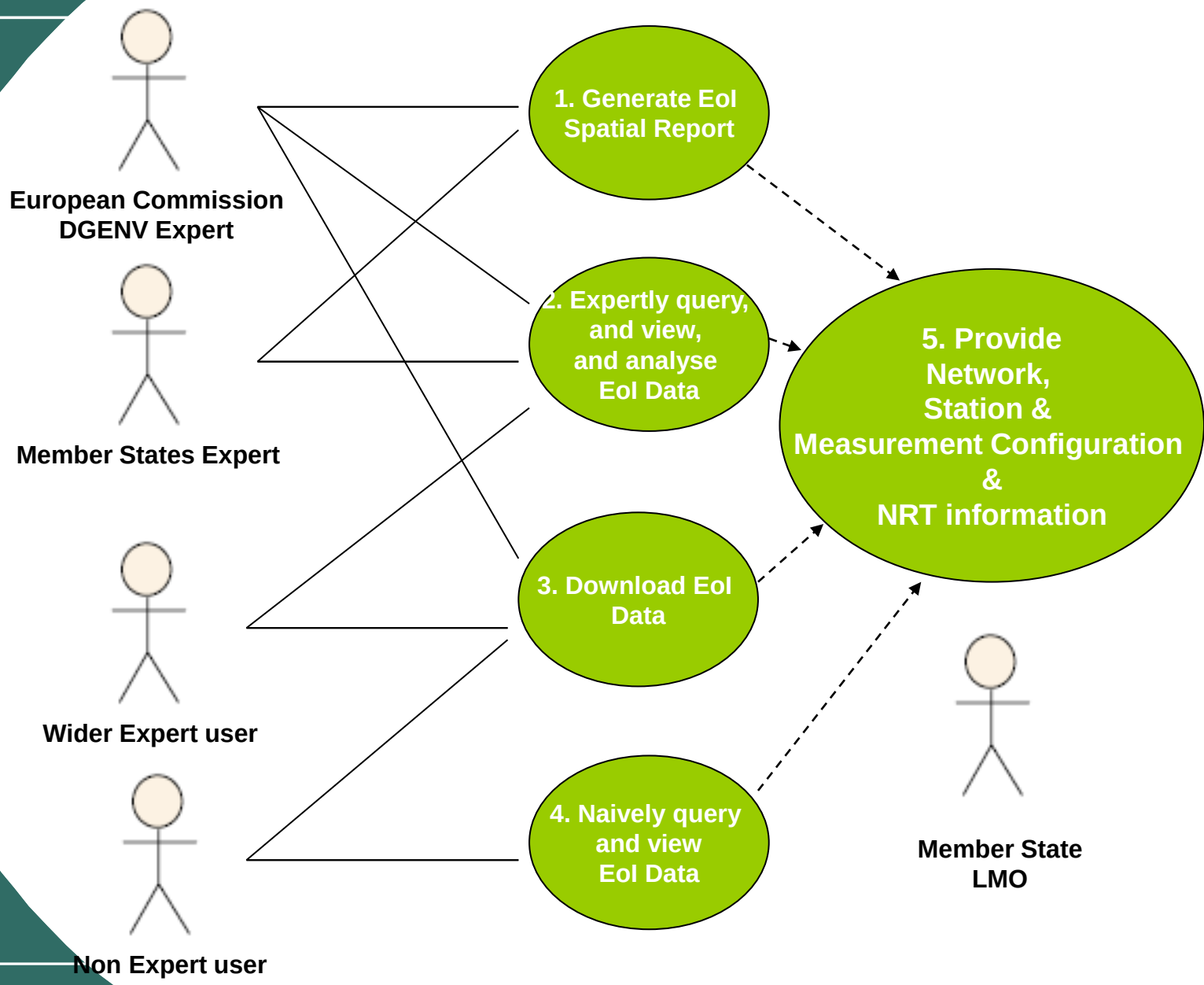
**USE CASE 2** – Exchange of Information (EoI) and wider data sharing – exchange of air quality information (networks, monitoring stations and associated data) between Member States and wider CAFE data dissemination. User Requirements:

i. DEM inputs;
ii. Exchange of Information Decision;
iii. Airbase;
iv. NGOs and Public Information;
v. Trend analysis;
vi. Epidemiological studies;
vii. Research;
viii. Information to the public (Developing Alert and Public Information Systems, OzoneWeb);

**USE CASE 3** –.Development of AQ policies at the Community and MS levels. User Requirements:

i. EC policy delineation;
ii. EC checking (Monitoring the Effectiveness of Control Measures);
iii. Developing Air Quality Action Plans (Implementing Control Measures);
iv. Monitoring of Plans and Programs and Time extensions;
v. Member State policy delineation;
vi. Member State checking (Monitoring the Effectiveness of Control Measures);
vii. Further NGOs and Public Information.


European Commission DGENV Expert
Member States Expert
Wider Expert user
Non Expert user
1. Generate CAFE Spatial Report Art 27
2. Expertly query, view, and analyse CAFE report data
3. Download CAFE Data
4. Naively query and view CAFE Data
5. Provide changes made in that year to the list & delimitation of Zones and Agglomerations
6. Provide List of Zones & Agglomerations in which the levels of AQ are > LV + MOT or > TV or > CL; w/ levels, dates & periods of exceedences
Member State LMO


European Commission
DGENV Expert
Member States Expert
Wider Expert user
Non Expert user
1. Generate EoI Spatial Report
2. Expertly query, and view, and analyse EoI Data
3. Download EoI Data
4. Naively query and view EoI Data
5. Provide Network, Station & Measurement Configuration & NRT information
Member State LMO

# Defining common CAFE metadata across the 4 LOTS

- A total of 40 metadata elements were proposed;
- with 31 being mandatory;
- a suggested Keyword list was offered; and
- a CAFE dictionary development by EEA was proposed.

PROPOSED

HARMONIZED METADATA SPECIFICATION PROFILE FOR REPORTING 2008/50/EC UNDER 2007/2/EC

BY THE 4 LOTS

NovaTel Systems
mouchel
LOT 1
AEA
LOT 3
INTERGRAPH
LOT 2
umweltbundesamt
LOT 4

# D.1.1

**AS IS ANALYSIS**
**Workflows and Dataflows**
**For current procedures**

**GAPS identified**

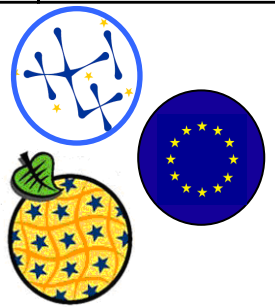
**Creation of**
**A UNIFIED Air Quality Database**

**Creating Programs to calculate**
**Metrics required**
**(e.g. annual Mean, hourly mean)**

**Flagging Data for QUALITY**
**and FITNESS of purpose**

# EXAMPLES OF CURRENT REPORTING PROCEDURES

| Full zone name | BRATISLAVA | Bratislavský kraj | KOŠICE | Košický kraj | Trnavský kraj | Banskobystrický kraj |
|---|---|---|---|---|---|---|
| Zone code | *SKBA01.1* | *SKBA02* | *SKKO01.1* | *SKKO02* | *SKTN01* | *SKBB01* |
| Pollutant(s), possibly separate protection targets, to which the zone applies | A | SNPBC | SNPBC | SNPBC | SNPBC | SNPBC |
| Type [ag/nonag] | ag | nonag | ag | nonag | nonag | nonag |
| *Area ($km^2$)* | 368 | 1685 | 245 | 6508 | 4148 | 9455 |
| *Population* | 426,927 | 183,923 | 234,237 | 539,866 | 557,151 | 654,668 |
| *Border coordinate pairs* | +170821+480832 | +170849+481816 | +211351+484013 | +211620+484112 | +173744+482208 | +192342+483149 |
| *Border coordinate pairs* | +170800+481413 | +165420+483030 | +211022+484122 | +201528+485007 | +172246+484636 | +195652+485202 |
| *Border coordinate pairs* | +170748+481353 | +165527+483034 | +211009+484128 | +201601+485000 | +172255+484622 | +195709+485148 |
| … | +170748+481353 | +165549+483032 | +210948+484129 | +201636+485012 | +172226+484548 | +200007+485150 |
| … | +170820+481357 | +165549+483105 | +210949+484142 | +201639+485045 | +172226+484529 | +200112+485138 |
| … | +170835+481341 | +165624+483105 | +211010+484153 | +201709+485108 | +172204+484528 | +200249+485136 |
| … | +170900+481339 | +170000+483126 | +211002+484202 | +201656+485117 | +172146+484517 | +200325+485124 |
| … | +170927+481401 | +170006+483201 | +210945+484157 | +201706+485121 | +172044+484450 | +200351+485125 |
| … | +170950+481334 | +170036+483156 | +210933+484206 | +201707+485135 | +172030+484449 | +200410+485131 |
| … | +171036+481322 | +170216+483205 | +210917+484227 | +201742+485202 | +172022+484435 | +200521+485124 |
| … | +171249+481210 | +170328+483200 | +210829+484300 | +201843+485151 | +172036+484426 | +200911+485102 |
| … | +171318+481141 | +170315+483210 | +210818+484304 | +201845+485157 | +172052+484431 | +201012+485204 |
| … | +171318+481141 | +170311+483228 | +210804+484320 | +201914+485214 | +172117+484411 | +201047+485137 |
| … | +171340+481123 | +170455+483212 | +210724+484326 | +201936+485232 | +172151+484419 | +201144+485119 |
| … | +171312+481121 | +170523+483214 | +210657+484344 | +201945+485253 | +172212+484413 | +201218+485120 |
| … | +171310+481112 | +170604+483230 | +210718+484356 | +201915+485327 | +172224+484414 | +201247+485111 |
| … | +171248+481107 | +170618+483226 | +210711+484443 | +201842+485337 | +172304+484434 | +201326+485048 |
| … | +171248+481107 | +170634+483216 | +210719+484451 | +201804+485325 | +172306+484443 | +201424+485040 |
| | +171256+481041 | +170657+483135 | +210740+484454 | +201739+485336 | +172335+484507 | +201528+485007 |

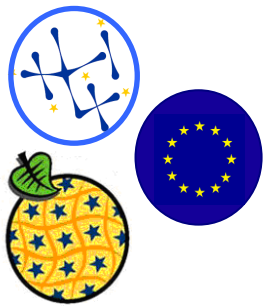


# EXAMPLES OF CURRENT REPORTING PROCEDURES

**Form 11 Individual exceedences of limit values and limit values plus margin of tolerance (MOT) (96/62/EC Article 11(1) (a) (i) and (ii), 1999/30/EC Annexes I, II, IV and V and 2000/69/EC Annexes I and II)**

**- Form 11h Exceedence of $PM_{10}$ limit value plus MOT (stage 1; 24hr mean)**

| Zone code | *EoI station code* | Month | Day of month | Level ($\mu g/m^3$) | Reason code(s) |
|---|---|---|---|---|---|
| SKBA01.1 | SK0004A | 1 | 17 | 74 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 1 | 10 | 69 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 2 | 21 | 69 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 2 | 22 | 62 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 2 | 20 | 59 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 12 | 26 | 58 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 12 | 18 | 57 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 1 | 18 | 56 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 12 | 1 | 55 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 10 | 17 | 55 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 12 | 6 | 55 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 12 | 21 | 55 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 12 | 31 | 54 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 11 | 18 | 54 | S1, S10, S9 |
| SKBA01.1 | SK0004A | 12 | 19 | 53 | S1, S10, S9 |



D.2.1.2.1

# CAFE/European data model for air quality data

Definition based on use cases

Definition based on types of data

# CAFE INSPIRE Data Model (27 MS)

collection of spatial data sets sharing the same CAFE product specification

**LMOs/ Responsible entities**

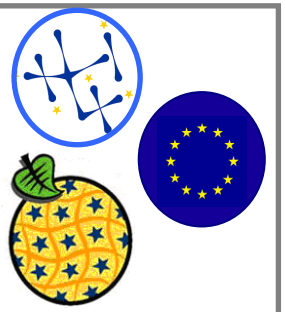
**Zones and Agglomerations**

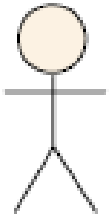
**Monitoring Facilities**

**Observation datasets**

**Assessment datasets**

uc Zones & Agglomerations



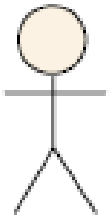


Member State
LMO

Checks Z&A changes

Have they Changed?

YES

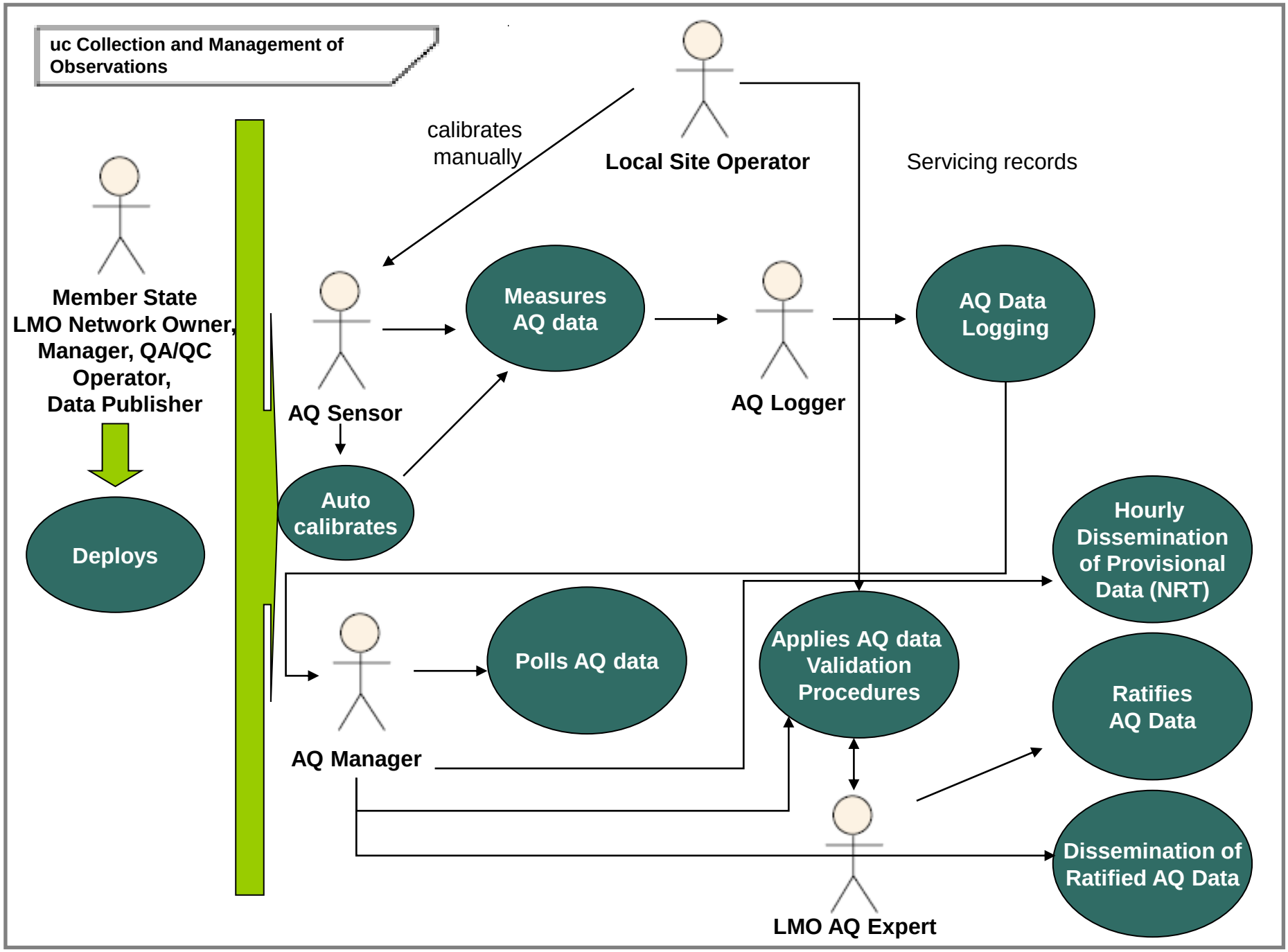


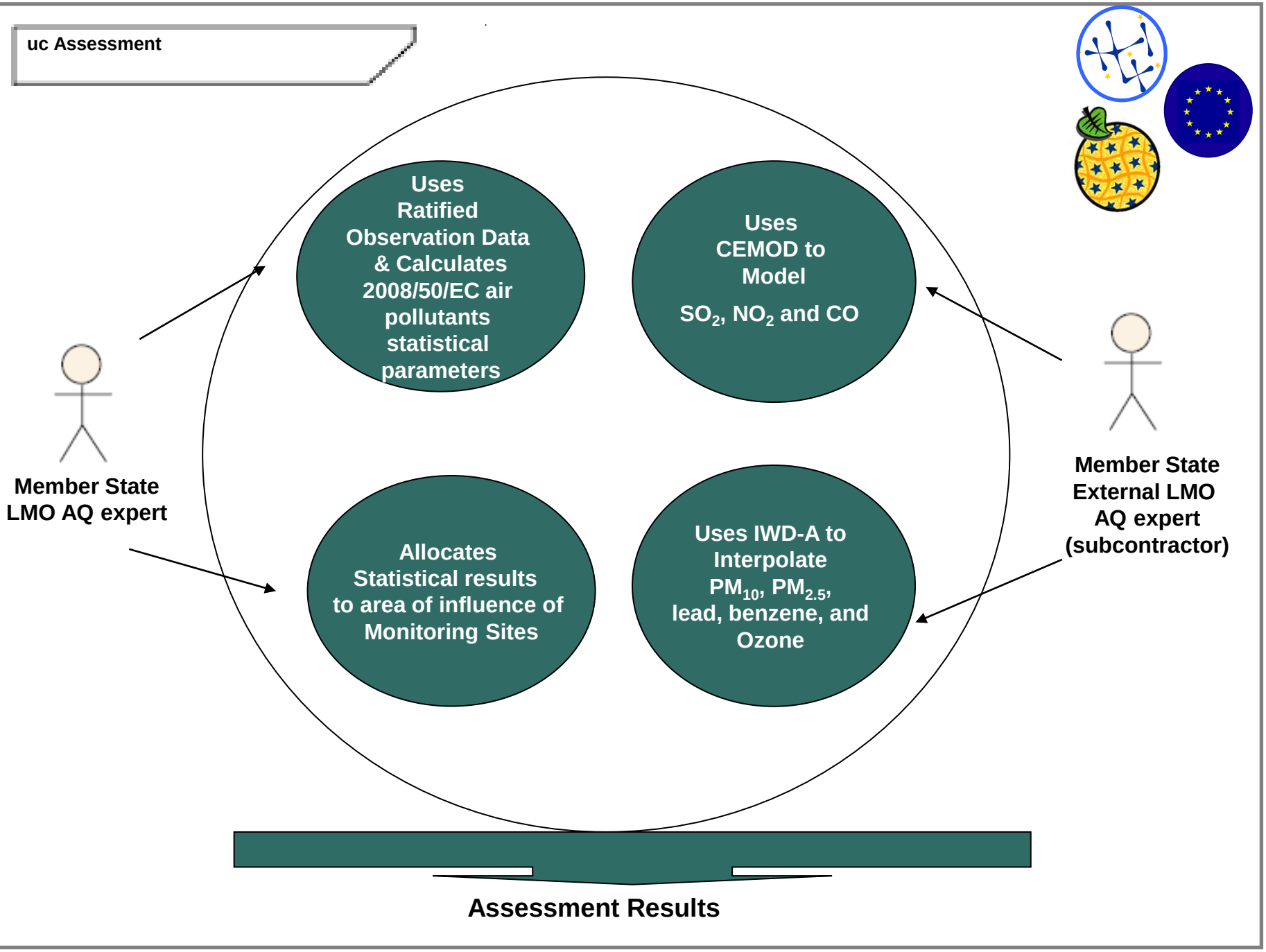
Member State
LMO

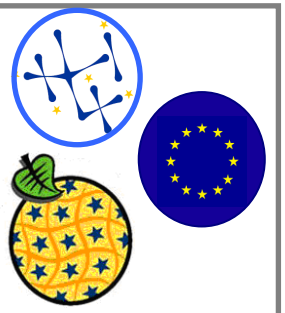
NO

No action required

Produces list of changes & reports


uc Collection and Management of Observations
calibrates manually
Local Site Operator
Servicing records
Member State LMO Network Owner, Manager, QA/QC Operator, Data Publisher
Deploys
AQ Sensor
Measures AQ data
AQ Logger
AQ Data Logging
Auto calibrates
Hourly Dissemination of Provisional Data (NRT)
AQ Manager
Polls AQ data
Applies AQ data Validation Procedures
Ratifies AQ Data
Dissemination of Ratified AQ Data
LMO AQ Expert


uc Assessment
Uses Ratified Observation Data & Calculates 2008/50/EC air pollutants statistical parameters
Uses CEMOD to Model
$SO_2$, $NO_2$ and CO
Allocates Statistical results to area of influence of Monitoring Sites
Uses IWD-A to Interpolate $PM_{10}$, $PM_{2.5}$, lead, benzene, and Ozone
Member State LMO AQ expert
Member State External LMO AQ expert (subcontractor)
Assessment Results



Measured Ratified Data for All Pollutants

Modelled Data from supplementary assessment

Zones & Agglomerations

Evaluation of 2008/50/EC calculated metrics for each pollutant

Higher than LV + MOT, TV, CV?

No

No Action Required

Yes

Provide List of Zones & Agglomerations in which the levels of AQ are > LV + MOT or > TV or > CL; w/ levels, dates & periods of exceedences

uc Reporting – Data Preparation

Air Quality
and GIS expert

Queries the
GIS Database for
Exceedences
per pollutant

Maps
the query
results
(locations and levels)
Per Zone
& Agglomeration at the highest
spatial resolution
available

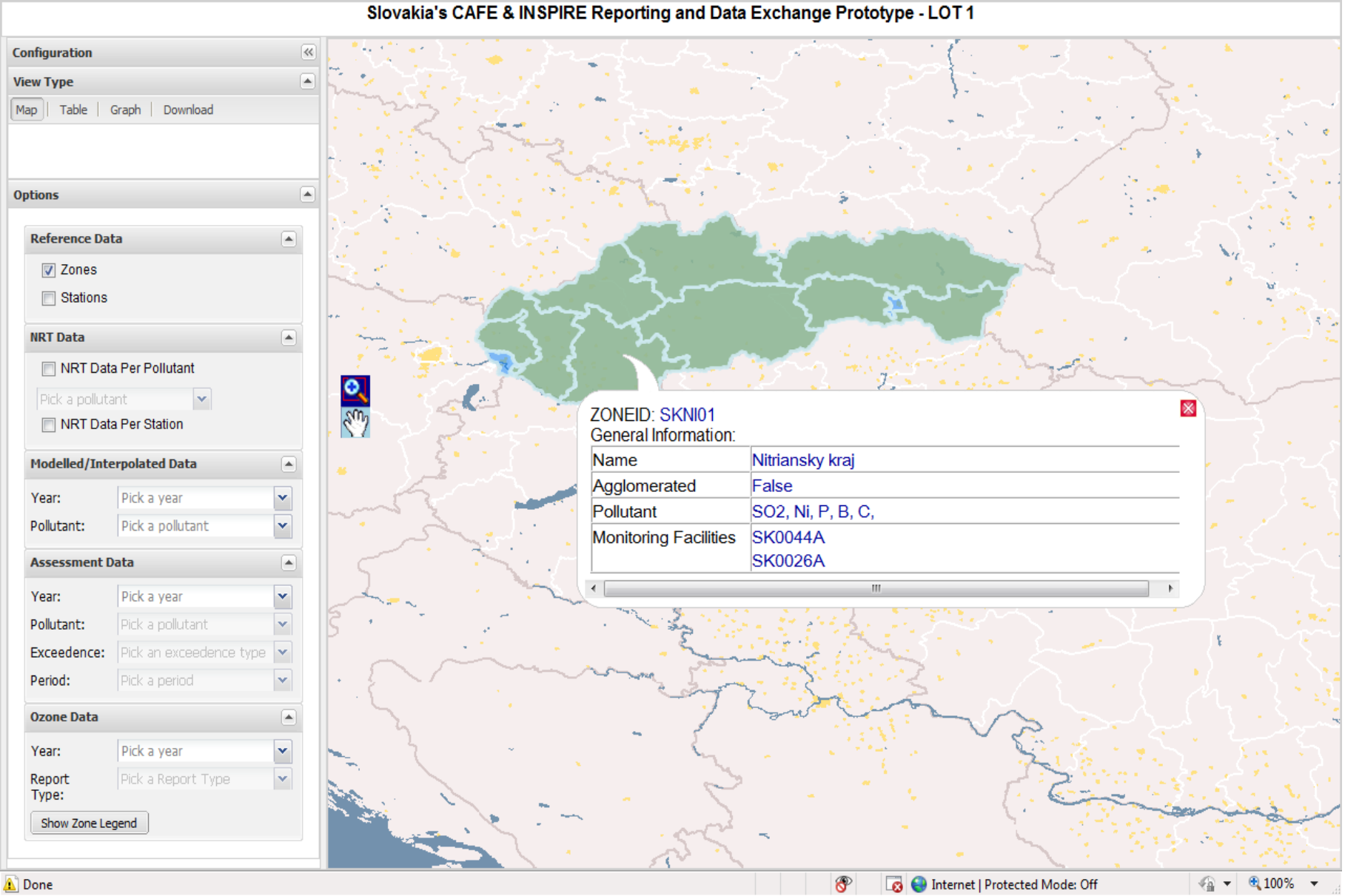
Tabulates
the query
results
(locations, levels, dates & duration)
of exceedence,
per pollutant
Per Zone
& Agglomeration

D.2.1.3.1

# Development of download and viewer services

## A pull approach versus a push approach

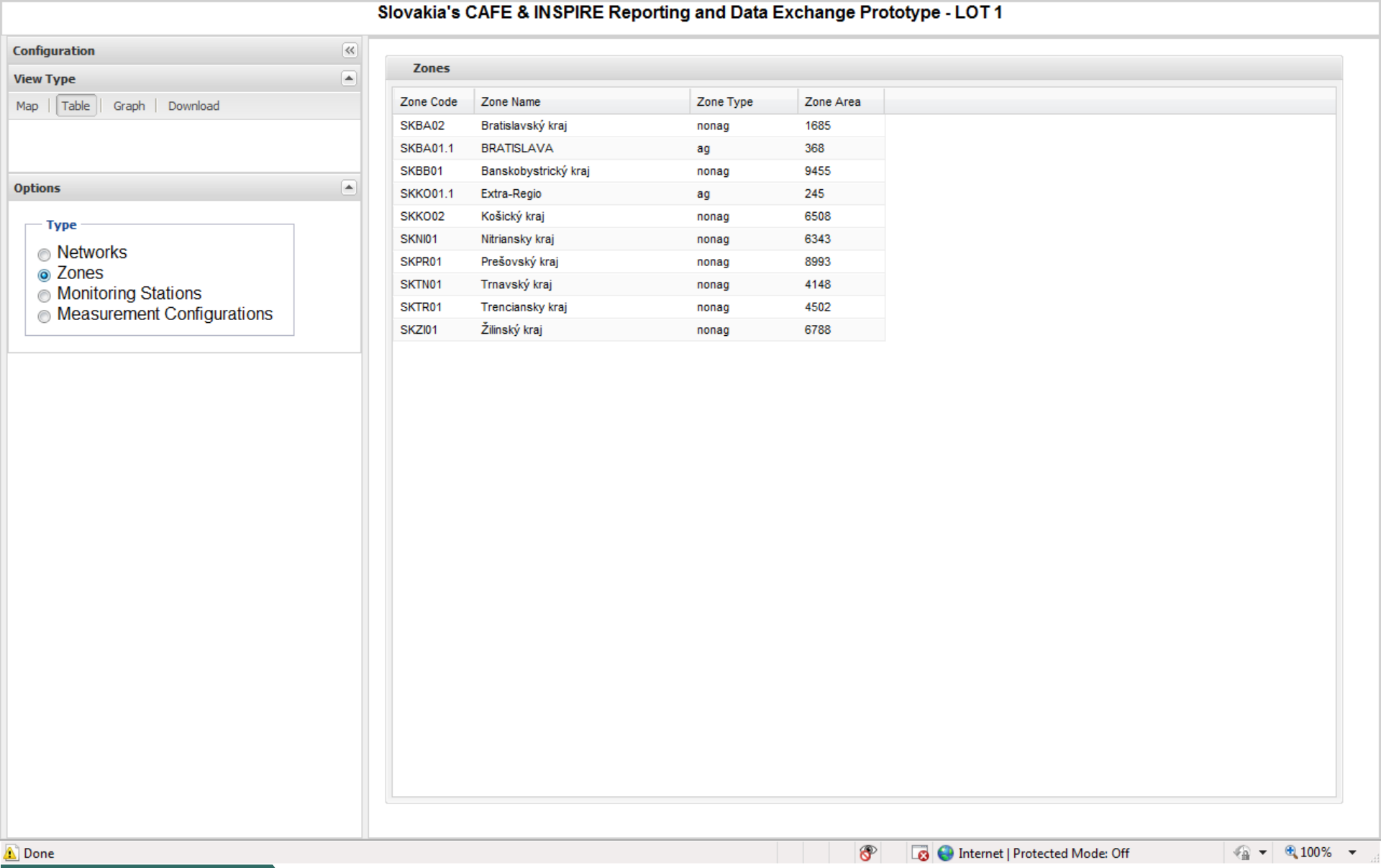
http://inspire.novatel.co.uk:8080/CAFE/MainEntry.html








**Slovakia's CAFE INSPIRE Reporting and Data Exchange Prototype - LOT 1 - Zones and Agglomerations reporting for Slovakia**

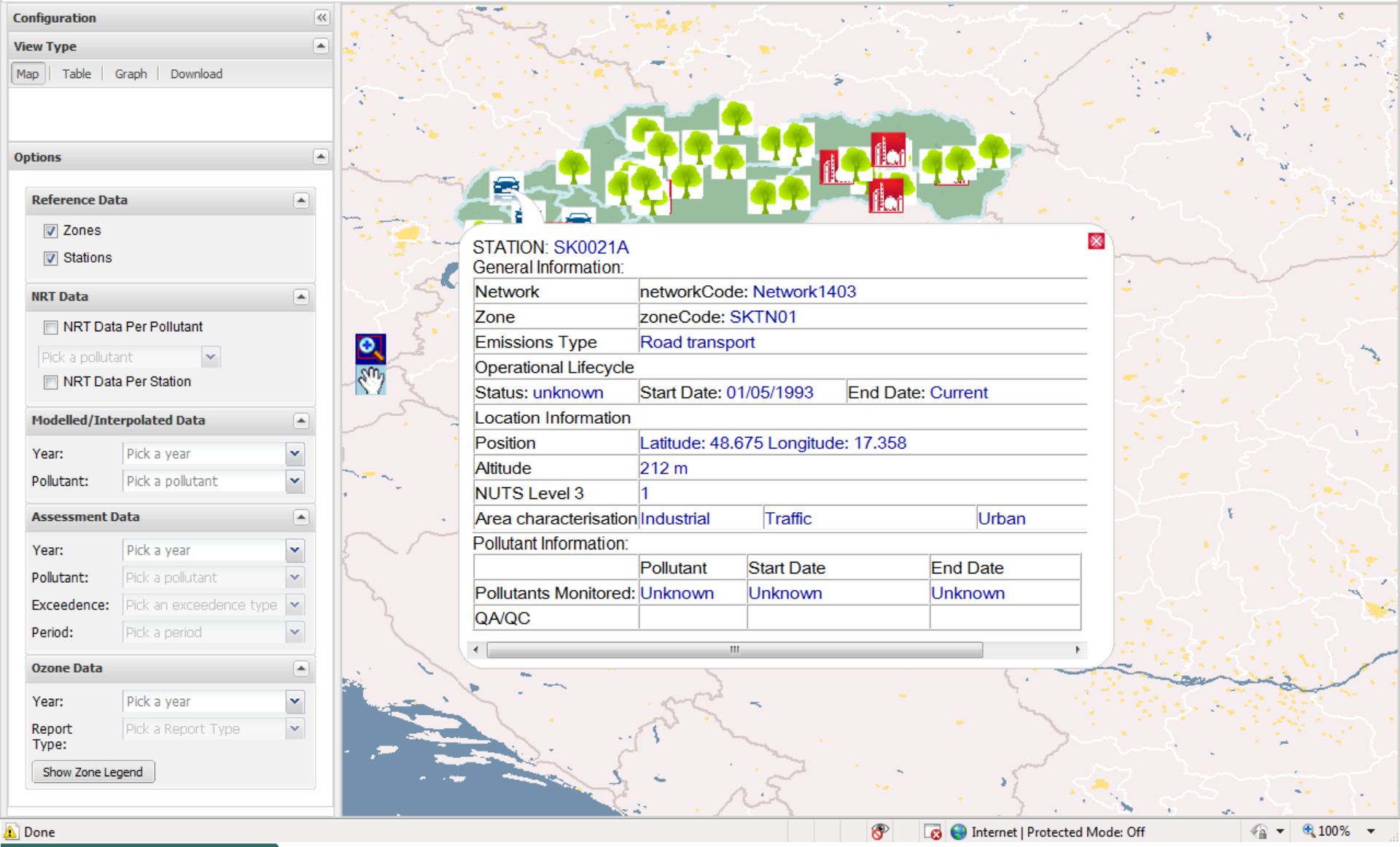



| Zone Code | Zone Name | Zone Type | Zone Area |
|---|---|---|---|
| SKBA02 | Bratislavský kraj | nonag | 1685 |
| SKBA01.1 | BRATISLAVA | ag | 368 |
| SKBB01 | Banskobystrický kraj | nonag | 9455 |
| SKKO01.1 | Extra-Regio | ag | 245 |
| SKKO02 | Košický kraj | nonag | 6508 |
| SKNI01 | Nitriansky kraj | nonag | 6343 |
| SKPR01 | Prešovský kraj | nonag | 8993 |
| SKTN01 | Trnavský kraj | nonag | 4148 |
| SKTR01 | Trenciansky kraj | nonag | 4502 |
| SKZI01 | Žilinský kraj | nonag | 6788 |



**Slovakia's CAFE INSPIRE Reporting and Data Exchange Prototype – LOT 1 - Tables with required information for Zones and Agglomerations**

Slovakia's CAFE & INSPIRE Reporting and Data Exchange Prototype - LOT 1






**Slovakia's CAFE INSPIRE Reporting and Data Exchange Prototype - LOT 1 - Monitoring Sites Information**

Slovakia's CAFE & INSPIRE Reporting and Data Exchange Prototype - LOT 1

Configuration

View Type

Map | Table | Graph | Download

Options

Reference Data

NRT Data

Modelled/Interpolated Data

Year: Pick a year

Pollutant: Pick a pollutant

Assessment Data

Ozone Data

Year: 2007

Report Type: Alert Threshold

Natural Sources and Events

Component: Ozone ($O_3$)

Station EU Code: SK0001A

Zone code: SKBA01.1

Zone name: Bratislava

Number of Exceedances: 1

Form 13b Exceedence of ozone alert threshold value:

| Month | Day of month | Starting Hour | Total Hours | Max 1-hour mean concentration ($\mu g/m^3$) |
|---|---|---|---|---|
| 7 | 17 | 14 | 1 | 270.0 |

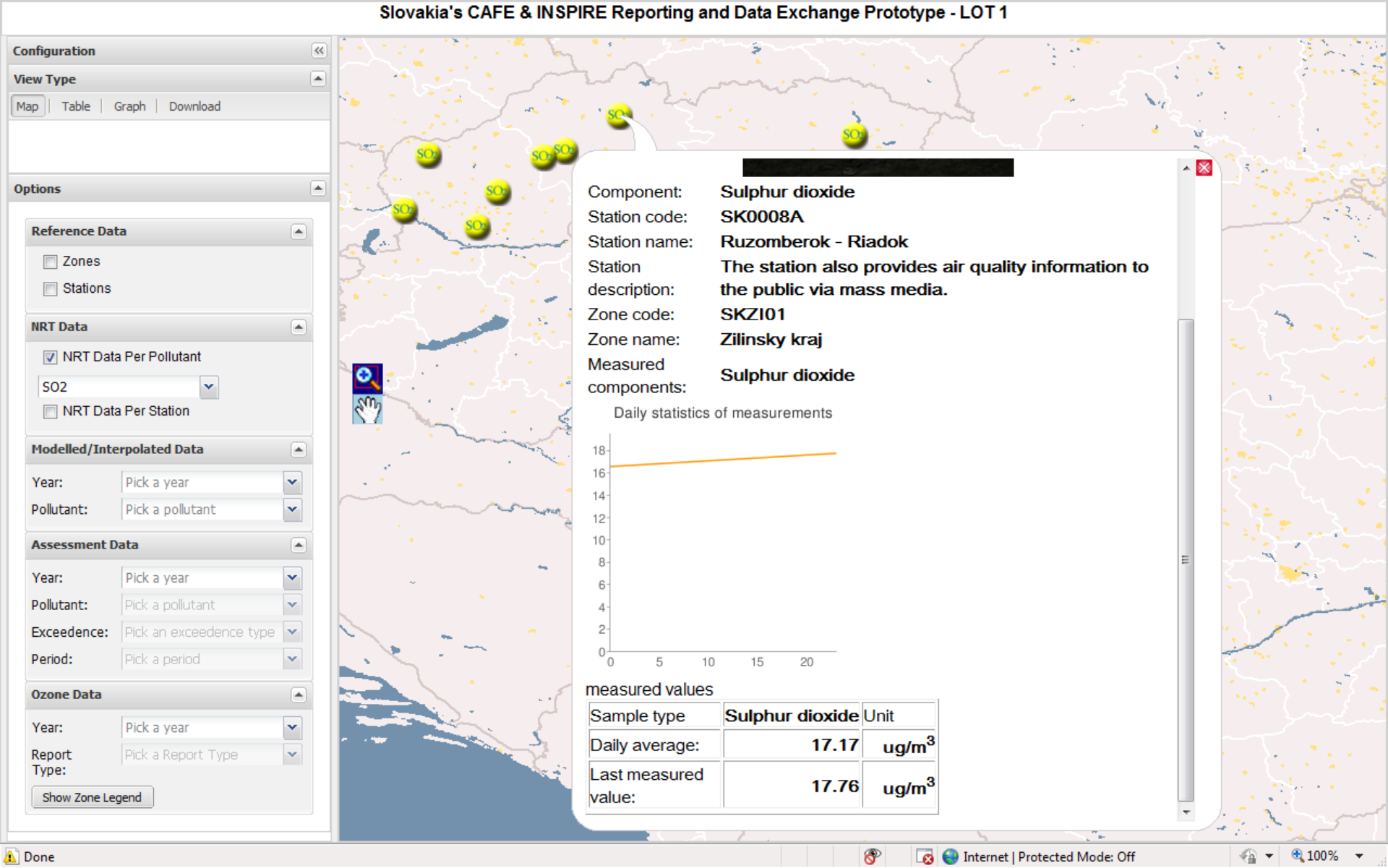
Done

Internet | Protected Mode: Off

100%

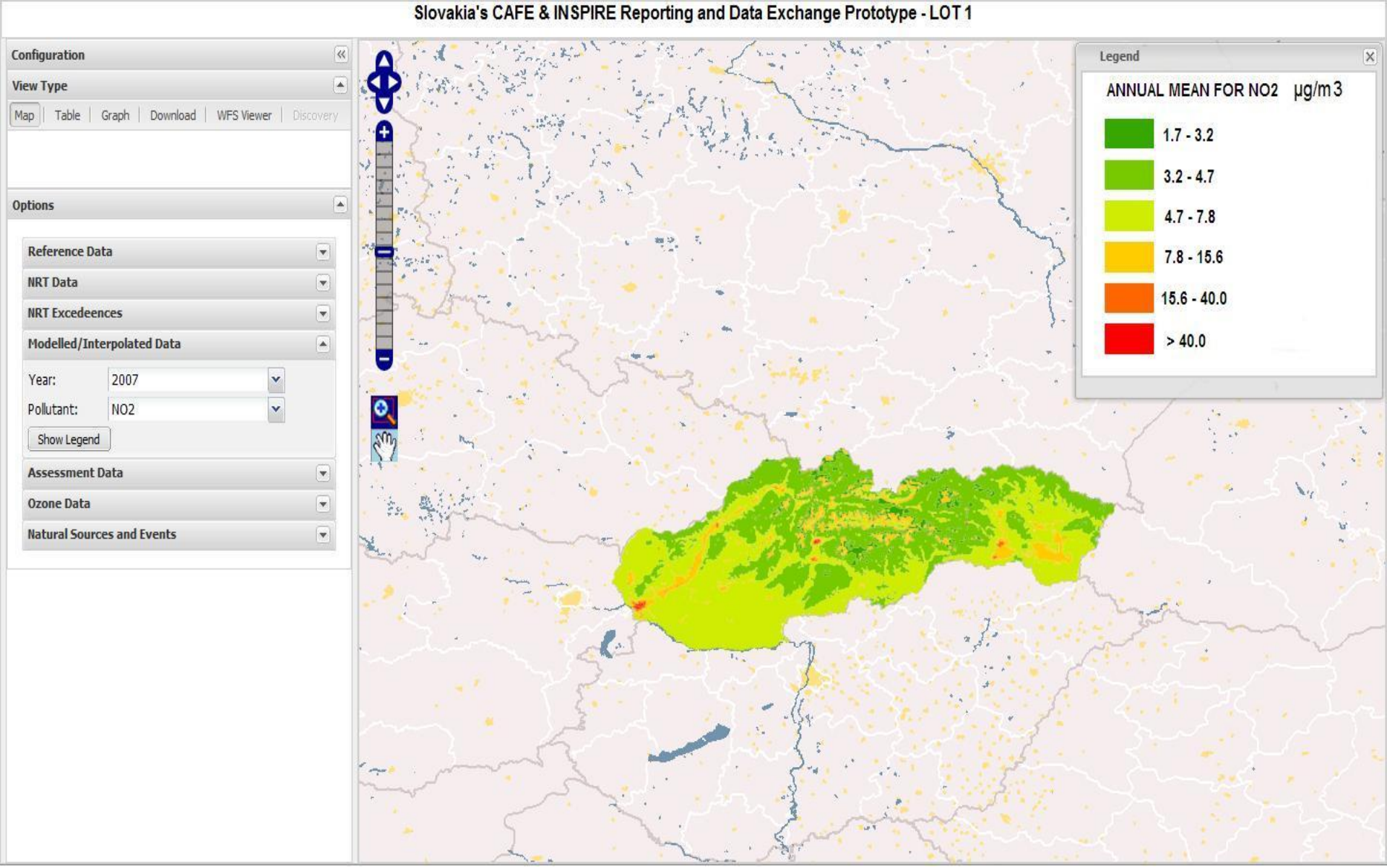


**Slovakia's CAFE INSPIRE Reporting and Data Exchange Prototype – LOT 1 -Assessment Data - Exceedence of the Alert Threshold for Ozone for 2007 ($\mu g/m^3$)**





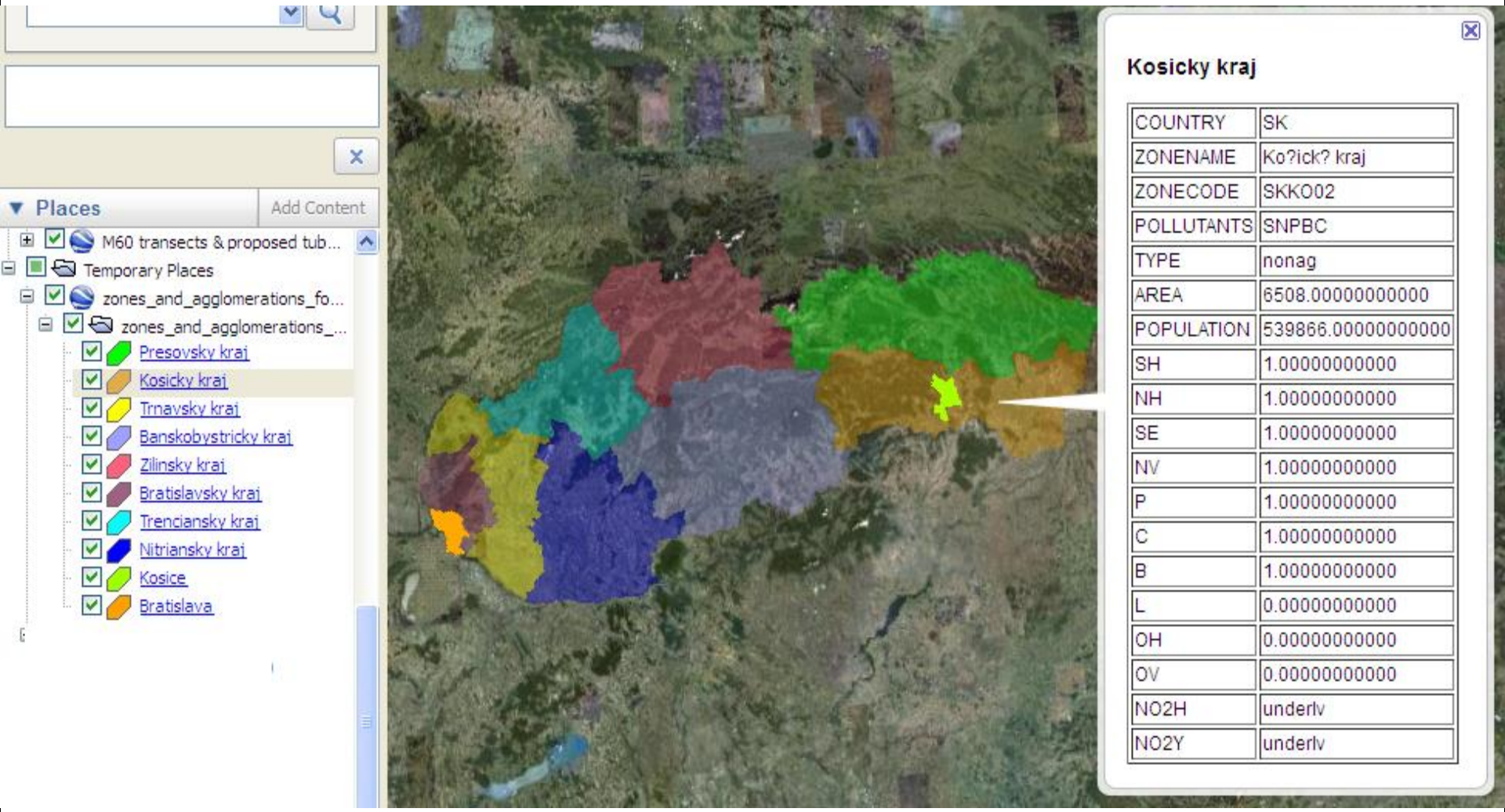

**Slovakia's CAFE INSPIRE Reporting and Data Exchange Prototype – LOT 1 - Near Real Time Data per Pollutant - $SO_2$**








**Slovakia's CAFE INSPIRE Reporting and Data Exchange Prototype – LOT 1 - Modelled/Interpolated Data - $NO_2$ Annual Mean ($\mu g/m^3$)**


Places
Add Content
M60 transects & proposed tub...
Temporary Places
zones_and_agglomerations_fo...
zones_and_agglomerations_...
Presovsky kraj
Kosicky kraj
Trnavsky kraj
Banskobystricky kraj
Zilinsky kraj
Bratislavsky kraj
Trenciansky kraj
Nitriansky kraj
Kosice
Bratislava
Kosicky kraj
COUNTRY SK
ZONENAME Ko?ick? kraj
ZONECODE SKKO02
POLLUTANTS SNPBC
TYPE nonag
AREA 6508.00000000000
POPULATION 539866.00000000000
SH 1.00000000000
NH 1.00000000000
SE 1.00000000000
NV 1.00000000000
P 1.00000000000
C 1.00000000000
B 1.00000000000
L 0.00000000000
OH 0.00000000000
OV 0.00000000000
NO2H underlv
NO2Y underlv

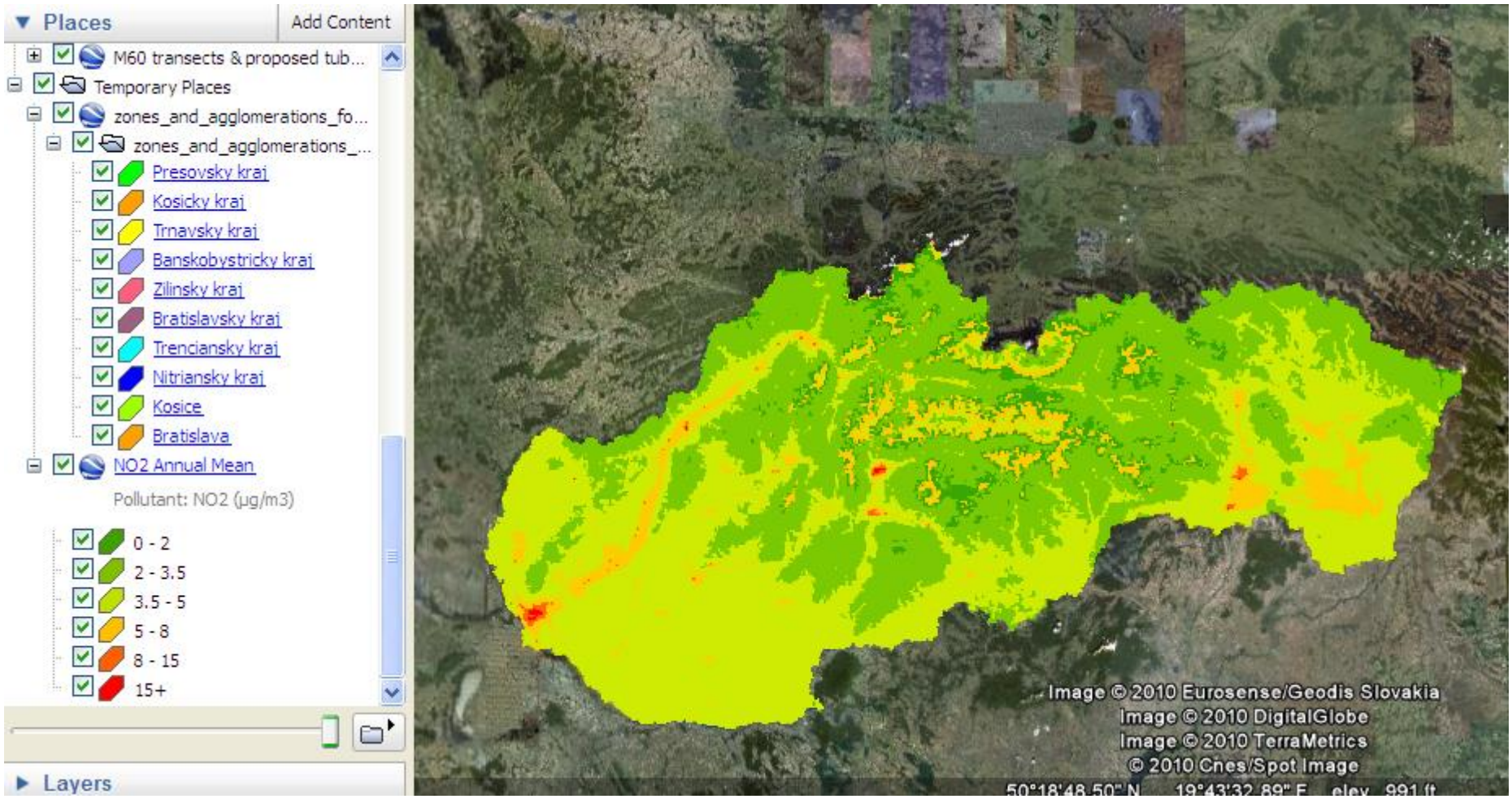

Places
Add Content
M60 transects & proposed tub...
Temporary Places
zones_and_agglomerations_fo...
zones_and_agglomerations_...
Presovsky kraj
Kosicky kraj
Trnavsky kraj
Banskobystricky kraj
Zilinsky kraj
Bratislavsky kraj
Trenciansky kraj
Nitriansky kraj
Kosice
Bratislava
NO2 Annual Mean
Pollutant: NO2 (µg/m3)
0 - 2
2 - 3.5
3.5 - 5
5 - 8
8 - 15
15+
Layers
Image © 2010 Eurosense/Geodis Slovakia
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Image © 2010 TerraMetrics
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**Evaluation tool: questionnaire**

**BENEFITS identified**

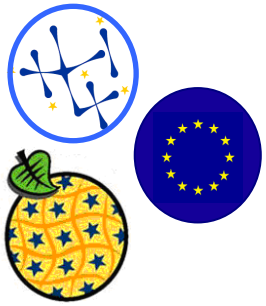
**Data quality improvement!!** ✓

**Data are findable** ✓

**Data made accessible and easy to download** ✓

**Evaluation made easy (fitness for purpose)** ✓

# BENEFITS identified



- Less time/resource associated with reporting/data exchange obligations
- Streamlining!
- Less consultancy fees spent by public authorities to get answers (e.g. PQ)
- Made looking at trends easy

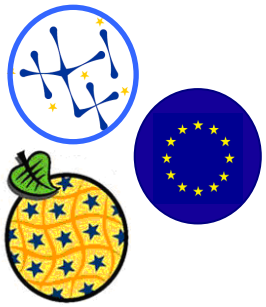
# BENEFITS identified

**Possibility to overlay themes over the same spatial area to support EIA analysis**

**No need to be an Air Quality expert to use the system and get the right information**

**People felt that by showing results in a transparent way demonstrated Government commitment to improve Environmental conditions**

# CONCLUSIONS



- IT WORKS! — D.2.3
- It is CONFORMAT — D.2.4
- Has significant and important BENEFITS
- Can be implemented by any Member State — D.1.2

FTR.1

# RECCOMENDATIONS

clear identification of data fitness for purpose required

CONSISTENT FLAGGING SYSTEM

Sensor to web only applicable monitoring data, inadequate for modelled data

Communication/Training/ Engagement Campaign with Public Authorities

FTR.1

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Introduction

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How

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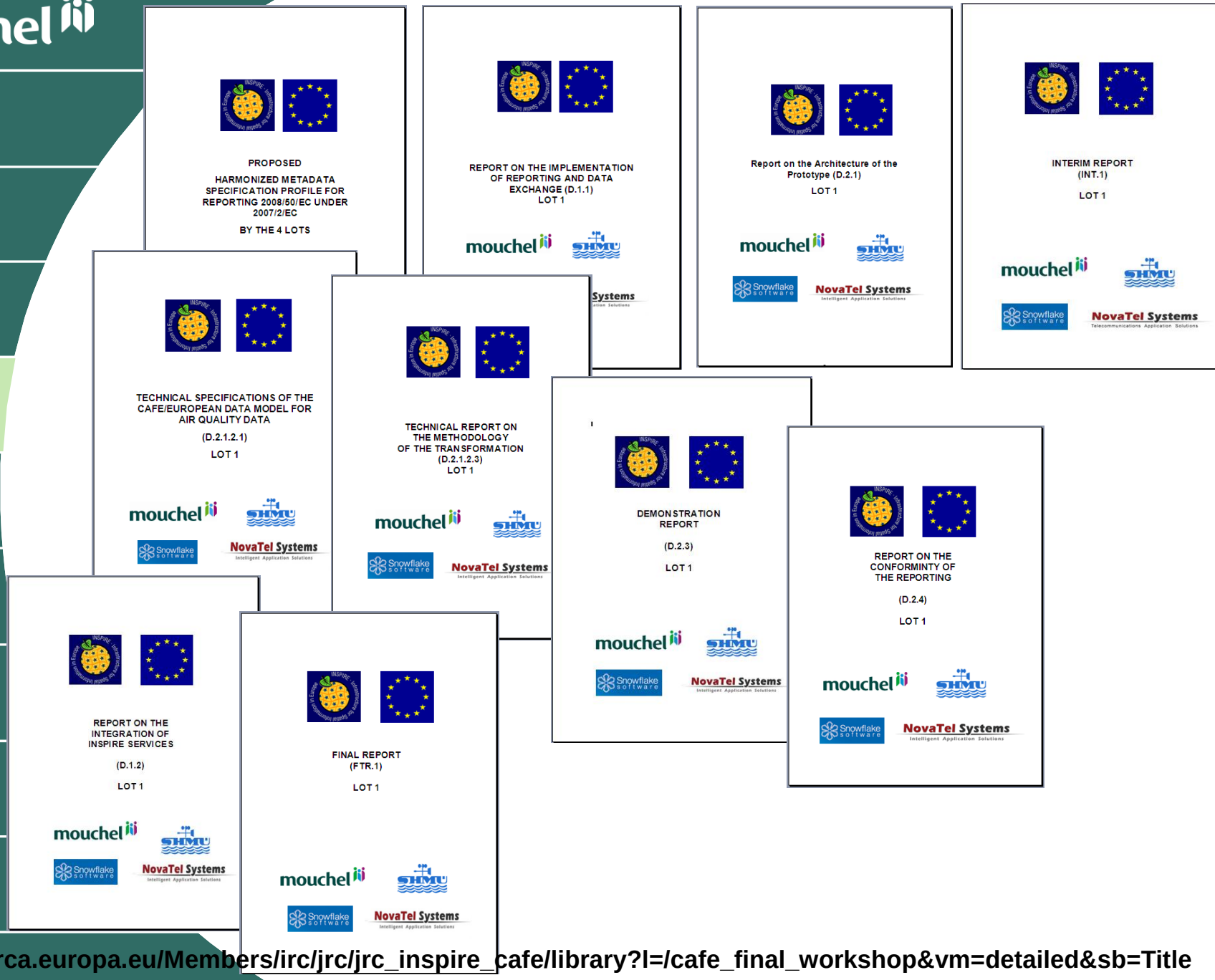


http://circa.europa.eu/Members/irc/jrc/jrc_inspire_cafe/library?l=/cafe_final_workshop&vm=detailed&sb=Title

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Summary

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# THANK YOU

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