



EUROPEAN UNION  
European Structural and Investing Funds  
Operational Programme Research,  
Development and Education

**MSMT**  
MINISTRY OF EDUCATION,  
YOUTH AND SPORTS



# ATMOSPHERIC CHEMISTRY

**Lecture No.: 3**

# Organisation of study

- Lecturer: Marek Staf, MSc., Ph.D., phone: +420 220 444 458  
e-mail: [marek.staf@vscht.cz](mailto:marek.staf@vscht.cz),  
web: <http://web.vscht.cz/~stafm/>  
building A, Dept. 216, door No.162  
e-learning:  
<https://e-learning.vscht.cz/course/view.php?id=106>
- Scale of subject: winter semester  
14 lectures, 14 weeks, 2 hours/week
- Classification: Exam - written + oral form (depending on result of the test)

The published materials are intended for students of the University of Chemistry and Technology, Prague as a study material. Some text and image data contained therein are taken from public sources. In the case of insufficient quotations, the author's intention was not to intentionally infringe the possible author(s) rights to the original work. If you have any reservations, please contact the author(s) of the specific teaching material in order to remedy the situation.

Uveřejněné materiály jsou určeny studentům Vysoké školy chemicko-technologické v Praze jako studijní materiál. Některá textová i obrazová data v nich obsažená jsou převzata z veřejných zdrojů. V případě nedostatečných citací nebylo cílem autora/ů záměrně poškodit event. autora/y původního díla. S eventuálními výhradami se prosím obraťte na autora/y konkrétního výukového materiálu, aby bylo možné zjednat nápravu.

# Scope of lecture 3

Examples of the most important environmental information systems

- History of information systems in the Czech Republic
- Examples of basic IS in Europe
- List of fundamental IS in the Czech Republic
- System of data collection for IS
- Example of user interface of IRZ
- Example of special database – sources of GHG within EU ETS

# Examples of IS and databases

- Some of the IS are only informative, others serve as platforms for restrictions, for dragging the public into the decision process etc.
- Some of the IS have public access, some have limited access for authorized persons and organizations only;
- Some of the IS are local, others are international.
- Examples of Environmental Information Systems (EIS):
  - EIS provide processing, searching and presentation of environmental data and information;
  - Example of national system: United Information System of Environment (JISŽP) in the Czech republic;
  - Examples of international systems: Shared Environmental Information System – SEIS);
  - EnviroWindows;
  - European Environment Information and Observation Network – Eionet.

# Examples of IS and databases

- Globally active Environmental information systems (EIS):
  - Global Monitoring for Environment and Security – GMES,
  - Global Earth Observation System of Systems – GEOSS.
    - It covers particular national as well as international observation systems
    - National observation systems are operated by the countries, which are the members of the Group on Earth Observations (GEO).

# Examples of IS and databases

- eEnvironment (in the EU)

- White book of eEnvironment introduced in plenary session of CAHDE (Council of Europe activities in the field of e-democracy) in 2007.
- Legal fundament for eEnvironment is the so called Aarhus agreement (according to regulation nr. 2003/4/ES, on access of the public to information about environment etc.)
- 5 basic principles of eEnvironment:

**Principle of control**

**Principle of participation**

**Principle of education**

**Principle of prevention**

**Principle of standardization**

# Examples of IS and databases

- eEnvironment (in the EU)
  - 5 basic principles of eEnvironment:

**Principle of control** = legal security of citizens requires access to resolutions of the state authorities (the access allows the public to be notified about errors).

**Principle of participation** = Right to have access to the information enhances transparency and allows the public to participate on the decisions of state authorities.

# Examples of IS and databases

- eEnvironment (in the EU)

- Basic principles of eEnvironment:

**Principle of education:** Knowledge about environment leads to enhancement of the public participation on adopting the measures for the environment protection.

**Principle of prevention:** Right to publish all environmental information should discourage potential polluters.

**Principle of standardization:** International agreements and European regulations and activities to approach to environmental information provide wide rules regarding the environment protection and data sharing (e.g. systems INSPIRE, GMES, SEIS)

- eEnvironment is a part of an extensive project of electronic democracy (eDemocracy).



# Historical situation in Czechoslovakia

- **After WW2, 1950s**

Intensive transformation from light and consumer industry to heavy industry, metallurgy, brown and black coal mining and so on;

Start of massive construction of the brown coal-fired power plants;

Monitoring of imission strain (stress) performed only in few isolated points by hygienic service organization;

At the end of 1950s - involvement of Hydrometeorological Institute (particularly monitoring of scattering of pollutants);

- **1960s**

Hike increase of imission strain due to growth of brown coal power plants;

First enforced cutting down of the forests damaged by acid rains.

1966 Foundation of Tušimice observatory for air monitoring;

1966 Law No. 20/1966, on public health care incl. environment;

1967 Law No. 35/1967, on measures against air pollution (so-called chimney law); HMI entrusted by problematics of air protection

1967 Foundation of Ministry of forest and water administration (incl. Management of air protection)

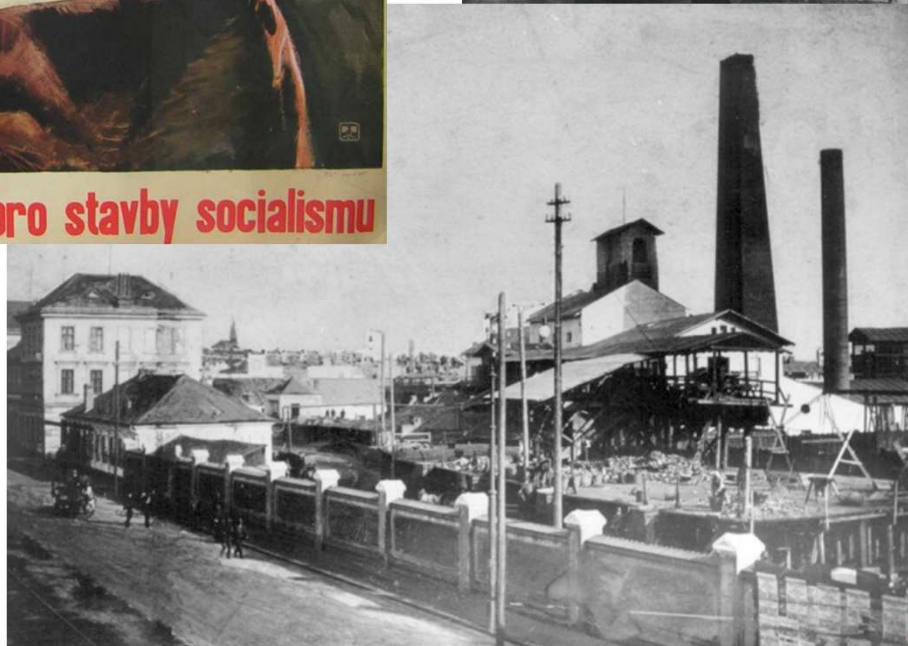
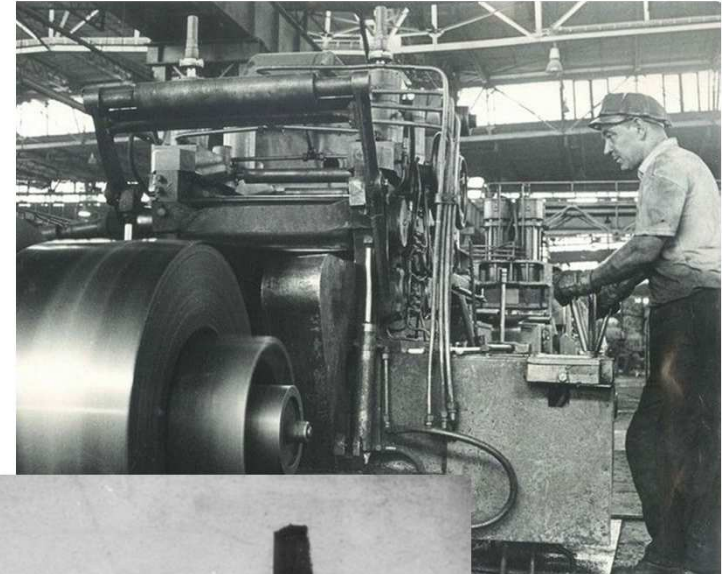
# Information systems in Czech republic

- Historical situation in Czechoslovakia – 1950s – heavy industry



**Ve 4. roce pětiletky více uhlí a ocele pro stavby socialismu**

(coal miner & founder)



# Information systems in Czech republic

- Historical situation in Czechoslovakia – 1960s

1968      Laboratory of air protection established by HMI

- **1970s**

Beginning of suppression of particulate matter emissions in power plant blocks (2-stage precipitators);

Significant damage of forests (especially spruces and pines) in the Northwest mountains by acidic deposition;

Increase of rate of chronic respiratory diseases and allergies;

1970      Laboratory of air protection completed with research of systems for air monitoring;

1971      HMI commissioned its internal computer information system; establishment of local Emission Information System – IIS;

1978      Czechoslovakia assessed by the UN as third worst country in Europe as regards SO<sub>2</sub> emission strain (1<sup>st</sup> east Germany, 2<sup>nd</sup> Belgium);

1979      Commissioning of nationwide information system Register of Emissions and Sources of Air Pollution (Czech abbreviation REZZO);

# Information systems in Czech republic

## ■ 1980s

Culmination of pollution levels;

Situation deteriorating due to contribution of brown coal power plants + long range transboundary transport of pollutants + pollution from local heating + growth of car traffic;

Preparation of the first complex of regulation measures (precautions made based on prognose of meteorological situations and data from Imission Monitoring)

1988      Establishing of laboratory/observatory Košetice for air monitoring;

## ■ 1990s

New Ministry of Environment established; CHMI transferred under competence of this ministry;

Increase of popular interest in air protection;

Building the AIM network on the nationwide scale;

Continuous monitoring of  $PM_{10}$  and  $PM_{2,5}$ , tropospheric  $O_3$  a VOCs.

1992      Start of the Information System of Air Quality (Czech abbreviation ISKO; IIS incorporated into ISKO);

# Information systems in Czech republic

- Current situation in Czech republic – examples of systems:

- **JISŽP** Unified information system on environment

Target: Preparation of one complex system, which covers water, air, waste management, sources of pollution etc.

Admin: Czech ecological institute

Status: Currently under construction, actual co-existence of 37 various particular IS, managed by different institutions.

- **ISOP** Information system of nature protection

Admin: Nature Protection Agency

Purpose: Data about protected areas, natural biotopes, natural heritage, etc.

- **ÚSOP** Central list of nature protection

Purpose: Overview of natural reserves, national parks, protected areas etc. (some data additional to ISOP, some duplicated)

# Information systems in Czech republic

- Present situation in Czech republic

- **HEIS** Hydroecological Information System

Admin: T. G. Masaryk Water Research Institute

Purpose: Composition of surface and underground water incl. wastewater;

- **ISKO** Information system of air quality

Admin: responsible Ministry of environment, assigned CHMI;

Purpose: common system containing sub-registers (e.g. REZZO)

It includes results of assessment and evaluation of pollution.

It also includes a register of emissions and a register of stationary sources of pollution.

Note: Ministry report on air and prediction for next 2 years published yearly;

It also includes ratios  $PM_{10}$  and  $PM_{2,5}$  compared to overall PM.

# Information systems in Czech republic

## ■ **REZZO** Register of Emissions and Sources of Air Pollution

Admin: Ministry of environment, assigned CHMI

Purpose: part of ISKO, contains list of pollutants (excl. local heating), information about concentrations in air and composition of rains

Divided into sub-registers:

- **REZZO 1**—large stationary sources > 5 MW of heat performance and very significant technologies;
- **REZZO 2**—medium stationary sources 0,2 – 5 MW and serious technologies;
- **REZZO 3**—small stationary sources < 0,2 MW;
- **REZZO 4**—mobile sources of pollution;

Data about large and medium sources submitted by polluters under supervision of Czech Inspection of Environment. Data about small sources received from municipal authorities;

Data about: PM, SO<sub>2</sub>, NO<sub>x</sub>, CO, C<sub>x</sub>H<sub>y</sub>.

# Information systems in Czech republic

- **IRZ** Integrated Register of Pollution

Admin: Formerly Czech ecological institute (Agency of integrated prevention) ⇒ currently Czech Environmental Information Agency CENIA; supervised by EEA (European Environment Agency)

Purpose: in the future it will replace following registers: REZZO, HEIS and ISOH (Information system of waste management)

Data for the database are obligatory submitted by polluters, based on Integrated system of accomplishing the report duties.

Laws: No. 25/2008 on integrated register of environmental pollution and system of accomplishing of the report duties in the area of environmental pollution updated by No. 77/2011 of the Legal Code

The above mentioned laws created on the basis of Directive 96/61/EC including (among other things) rules for IPPC

(Integrated Pollution Prevention and Control)



# Information systems in Czech republic

- **IRZ** Integrated Register of Pollution

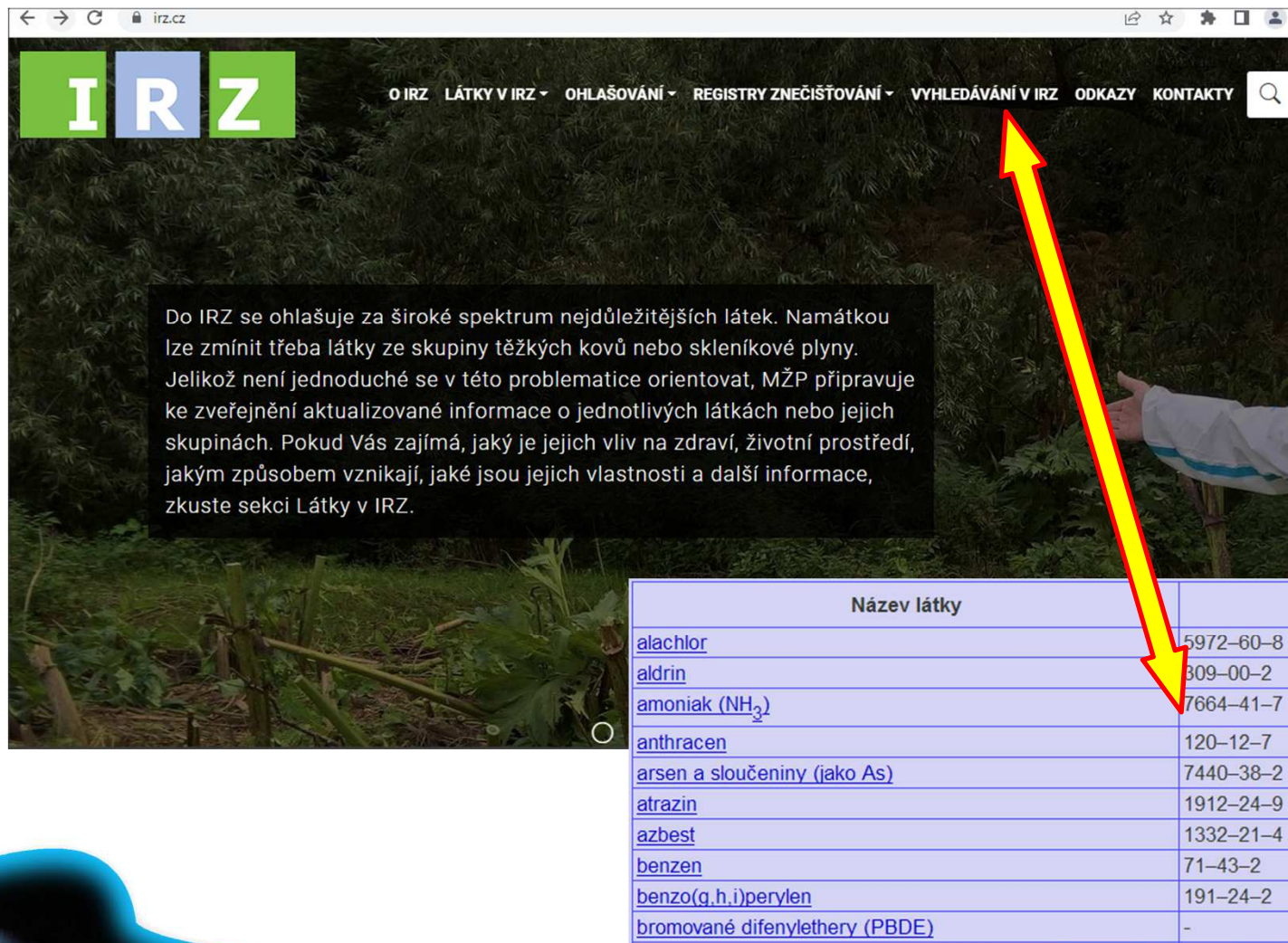
Scope: the total of 88 substances requiring obligatory reporting  
(both inorganic and organic)

IRZ constructed on the basis of European Directive 96/61/EC, containing (besides other things) IPPC and rules for other activities:

- European Pollutant Emission Register (EPER)
- Commission releases its outcomes in three-year intervals
- Register EPER is completed by PRTR (Pollutant Release and Transfer Register) concerning wastes especially
- Czech agency for Integrated Pollution Prevention and Control – (IPPC) incorporated into CENIA in 2002.

# Information systems in Czech republic

- IRZ Integrated Register of Pollution – example of web search:  
Initial page: <http://www.irz.cz>



The screenshot shows the IRZ website interface. At the top, there is a navigation menu with the following items: O IRZ, LÁTKY V IRZ, OHLAŠOVÁNÍ, REGISTRY ZNEČIŠŤOVÁNÍ, VYHLEDÁVÁNÍ V IRZ, ODKAZY, and KONTAKTY. A search icon is located to the right of the menu. Below the menu, there is a large text block in a dark box with white text. A red arrow points from the search bar area down to the table below.

Do IRZ se ohlašuje za široké spektrum nejdůležitějších látek. Namátkou lze zmínit třeba látky ze skupiny těžkých kovů nebo skleníkové plyny. Jelikož není jednoduché se v této problematice orientovat, MŽP připravuje ke zveřejnění aktualizované informace o jednotlivých látkách nebo jejich skupinách. Pokud Vás zajímá, jaký je jejich vliv na zdraví, životní prostředí, jakým způsobem vznikají, jaké jsou jejich vlastnosti a další informace, zkuste sekci Látky v IRZ.

Název látky	Číslo CAS	
<a href="#">alachlor</a>	5972-60-8	<a href="#">pdf</a>
<a href="#">aldrin</a>	309-00-2	<a href="#">pdf</a>
<a href="#">amoniak (NH<sub>3</sub>)</a>	7664-41-7	<a href="#">pdf</a>
<a href="#">anthracen</a>	120-12-7	<a href="#">pdf</a>
<a href="#">arsen a sloučeniny (jako As)</a>	7440-38-2	<a href="#">pdf</a>
<a href="#">atrazin</a>	1912-24-9	<a href="#">pdf</a>
<a href="#">azbest</a>	1332-21-4	<a href="#">pdf</a>
<a href="#">benzen</a>	71-43-2	<a href="#">pdf</a>
<a href="#">benzo(g,h,i)perylen</a>	191-24-2	<a href="#">pdf</a>
<a href="#">bromované difenylethery (PBDE)</a>	-	<a href="#">pdf</a>

# Information systems in Czech republic

- **IRZ** Integrated Register of Pollution – example of web search:  
Initial page: **<http://www.irz.cz>**

The image shows a screenshot of the IRZ website. The top navigation bar includes the IRZ logo and menu items: O IRZ, LÁTKY V IRZ, OHLAŠOVÁNÍ, REGISTRY ZNEČIŠŤOVÁNÍ, VYHLEDÁVÁNÍ V IRZ, ODKAZY, and KONTAKTY. A search icon is also present. Below the navigation bar, there is a text box with the following content:

Do IRZ se ohlašuje za široké spektrum nejdůležitějších látek. Namátkou lze zmínit třeba látky ze skupiny těžkých kovů nebo skleníkové plyny. Jelikož není jednoduché se v této problematice orientovat, MŽP připravuje ke zveřejnění aktualizované informace o jednotlivých látkách nebo jejich skupinách. Pokud Vás zajímá, jaký je jejich vliv na zdraví, životní prostředí, jakým způsobem vznikají, jaké jsou jejich vlastnosti a další informace, zkuste sekci Látky v IRZ.

Below the text box, there is a search result page for 'Evropský registr úniků a přenosů'. The page title is 'ODKAZY' and it contains the following links:

- [EU registr průmyslových míst](#)
- [EPER \(archivované stránky\)](#)

At the bottom of the page, there is a footer with the text 'Ministerstvo životního prostředí'.

# Information systems in the EU

- **European Industrial Emissions Portal** – example of web search:  
Initial page: **<https://industry.eea.europa.eu>**

**European Industrial Emissions Portal**

HOME EXPLORE ANALYSE DOWNLOAD POLLUTANTS ABOUT

European Environment Agency

## Welcome to the European Industrial Emissions Portal

The website presents information on the largest industrial complexes in Europe, releases and transfers of regulated substances to environmental media, waste transfers as well as more detailed data on energy input and emissions for large combustion plants in EU Member States, Iceland, Liechtenstein, Norway, Serbia, Switzerland and the United Kingdom.

If you are new to this topic, please make sure that you [read our guide](#) on what to find in the portal. You can explore the data online, or [download](#) datasets and work with them in a software of your own preference.

**EXPLORE THE DATA** See what's happening in your area

**ANALYSE**  
Find the biggest polluters and compare data across countries

**DOWNLOAD**  
Work with raw datasheets on your own choice of software

**Air pollutants emission inventory**  
Compiled data include annual national total and sectoral emissions of air pollutants and associated activity data reported by European Environment Agency member and cooperating countries under the Long-Range Transboundary Air Pollution Convention.  
**DOWNLOAD**

**Greenhouse gas emission inventory**  
Data on greenhouse gas emissions and removals, sent by countries to the United Nations Framework Convention on Climate Change and to the greenhouse gas monitoring mechanism by EU Member States.  
**DOWNLOAD**

**Energy Community database**  
This dataset contains the location and administrative data for LCP in the Energy Community (Energy Community Treaty 2006/500/EC) participating countries, along with more detailed data on energy input and emissions to air.  
**DOWNLOAD**

**European Emissions Trading System**  
The EU emissions trading system is a central instrument of the EU's policy to fight climate change and achieve cost-efficient reductions of greenhouse gas emissions.  
**DOWNLOAD**

- More complex and modern version of the former EPER (European Pollutant Emission Register)

# Information systems in the EU

- **European Industrial Emissions Portal** – example of web search:

Initial page: **<https://industry.eea.europa.eu>**

- Example: accessible data from the EU ETS system

## European Union emission trading system

The EU emissions trading system is a central instrument of the EU's policy to fight climate change and achieve cost-efficient reductions of greenhouse gas emissions.

**DOWNLOAD**

# Database of GHG sources EU ETS

- Information sources: mandatory reports about emissions from polluters
- Purpose: preparation of background for trading with emissions allowances
- Principle: ETS = Emission Trading System  
System works on the principle „cap and trade“, where the limit values are decreased step by step.
- Initial target: In 2020, the emissions within the ETS reduced by 21 % compared to the year 2005 (benchmark)  
Beginning in 2013, yearly decrease of emissions by 1.74 %  
⇒ meaning allocated allowances from stationary sources
- Actual target: based on the EU Green Deal policy and subsequent Fit for 55 rules: 55 % reduction required till 2030

# Database of GHG sources EU ETS

- Trade process: Polluters obtain or purchase emission allowances.  
The allowances may be sold to other subjects.  
Polluters may also purchase international credits of the projects aimed at emission sequestration.  
At the end of a calendar year, every company must write off the exact number of allowances, which covers its own emissions.
- Legislation: Introduced in 2005 by Directive 2003/87/EC, and for Czech rep. transposed by:  
Law No. 695/2004 on conditions for trading with emission allowances for greenhouse gases  
updated by law No. 212/2006 and No. 315/2008.  
Instructions for monitoring and declaration of GHGs emissions (Greenhouse Gases) done by  
Commission regulation 2007/589/ES

# Database of GHG sources EU ETS

- Data acquisition: regular reporting from polluters
- Scope: Only big pollution sources involved into the EU ETS database.
- ETS includes: CO<sub>2</sub> from production of heat and electric energy, from energetically important industrial productions (refineries, production of steel, iron, aluminium and other metals, cement, ceramics, treatment of cellulose, acids and other chemicals) as well as CO<sub>2</sub> from commercial aeronautics  
N<sub>2</sub>O from production of nitric acid, adipic acid, glyoxal (ethanedial) and glyoxalic acid (oxoacetic acid).  
perfluorinated hydrocarbons (PFCs) aluminum production
- EU ETS is currently the biggest carbon market in the world
- Involves more than 11000 facilities and power plants within 31 countries worldwide + air transportation (since 2013); covers ca. 45% of overall GHGs emissions in the EU.



# Database of GHG sources EU ETS

- Data verification - Correctness of values verified at following levels:
  - Big companies have their own ecologist responsible for reporting;
  - Ecologists are checked by independent inspectors, having appropriate certificates (e.g. from Czech Accreditation Institute);
  - Companies elaborate monitoring plans – inspectors controls conformity of real data with the plans; audit once per 3 years (checking if emission lists are complete and data are correct);
  - Inspectors assess validity of training of authorized personnel;
  - Inspectors check conformity of relevant parameters (consumption of natural gas, coal, invoicing data about fuels etc.);
  - Activity of inspectors is secondarily checked by so-called experts, assigned by the accreditation institute.

Data example: Year 2014 Czech republic – 339 polluters identified

Overall reported weight of emitted CO<sub>2</sub>

66,435,610 metric t/year

# Database of GHG sources EU ETS

- User data editing: E.g. outcomes for various projects, aimed at sequestration of GHG emissions; example of aggregated data = divided into groups according to criteria (Czech republic 2014):

