CONTAMINATED SITES INVENTORY PROJECT IN THE CZECH REPUBLIC -
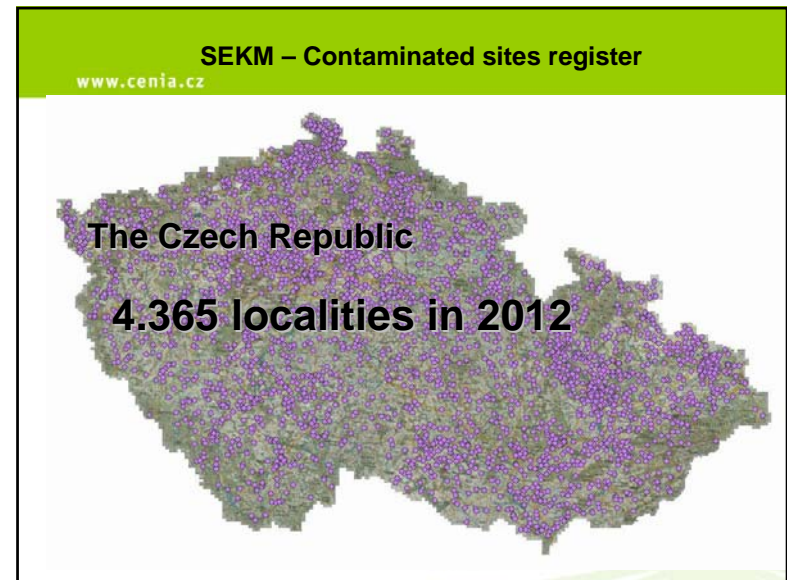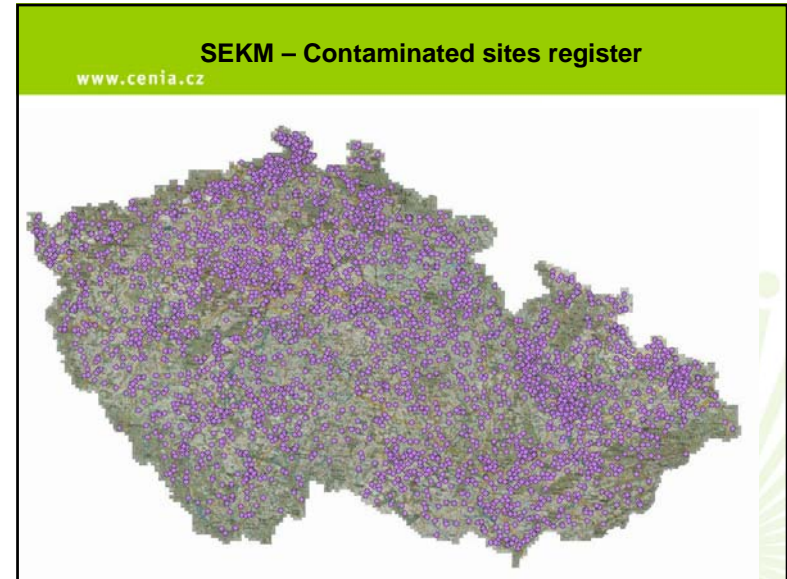
METHODOLOGY OUTLINES

Zdeněk Suchánek

N!KM
národní inventarizace
kontaminovaných míst

INTERNATIONAL CONFERENCE
CONTAMINATED SITES 2013
BRATISLAVA MAY 29–31, 2013

www.cenia.cz

SEKM – Contaminated sites register
www.cenia.cz

SEKM – Contaminated sites register
www.cenia.cz

The Czech Republic

SEKM – Contaminated sites register
www.cenia.cz

The Czech Republic

4.365 localities in 2012

The Czech Republic

4.365 localities in 2012

4.364 localities in 2013

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- Existing Contaminated Sites Database System (SEKM) is an incremental database and represents a useable source of information about the contamination of soils and rock formations.
- It doesn't cover all identifiable contaminated and potentially contaminated sites in the Czech Republic.
- MoE assigned the task of creating conditions for modernizing the database and to perform an inventory based on a surface survey, i.e. obtaining the fullest possible overview of contaminated sites throughout the state's territory.
- NIKM project is co-financed by the Operational Programme for the Environment.
- The preparatory stage of the NIKM project resulted in an approved methodology of the inventory.

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Framework for the inventory - methodological documents of the MoE

- The MoE's Environmental Risks and Environmental Damages Department's responsibility covers the issues of the remediation of contaminated sites, old environmental damage and other activities related to the issue.
- An integral part of the Department's competency is the running of the publicly available database system - the registry of contaminated sites.
- Since 2005 it was in the form of the Contaminated Sites Database System – (SEKM) – **www.sekm.cz**.
- Priority evaluation and a risk profile of each contaminated site is also included in SEKM.

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Framework for the inventory - methodological documents of the MoE, cont.

The set of the MoE's methodological documents:
- **Methodological Guidances** (7 documents),
- **Methodological Handbooks** (6 documents) and other
- **Guidelines and Guidances** (3 documents).

- In relation to the issue of the contaminated sites inventory the most important is:
  Methodological Guidance of the Ministry of Environment for the filling in the SEKM database incl. a priority evaluation (2011).

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Framework for the inventory - methodological documents of the MoE, cont.

- In 2008 the MoE decided, in connection with the task from the State Environmental Policy, to create conditions for modernizing the database and to perform an inventory based on a surface survey, with the aim to obtain the fullest possible overview of contaminated sites throughout the state's territory.
- Based on the call from the Czech Operational Programme Environment (EU Cohesion Fund), a project proposal of the National Contaminated Sites Inventory (NIKM) was prepared by CENIA.
- After being approved in 2009, the NIKM project was run by a project team composed by CENIA and several suppliers selected from an open public tender process.

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Project Status - National Contaminated Sites Inventory (NIKM)
The first stage of the NIKM project to be finished by the first half of 2013. Its basic goals:
- elaboration of methodology and tools for territorial inventory planned as the second stage;
- piloting and testing of developed methodology and tools including their modification according to experience obtained in pilot areas;
- collection and unification of existing data sources containing information on contaminated sites from the state territory (needed as an input for the 2nd stage of the inventory);
- to prepare a draft of the executive stage of the project.

NIKM METHODOLOGY OUTLINES
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- The first stage of the NIKM project performed in the period 2009 – 2013.
- Individual partial outcomes and final project outcomes finished in autumn 2012.
- Externally reviewed and tested (software, programme solutions and application tool tests).
- Detailed information from the project is publicly disclosed on the project web site: http://www1.cenia.cz/www/projekt/nikm.

## NIKM METHODOLOGY OUTLINES
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Application solutions - inventory tools
- NIKM IS - an information system for ensuring contaminated site registration under development.
- The register - database will contain the contaminated sites already registered in the existing system of SEKM and the contaminated sites newly registered during inventory.

An application support (application platform – see Fig.) for inventory works is composed by:
- On-line application **NIKM Editor** – client environment available through a web browser. It allows record management in the central data warehouse, data editing, inserting of measurements and other findings.
- Off-line application **NIKM Client** – allowing field data collection.
- **Web portal NIKM** – for publishing data on contaminated sites for the general public and public administration.
- **Central Data Warehouse** built up on the Oracle 11g platform. Client applications are built up on a JSF basis. The graphic component ensuring the GIS Client functionality is based on OpenGIS standards and uses Javascript, AJAX technologies.
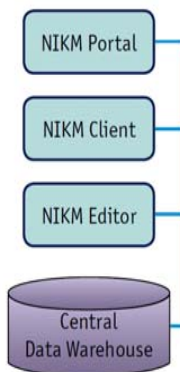
NIKM METHODOLOGY OUTLINES
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Technological scheme of application platform
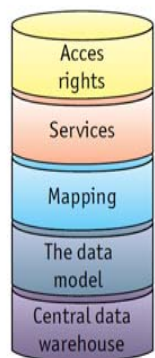
- The rights for the treatment of data access and their management
- Services that provide data surrounding applications (NIKM Editor, NIKM Client, WEB Portal)
- The system transfers data sources to the uniform environment of the Central Warehouse
- The model respectful to the heterogeneity of data sources
- Warehouse integrating data from all considered sources containing data on contaminated sites

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NIKM METHODOLOGY OUTLINES
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NIKM Editor
Client environment available through a web browser. It allows record management in the central data warehouse, data editing, inserting of measurements and other findings.

- Centralized web application – a tool for collecting, processing and management of all data on localities stored in the NIKM central data warehouse.
- Ensures data editing, background documents evaluation and data preparation for field examination (generation of the list of localities from the defined area, acquisition and completion of data from external sources), receiving modified data from the field application (NIKM Client) and a evaluation of necessary corrective measures.
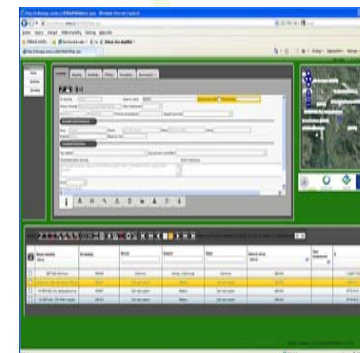
NIKM METHODOLOGY OUTLINES
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NIKM Editor, cont.
- Data background: records of potencial contaminated sites and contaminated sites and of subordinated entities (drill holes, constructions, remmedations, and partial areas of localities), all stored in the central warehouse.
- The main output : a printed set of data on locality in the form of Summary form (MoE Methodological Guidance, 2011.
- Available editable forms containing data on locality, and map sectors for localization, and for the display/analysis of maps. An inventory expert can add any map sources in the form of a WMS service or local GIS data in various formats. The system architecture includes the map server - Geoserver, which enables an export of GIS data in the form of WMS and WFS services.

NIKM METHODOLOGY OUTLINES
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NIKM Editor, cont.
- An important tool - pairing module providing a search and pairing of duplicate localities. Possible conflicts during parallel editing of localities are dealt with through marking localities with a lock for expert editing in the on-line application and in the off-line field application.
- The import function - data import to a central data warehouse in a standardized format. An administration section is used to manage the data content, including access rights. The on-line application is available only to registered professional staff via a web browser. Among the supported web browsers included are MS Internet Explorer version 7 or higher and Mozilla Firefox version 3 or higher.

NIKM METHODOLOGY OUTLINES

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NIKM Client

A tool for off-line (field) data acquisition - for collection of data on contaminated sites in-situ and ex-situ.

It allows to:

- downloading the prepared data for verification, from a central warehouse of NIKM to an off-line database;
- edit data on localities, based on information collected in field investigation and interviews, or to create a new locality record in the case of a new clue or contamination discovery;
- adding of document and photo attachments, text records or voice memo records and also data exports;
- display the locality in a map and to spatial definition – navigation to the site, site bordering manually or using GPS and displaying map data;
- upload modified data about the locality, including newly-discovered, to the central warehouse.

NIKM METHODOLOGY OUTLINES

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NIKM Client, cont.

The input level - a list of localities - offers an overview of localities from a defined territory. Selection / sorting records functions.

The second level - detailed locality information displayed through locality form divided into bookmarks:

- Characteristics of locality,
- Conflicts and threats to the environment,
- Contamination and remedial measures,
- Attachments.

The inventory expert can edit data, add and remove attachments, write text records or record voice memos, export data to a spreadsheet etc.

NIKM METHODOLOGY OUTLINES

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NIKM Client, cont.

The last level is a mapping support for working with locality spatial data (the base layers, a layer of locality, instruments providing needed functionality).

- A tool for editing the currently selected locality manually or using GPS.
- Tools for map control (the zoom function), GPS navigation on the selected location, calculating the coordinates of centroid or the area of the site, geodata export and map's print. A transformation of the coordinates between projections. For saving spatial component - a layer of the type GeometryCollection - site can be located using point, line or polygon.
- Underlying layers helping in better orientation in space and precise localization. Because of the need to work off-line it is not possible to form these layers using WMS services. It is necessary to have them physically in the field. Raster documents stored in a predefined file-directory structure. The map project loads them with the use of RasterCatalogue, ensuring their quick and easy display.
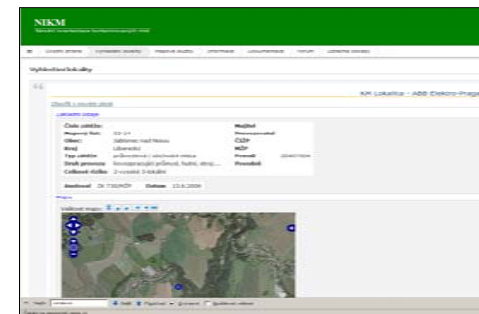

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Web Portal

- The website prepared for the 2nd stage of the project NIKM
- Designed as a professionally profiled portal - a gateway to information on contaminated sites and for work with them.

Services:

Searching the localities of contaminated sites. Through this service an access for state administration and the public to individual localities is provided. Information on the contamination and handling with the locality itself are available in the form of displaying more detailed information as well as a standardized output.

Web Portal, cont.

- The portal gateway - a links catalogue to services or external sources.
- The tools integrating mapping services of the national geoportal with mapping services of the NIKM central warehouse. This enables the user to access not only data on the contaminated site, but also its location and display it on the map.
- Technologically, the portal is based on the environment and services built over WordPress (open source), where the support of data, mapping and search services was implemented.

Input content of the central data warehouse

- The central data warehouse - the core of the structured and distributing data storage.
- Ensuring through application editing, storing and managing data on contaminated sites and potencionally contaminated sites.
- At the start of the second stage of NIKM, its input content will be available to inventory teams. During the inventory process, all records of this initial fill will be examined, updated and evaluated or excluded as irrelevant or as a duplicate of other sites.
- The input fill was prepared via the transformation and merging of partial data sources from the Czech Republic's territory.
- In the data warehouse there are now concentrated partial data sources that were succesfully identified and taken from their owners / operators.
- It represents the input source of existing information on the CC for 2nd NIKM stage. During the inventory process it will be completed with records of newly discovered KM.

Input content of the central data warehouse, cont.

- The data stored in a uniform format, while maintaining access to the records in their original form.
- The record includes information, from which the partial source of the record has come from. The result of the transformation of other data sources outside of SEKM (which will be in the 2nd stage of the inventory subjected to verification, updating, evaluation of priorities and registration) are **63,942 sites** transformed from partial data sources, of which **49,809 sites** resulted after merging and automatic duplicates being removed.

Input content of the central data warehouse, cont.
- An important set of transformed data sources are the partial data sources REZZO (air monitoring data), ISOH (waste monitoring data), IRZ (Integrated Pollution Register) and DIAMO (mine water discharges) that, based on experience from pilot verification work of the inventory, are not relevant.
- These partial sources contain a total of **31,925 localities** not listed elsewhere already. However, this is information that is useful for the inventory process indirectly - as the primary information is, that in a certain village there are currently certain types of production or other activities, to which could be behind the emergence of contamination in the past.
- In the remaining set of sites relevant to NIKM there are **17,884 localities**. Even in this data set there can be expected over an estimated three thousand duplicates. A large part of sites are just in the UAP (Planning analytical materials) and at least half of the sites without coordinates are candidates for being removed as duplicates. Removal of these duplicates will be done in the input field verification of the central data warehouse.

Project Methodology

A set of NIKM methodological materials that define the obligatory process of the proper inventory.

- **"Inventory Methodology"** (about 60 pages of A4 format),
- **"Organization and management of the inventory"** (about 120 pages) and
- **"Manual for inventory"** (about 70 pages).

Methodological materials are designed to hit on the needed completeness all of the inventory process, and to enable a comprehensive idea of the continuity and sequence of phases and activities carried out within them and the links among them.

Project Methodology, cont.

Flow Chart Diagram – processes and outcomes from the inventory

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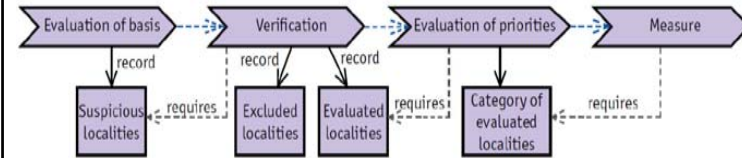
**Process Diagram of Inventory Methodology**
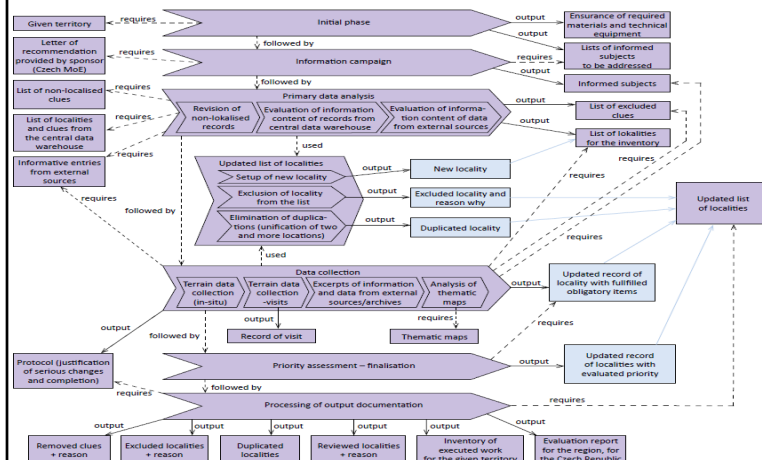
Project Methodology, cont.

- While the document "Inventory Methodology" defines the basic conceptual principles of the inventory, the document "Manual for inventory" specifies in detail the procedures (step by step descriptions and instructions for execution) of individual activities.

- The document "Organization and management of the inventory" then elaborates in detail the organization and management process.
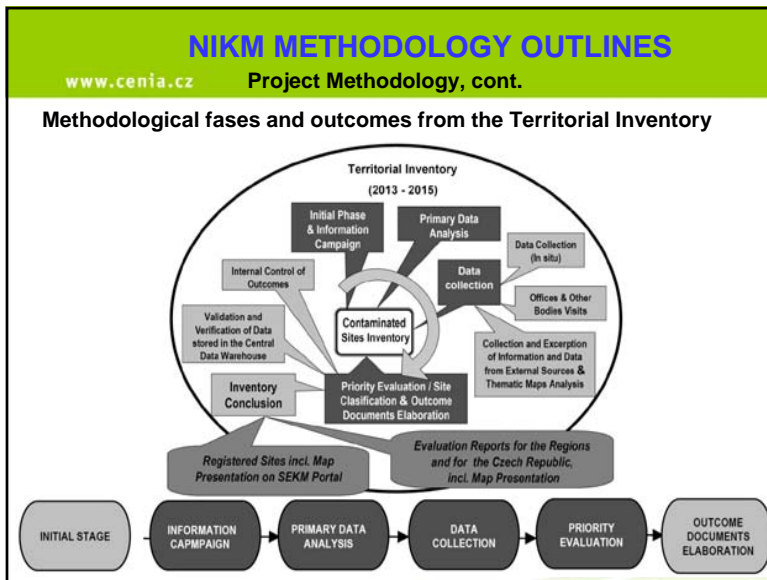
Relationships among the documents composing a set of NIKM basic methodological documents
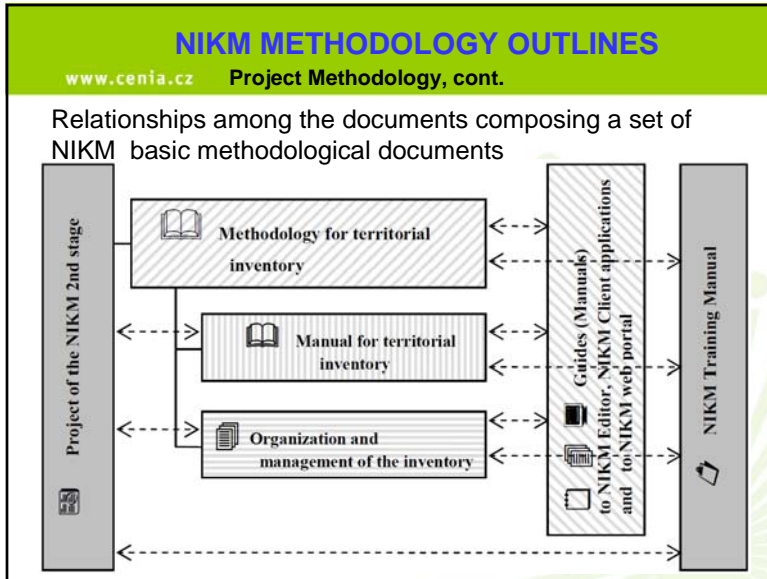
Project Methodology, cont.

The territorial inventory of contaminated sites includes the executive stages:

- **"Information campaign",**
- **"Primary data analysis",**
- **"Data collection" and**
- **"Priority evaluation".**

Methodological fases and outcomes from the Territorial Inventory

Organization and management of the project

- Implementation of the project (2nd stage) is limited by the availability of funding from the Operational programme Environment of the current programming period, ie by 2015, and by the technical and organizational aspects - by the need to manage the territorial inventory for the entire country in a maximum of two field seasons in the period 2013-2015.
- During the years 2013-2014 there should be a preparatory stage conducted, including the launch of a public tender for the supply of the inventory works, raster data and supervision.
- CENIA's work includes the creation of raster data - remote sensing, merging the database of the 1st NIKM stage with the existing databases for contaminated sites (called SEKM2 in the form available at www.sekm.cz) into a single database.
- This will be used not only for the inventory process but simultaneously for the recording of new entries from other bodies performing investigative a remediation projects, based on the obligations under the current legislation.

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Support inventory methods of remote sensing

- The created raster data platform provides geographic support for the project.
- Prepared methodology was successfully verified in 3 pilot regions (each of them 50x50 km) representing nearly 10 % of the territory of the Czech Republic. Developed and tested methodology of identification clues for potential contaminated sites is based on the use of multispectral satellite images analysis and on the interpretation of orthophotos (current orthofotomap and orthophotomap created from historical images of the first nationwide aerial photography from the 50´s).
- Created orthophotomaps are placed on http://kontaminace.cenia.cz (Contaminated sites), which is already available for public viewing.
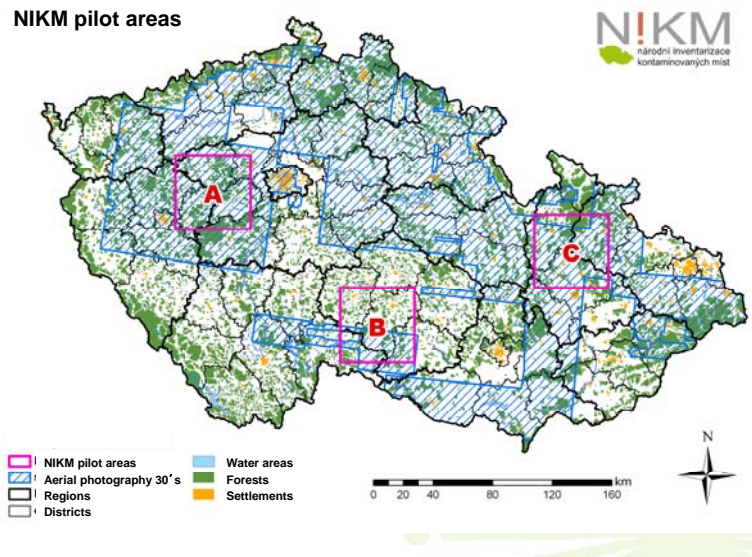
NIKM METHODOLOGY OUTLINES
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Support inventory methods of remote sensing, cont.

- Verification activities in the 1st NIKM stage brought a lot of qualitative and quantitative knowledge about the nature of newly recorded sites, allowing for their classification into established categories of priority.
- Using raster data analysis, **6 571 clues** of potential contaminated sites were identified within the pilot regions. From their field examination, this resulted in less than 5 % of them being finally considered as a real potential contaminated site or contaminated site. Examination of remote sensing clues served as the backbone of the field work's routing.
- In the 2nd stage of NIKM, a specialized professional team will perform an analysis of the raster platform for the whole country. Obtained clues will be gradually sent in batches to the central data warehouse, where they will be available for inventory teams. In-situ verification of all the clues from remote sensing will be part of the field phase of the inventory.

NIKM pilot areas

NIKM pilot areas	Water areas	
Aerial photography 30´s	Forests	
Regions	Settlements	
Districts		

NIKM METHODOLOGY OUTLINES
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Collecting and indicating environmental contamination

- Part of the collection of information from the public in the project phase "Information campaign" will be an assembly of indications or clues of possible contamination through historical map application "Contaminated sites". Each user of this map application is already able to announce suspected localities (indication of unknown environmental contamination, eg old illegal landfills).

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Discussion on the use of the methodology for other purposes
- Independently of the primary purpose of the prepared methodology (i.e. for the implementation stage of the NIKM project), the question of "using it for other purposes" is frequently raised.
- In the case when the nationwide inventory is not launched it can be used for territorially smaller inventory projects, e.g. for regions (the Czech Republic is devided into 14 regions).

There are only two pre-conditions:
- The first is the merging of the database warehouses of NIKM (containing transformed data sources) and SEKM2 (currently a running system). This needs a moderate project activity to bridge several incompatibilities (approx. a 6 month long project task).
- The second is the availability of financing (EU Funds?).
- The methodology can be used also for other activities – e.g for a transboundary comparison study of inventory systems in neighbouring regions, or on a specialized inventory focused on selected types of contamination.

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Conclusions
- In 2013 the first (preparatory) stage of NIKM will be finishing, having been handled by CENIA since 2009.
- From 2013 it should be followed by the second (implementation) stage.
- In the 1st stage the project team created and verified methodology for the nationwide inventory.
- The project included the extraction and consolidation of the existing information on contaminated sites, involvement of remote sensing in identifying potential contaminated sites, design of inventory tools and practices and the development of the knowledge base for the nationwide inventory.

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Conclusions, cont.

- The methodology was successfully verified in 9 % of the territory of the Czech Republic.
- On the basis of the methodology a procedure for the nationwide inventory, including timeschedule and financial costs, was drafted.
- The objective of 2nd stage is the identification, registration and basic assessment of the largest possible amount of contaminated sites, updating information on all known locations and the creation of a sustainable information system on contaminated sites throughout the Czech Republic.

NIKM METHODOLOGY OUTLINES
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Conclusions, cont.
We expect that future use of the performed inventory ensures or substantially contributes to:
- reducing the contamination burden on the environment;
- more effective spatial planning;
- access to current information about contamination to the general public;
- increase the legal certainty of owners or potential owners about the status of land from the point of view of contamination;
- recording and evaluating groundwater contamination and the balancing of the contamination load according to the requirements of the relevant European Directives;
- compliance with the requirements and principles of the prospective EU Directive on soil protection;
- promotion of the state administration in the field of environmental damage; and,
- the promotion and involvement of public administration on the contaminated sites issue within the whole process (from the inventory to remediation).

Acknowledgements

- *Project NIKM - 1. Stage (CZ.1.02/4.2.00/08.02683 National Inventory of Old Environmental Burdens) is co-financed from European Union Funds - the Cohesion Fund - in the frame of the Operational Programme Environment 2007-2013, Priority axe 4 - The Improvement of Waste Management and the Rehabilitation of Old Environmental Burdens, the area of intervention 4.2. - The Rehabilitation of Old Environmental Burdens ".*

Thank you for attention!

Zdeněk SUCHÁNEK
Project Team Leader
The National Inventory of Contaminated Sites (NIKM) Project
CENIA, Czech Environmetal Information Agency, Prague
Vršovická 65, 100 10 Prague 10
Czech Republic

tel.: +420 267 225 288, +420 604206757
zdenek.suchanek@cenia.cz, www.cenia.cz