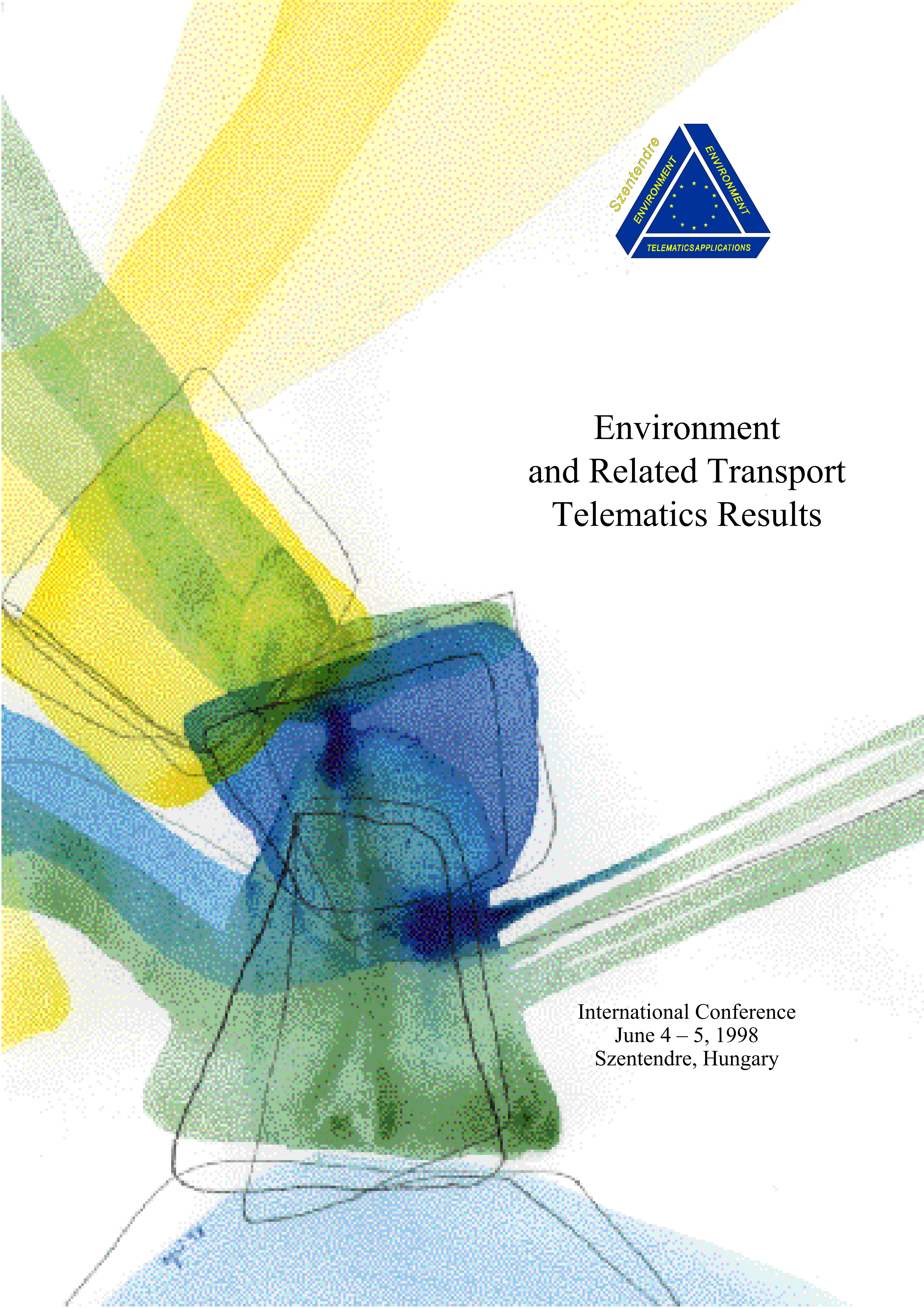

Environment and Related Transport Telematics Results

International Conference
June 4 – 5, 1998
Szentendre, Hungary

International Conference
June 4-5, 1998
Szentendre, Hungary

DG XIII - Telecommunications

Environment and Related Transport Telematics Results

Innovative Services and Solutions for the Citizen

Conference Proceedings

Werner Pillmann, Jerome Simpson (eds.)

ISEP

Forschungszentrum Karlsruhe

THE REGIONAL ENVIRONMENTAL CENTER for Central and Eastern Europe

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PREFACE

During June 4-5, the Regional Environmental Center (REC) for Central and Eastern Europe hosted a dissemination event on behalf of the European Commission's (EC) Telematics Application Programme (TAP) in Szentendre, Hungary. The event was organised by the International Society for Environmental Protection (ISEP) in cooperation with the REC and the Research Center Karlsruhe, (FZK).

The international conference, which showcased TAP research and development project results in the environment and transport fields was attended by some 140 persons. Participants from Central and Eastern Europe (CEE) largely represented national governments, research institutes and local municipal authorities, while those from Western Europe represented telematics experts and project managers.
The objective of the event was to disseminate the results of research projects funded largely under the Telematics Application Programme in the environment sector to a CEE community, to facilitate the uptake of these results in CEE, and to raise awareness of the TAP. The Telematics Application Programme will be opened up to the ten accession countries in 1998 or 1999, and the event provided a preview of Programme opportunities. The Telematics Application Programme in particular can be seen as a valuable means for facilitating the EU approximation process of CEE countries, as the applications developed under the Programme help meet the objectives and targets of specific EU Regulations and Directives.

The conference also provided a valuable opportunity to determine the existing environmental problems and priority needs for future telematics applications in CEE. Through two panel discussions, the constraints to implementing and transferring telematics applications in and to the region were examined, and priority areas for future environment research projects were analysed.

All papers presented at this conference, the two panel discussions and the political sessions are included both here in the hardcopy proceedings in order of presentation, and on the online Internet version on the REC's homepage under http://www.rec.org/telematics/determine. A full participants list giving contact information to persons involved in the European telematics field is also included.

Sealing the success of the meeting was the approval of the 'Szentendre Statement' by all represented CEE countries, a non-binding political declaration that seeks to encourage closer collaboration between CEE Environment and Research Ministries, and the European Commission. Under the aegis of the EU's forthcoming Fifth Framework Programme this can begin to be achieved. The organisers of the DETERMINE conference and DGXIII of the European Commission wish to thank the political speakers, authors, exhibitors, panel discussion members and participants for their valuable contributions. In the long term, the real success of the DETERMINE conference will be the development of further applications in the field of environmental telematics and the information exchange between experts, decisionmakers, entrepreneurs and the public within a broader Europe.

Wolfgang Boch	Werner Pillmann	Jernej Stritih
EC DG XIII	ISEP	REC

TABLE OF CONTENTS

Acknowledgements

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In particular, the authors and following persons should be acknowledged. Michaela Arndorfer (ISEP) and Jerome Simpson (REC) for conference preparation, Martin Mudri (ISEP) for liaising with authors and editorial support, Michael Weinzettl (ISEP) for proceeding layout, Ivelin Roussev (REC) for drafting and finalising the Szentendre Statement, and Darek Urbaniak (REC) who summarised both Panel Discussions.

Jerome Simpson (REC) proof-read and copy-edited the entire proceeding text, and compiled and finalised all papers given during the opening session. Adelheid Pillmann (University of Music and Dramatic Arts, Vienna) painted the cover illustration and donated this to ISEP.

All papers, summaries, and background information to this conference were mounted on the World Wide Web by Rossen Roussev, and can be found under http://www.rec.org/telematics/determine.

DETERMINE, Szentendre 1998

Welcome and Introduction

Jernej Stritih
Executive Director, The Regional Environmental Center for Central & Eastern Europe
Ady Endre ut 9-11, 2000 Szentendre, Hungary
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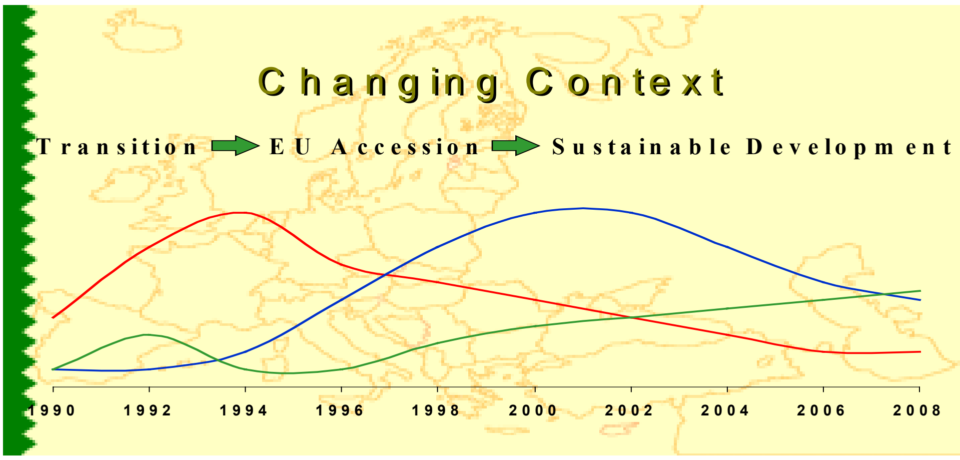
INTRODUCTION

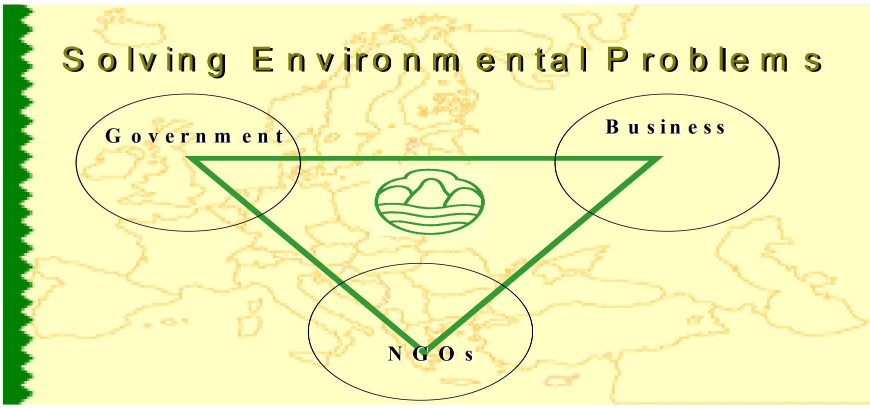
Mr Jernej Stritih, Executive Director of the Regional Environmental Center (REC) opened the conference by welcoming delegates and briefly summarising the history and activities of the REC since its opening in 1990. A summary and the powerpoint slides for this presentation are given below.

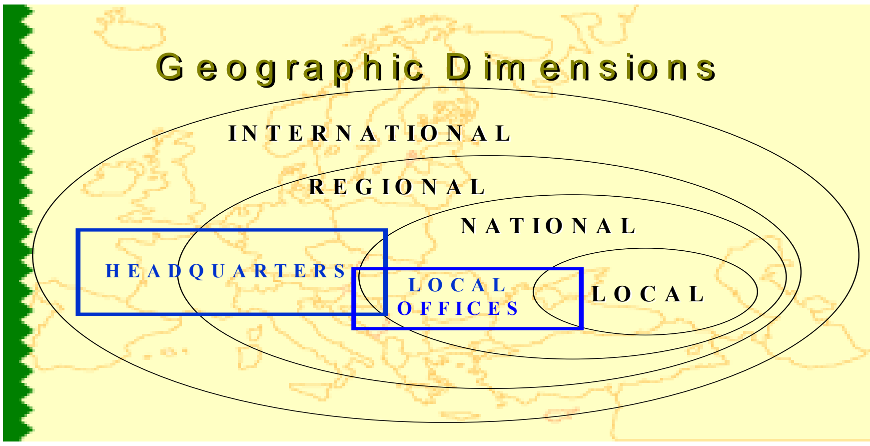
He also drew attention to the circulated draft of the 'Szentendre Statement', a non-binding political declaration that seeks to encourage closer collaboration between CEE Environment and Research Ministries, and the European Commission. Inviting comments to this, Mr. Stritih proposed that pending no major objections, a final text would be adopted at the close of the conference on the following day. The full text to this Statement can be found in the Appendix.

THE REGIONAL ENVIRONMENTAL CENTER

The REC was founded during the early stages of the transition process in CEE. Its goals and mission are to help solve environmental problems through the promotion of cooperation among environmental stakeholders, principally government, business, and nongovernmental organisations. This is achieved through capacity building activities, the exchange of information, and by encouraging public participation in the decisionmaking process. Since the REC was established, it has grown as an organisation and now incorporates 15 Local Offices and more than 150 staff. Operating at both the local and international level, with the increasing shift toward EU accession in CEE, REC is able to help facilitate the flow and exchange of information in fields such as Telematics and to foster EU-CEE cooperation. These are among the reasons for REC hosting the DETERMINE conference.







Organization - staff

	Program staff	Support staff	Total
Headquarters	48	20	68
15 Local Offices	28	10	38
Total	76	30	106

Welcome Address of the CEE Host Country

Klara Akots
Deputy State Secretary, Ministry for Environment and Regional Policy
Fo utca 44-50, H-1011 Budapest, Hungary

Ms. Klara Akots of the Hungarian Ministry for Environment and Regional Policy opened the meeting by presenting the perspective of an EU Associate Member with respect to the accession process and how the field of Telematics fits into this.

Referring to the accession process, the environment sector can not be considered an independent element but an integrated concept in the so-called sectoral approach. In autumn 1997, the National Environmental Programme was adopted and represents a milestone in Hungary's preparation for EU accession, nature conservation and regional policy under Ministry for Environment activities. This Programme will run for the next six years and will not only help to ensure cross-sectoral cooperation, but Hungary's path toward EU harmonisation. This also helps to guarantee Hungary's participation in pre-accession funding and programme opportunities such as the 5th Framework Programme.

The National Environmental Programme has helped in assessing Hungary's position with regard to overall environment progress and related activities in the Telematics field. Telematics is not considered simply an add-on tool for solving environmental problems but a basic founding activity integrated within the overall harmonisation process. This special and upcoming field is growing in importance in Hungary's pre-accession work, both in environment and EU harmonisation, and helps underline the principle of subsidiarity. Telematics is recognised as a tool that can help to ensure the full transparency of this process, which can involve and inform the public, nongovernmental organisations and environmental interest groups, and which can help ensure cooperation with other sectors of the economy (energy, construction, medicine, and agriculture). It can also help to ensure the availability of *reliable* environmental information for the decisionmaker, an element central to the success of the above processes.

In closing, full support was given to the conference, its goals and objectives. The European Commission was also thanked for its assistance to date in this field, along with UNEP GRID, and the OECD for enabling Hungary to reach its current level of development. Hungary in particular looks forward to future cooperation in this field.

Welcome Address of the EU Presidency

Angela Eagle MP
Parliamentary Under Secretary of State, Department of the Environment, Transport and the Regions
Eland House, Bressenden Place
London SW1E 5DU, United Kingdom

Mrs. Eagle was not able to present and welcome the delegates of the DETERMINE conference on behalf of the UK, and EU presidency, and a faxed message was therefore received by the Regional Environmental Center for presentation at the conference. This message (included below) was delivered to the conference by the Executive Director of the REC.

DETR
Department of the Environment, Transport and the Regions

ENVIRONMENT AND RELATED TRANSPORT TELEMATICS RESULTS -
INNOVATIVE SERVICES AND SOLUTIONS FOR THE CITIZEN CONFERENCE

On behalf of the UK Department of the Environment, Transport and the Regions and the EU Presidency, I send warm greetings to the conference and trust it will be successful.

The UK fully supports the candidature of countries of from Central and Eastern Europe in their desire to join the European Union. The accession of these countries would be an historic step in strengthening democracy across Europe.

One of the ways in which potential new members of the EU can become involved at an early stage is through appropriate participation in relevant parts of the Framework Research Programme. Therefore, I encourage all candidate countries to take the opportunities offered by the Fifth Framework Programme which is planned to start in 1999.

There are many environment and transport problems facing all our countries. The solution to these will require developments in policy and technology across a broad range, and the application of appropriate telematics will be one element of the overall approach. The new Framework Programme will be expected to continue the development of telematics based systems and services to help citizens, industry and administrations move towards a sustainable society.

So, I welcome this conference and wish every success to deliberations and I look forward to a fruitful partnership between EU and CEE countries in the Fifth Framework Programme.

Angela Eagle

ANGELA EAGLE

EU Environmental Policies and Priorities Related to Agenda 2000

Jesper Jörgensen
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INTRODUCTION

For his presentation, Mr. Jörgensen summarised the EU's opinions on the required accession strategies for Central and East European countries in the environment field, especially the challenges faced in legal approximation and the harmonisation of institutions and infrastructure, priority setting and the associated costs. In particular, he drew upon "Agenda 2000" and the "Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee, the Committee of the Regions and the Candidate Countries in Central and Eastern Europe on Accession Strategies for Environment: Meeting the Challenge of Enlargement with the Candidate Countries in Central and Eastern Europe" (COM document (98) 294). The full text to these documents can be found under: http://europa.eu.int/en/comm/dg1a/agenda2000/ and http://europa.eu.int/en/comm/dg11/docum/98294sm.htm and is briefly introduced below.

THE ENVIRONMENTAL APPROXIMATION PROCESS

In the forthcoming enlargement of the Union, the environmental dimension will present greater challenges than in any previous accession. This relates both to the sheer scale of past environmental liabilities and the gap in the level of environmental protection in Central and Eastern Europe compared with the situation in the EU. On the other hand, the candidate countries also possess vast areas of untouched nature which contribute considerably to biological diversity in the whole of Europe. To keep these assets and at the same time to develop and manage an economically and environmentally sustainable framework, is the major challenge ahead.

The cornerstone for such a framework is the environmental acquis of the European Union. However, as recognised in the Commission's Agenda 2000, full compliance with the environmental acquis will probably only be achievable in the long term for all candidate countries in Central and Eastern Europe. Against this background, Agenda 2000 proposed that a special strategy for the adoption and implementation of the environmental acquis should be set up and combined with a reinforced Community pre-accession assistance strategy where investment for adoption of the environmental acquis is one of the priorities:

In partnership with the Union, realistic, national, long-term strategies for gradual effective alignment should be drawn up and start being implemented in all applicant countries before accession, in particular for tackling water and air pollution. These strategies should identify key priority areas and objectives to be fulfilled by the dates of accession as well as timetables for further full compliance; ensuing obligations should be incorporated in the accession treaties. All new investments should comply with the acquis.

Important domestic and foreign financial resources, in particular from the private sector, will have to be mobilised in support of these strategies. The Union will be able to make only a partial contribution. (See COM(97)2000 Vol. 1 p.65)

This special strategy for the environmental approximation calls for special measures and consideration both in the candidate countries and in the Community. The aim of the Communication is to examine, in view of the indications in Agenda 2000 some of the practical considerations which the Commission believes that the candidate countries should take into account when further developing their national strategies for achieving full compliance with the environmental acquis. This examination does not prejudge the allocation of the future pre-accession facilities.

The Communication falls within the Union's reinforced pre-accession strategy. It aims to complement the Accession Partnerships, and to provide assistance to the candidate countries in the refinement of their National Programmes for the Adoption of the Acquis. It does not in any way prejudge the accession negotiations, or the scope and duration of any transitional arrangements that might be the result of these negotiations.

The Environment Action in the Information Society Research Programme - The Follow-up to the Current Telematics Application for the Environment Initiative

W. Boch, for M. Richonnier,
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WELCOME ADDRESS

Wolfgang Boch of DGXIII, Telecommunications, Information Market and Valorization of Results, Head of the Environment Sector of the Telematics Programme was nominated to replace Michel Richonnier, Director, of the Telematics Applications Programme shortly before the DETERMINE conference took place to give the above presentation and to welcome delegates on the Commission's behalf.

Mr. Boch first welcomed the opportunity to meet with Central and East European (CEE) delegates to discuss the environment telematics needs which might be met by the European Union’s future research activities, and reiterated this was the main objective of the conference. By introducing delegates first to the applications funded under the research programme, Mr. Boch looked forward to the communication of these needs during the course of the meeting, and CEE countries' more long-term participation in the forthcoming 5th Framework Programme.

Mr. Boch stressed research was not being undertaken for the sake of research, but under the principles laid down in the Maastricht treaty is being carried out to support the competitiveness of European industry and in the context of other related European Community policies (citing for example, the 5^{th} Environmental Action Plan and referring to the implementation of "preventive" measures reflected by accident and early warning systems, as opposed to "remedial" measures and "end-of-pipe" technologies). In this respect, many of the state-of-the-art technology projects in the information and telecommunication field that have been funded are now being successfully extended and practically applied, independent of EU support in European regions. This serves as an indication of the value and benefit brought by the project, and a further reason for presenting these projects to a CEE community, particularly in light of the EU accession process.

Presented overleaf is a recently revised version of the background paper presented by Mr. Boch, summarising the application and service areas, critical issues and benefits of existing research and development activities, and some examples of projects funded under the existing Telematics Applications Programme for the Environment. An outline of the new Fifth Framework Programme and opportunities is also given.

Environment Applications in Information Society Technologies Research

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ABSTRACT

Environmental problems are of concern to us all, and not only since the Kyoto conference. Environmental issues in many instances are common issues, which call for joint action and common responsibility. Specific actions corresponding to the European Union enlargement process to Central and Eastern Europe (CEE) will be developed as part of the environmental approximation strategies, and will include collaborative Research and Technical Development (RTD) efforts, e.g. as part of the future Information Society Technologies Research Programme of the European Union (1998-2002). The objective of this background paper is therefore to outline:

(i) The expected benefits of R&D in environment telematics;
(ii) The present and future EU R&D activities in this domain.

The future Information Society Technologies (IST) Programme should be seen in the context of the major societal shift from the “industrial age” to the “information society age” at the start of the next millennium. The implications are global and will concern the whole of Europe, affecting actors in both Central and Eastern Europe and Western Europe. The IST Programme thus will offer increased opportunities for cooperation on common environmental issues, such as air quality, water quality, waste management, nature protection, industrial pollution control and risk management.

THE EXPECTED BENEFITS FROM R&D

Both the EU and CEE countries are facing serious environmental challenges. East European Countries have suffered severe and well-known environmental problems, such as Chernobyl (in Ukraine) or the Black Sea Disaster. However, the economic development of West European countries have also had adverse effects on the environment, with many eco-systems in the EU now endangered. From these perspectives, what is the role of the EU's Information Society Technology Research Programme and application to the Environment?

If information and communication technologies are developed in an appropriate way, citizens, administrations and industry can significantly benefit in a range of areas, including:

i) Environmental control, with more emphasis on preventive measures;
ii) Environmental management, water resource management;
iii) Lower impact of pollution on health;
iv) Public information systems.

In monetary terms, the benefits are difficult to quantify. However, it seems reasonable to assume that they are proportional to the damage arising. The following examples and figures illustrate the dimension of these issues.

a) **Water resources:** Two-thirds of the world's cities with more than 5 million people lack water distribution and adequate resources. *This requires RTD actions for efficient urban environmental management systems*. Three million people worldwide die each year as a direct result of drinking unsafe water, while 120 million people in the WHO European Region cannot enjoy an uninterrupted supply of microbiologically safe drinking-water. *This requires RTD actions for Water quality monitoring systems and services.*

b) **Air pollution:** 30 to 40 percent of Europeans living in cities are exposed to air pollutants above the levels defined by WHO or EU guidelines (Ozone, Sulphur and Nitrogen dioxides are the main causes for decreases in pulmonary functions). According to the European Environment Agency (EEA) and WHO sources, 14 million people each year suffer more than a 5 percent decrease in pulmonary functions caused by pollution. Of this number, four to eight thousand people suffer from asthma leading to hospital admissions. *This requires RTD actions for air quality management and monitoring systems and services, and for research into better understanding of health effects caused by environmental pollution*.

c) **Earthquakes:** Earthquakes are responsible for the death of many thousands of people each year throughout the world. *The requirement exists therefore for detection systems that can warn local authorities of earthquakes, enabling them to evacuate inhabitants from threatened areas. Similar systems are required for tornadoes, tsunami and volcanoes.*

d) **Global Warming:** Sea levels are rising between 3 and 9cm every 10 years. 70 percent of the world's population lives on coastal plains.

e) **River Floods:** In 1995, 200 thousand people were evacuated along the Rhine. The same also happened in August 1997 along the border between Germany and Poland. A similar disaster occurred more recently in Campania (Southern Italy). *This requires RTD actions for flood monitoring systems and services, and also real-time control for seawalls, dikes and dams.*

f) **The Black Sea Disaster:** Severe damage has been suffered by sea life from decades of pollution. The surrounding six countries have estimated that some USD 400 Million is necessary to correct the most pressing problems. *This requires RTD actions for sea pollution management and control systems and services, both for coastal emissions and oil-spills from vessels.*

g) **Energy Management:** Using telematics and voltage control at four levels of power generation (generator, power plant, regional and system levels) could save ECU 1.2 billion in the EU alone, per year.

Many other critical examples or figures could be provided. However, the need for action should also be seen in view of the fast growing eco-industry market. The eco-industry in Europe is estimated at ECU 90 billion annually, and represents a workforce of 1.6 million among the 15 EU Member States. Green business as a whole represents USD 280 billion and 2 percent of the total employment for OECD countries in 1995. The estimated market by 2010, with an annual growth rate of 8 percent, should be about USD 640 billion (Source: Global environment Markets - An Update, ECOTEC and JEMU, 1997).

In the forthcoming years, environmental telematics systems and services are expected to represent a significant share of this market. Consider for instance the potential of systems which are already increasingly deployed: environmental monitoring systems, environmental public information systems, or systems for automatically controlling urban traffic, or for warning authorities when dangerous thresholds are at risk of being exceeded. Similarly, systems are increasingly enabling online and real-time industrial emissions control (to air or rivers). They enable prompt reaction in case of emergencies such as floods or fires.

Finally, some indications of the potential impact of transport telematics services. In urban areas, interactive traffic control may offer a 20 percent reduction in delay time, which implies about a 10 percent reduction of CO, NO_x, HC. Interactive traffic control, combined with environmental monitoring could even lead to a 50 percent reduction in pollution levels. These success stories come from the Telematics Applications Programme (TAP) QUARTET project, and from the CITIES case study in Athens, Greece.

PRESENT AND FUTURE EU R&D ACTIVITIES IN ENVIRONMENT TELEMATICS

In the field of Community research, besides R&D in Telematics, a number of activities relating to the environment are being (or have already been) carried out. These include:

- Within the *"ESPRIT" Programme of DG III,* which is devoted to information technology (micro-electronics, basic research, data processing, High Performance Computing...etc.), some 94 projects have contained environmental considerations and components.

- The *Environment and Climate Programme* of DG XII is dedicated to problems such as water control, land pollution, and the environmental effects of global climate change. These projects are close to basic research and contribute to the laying down of scientific foundations for European environmental policy.

- Within the *3rd RTD Framework Programme (1990-1994),* DGXIII launched *Environmental actions* of a more diverse nature, particularly within transport and administration. For instance, the QUARTET project on the management and planning of urban transport networks takes into account air pollution. Pilot experiments were executed in Turin, Toulouse and Athens. The follow-up project to QUARTET, QUARTET-PLUS, was presented in the conference session on sustainable transport systems. The EWTIS project, addressing the marine transport of dangerous goods takes into consideration the environmental consequences. The ENVIRONET project, which involved more than 50 national and regional authorities, was concerned with the exchange of information on air, water and river pollution.

- Environmental research under the current *Telematics Applications Programme (1994-1998)* is the first coordinated, systematic and formalised initiative to put environment into the framework of telecommunication and information technologies. It has a budget of ECU 22m, a portfolio of 26 projects, attracted more than 200 actively involved organisations, including industries, local authorities and research organisations, and covers more than 25 cities and 30 regions. This research supports the development of a series of new and powerful telematics-based tools which will enable citizens, industries and local authorities to have access to information on the quality of the environment, establish the basis for informed decisions, and improve the quality of the environment.

4th Framework Programme Environment Telematics Application Areas – Some Examples

Exemplary topics in the environment sector of the Telematics Applications Programme include:

- *Management of air quality, water quality and water resources*
  Among the projects in this area are EFFECT and EMMA, which deal with integrated air quality and traffic control in urban areas in cities such as Madrid, Stockholm, Gothenburg, Leicester, and Genova. The monitoring networks, models and forecasting tools have been fully exploited by the EMMA partners, and the city authorities are committed to using and maintaining the tools beyond the end of the project (June 1998). The WATERNET project assists the City of Barcelona and the department of Hauts-de-Seine in the control of water quality for the production of drinking water.

- *Prevention and handling of catastrophes and risks, such as floods, forest fires, earthquakes, industrial accidents, marine pollution, etc.*
  A key area addressed by the environment sector of TAP projects in this domain include: DEDICS (for forest fires), RADATT (for earthquakes), and ENVISYS (for marine oil pollution in the Mediterranean and the North Sea).

- *Access to, and the provision of environmental information to the public*
  Many projects use Internet technologies, Intranet among administrations, ISDN connections and components of multi-media solutions, and often GIS systems as an anchor interface. Moreover, numerical modeling and computer simulations and multi-lingual systems are important issues covered by TAP projects.

- *Multi-lingual environmental thesaurus*
  The multi-lingual environmental thesaurus under development by the EEA, in close cooperation with the REMSSBOT project, deserves particular attention. Other projects touching on this issue are E-MAIL

(environmental information to regional authorities and citizens in Corfu, Rhone-Alps, Tuscany), and TEMSIS (environmental information exchange between administrations and the citizens in the border zone between Germany and France).

Linkage with the European Environment Agency and the Centre for Earth Observation

It is important to stress the role of the Telematics Applications Programme Environment Sector within the framework of cooperation with the European Environment Agency (EEA) and the CEO (Centre for Earth Observation) managed by the Institute of the Space Applications under the auspices of ISPRA. Examples of this cooperation are the EMMA and ECOSIM projects, in which the Joint Research Centre is directly involved. The EEIS project, which started in 1998, concerns the integration of the Catalogue of Data Sources of the EEA, and the Enabling Services of the CEO. The IRENIE Project builds air and water quality management solutions within the EIONET. Both projects are directly overseen and supervised by the EEA.

Environment Telematics Applications and Actions Funded under the INCO Budget

Several Telematics Application projects include participants from CEE. Their participation is funded by a special EU budget reserved for the assistance and support of third countries and international organisations. This is the case for instance within the DETERMINE project, which has organised this conference, and the ECOSIM project application, involving Poland (Gdansk).

Similarly, the ENWAP User Forum, which was launched in May 1997, funds CEE participation under INCO. The objectives of the user forum focus on the exchange of information on issues such as common user requirements and best practices in air and water pollution management. The first release of the User Requirements and Good Practices guides were distributed during the DETERMINE conference. The user forum platform facilitates the uptake of the TAP Environment 'end-products' and fosters the future implementation of 'end-products'. Project catalogues and annual reports from the sector were also made available at this conference.

Environment Applications in the IADS

Another major activity launched last year concerns “Integrated Applications on Digital Sites" (IADS). 11 projects were selected with a total budget of ECU 45m. These will integrate a broad range of telematics applications and validate integrated services and user acceptance, typically within five to ten European “digital” sites. Environmental applications will be integrated into the services to be established by at least three of the IADS projects. One of these projects, TITAN (Tactical Integration of Telematics Applications across Intelligent Networks), is based on the TAP Environment E-MAIL project. This project focuses on regional environmental planning by integrating heterogeneous data sets, a key issue when setting up integrated services. Another project, EQUAL (Electronic Services for a better Quality of Life), addresses environmental monitoring and forecasts in urban areas, linked with traffic management, smart cards and public access to cultural services.

Exploitation and Commercialisation of Results

Most projects require further maturation before serving as commercial products, therefore one may expect the commercialisation of results perhaps one or two years after the end of the project. However, some projects such as EMMA and E-MAIL intend to see the commercialisation of results before the end of this year, while others such as EFFECT, ECOSIM, and WATERNET might follow in 1999.

FUTURE RESEARCH ACTIVITIES WITHIN THE 5TH FRAMEWORK PROGRAMME (1998-2002)

On 9 April 1997, the European Commission submitted its first proposal for the 5th European Research, Technological Development and Demonstration Framework Programme (ECU 16.3m)[1] to the Council and the Parliament. A second amended proposal was presented in January 1998.

[1] Indicative figures, based on the Commission proposal

The new Programme, which is currently under discussion in the European Parliament and the Council of Ministers, will cover the period 1998-2002. It should mark a double change compared to the four previous Programmes.

Concentrating the efforts of research in only seven programmes - four "thematic" programmes and three horizontal programmes. The four thematic programmes and their proposed budgets[1] are :

i) Improving the quality of life and management of living resources (ECU 2.65m);
ii) Creating a user friendly information society (ECU 3.925m);
iii) Promoting competitive and sustainable growth (ECU 3.1m), and;
iv) Preserving the ecosystem, which will address energy and the environment in an integrated manner (ECU 2.1m).

Each of the four thematic programmes will include a series of key-actions. Environment related research primarily finds a place in:

i) "The Information Society" Programme with its key-action "Systems and Services for the Citizen", and
ii) The "Preserving the Ecosystems" Programme, with its key-actions "Management and Quality of Water", "Global Environmental Changes and Climate", and "The City of Tomorrow".

The Information Society Programme, Key Action 1: "Systems and Services for the Citizen"

This activity will address systems and services in five domains: health, people with special needs, administrations, environment, and transport and tourism. The environment related RTD activities will include:

- *Intelligent environmental monitoring, analysis, forecasting and decision support*, in domains such as air, water, waste, nature and bio-diversity;

- *Information and management support tools and systems for sustainable development* (durable management of ecological resources), in areas such as the management of energy resources and other resources, clean technologies in production, etc.

- *Real-time, high performance risk and emergency management systems and services for the prevention, the management and mitigation of emergencies*, *man-made or natural*; including forest fires, earthquakes, floods, droughts, nuclear emergencies, etc.

The time schedule for the 5th Framework Programme can be anticipated as follows:

- End of 1998 : adoption of the 5th FP and the (first) specific Programmes;
- Beginning of 1999: first call for proposals of the specific Programmes.

CONCLUSIONS

- Due to the global nature of the Information Society and disappearance of national boundaries, international cooperation is becoming extremely important and cost-effective, and even an economic necessity.
- The 5th FP is expected to enable an efficient framework for collaboration with the EU accession candidate countries, provided agreements for participation are timely and in place.
- Initiatives such as this conference have facilitated and eased the gradual accession of CEE countries, support for the approximation process, and enabled the preparation of common future actions, which can have a positive effect on common economic development and also protection of the environment for future generations.

[1] Indicative figures, based on the Commission proposal

- Research actions like the Telematics Applications for Environment Programme will allow Europe (EU and CEE) to continue to progress towards sustainable development, thus contributing to the economy, the environment and our society.
- Not incidentally, the priorities of the IST-Environment research action are matched to a large extent with the priorities of the “environment acquis” for enlargement.
- Existing and future telematics services should be considered as catalysts and "enablers" for putting the principle of Sustainable Development into action.

CEE Requirements in the Environmental Sector (and the View to Approximation)

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SUMMARY

The objective of this presentation was to examine the various driving forces behind addressing environmental issues in the Central and East European (CEE) region. In particular, the EU accession process, the environmental action programme (EAP), Agenda 21, and so on. Mr. Benes offered the Czech Republic's perspective as being representative of most accession countries, and in particular examined the priorities identified under Agenda 2000, legal approximation, and the improvements expected in state of the environment monitoring and information systems under the new Czech Law on Environmental Information and closer cooperation with the European Environment Agency.

Distinguished delegates, ladies and gentlemen,
it is a great and unexpected honour for me to address the participants of this conference on behalf of the Czech Ministry of Environment. My name is Jaroslav Benes, I am the Director of the Environmental Strategies Department at the Ministry of Environment, and am responsible for environmental reporting and updating, and environmental policy concepts. I would like to excuse the Deputy Minister, Mr. Erik Geuss who was not able to participate in this conference, and excuse myself for not speaking on behalf of the entire CEE region. Rather, I will summarise the experiences gained by the Czech Republic, with the firm belief that these conditions are very much similar or identical to the other countries of the region.

Prior to 1989, Czechoslovakia could be characterised by extensive economic development which took place at the expense of the environment and nature protection, and confidentiality of most state of the environment data. A good set of environmental laws had been established, but due to political pressure, there were thousands of violations and exemptions. Emissions from huge power stations were released to the atmosphere, untreated sewage poured into surface waters, and groundwaters were polluted by nitrate contamination.

The pressure exerted by environmentalists and concerned citizens was a strong element in the overall effort to bring down the communist regime. Numerous alarming environmental issues were published in an illegal „samizdat“ newspaper. The first systematic and realistic report on the state of environment was published by the Biological Society of the Academy of Science and distributed not long before the „Velvet Revolution“ of 1989.

Since November 1989 all barriers have fallen and the environment has become an important political theme. Within a few weeks of the Revolution, the Ministry of Environment was established and the spontaneous upheaval of official and NGO activity attempted to bridge the existing gaps in environmental protection. The Ministry and the Federal Committee prepared a whole range of new environmental laws which were adopted by Parliament. Research institutes and monitoring systems were strengthened, while the Czech Inspection Agency and the State Fund of the Environment were established.

The first *Statistical Yearbook on the Environment of the Czech Republic* was published in 1990 by The Centre for Environmental Information. The structure adopted for this is the now generally accepted review for driving forces, pressures state, impacts, responses or the DPSIR scheme.

In accordance with our accession to the European Union, serious and systematic changes in our environmental management system were also launched. ISAP, the Information System for Law Approximation, deals with European Union (EU) environmental legislation and the level of harmonisation of national legislation with the legislation of the EU, the Acquis Communautaire.

Our activities in the near future are defined by the EU's *Agenda 2000* document. This evaluation of our application for accession to the EU reveals the most serious gaps and deficiencies in our environmental management system. The issues of air and water quality, waste management, insufficient use of economic tools, and poor implementation of environmental laws are among the priorities listed.

The Commission has also given special attention to the number of topics that are highly relevant to the theme of this conference. In particular, the serious shortcomings in the fields of awareness to environmental problems, environmental education, insufficient public participation in the decisionmaking and environmental management processes, and obstacles in public access to environmental information. These are exactly the problems that an improved telematic and integrated environmental information system might help to solve.

Let us analyse in detail the field of environmental information systems and environmental reporting. I am not, due to my age, an expert in information technology, their potentials and perspectives, but I do believe I serve a good representative of the demand side. Effective monitoring and information systems should always be demand driven. The support of an integrated information system for environmental management can be demonstrated by the DPSIR scheme.

In summarising the present state of environmental monitoring and information systems, and environmental reporting in the Czech Republic, modern, expensive, but effective specialised monitoring systems for air and water quality and radiation safety have been established. Monitoring in this respect is defined as the continuous measurement giving real-time information and data, with the possibility to intervene with the investigated processes and implementation of necessary measures in case of emergency. Information system is defined as the collection of data and information with the perspective of later evaluation, analysis and utilisation. Numerous other information systems covering energy, industry, transportation, agriculture, forest management, health statistics and the data of the State Statistical Office are today at our disposal. An integrated meta-information system, compatible with the European EIONET system is currently being established with the assistance of the PHARE Programme.

Immediately following the downfall of the totalitarian state, the first *Report on the State of the Environment* appeared. At present the following types of reports appear annually:

- Statistical Yearbook on the State of the Environment;
- Report to the Government on the State of the Environment;
- Regional reports on the State of the Environment in the 9 regions;
- Report on the Industrial Activities in the field of Environment;
- Report on the State of the Environment in our capital Prague;
- Numerous sector and media oriented yearly reports (air, water, agriculture,..).

Of course, all these reports are available in print, but many of them now also appear in electronic form (Internet, CD-ROM).

The Commission's opinions within Agenda 2000 enabled us to recognise the existing deficiencies. Ensuring the free flow and sharing of data still faces many technical and organisational obstacles although the new Law on Environmental Information will help to overcome some of these. Currently being approved by the Czech Parliament, it envisages the free access to the environmental information for any NGO or even individual citizen, without giving reason or announcing the purpose for which this information is required. In order to prevent central and local authorities being overburdened with the collection and dissemination of information in complying with these expected requirements, if necessary to implement well designed and efficient telematics systems on environmental information. This system must cover not only physical, chemical, social and economic data, but also the whole array of laws, administrative documents, decisions and correspondence.

There are two parallel trends in gathering and disseminating environmental information. On the one hand there is as an ever growing requirement to increase the number of investigated phenomena, to bring new data on new factors, and new aspects of environmental changes, and to relate the resulting impacts of environmental changes. On the other hand, there is a trend to concentrate on a few representative indicators, that would facilitate the understanding of the main trends and would enable mutual comparison on an international scale. We cannot avoid following both trends, and to use the proper one for each intended purpose.

The EU approximation process is defined by the *National Programme - Access of the Czech Republic to the European Union***.** There is much to be accomplished in all sectors, but energy, agriculture and ecology are considered to be the most difficult among them. The review of environmental issues indicates some short and medium-term objectives in the raising of environmental awareness, education and in providing public access to information. The relevant tools facilitating them will be the approved new Law on Environmental Information, the Concept of Environmental Education and Information (currently being discussed by various sectors), and the organisation of professional courses for regional environmental administrations. All these measures can be enhanced by the use of improved telematics information systems.

To conclude, the Czech Republic witnessed the birth of a pan-European approach to environmental management and environmental reporting, when at the initiative of the late Mr. Vavroušek, the Environment Ministers of all European countries met for the first time in 1991, in Dobříš in the Czech Republic, and helped draft the first report on the European environment, (the so-called *Dobříš Assessement: Europe´s Environment).* Since then, Environment Ministerial conferences have taken place in Luzerne, Sofia and most recently Aarhus, Denmark, where *Dobříš +3* was presented. The Czech Republic maintains its position in supporting the ongoing collection and dissemination of environmental information. Integration with the EEA and the nucleus of the pan-European telematics information system, the EIONET, will serve as a driving force for this, further facilitating the European integration processes and improving our own national performance in environmental reporting and environmental management.

An Overview of the Strategic Value and Status of Environment Telematics in Central and Eastern Europe

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INTRODUCTION

Reading through the literature on the Telematics Research Programme and the various applications developed through this, it is clear that these systems and services provide valuable solutions for protecting and improving the environment. Powerful new tools that bring together telecommunications, information management and environmental expertise, and which enable citizens, industry, business and public authorities to access and share better quality environmental information, are now becoming increasingly commonplace within the European Union. But what about the countries of Central and Eastern Europe? For those already embarking on the process of EU accession, in time they will also begin to share these benefits, as their policy objectives for improving the quality of the environment are harmonised, and gradual assimilation into the European Union becomes a reality. However, some of the countries of the region have already began to implement telematics-like solutions for dealing with environmental problems. Frequently with Western support but increasingly funded locally, many have had measurable positive effect. It is the objective of this presentation to overview some of the initiatives in the environment field, and their corresponding strategic value, not least perhaps in facilitating the EU accession process itself.

IMPROVING DATA COLLECTION AND DISSEMINATION

Prior to the political changes which took place at the end of the last decade in Central and Eastern Europe (CEE), environmental information was irregularly collected. When compiled, it was seldom made available to the public, while poor quality methods for data collection often had a tendency to render the data unreliable. Given the rise, however, in the importance attached to environmental issues globally during the last few decades, and the transition of CEE countries toward democratic free market societies, demand for reliable environmental information increased. Not just at the local level among the public, but at the decisionmaker level where a need for precise factual information concerning the state of the environment was deemed necessary for making accurate judgements in drafting and implementing measures for the protection of the environment.

The need for increased transparency at the governmental level with regard to collecting and disseminating data also became important, with growing demand from society for the availability of better quality information on the environment in which they live. Improved access to environmental information is said to be the seed for public participation in the environmental decisionmaking process, which in turn ensures better accountability of governments and businesses for their actions. This also helps to improve cooperation between the public, nongovernmental organisations (NGOs) and the government sector in solving environmental problems.

Among the driving forces behind this growing trend for improving the availability of information in the CEE countries are the forthcoming 'Convention on Access to Environmental Information and Public Participation in Environmental Decisionmaking', due to be signed by most of those CEE countries seeking EU accession, in Aarhus, Denmark later this June at the Environment Ministers Conference. Additionally, the EU's Directive on Access to Information stipulates that public authorities are required to make available information relating to the environment to any person upon request without having to prove an interest runs central to the need to increase the availability of environmental data as well as the EU accession process.

APPROXIMATING EU LEGISLATION

Nearly all the countries of CEE have expressed a desire to join the European Union, with ten countries already initiated as Associate Members, and five of these (the Czech Republic, Hungary, Slovenia, Poland and Estonia) currently negotiating their accession. In conjunction with this, harmonisation with all of the EU's legislation is necessary, including that which focuses on the environment. Policies in these countries are beginning to be shaped around EU Directives such as Access to Information, Environmental Impact Assessment (EIA), air and water quality standards, EMAS (Eco-management and Audit Scheme), and so on. At this point we can begin to relate the strategic value environment telematics applications can offer the CEE region.

Many Telematics projects in CEE and in the EU assist in some way in the meeting of specific requirements of EU Directives, while also ensuring decisionmaker and public access to environmental information. In CEE, these can also be seen therefore to facilitate the EU accession process. This link with EU Directives will be clearly shown during the course of the next two days, however, briefly I would like to touch upon a few regional examples.

FACILITATING ACCESS TO ENVIRONMENTAL INFORMATION

In terms of facilitating public and decisionmaker access to information, international organisations like UNEP and the EEA have spearheaded initiatives at the governmental level to enhance data collection and dissemination. Since 1994, 'ENRIN', the UNEP GRID's Environment and Natural Resources Information Network has been extended to most of the north European countries and is now being expanded into the NIS region. This regional network links national scientific and information centres with the objective to improve the availability of environmental data and information for decisionmakers and the general public. This is achieved through the compilation of national state of the environment assessment reports by representatives of Ministries of Environment, and can be accessed via UNEP GRID's Internet homepage: http://www.grida.no/ . ENRIN also incorporates a capacity building element to its activities, thus contributing to the implementation of Agenda 21, strengthening national environmental information management capacities.

UNEP's ENRIN shares similar goals and activities to the EU's and EEA's 'EIONET' (the European Environment Information and Observation NETwork). EIONET was created to provide reliable environmental information at a European level and is a cooperative activity between the EEA and EU Member States. With the EU accession of CEE countries, the EIONET is currently being extended to this region with the appointment of National Focal Points already having taken place. As a result of the overlap between EIONET and ENRIN, the two programmes will be closely harmonised to provide objective, reliable and comparable environmental information that enables decsionmakers to take the requisite measures to protect the environment, to assess the results of such measures and to ensure that the public is properly informed about the state of the environment.

The EIONET concentrates on providing periodic reports on the state of the environment, including media oriented monitoring, assessment of trends affecting the environment, source oriented monitoring, assessment of pressures, problems, areas and sectors etc. through National Focal Points to its network of Topic Centers. Each Topic Centre concentrates on collecting and disseminating information in a specific area, for example, inland waters, air quality, land cover, and nature conservation. These elements are connected together through a telematics network. The expansion of this network to CEE started during 1997 and has already begun to improve the accessibility of environmental information for the decisionmaker, improve data collection methods and harmonise this on a pan-European level. While essentially still an Intranet, improved public access is also achieved through the EEA's web site: http://www.eea.dk from which links to Topic Centres are available.

The EU's Phare Programme has been active in many of the countries of Central and Eastern Europe since 1990 and has financed a number of activities that have supported improved environmental data collection, analysis and dissemination. Its support of the Environmental Programme for the Danube River Basin (EPDRB) has seen the implementation of an international surface water quality monitoring, data collection, and assessment system provided currently though eleven monitoring stations, and an Accident Emergency Warning System (AEWS) served by Principle International Alert Centres (PIAC's) in each of the 17 Danubian countries. This has brought tangible benefits to the host CEE, countries including strengthened national and international capacity to provide reliable information, an information management system capable of serving environmental managers at the national level, while permitting the exchange of information at the international level, and improved comparability of sampling techniques and laboratory analysis.

These benefits help to ensure improved information with regard to polluters, the monitoring of compliance with EU standards, and advance knowledge of emergencies such as oil spills and pollution leaks. Information on the state of the Danube is made available through a National Information Centres Network and National Reference Laboratory Network.

The Black Sea Programme, an internationally funded initiative has also seen similar benefits with the launch of a pollution monitoring programme. Assessments of land-based pollution sources in the different countries of the region has enabled scientists and decisionmakers to make a first assessment of priority actions for controlling land and sea based sources of pollution, and encouraged international cooperation in improving the quality of the Black Sea. A Geographic Information System (GIS) has also been developed through the cooperation of eleven scientific institutions and more than 50 experts in the region, and is the first comprehensive, multi-disciplinary resources developed for scientists and environment managers, for the public and NGO community. The Black Sea Information System meanwhile, can be accessed via the Internet at http://www.domi.invenis.com.tr/blacksea and provides metalevel data on major marine environmental datasets collected through the above systems, as well as contact information to scientists, experts, research programmes, summary reports and so on.

The Corine projects have served to collect data on Land Cover, Air quality and Biotopes through the so-called Corine inventory.

In 1990, the CORINAIR Programme, a PHARE funded initiative, launched an air emission inventory for the CEE countries beginning with a telematics-based assessment of all known pollution sources, such as industry, transport, agriculture, and nature. This has enabled policymakers to effectively list the priority actions required for controlling air pollution. A secondary benefit was the establishment of a standardized methodology for air emission inventorying in the EU as well as in the CEE countries, permitting a common approach on the analysis of problems and search for possible solutions.

The CORINE Land Cover inventory project aimed to classify and define land cover related to geographic context by relying on GIS technology. Each classification is thus documented with colour photographs, generalized patterns, statistics (for the total area of a given class in hectares, with a number for the classified area, and for the classified area in relation to the country's total area), as well as a description followed by ancillary data and satellite image hardcopies. The results from the project are intended to assist in the effective development of relevant policy on European environmental land cover applications and indicators, maintenance of the European CORINE Land Cover database, as well as analysis of land cover and changes in land use.

In Bulgaria, the CORINE Biotopes Programme of the European Commission played an important role in initiating a standardized, coherent and compatible national database on protected and/or threatened plant and animal species and habitats for the benefit of nature conservation management. The project has served as a basis for the development of a nation-wide Biodiversity Monitoring Programme. The aim of the classification was to create an effective habitat identification tool for a wide range of field workers, botanists, zoologists, and conservation experts, to map the habitat mosaic patterns on the landscape level at a scale of 1:25,000, which falls between the scale of CORINE Land Cover data and usual vegetation maps, as well as to monitor the changes in habitat diversity using satellite images and aerial photographs combined with surface mapping of habitat units.

Much of this data is now collected on CD-ROM and is available free of charge to most public research institutes, libraries and resource centers, making it a valuable resource for the public at large.

TELEMATICS AT THE LOCAL LEVEL

The Estonian Telecottages network is a grass-roots initiative that improves access to information for small communities and regions. Starting in 1993 as part of a local initiative to support rural development, some 50 telecottages have either been established or are due shortly, linking the most remote villages and towns through telematics. Telecottages provide local information and advice to the public, provide remote students and businesses with Internet connections and email, and are used to raise awareness to campaigns and village events, high schools, nongovernmental organisations libraries and local governments.

In the environment field, telecottages assist local municipalities in elaborating local sustainable development plans, raising awareness to proposed environmental investments, and assist in studies concerning local needs. Data pertaining to the changes in nature and landscape, land use, travel information, and sustainable development are collected and disseminated by the network. The work of the telecottage is usually voluntary but has been financed in the past with the support of local development programmes.

At the municipal level, the Prague Environmental Information System (IOZIP), managed by the Institute of Municipal Informatics of the City of Prague (IMIP), collects environmental data from different sources, processes this into a digital form and disseminates this for the benefit of the Prague City Authorities, experts and the public. A wide range of subjects are covered by the system including air, water, soil, landscape and noise pollution. Modern technologies such as GIS and the Internet are utilised for data processing, with information standardized for output either in digital form (on CD-ROM), on the Internet (through http://www.monet.cz/) or printed materials (yearbooks, atlas etc.). The institution is supported by the City of Prague municipal budget and is responsible for supporting activities aimed toward the development of the City´s information systems, including those in the environment field. An interesting feature to note is the fact that the data management system, IOZIP, was initiated more than ten years ago.

In the field of EIA, increasing attention is being given to the use of GIS in surveying land use and risk assessments. The value in this technology for surveying many different social elements (land use, pollution levels, climate trends, populations, transportation use etc.) at once makes it an excellent tool for urban planners, either within local authorities or within the private sector. Particularly, GIS technology can be applied for screening new investments that could have a potentially harmful effect on the environment, industry, for example. This screening procedure is increasingly requested by EIA legislation, which itself is growing in importance, not just in CEE countries but across the European region. The procedure is increasingly relying on municipal information systems (such as IOZIP or Telecottages) and sources like the Internet for signalling announcements of new investments. Electronic dissemination also helps to encourage among other things, public participation in the environmental decisionmaking process. A system that not only details new investments but also invites public opinion to be submitted electronically by email, Internet or public kiosks could be of considerable strategic value to the public, to city and local authority planners, and to the private sector in seeking an ideal means to solicit public opinion concerning proposed developments.

ENSURING COMPLIANCE

A more traditional use of telematics applications also being applied in the CEE countries is that of monitoring the quality of air and water. While in the past the monitoring and enforcement of emission standards was weak, owing to the fact that the state was the regulator and the regulated (through the absence of any real private sector), there are now a number of driving forces ensuring that standards are monitored and maintained. The EU accession process, the need to improve the quality of the environment, and the growth of the private sector and the need to regulate their polluting activities among these. The use of telematics solutions provided through the PHARE Programme, for example, in the Black Triangle region (encompassing the border regions of Poland, eastern Germany and the Czech Republic) have enabled government and local authority decisionmakers to check polluters of the environment, solve environmental problems in their region, and ensure that emissions are kept within reasonable limits. 42 automatic air monitoring stations provide fast and reliable information that measure the content of pollutants in the air, and in taking into account the meteorological conditions, serve also as an early warning system. Stiffer fines for environmental pollution are forcing polluters to take notice of standards, and available means for reducing emissions, while the valuable revenue gained from the fees and fines charged for the use and exploitation of natural resources are collected by state environmental funds and channeled into priority environmental investments. The value of telematics systems in this area cannot be underestimated in enforcing compliance. Other examples one can speak about and already referenced above include the Danube Water quality Monitoring Network and the Black Sea monitoring network. As standards become stricter in line with the EU accession process, the role Telematics can play not only in monitoring compliance, but also by informing the local decisionmaker with the most up-to-date information on the state of the environment, becomes more and more apparent.

PRIVATE SECTOR DEVELOPMENT

With the growth of the private sector, it is also clear that companies could benefit from the development of telematics applications in their fields of interest, through for example, the need for environmental accountability to the public. A green image is now a marketable commodity and can help win market share among an increasingly environmentally conscious public in CEE as well as within the EU. Schemes like EMAS, ISO14000, and the Eco-Label award, encourage businesses and industry to keep track of their environmental activities, emissions, pollutants, waste management activities and so on. This perhaps therefore represents a growth market for telematics applications that might monitor product life cycle analysis, from manufacture through to reuse, or that might provide decision support or pollution monitoring systems: information dissemination systems that help to ensure accountability and a green image with the public. Again EU harmonisation is also likely to be a driving force in this area.

MAXIMISING BENEFITS

While Telematics can bring tangible benefits, their strategic value can only be realised when undertaken in conjunction with a number of other activities, and by overcoming a number of constraints and barriers, which today are very much in-existence in CEE. Lack of finance represents a key obstacle. While the systems might themselves be available to decisionmakers at the central, regional and municipality level, the costs of full implementation can often be high, particularly when other issues like social security, unemployment, low wages, and public health services remain high on the political agenda.

Secondly, while some organisations may be fortunate enough to receive financial support and donations of equipment and technical support, much of this remains superficial without the necessary training of individuals in how to effectively use the equipment. In some cases, decisionmakers still prefer to glance out the window for detecting poor air quality rather than switch on their hi-tech PC which delivers the information to their desk.

Thirdly, support that is initially offered should be provided with a guaranteed source of technical support and replacement hardware, for example when elements of the system wear out or become obsolete. With equipment supplied from the EU or the USA, it can often be impossible to upgrade or replace without the procedure becoming a time-consuming and costly affair.

Fourthly, in spite of considerable investment, the telecommunications infrastructure in Central and Eastern Europe remains weak for supporting live, real-time telecommunications links. Data transfer can often be interrupted, making the process of data collection time consuming and frustrating.

Finally, while telematics equipment can offer the local decisionmaker increased awareness of those polluters of the environment, vague rules on environmental responsibility passed down from the central level can leave the authorities powerless to act in terms of regulating polluters.

THE FUTURE FOR TELEMATICS IN CEE

In summary, I think there is one final clear-cut benefit arising from the use of Telematics that we can concentrate on, and which can only help to serve as an incentive to foster and further the development of Telematics in CEE. Specifically, Telematics applications provide a vehicle for enhancing cooperation and dialogue within all levels of responsibility, among all stakeholders, and on a transboundary scale. These benefits can only serve to encourage and assist environmental stakeholders across not only the CEE region but on a pan-European level in their desire to improve the state of the living environment.

EMMA - Developing and Validating Air Quality Monitoring and Forecasting in Urban Areas

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Integrated Environmental Monitoring, Forecasting and Warning of Air Pollution in Urban Areas

WHY EMMA?

Air Quality Monitoring in urban areas is essential for ensuring human health. Efficient management, including 24-48 hour air pollution forecasts provides crucial information to policy makers and planners to make informed decisions on the day-to-day management, e.g. imposing traffic restrictions and informing the public with regard to critical health pollution levels.

WHAT IS EMMA?

The key features of EMMA include:

- Easy access to accurate, practical air quality information for decisionmakers in *Local Environmental Administrations*;
- Accessible and comprehensive air quality information for the general public;
- Accurate 24 hour (and in certain cases 48 hour) air quality forecasts;
- Capability to disseminate information to the general public through different user-friendly communication media such as: common EMMA WWW interface, kiosks, Variable Message Signs, and RDS/TMC messages;
- Support to the development of standard European air quality indicators;
- Improved quality control and assurance of air quality data;

Among the technologies employed by EMMA are Geographical Information Systems (GIS), multi-media archiving systems, advanced local area networks, and World Wide Web/Internet.

HOW IS THIS ACHIEVED?

The demonstrator, based in Genoa has focused on developing an integrated Air Quality System, that includes an emission database and prognostic dispersion models, with GIS-functionality using the existing monitoring system. In Stockholm, local partners there placed special emphasis on software enhancement for the remote sensing technique (SODAR) and on improved forecasting capabilities.

The major challenge for the Leicester-based partner has been to develop software interfaces between the air quality system and the traffic management system, and to demonstrate that the two systems work well together and can produce output reliable enough for immediate measures to be taken. The Madrid-based demonstrator has begun operating a complex, highly sophisticated non-hydrostatic meteorological forecasting model.

EMMA IN PRACTICE

Pollution and weather data are collected through highly automated telematic networks from all fixed and mobile monitoring stations available in metropolitan areas. With regard to air quality, ozone, SO_2, NO_X, O_3, CO, benzene and toluene data is collected, while concerning the weather conditions, humidity, wind, temperature, turbulence, vertical meteorological conditions data is retrieved.

The data is collected and stored in integrated relational databases, and analysed and distributed according to EMMA architecture. Using graphical tools such as GIS, Internet, RDS/TMC, and Local Area Networks it is presented in a user-friendly way.

A special feature of the EMMA System is the high degree of *integration*, especially between environmental and meteorological phenomena.

Each of the four local demonstration sites (Madrid, Stockholm, Leicester and Genoa) have implemented their systems, configured to meet local climatic and environmental conditions, and the specific needs of local users.

The ability to forecast is fundamental. For all EMMA demonstration sites, 24 hour and 48 hour forecasting of the local weather is possible, leading to accurate simulations of 'what if' and 'in case' scenarios (for instance, for fog or temperature inversion conditions), and critical pollution situations (for instance, the presence of toxic cloud).

CHARACTERISTICS OF AIR QUALITY NETWORKS IN USE AT EMMA DEMONSTRATION SITES

DEMONSTRATION SITES	FIXED AIR QUALITY CABINS	MOBILE UNITS	AIR QUALITY NETWORKS	METHOD-OLOGICAL CABINS	VERTICAL MEASURE MENTS	PUBLIC DISSEM-INATION
STOCKHOLM (Royal Institute of Technology)	21	-	1	4	-	3 Public Access Terminals
GENOA (Italtel – Telecom Italia)	17	3	2	9	SODAR	3 Public Access Terminals
MADRID (Sice)	30	4	2	17	Fixed M sensors	6 Public Access Terminals
LEICESTER (Leicestershire CC)	-	-	-	-	-	RDS WWW

ECOSIM - An Urban Environmental Management Information System

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ABSTRACT

ECOSIM is an environmental management information system that integrates monitoring and simulation modeling for environmental decision support in urban areas. The project develops and demonstrates an environmental decision support system based on a modular and distributed client-server architecture using wide-area network technology and the Internet to connect clients, monitoring networks, and high-performance model servers. Traffic generated air pollution including photochemical smog, coastal water quality, and groundwater are the initial application domains, analysed by a set of state-of-the-art simulation models with a multi-media user interface. ECOSIM involves participants from Austria, Germany, Greece, Italy, Poland, and the UK, and works with the cities of Berlin, Athens, and Gdansk as validation sites and initial end users.

The successful use of ECOSIM will result in more effective environmental planning within urban areas which, for the citizen, should mean a cleaner environment. ECOSIM will also provide more information on pollution levels of general interest to the public, but can also be used as the basis for a more general environmental information system, distributing information over the Internet, to the general public.

ECOSIM is designed to support the implementation of European environmental policy, guidelines and standards such as 96/62/EC; the Directive on Air Quality Assessment and Management, (the Air Quality Framework Directive). The general regulatory framework is described in the Guide to the Approximation of European Environmental Legislation (http://europe.eu.int/comm/dg11/guide/contents.html).

INTRODUCTION

The ECOSIM project builds a model-based information and decision support system for urban environmental management. It integrates data acquisition and monitoring systems, GIS, and dynamic simulation models in a flexible client-server architecture based on standard protocols.

The main objectives of ECOSIM is to develop a tool that:

- Is easy to use for administrators, planners, engineers, and decisionmakers;
- Supports environmental planning and decisionmaking by providing scientifically sound information from state-of-the-art tools in a format that is of directly relevance to the decisionmaking process;
- Integrates numerous information sources, from online monitoring to databases, geographic information systems, and complex simulation models, in one common framework and presentation format;
- Is cost-efficient by using a flexible architecture that minimises investment requirements by allowing more expensive components, such as high-performance computing equipment but also specific expertise, to be shared over the Internet.

THE TECHNICAL APPROACH

The main objectives are to demonstrate the integration of a range of distributed information resources including monitoring systems, and simulation models including HPC (high performance computing) models implemented on parallel machines, in an easy to use multi-media framework that provides useful information in support of environmental planning and decisionmaking processes based on state-of-the art scientific methods and information technology. Integration of information resources, a range of forecasting and simulation tools, GIS and expert systems, and decision support components as well as their validation in three parallel case studies are the focus of the second project phase.

The main product is the generic ECOSIM Server and the underlying generic client-server architecture together with a set of generic and partly specific environmental simulation models, implemented and tested in three case studies covering a range of climatological, environmental, and technological conditions. ECOSIM integrates, through a distributed client/server architecture:

- Data acquisition from environmental monitoring networks;
- Data analysis and visualization tools;
- A range of numerical environmental simulation models (ranging from very simple, but fully interactive, scoping models to multi-layer forecasting models and ultimately fully 3D dynamic simulation models);
- A hybrid geographical information system;
- An embedded expert system;
- Strong visualization components.

These components are integrated into a common interactive, graphical user interface and implemented through a distributed architecture based on TCP/IP and http (hypertext transfer protocol).

ECOSIM supports integrated quantitative and qualitative analysis of the environment in urban and industrial areas across different environmental domains in a common framework. The tools range from strategic planning models to daily operational forecasting tools. By using a broad range of distributed information resources and existing databases and models, the ECOSIM solution offers a new and efficient tool for urban environmental management. Three public authorities at Berlin, Athens and Gdansk are providing day-to-day feedback to the ECOSIM developers and use the system to manage current environmental problems during the project validation phase.

Rapid prototyping, object oriented design, and distributed client-server implementation are the main technological features. ECOSIM makes use of high performance computing technology where necessary to provide sufficient power to conduct its complex simulations. The wide range of data and results which ECOSIM can include are managed by a multi-media tool-kit and a Geographic Information System.

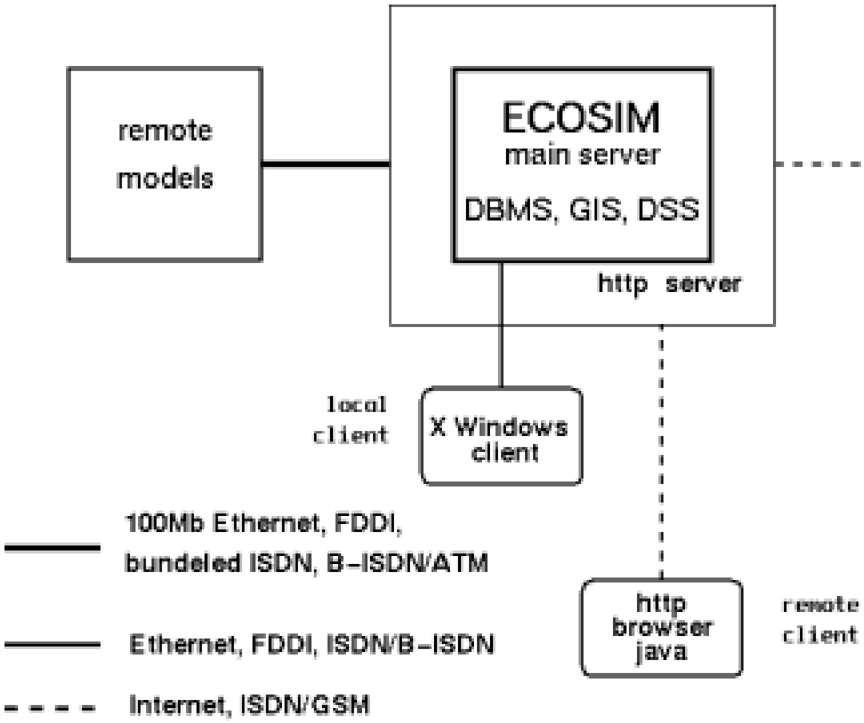
THE BASIC ARCHITECTURE

ECOSIM is based on a distributed client-server concept. This simply means, that different functions can, where feasible and desirable, be implemented on different computers connected through the TCP/IP protocol, the core of the Internet. However, all the available functionality can also be made operational, in principle, on a single workstation.

The ECOSIM client-server architecture takes advantage of the http protocol. The main server provides the basic user interface and controls the user dialogue, displays information, and connects to external information resources (monitoring data, databases, simulation models) as required.

This communication is based on the public http protocol, and can be based on the Internet, or dedicated connections (such as ISDN phone lines) for the physical communication layer. This protocol also forms the basis of World Wide Web browsers like Netscape or Internet Explorer. The following diagram summarizes this architecture:

The same method that can connect various computers supporting different tasks such as models, can link online monitoring systems into the ECOSIM framework. While monitoring provides valuable, and often mandatory information on the environment, it is also an essential element of modeling used for strategic analysis or operational forecasting. One class of conceptual clients in the ECOSIM framework provides a user interface which is fully interactive and menu-driven, and offers graphical interaction supported by an embedded rule-based expert system that helps less experienced users, and extensive graphical visualisation of data and model results.



ECOSIM ARCHITECTURE DIAGRAM. Also see:
http://www.ess.co.at/ECOSIM/architecture.html

BASIC FUNCTIONALITY

The generic ECOSIM information system framework consists of:

- Graphical User Interface, menu system and interaction control;
- Geographic Information System (GIS);
- Object database including object editing and display functions;
- Embedded rule-based expert system;
- Hypertext system and embedded WWW browser.

Within this framework, using a generic client-server architecture based on the TCP/IP and the http protocol, individual information resources such as databases and a set of environmental simulations models as the analytical core of the system can be linked and integrated.

The Graphical User Interface

The information system framework relies on a fully menu driven, largely icon-based, graphical user interface. Almost all user interaction consists of point, drag, and click operations. Text input, wherever possible, uses multiple-choice selection rather than text input (typing) to minimize the potential for operator error. Menus, selections, and a range of graphical analogue data entry tools (sliders, compass, etc.) are all context sensitive and constrained to feasible ranges or choice sets to ensure consistent and plausible user input. The various icon menus and option selectors are coordinated by event loops and callbacks that translate the interactive user specifications into the appropriate actions. Consistent layout across pages, use of colours and fonts aims to simplify interpretation and learning within the system. A status bar and an embedded help and explain hypertext system (see below) provides guidance for the novice or infrequent user.

Geographic Information System (GIS)

Almost all objects in the environmental information system are spatially referenced. As a major integrating tool, an embedded GIS manages this spatial data. The GIS provides for the smooth integration of different formats, including vectors, graphs, rasters, cell-grids, digital elevation models (DEMs), triangulated irregular networks (TINs), finite elements (FE), and finite difference (FD) model grids, and dynamic model output. Its main function is to provide a spatially organized interface to the system's data objects and associated functions, as well as the display and analysis of (spatially distributed) model results.

Object Database

The information system is based on an object oriented design. This approach supports the representation and structuring of the problem domain in terms of natural, real-world objects and related information requests in a format and style that is directly understandable and useful for the end-user. It supports a problem (and therefore user) oriented rather than a data or model-oriented view of the problem domain.

Objects or object classes in this framework include:

- Individual functional components such as emission sources, power plants, treatment;
- Plants, observation stations, etc;
- Related data such as observation time series or emission inventories;
- The individual variables or parameters that define the attributes of compound objects (descriptors in the expert systems knowledge base);
- Structural and geographic elements such as road segments, city blocks or districts, hydrographical catchments, parks, etc.;
- Tasks or decision scenarios;
- Individual analytical tools such as simulation models.

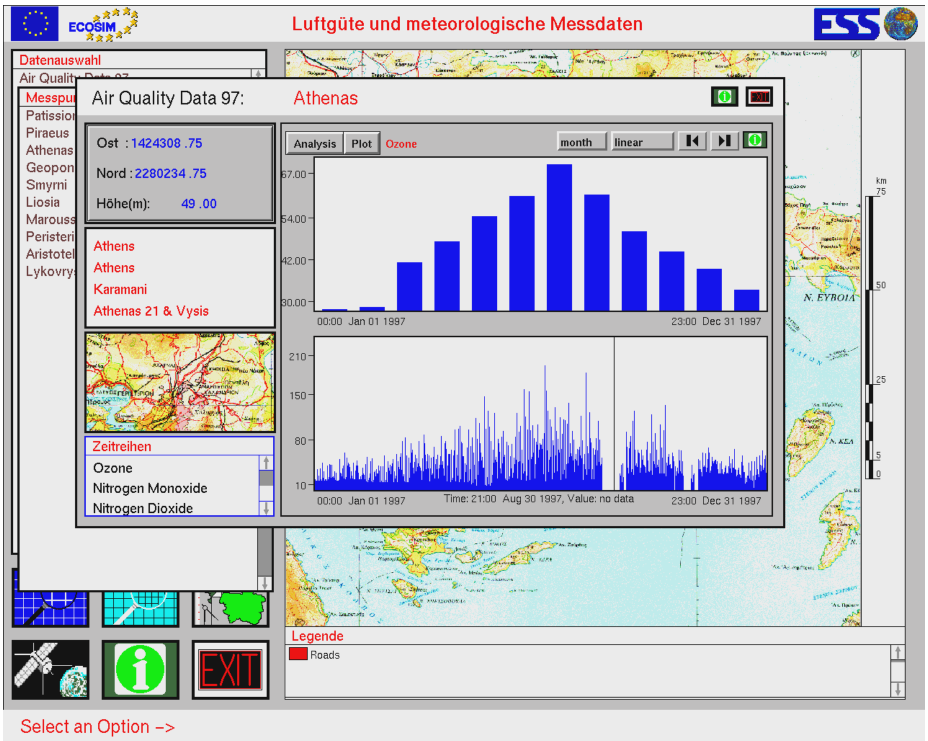


Diagram 1: Display of monitoring data: Air quality observations, Athens.

Embedded Rule-based Expert System

As an important generic function of the framework, an embedded rule-based expert system is used to assist the user in the definition of decision and input variables, as well as in the interpretation of results. In addition, the expert system can be used to serve as a classification tool, for example, for Environmental Impact Assessment tasks. The system uses near-natural language 'Rules' (first order logic) and as its variables, 'Descriptors'. Through an interactive dialogue, the system compiles information from the user through an inference process is used to deduce answers (i.e., updated attributes of objects in a changed context).

Hypertext and WWW Integration

The hypertext system is embedded within the overall user interface as a help and explain function associated with information icons throughout the user interface. It also provides meta-data and background information on individual objects such as the descriptors of the expert systems, a model, or a decision-related scenario. In line with the distributed network architecture of the system, the hypertext browser can use both an internal hypertext format as well as (in parallel) embedded web browser HTML documents. This supports direct access to local HTML pages as well as to the entire Internet.

THE BASIC SIMULATION MODELS

What distinguishes ECOSIM from existing systems is its capacity to perform integrated quantitative and qualitative analysis of the environment, in urban and industrial areas across different environmental domains and sub-domains. In addition, the interrelations between the domains and their dynamic behaviour is analysed and the available multi-media data sources and modeling results are cross-calibrated (see Diagrams 2 and 3).

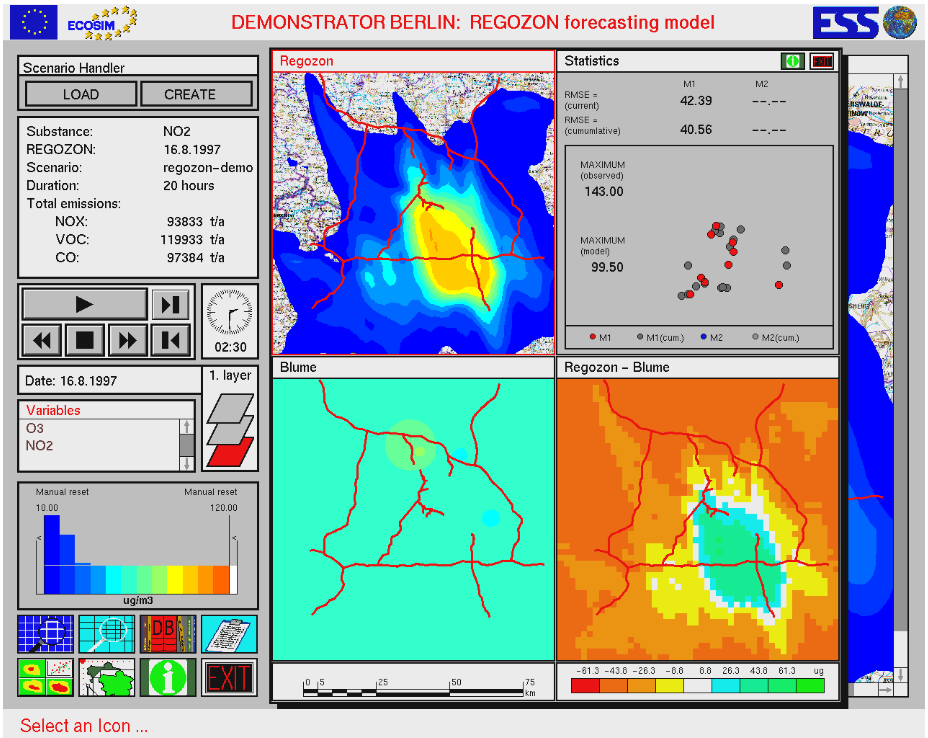


Diagram 2: Ozone forecasting and comparison with observation data: REGOZON, Berlin.

The system at each local site includes the following numerical modeling tools, which are connected on-line to the users' individual monitoring networks:

- Atmospheric wind-field model;
- Air pollution dispersion and air chemistry model;
- Ground and surface water level and pollution model;
- Coastal water pollution model;
- Traffic and traffic emission model.

The flexible modular architecture, enables the simple addition of new components into the same integrated framework for other environmental domains and problems such as waste management, noise abatement, surface water pollution, etc.

The ECOSIM Demonstrator includes the following models:

- MEMO - mesoscale atmospheric model;
- DYMOS - air pollution dispersion and air chemistry model system;
- POM - Princeton Ocean Model;
- MODFLOW/MT3D - groundwater modeling system.

In addition to these detailed models, ECOSIM also includes a number of forecasting and screening level models that combine fast response with a solid scientific basis (see Diagram 3 below). The technical details on the models can be found under: http://www.ess.co.at/ECOSIM/models.html

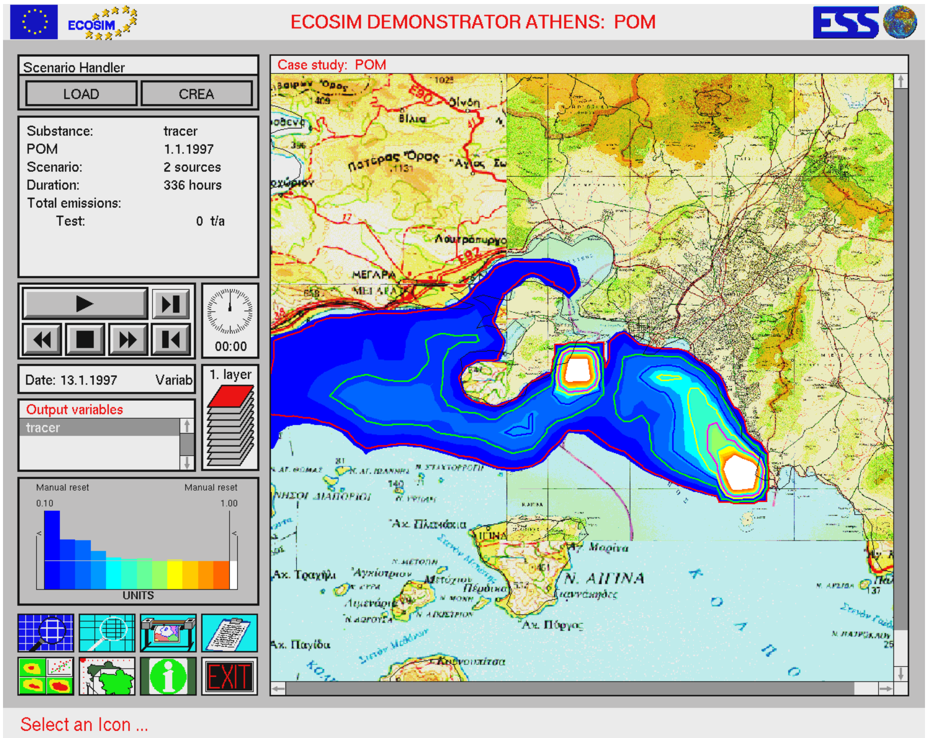


Diagram 3: Coastal water quality modeling: POM, Athens.

SUMMARY

ECOSIM provides a powerful, but simple tool for environmental planning, management, and decisionmaking that conforms to European environmental policy, guidelines, and regulations. The main concepts are the integration of distributed and diverse information resources through wide area networking (Internet based) methods, but with an easy-to-use interface that makes the technical complexity completely hidden from the user. Menu driven, graphical, and supported by an embedded expert system, the interface makes interaction with complex models easy. Being able to run these demanding codes remotely, through a client-server connection, makes it possible to use them as an external service, on demand, without a need to invest in powerful computers, expensive training and code maintenance. The modular structure simplifies the configuration of the system for any urban or regional domain and its corresponding environmental problems, and the integration of the available data sets and tools within a new, powerful information and decision support system framework.

ENSIS - A Modern System for Air and Water Quality Management

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ABSTRACT

The main feature of the modern environmental management system is the integrated approach that enables the user direct access to data for assessment and planning of actions. The demand for an integrated system that enables monitoring, forecasting and warning of pollution situations has been increasing and will increase in the future.

The AirQUIS system, developed by the Norwegian Institute for Air Research (NILU) is a map oriented, user-friendly air quality management system for use in urban and industrial areas. It contains all modules necessary to perform air quality assessment, such as databases for measurement and emissions, dispersion models, and an exposure module for health and materials. The AirQUIS system operates through menus and maps on the modern Windows NT platform in a network environment with several PC clients.

INTRODUCTION

The ENSIS group, consisting of the Norwegian Institute for Air Research, the Norwegian Institute for Water Research and the Norgit Center, has developed an Environmental Surveillance and Information System (ENSIS). ENSIS consists of three modules; AirQUIS, WaterQUIS and CorrCost, which serve as management systems for air pollution, water pollution and material damage, respectively.

The air quality component, AirQUIS, was first demonstrated at the Winter Olympic Games at Lillehammer in 1994. Since then, AirQUIS has been further developed and has now been installed in several cities in Norway and Asia.

OBJECTIVES OF AIRQUIS

The modern environmental surveillance platform enables direct data and information transfer and offers the more or less direct and remote quality control of the data collection process. Systems also contain online atmospheric dispersion and exposure models for planning and forecasting air pollution in a given area.

In meeting the requirements and objectives of its main users, a modern management system will also:

- Provide information on how much air pollution the population is exposed to;
- Establish a basis for strategies to reduce air pollution;
- Estimate environmental impacts from present and future developments.

To meet the requirements of an integrated modern system, the AirQUIS system includes among its objectives:

- A manual data entry application;
- An online monitoring system;
- A module for data acquisition and quality control;
- A measurement database for meteorology and air quality;
- A modern consumption/emission inventory database with emission models;
- Numerical models for transport and air pollutant dispersion;
- A module that examines population exposure;

- Statistical treatment and graphical presentation of measurements and modeling results;
- A user-friendly menu and map oriented interface;
- Import/export wizards for the import of data and dissemination of results.

All objects described above are integrated into a map and menu-oriented, user-friendly interface with direct links to databases of measurements and emissions, and presentation tools. Advanced import/export wizards enables the simple transfer of data to and from the AirQUIS system.

SENSORS AND MONITORS

The modification and development of new air quality sensors and monitors are necessary for the establishment of a complete environmental information system that meets the requirements of today's users. Several sensors and monitors for meteorological purposes, noise, air and water quality are already available on the market. The AirQUIS system can be implemented within the existing monitoring networks by adapting the protocols for data exchange or using the monitoring equipment used by NILU.

The inclusion of meteorological data is important for information, forecasting and planning purposes, and together with climatological data helps provide background and explanatory reasons for simulations.

DATA TRANSFER AND QUALITY ASSURANCE

Modern digital data loggers developed by NILU for the remote control of monitoring equipment ensures quality data availability and greater flexibility in the collection of air quality data. This also serves as a local backup storage unit for several months in case of loss of connectivity.

The AirQUIS system contains both manual (MDACS) and automatic (ADACS) data acquisition systems for the import of measurements. In addition, import functionality for time series data is available by using pre-defined data formats.

ADACS – Automatic Data Acquisition System

The online monitoring stations require a robust and stable communication network. Communication between the monitoring station and the central system relies on public telecommunication lines. The data logger has a storage capacity of several months in case of line failure. The NILU developed Automatic Data Acquisition System (ADACS) can be used for the automatic collection of monitoring data. The measurements are transferred to the central server and automatically stored in the AirQUIS database for further evaluation and presentation.

Data quality assurance programmes including direct quality control is performed at different levels within the data collection process including;

- Onsite during automatic and manual calibrations and controls;
- At the central data collection site following quality assurance routines according to ISO 45001;
- Within an approval system in the final data base;
- Simple statistical and graphical evaluations that check validity and the representativeness of data.

The quality control procedures help to ensure data reliability, essential for reporting, control and planning purposes. The comparability and compatibility of data is also essential for sound scientific and environmental management.

DATABASE USE

The development of an associated database or *metadata* is important to all modern environmental monitoring and information systems. The database system may consist of several databases which serve as the main storage platforms for:

- Environmental data collected online;
- Source oriented emission data including procedures for emission modeling;
- Calculated levels of emissions, concentrations and exposure;
- Historical data with trends, background information (such as land-use, population distribution, regulations, and guideline values), and information that supports the decisionmaking process.

The information collected enables the evaluation of the actual state of the environment, trend analyses, emergency warnings, and the undertaking of response measures in case of high pollution alerts.

MODEL SCENARIOS

A major component of the AirQUIS system are the dispersion models for pollutant emissions to air. These can be used as planning tools for the reduction of air pollution. Relevant models must be developed for the area in which the AirQUIS system is to be implemented, and must be evaluated and verified.

The models included in the system cater for air pollution on all scales; traffic emissions from parking places and along roads, industrial emissions and household pollution. This can be modelled at an urban level and on a regional scale.

The NILU developed, source oriented numerical dispersion model, EPISODE, calculates spatial distribution of hourly concentrations of SO_2, NO_x, NO_2 and suspended particulates. The NILU models, ROADAIR and CONTILENK, are used to estimate concentrations close to roads while a puff-trajectory model is used to calculate the influence of point sources.

To obtain a sound description of wind activity in complex terrains, NILU has included the terrain influenced windspeed model, MATHEW. The model is responsive and on an hourly basis performs windfield analysis, which serves as input to the dispersion model for pollutant emissions to air.

POPULATION EXPOSURE

The AirQUIS system also includes models for estimating population exposure to air pollution. The impact on health can be estimated by combining calculated concentrations, either from grid or receptor points such as building addresses, with the population distribution. Exposure estimates can be used to indicate how many people are exposed to air pollution above air quality guidelines, and for how long. This data can be, and often is used as input to local air quality indicators.

ENVIRONMENTAL INDICATORS

The selection of parameters for the monitoring and modeling programmes should enable automatic access to data relevant for assessing the environment, including air pollution, noise and radiation. For each environmental component, a set of environmental indicators should be developed.

Ideally, the indicator should:

- Be relevant to environmental quality;
- Be easy to interpret;
- Respond to changes;
- Provide international comparisons;
- Have a target or threshold value that provides a basis for assessment;
- Be able to show trends over time.

Indicators can be aggregated data, or the observed single parameters. Aggregated data, however, will express the direct impact and stress on the environment (e.g., health, materials, vegetation) and will represent a better indicator for international comparisons and trend analyses. It will also serve to indicate the actual air pollution problem in a given area or region.

DATA PRESENTATION; GRAPHICS AND GIS

The AirQUIS system operates through a system of maps and menus. The use of a user-friendly interface offers the user a means to work without specialised data instructions.

An important feature of an integrated system is the ability to present measurements, statistical and modeling results, emission data, background information and other relevant data directly or aggregated for different types of users.

Multi-media information may be delivered in the form of text, tables, graphs, images, sound or video, and can be tailored to individual end-user requirements. Among the systems target end-users are:

- Authorities at different levels (municipal, regional, national, international);
- Industrial users;
- Schools, universities and the scientific community;
- Various organisations (research, international, NGO);
- The public and the media.

The use of maps or digitalized Geographical Information Systems (GIS) is suggested for the presentation of results, particularly monitoring data that is supported and supplied by model estimates of spatial concentration distributions and impacts.

TECHNICAL PLATFORM SUPPORTING ENSIS

Software

ENSIS is a user-friendly system, that integrates data forms and maps within the same application. The system is developed in VisualBasic and MapObject (similar to GIS) and relies on the following software:

- PCs operating from Windows NT version 4.0 (version 3.51 is also possible);
- A server running on ORACLE version 7.3 (version 7.2 is an alternative);
- Communication software between the server and its client(s);
- Seagate Crystal Reports version 6.0 Professional.

Hardware

In terms of hardware, ENSIS relies on the following:

PC/Clients :

- IBM-compatible PC Pentium Pro
- 64 Mbyte RAM
- 1.0 Gb hard disc
- CD player

PC/Server :

- IBM compatible Dual Pentium Pro
- 128 Mb RAM
- 8.0 Gb hard disc
- CD player

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Remote Sensing as Tool for Vehicle Exhaust Emission Control

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INTRODUCTION

The Transport Authority of Budapest serves under the jurisdiction of the Ministry of Transport, Communications and Water Management (Közlekedési, Hírközlési és Vizügyi Minisztérium - KHVM). It is a regional organization of the state administration established by *Government Decree 94/1991 (VII. 23) Korm.sz.* concerning the creation of a uniform traffic authority. The purpose of the Transport Authority is to administer public road and railway affairs. (Waterway traffic is the responsibility of the Transport Authority of Pest County). The Transport Authority of Budapest (hereafter Authority) functions according to the Law on the Juristic Conditions of Public Servants and has independent wage-management and investment authority.

The general governance of the Authority, the approval of its organizational statutes, of regulations and of operation rules is performed by the National Transport Authority (Közlekedési Főfelügyelet - KFF). The Authority manages its economic affairs, in conformity with the annual plan and estimates, determined under separate rules and approved by the budget.

ACTIVITIES OF THE AUTHORITY

- On-road testing, inspection of traffic safety, the technical assessment of vehicles, and level of environmental damage caused by public vehicles;
- Licensing alterations and monitoring the composition of the vehicle fleet;
- Licensing, maintenance, and inspection of public road services (such as taxi services, international and internal transport of goods and dangerous goods (ADR) etc.;
- Inspection of vehicles both on public roads and at company facilities;
- Supervising the training of drivers, driver examination, license issue, and document maintenance;
- Road construction and management;
- Assigning and control of dangerous goods vehicle routes;
- Licensing the construction of tramways and other settled lines (paths) for local vehicles, authorising construction of rolling stock;
- Inspection of public and company railway lines, and related facilities.

The technical inspection of public road vehicles and issuing of driving licenses is undertaken by the policing authorities (the Budapest Police Headquarters and the District Police), and the Budapest Transport Authority.

With regard to the inspection of public road traffic services, in terms of production and initial circulation, the Authority cooperates with the bodies responsible for Consumer Protection and Environmental Protection.

On the basis of a Government Decision, the Authority also has close contact with the Customs authority, in the sphere of common custom control, control before clearance, traffic safety control, environmental protection control, and licensing before initial circulation.

The Authority cooperates with the branch-administration organs of the Public Administration Bureau under the jurisdiction of the Chief Executive of the Bureau.

Cooperation is also undertaken with the Lord Mayor's Office, especially with its Environmental Protection Department, headed by Mr. István Pólay who has provided the second part of this presentation.

The Budapest Transport Authority is responsible for vehicle testing not only during the regular road vehicle certification process, but occasionally the 'on-the-spot' checks on public roads between these and regular technical tests. These occasional inspections are undertaken for the benefit of all road-users and aim to identify whether the given vehicle meets the operational requirements. During the course of these inspections, an objective is to cause the minimum of disturbance to other road users.

For this reason, it is of great importance that we hold up only those vehicles causing a problem or those vehicles whose operation can cause problems. An experiences public road inspector can identify vehicles by certain characteristics, e.g., poor fixing or poor position of the load, visible exhaust smoke (especially on steep roads), failure of mandatory lighting equipment, damaged vehicles etc. In certain cases, these characteristics are multiple and are not directly visible; e.g., the movement and behaviour of the vehicle and the driver. As part of our public road control activities, we operate successfully and in full cooperation with the police authorities.

A team of 14 persons fulfil the above-mentioned tasks. Besides collaborating in periodic inspections organized by partner-authorities, activities include taxi inspections, ADR control, environmental protection measures, inspection of training vehicles, and increased testing of Romanian buses (see also Figure 1 below).

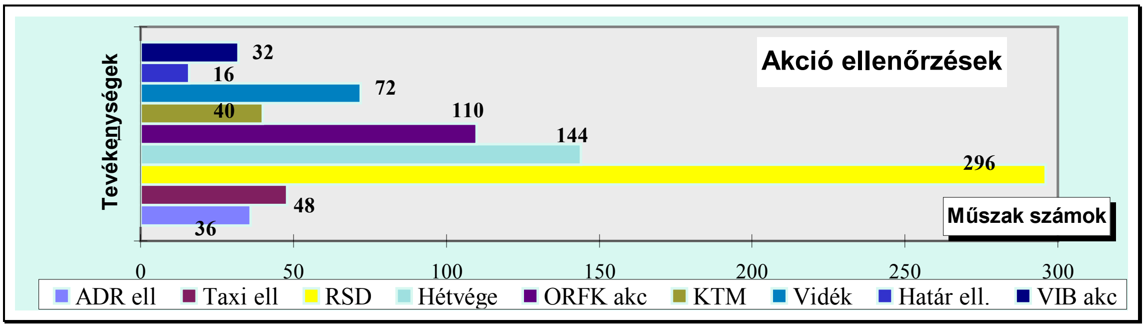


Figure 1: Breakdown of irregular inspections

Legend:

Akcio ellenorzesek = Inspections
Tevekenysege = Activities, Checks
Muszak szamok = Number of shifts
ADR = Dangerous Goods Vehicles
Taxi ell = taxi checks
RSD = Remote Sensing Device checks
Hetvege = Weekend checks
ORFK = Police cooperation
KTM = Ministry of Environmental Protection (environmental checks)
Videk = Countryside checks
Hatar ell = Border checks
VIB = Training vehicles

In 1997, the Budapest Transport Authority exceeded the compulsory number of required inspections, having tested 100,423 vehicles (104.6 percent). A statistical breakdown of these inspections is given in Table 1.

Vehicle Inspections, 1997	
Total number of vehicles inspected	100,423
Comparison with required number of inspections	104.6%
Number of vehicles failing inspection	19,219 cases
Percentage of vehicles failing examination	19.13%

Table 1: Inspection Statistics, 1997

Besides inspections, the same vehicles are examined according to several other criteria. These are listed in Table 2 below along with the number of inspections undertaken. Figure 2 shows the corresponding number of failures.

Vehicle Inspections, 1997	
Technical and traffic safety inspection	100,423
Environmental protection	33,465
International public road transport	1,138
Internal public road transport	25,725
Transport of dangerous goods (ADR)	703
Other public road inspection	83

Table 2: Nature of Vehicle Inspections, 1997

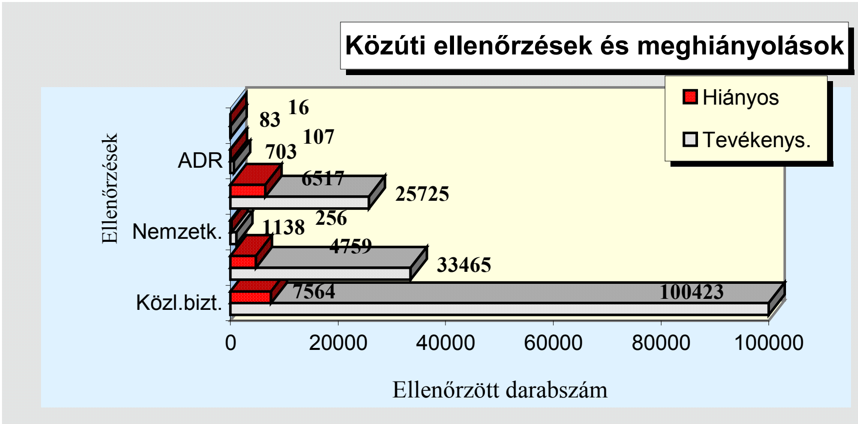


Figure 2: Breakdown of vehicles failing the examination

Legend:
Kozuti ellenorzesek es meghianyolasok = Road Inspections and Failures
Ellenorzesek = Inspections
Ellenorzott darabszam = Number of vehicles inspected

TECHNICAL AND TRAFFIC SAFETY INSPECTION

Observations during recent years have shown that vehicle license plates and terms of validity have been falsified. A planned new vehicle license system system and matrix to be attached to the number plates should help to overcome this problem.

During 1997, 245 of the vehicles inspected were requested to undergo further technical testing. In cooperation with the police authorities, requests of this nature can also warrant the on-the-spot withdrawal of license plates and documentation. Such vehicles may be used once again only after meeting the official technical standards of inspectors or the police. Figure 3 shows the breakdown of technical and traffic safety failures.

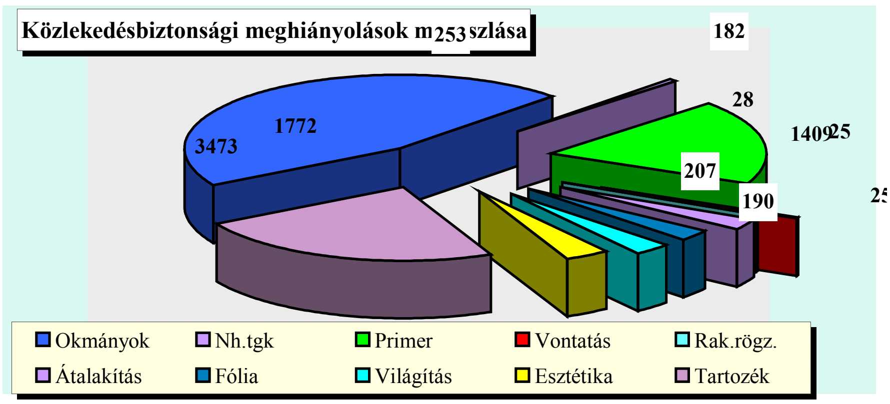


Figure 3: Breakdown of technical and traffic safety failures

Okmanyok =Documents	Vilagitas = Lights
Etalakitas=Alteration	Vontatas =Towing
Nh.t gk=Heavy trucks	Estetika=Aesthetics
Folia=Foil	Rak. Rogz = Load fixing
Primer = Very dangerous cases	Tartozek=Accessories

Upon suspicion of the falsification of documentation, 26 cases were transferred to the police authorities for further action. On 31 separate occasions offence procedures were initiated owing to the falsification of the Environment Protection Card and the alleged falsification of the Vehicle License or Driving License.

ENVIRONMENTAL PROTECTION CONTROL

33.3 percent, i.e. 33,465 vehicles of the 100,423 inspected vehicles have been tested for their conformity to environmental protection standards, with 14.22 percent of these (4,759) being refused, a rise of 3.2 percent above 1996 figures. Further data on the nature of vehicles examined for environmental performance failures and the corresponding actions is given in Table 3 and Figure 4.

Failures	4,759
Number of vehicles without a valid card or no card	1,949
Number of vehicles whose road use was restricted	810
Number of vehicle transfers to police authorities	2,000

Table 3: Vehicles Failing Environmental Protection Standards and Corresponding Actions

Upon observing a discrepancy or failure related to the Environmental Protection Card (for example, a lack of data, overwriting, crossed out information, or false data regarding the engine-number, registration number or existence of catalyzer), the Card was withdrawn and transferred to the county authority or to our own Inspection Department.

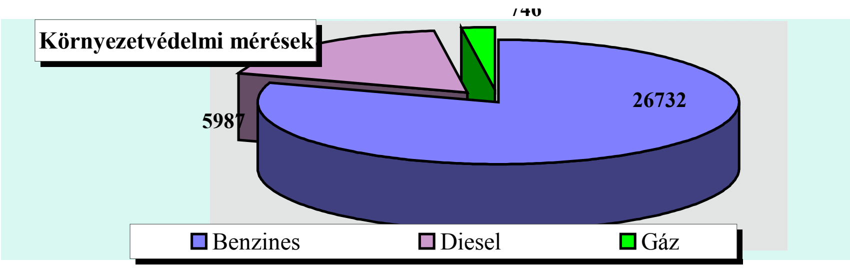


Figure 4: Vehicles inspected for conformity with environmental standards

Remote Sensing of Exhaust Emissions

Between 1995 and 1996, the Lord Mayor's Office of Budapest improved the efficiency and effectiveness of environmental protection control by purchasing and installing the measuring RSD-2000 Remote Sensing Device. The RSD-2000 basic unit measures carbon monoxide (CO), carbon dioxide (CO_2), hydrocarbons (HC) and nitrogen oxides(NO_x) by passing a beam of infrared (IR) light through a vehicle's exhaust as the vehicle travels between the RSD-2000's light source and respective detectors. The license number of the vehicle is captured, as well as the percentage of CO, the percent of CO_2, PPM of HC and PPM of NO_x). Figure 5 presents the breakdown for vehicles pre-tested using RSD.

The use of the **remote sensor** is particularly advantageous since it enables the Budapest Transport Authority to collect all relevant data concerning traffic offences in the field of environmental protection effectively. Without having to unnecessarily hold up the flow of traffic for testing, it thereby helps to avoid disturbing other road users.

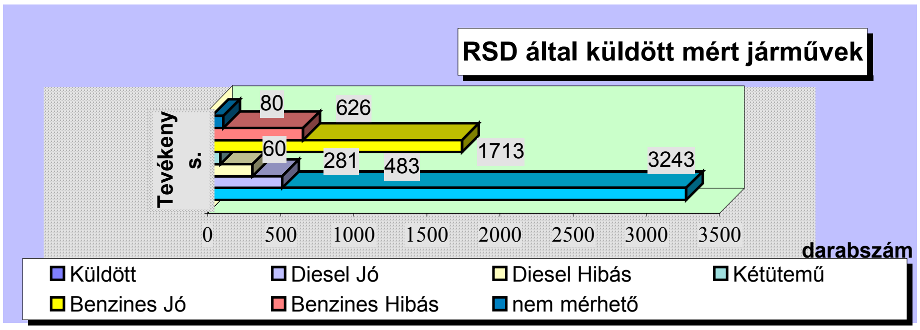


Figure 5: Vehicles pre-selected by RSD

Tevekenys = Activities
Darabszam = Number of vehicles
Kuldott = Pre-selected by RSD
Benzines Jo = Petrol vehicles within limit
Dieszeles Jo = Gas oil within limit
Benzines hibas = Petrol vehicles out of limit
Dieszeles hibas = Gas oil out of limit
Nem merheto = Not measurable
Ketutemu = 2-stroke engines

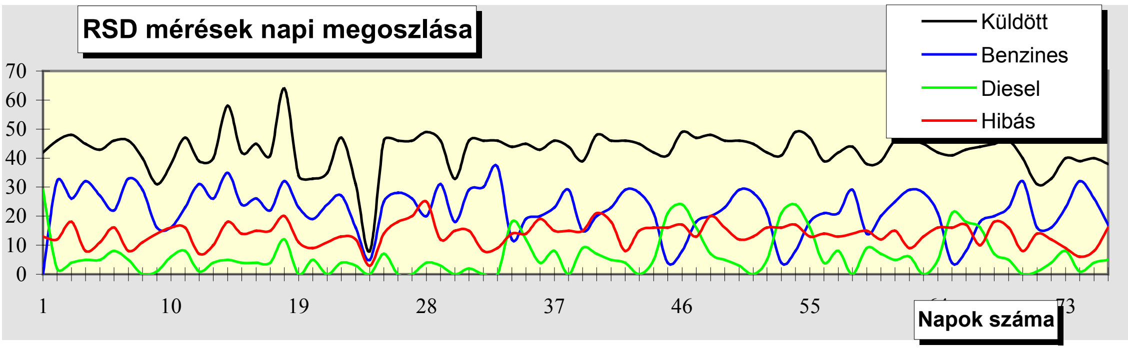
Verifying the effectiveness of the system, the number of captured traffic offenders increased as a result of its implementation. Table 4 overleaf shows the breakdown of vehicles failing the environmental examination.

Diesel-engined vehicles	
within limit	281
out of limit	60
Petrol-engined vehicles	
within limit	1,713
out of limit	626
Not measurable	140
2-stroke engine of them	60[1]
defective engine	18[2]
cold engine	62
Total number of vehicles pre-selected by RSD	3,243

Table 4: Total number of vehicles examined using RSD

[1] The analyzer would suffer extreme pollution.
[2] The exhaust system is damaged (holed, broken, incomplete etc.)
(For those vehicles falling under categories 1 and 2, a full authorized inspection and maintenance was ordered).

The remote sensing device, however, only serves as a preliminary means for testing road vehicles since the official measurement of a vehicle's environmental performance can only be executed while idle. Figure 6 shows the number of vehicles pre-selected for idle testing. On the other hand, vehicles with 3-way catalysers are tested also at a revolution of 60 percent of the nominal speed, although the end-result of such a measurement is not usually a fine (but Card restriction). If the result of such a measurement is negative, public road inspectors tend to direct the attention of the driver to the levels of higher consumption that may be caused by the incorrect tuning of the engine.



Napok szama = Number of days

Figure 6: Number of vehicles pre-selected by RSD and stopped - per day

Legend:

(black line)	Pre-selected total (upper line) *Kuldott*	(green line)	Pre-selected diesel-based vehicles (lower line) *Diesel*
(blue line)	Pre-selected petrol based vehicles (2nd upper line) *Benzines*	(red line)	Out of limit (2nd lower line) *Hibas*

Based on the positive experiences encountered during the first half of 1997, further measuring equipment was installed at new localities. In order to deal with the increased number of environmental offenders, the number of inspectors and vehicles have been doubled. However, owing to the problems arising from holding up too many vehicles in one spot, inspectors operate in many different locations.

Measured Petrol-based vehicles **Measured Diesel-based vehicles**

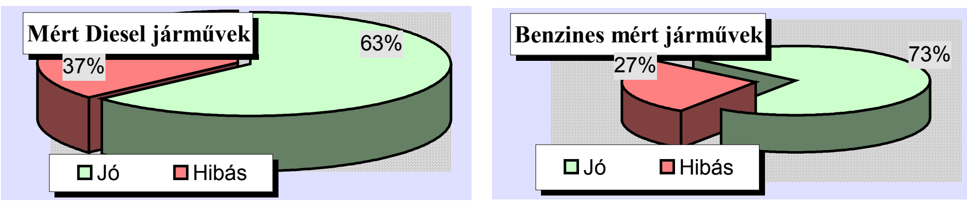


Figure 7: Vehicles preselected by RSD conforming with accepted environment standards

Jo = within limit Hibás = outside limit Jo = within limit Hibás = outside limit

In conclusion, it can be said that the remote sensing device works efficiently as a pre-selector of vehicles not meeting environmental protection standards. Thanks to this device it is now possible to isolate a considerably greater number of vehicles that pollute the air of the capital city. As is shown in Figure 7, 27 percent of petrol-based vehicles, and 37 percent of Diesel-engined vehicles, pre-selected by RSD did not conform with the accepted environment standards. Furthermore, this system through the capture of license plate data also enables the ordering of the vehicle to a local inspection and maintenance station.

Transboundary Air Quality Monitoring in the Black Triangle Region

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INTRODUCTION

The Polish, Czech and German border areas (see Figure 1) have been recognised as the most degraded region of Europe. It covers an area of 32,400 sq. km, and has a population of 6.4 million.

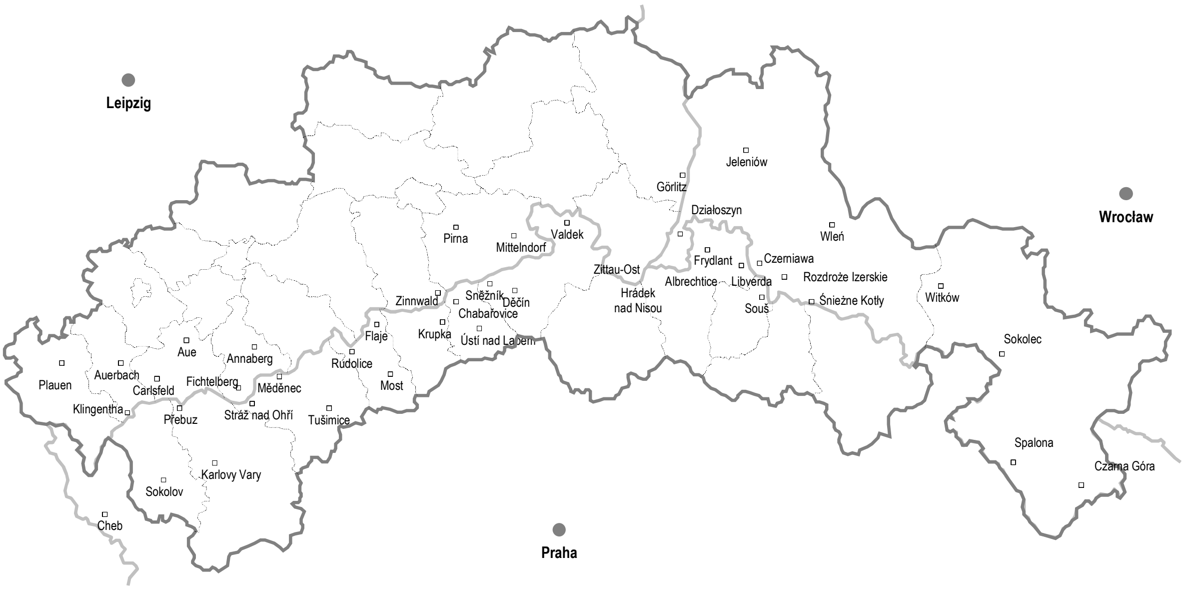

Figure 1. Map of the Black Triangle with station names and locations

The intensive mining of lignite began in Central Europe in southern Saxony in Germany, northern Bohemia in the Czech Republic, and Lower Silesia in Poland during the 19th century. Following the development of lignite-mining, the region became intensively industrialised after the 2nd World War. The side effect was environmental pollution, which with the accumulation of industrial activity within a small area and without sufficient measures for the protection of the environment caused not only local pollution but also that of distant regions.

In 1990, with the advent of political change, Czechoslovakia, Germany and Poland found themselves facing a difficult legacy -- the results of a long period of relentless environmental destruction. They also found that only common, trilateral co-operation could lead to the significant improvement of the environment in this Central European lignite-mining area.

In June 1991, the Environment Ministers of Czechoslovakia, Germany and Poland issued a joint declaration at a meeting in Dobris that created a trilateral Working Group for neighbourly co-operation. The primary task of the Working Group was to prepare an action plan of joint priority tasks. The programme created by the Ministers became the international Regional Environmental Black Triangle Programme. The European Commission joined the Working Group as a fourth partner, providing financial support through the PHARE Regional Environment Programme. One of the first common achievements the Black Triangle Programme was the establishment of the Joint Air Monitoring System.

OBJECTIVES

The Joint Air Monitoring System (JAMS) shared the following objectives to:

- Support international cooperation in the field of air protection concerning the transboundary pollution caused by large power plants fired by brown coal;
- Create a mechanism for continuous air quality control;
- The measurement of meteorological parameters;
- Collect complementary information concerning the quality of different environmental components;
- Assure good quality measurement according to international standards, recognisble by all cooperating countries and international institutions;
- Create an early warning system for dealing with smog situations;
- Enable the creation of a decision support system for efficient environmental management;
- Enable research into the movement and quantities of transboundary pollution;
- Collect data for dispersion model evaluation and validation.

USER NEEDS

Several groups of end-users rely on and benefit from the air quality monitoring data. These include:

- Environmental protection services, forestry services, the staff of national parks and protected area administrations;
- Researchers of universities and institutes;
- Local and regional authorities, administration and decisionmakers;
- The general public via the media (newspapers, tv, internet).

All the above mentioned groups rely on information concerning the quality of environment. Some of them, particularly specialists, need more detailed data for further analysis and research. Non-specialists, i.e. journalists and the public, need elaborated reports and publications, where information is more general and carries clear conclusions.

The organisation responsible for the operation of the Polish component of JAMS offers access to the following information:

1. Monthly reports, containing a description of the environmental situation for the previous month with graphical presentation of data. Two versions of the monthly report are available, including:
    - One for environmental specialists within universities, institutes and administrations, consisting of tabular presentations of pollutant concentrations;
    - And one for others where the statistical data is not included.
2. Specific yearly reports, concerning air quality in the Black Triangle region, which consisting of comprehensive presentation and descriptions, text and tables, as well as graphics with maps and charts;
3. A general annual report, containing complementary information about the overall activity of the Voivodsip Inspectorate.

Up-to-date user-friendly information concerning the network and monthly reports are made available via the Internet.

AREA OF APPLICABILITY

The monitoring network consist of three independent components, the Polish, Czech and German segements.

There are a total of 43 static monitoring stations within the Black Triangle air monitoring system. Ten stations are based in Poland in the provinces of Jelenia Góra and Walbrzych, twelve stations are based in Germany in the provinces of Chemnitz and Dresden, and 21 stations are located in the Czech Republic in the counties of Sokolov, Karlovy Vary, Chomutov, Most, Teplice, Ústí nad Labem, Decín, Ceska Lipa, Liberec, Jablonec, Semily, Trutnov). In Poland, there is also one mobile station, which is used for contemporary measurements in both Polish provinces.

The basic monitoring programme includes the continuous measurement of sulphur dioxide (SO_2), nitrogen oxides (NO and NO_2) and suspended dust. Most stations measure ozone (O_3). Some stations also measure carbon monoxide (CO). In parallel, air quality meteorological parameters are also collected, i.e., windspeed and direction, temperature, humidity, solar radiation and atmospheric pressure.

Apart from the automatic data acquisition of air pollution compounds and meteorological parameters, manual measurement is also made in selected stations. Those parameters are poly-nuclear aromatic hydrocarbons and metals measured from dust samples and pH, conductivity, sulphates, nitrates and other parameters measured from automatic rain collectors.

The monitoring programme of the entire Black Triangle network is presented in the tables below. The locations of the Monitoring Stations are given in Figure 1.

Table 1. List of stations in Poland

Station N°	Station Name	Voivodship	Altitude [m]	Location
1	Dzialoszyn	Jelenia Góra	362	rural
2	Czerniawa	Jelenia Góra	645	mountains
3	Wlen	Jelenia Góra	303	edge of town
4	Sniezne Kotly	Jelenia Góra	1490	mountains
5	Jeleniów	Jelenia Góra	244	rural
6	Spalona	Walbrzych	810	mountains
7	Czarna Góra	Walbrzych	1133	mountains
8	Sokolec	Walbrzych	865	mountains
9	Witków	Walbrzych	480	rural
10	Rozdroze Izerskie	Jelenia Góra	767	mountains

Table 2. List of stations in Germany

Station N°	Station Name	County	Altitude [m]	Location
1290	Annaberg	Annaberg	545	town edge
1291	Fichtelberg	Annaberg	1214	mountains
1289	Aue	Aue	348	town centre
1292	Carlsfeld	Aue	896	mountains
1286	Klingenthal	Auerbach	540	town centre
1288	Auerbach	Auerbach	459	town centre
1297	Zinnwald	Dippoldiswalde	877	mountains
1295	Görlitz	Görlitz	210	town centre
1293	Pirna	Pirna	118	town centre
1296	Mittelndorf	Pirna	323	rural
1287	Plauen	Plauen	380	town centre
1294	Zittau-Ost	Zittau	230	town edge

Table 3. List of stations in the Czech Republic

Station N°	Station Name	County	Altitude [m]	Location
1037	Cheb	Cheb	488	town edge
1000	Medenec	Chomutov	827	mountains
1002	Tusimice	Chomutov	322	rural
1014	Decín	Decín	131	town centre
1013	Sneznik	Decín	588	mountains
1015	Valdek	Decín	438	rural
1022	Sous	Jablonec	740	mountains
1029	Stráz nad Ohri	Karlovy Vary	323	town edge
1030	Karlovy Vary	Karlovy Vary	429	town edge
1019	Hrádek nad Nisou	Liberec	250	town edge
1018	Frydlant-Údoli	Liberec	381	rural
1021	Libverda	Liberec	486	rural
1020	Albrechtice u Frydlantu	Liberec	535	rural
1005	Most	Most	221	town centre
1004	Fláje	Most	739	mountains
1317	Rudolice	Most	840	mountains
1033	Prebuz	Sokolov	905	mountains
1032	Sokolov	Sokolov	476	town edge
1007	Krupka	Teplice	533	mountains
1012	Ústí nad Labem	Ústí nad Labem	149	town centre
1010	Chabarovice	Ústí nad Labem	199	rural

Table 4. The Monitoring Programme in Poland

No	Station	Measured Parameter					
		sulphur dioxide	nitrogen oxides	suspended dust	carbon monoxide	ozone	meteorological data
1	Dzialoszyn						
2	Czerniawa						
3	Wlen						
4	Sniezne Kotly						
5	Jeleniów						
6	Spalona						
7	Czarna Góra						
8	Sokolec						
9	Witków						
10	Rozdroze Izerskie						
11	mobile station						

Table 5. The Monitoring Programme in Germany

No	Station	Measured Parameter					
		sulphur dioxide	nitrogen oxides	suspended dust	carbon monoxide	ozone	meteorological data
1290	Annaberg						
1291	Fichtelberg						
1289	Aue						
1292	Carlsfeld						
1286	Klingenthal						
1288	Auerbach						
1297	Zinnwald						
1295	Görlitz						
1293	Pirna						
1296	Mittelndorf						
1287	Plauen						
1294	Zittau-Ost						

Table 6. The Monitoring Programme in the Czech Republic

No	Station	Measured Parameter					
		sulphur dioxide	nitrogen oxides	suspended dust	carbon monoxide	ozone	meteorological data
1037	Cheb						
1000	Medenec						
1002	Tusimice						
1014	Decín						
1013	Sneznik						
1015	Valdek						
1022	Sous						
1029	Stráz nad Ohri						
1030	Karlovy Vary						
1019	Hrádek nad Nisou						
1018	Frydlant-Údoli						
1021	Libverda						
1020	Albrechtice u Frydlantu						
1005	Most						
1004	Fláje						
1317	Rudolice						
1033	Prebuz						
1032	Sokolov						
1007	Krupka						
1012	Ústí nad Labem						
1010	Chabarovice						

TECHNICAL ASPECTS OF THE JAM SYSTEM

The backbone of the JAMS are sets of automatic air quality monitors and meteorological sensors. Poland received a complete automatic monitoring system of ten stationary and one mobile station. The Czech Republic received a set of monitors and meteorological sensors to update the existing network in Northern Bohemia, while a member of the European Union, Germany linked up to the Black Triangle JAMS with it's own monitoring network without financial support from the PHARE Programme.

For the purpose of exchanging monitoring data between the three countries, a data exchange system was developed, based on the Meteosat satellite. Satellite communication via Meteosat offers a technical means for data acquisition from stations located across Europe, as well as from north Africa The monitoring centres in Jelenia Góra, Radebeul at Dresden, and Ústi nad Labem were all therefore equipped with satellite receivers.

Apart from a standard communication system, the stations in Poland and Germany are also equipped with satellite transmitters. German stations already use the Meteosat system and data is directly received in Poland and the Czech Republic. Polish stations will begin satellite data transmission in 1998. Validated data will be exchanged between the country centres via the wide area network *DatexP, EuroTel* and *Polpak* as well as the *Internet.*

Measurement results are collected in country regional centres and go through a validation and processing procedure. Furthermore the data is distributed in textual and graphical form to the relevant institutions and to the public. Lastly data from each monitoring centre is exchanged online, assuring direct access to environmental information across the region.

The Central Acquisition System in Jelenia Góra (Poland) was recently connected to Internet through a high speed leased line, giving access to data for authorised persons, online, 24 hours a day.

The Polish Central Acquisition System (CAS) is located at the Voivodship Inspectorate of Environmental Protection (Wojewódzki Inspektorat Ochrony Srodowiska) in Jelenia Góra. CAS is equipped with an IBM RS/6000 workstation. The central computer works under the IBM AIX 3.2.5 Operating System with an X/Window graphical user interface. The application of software conforms to the ISO 7168 standard and is approved by the French agency, ADEME.

The CAS software has built-in communication procedures within monitoring stations. The system uses a wireless packet radio communication system. Any station can also be served also via switched telephone or direct cable links. The advantage of such a multi-tasking software environment allows the simultaneous performance of different tasks.

The Czech Central Acquisition System is located at the Czech Hydrometeorological Institute (Cesky Hydrometeorologicky Ustav), in Ústí nad Labem.

The German Central Acquisition System is located at Sächsisches Landesamt Für Umwelt und Geologie at Radebeul in Dresden.

The Czech Republic and Germany use the public telecommunications network to communicate with their stations (see Figure 2).

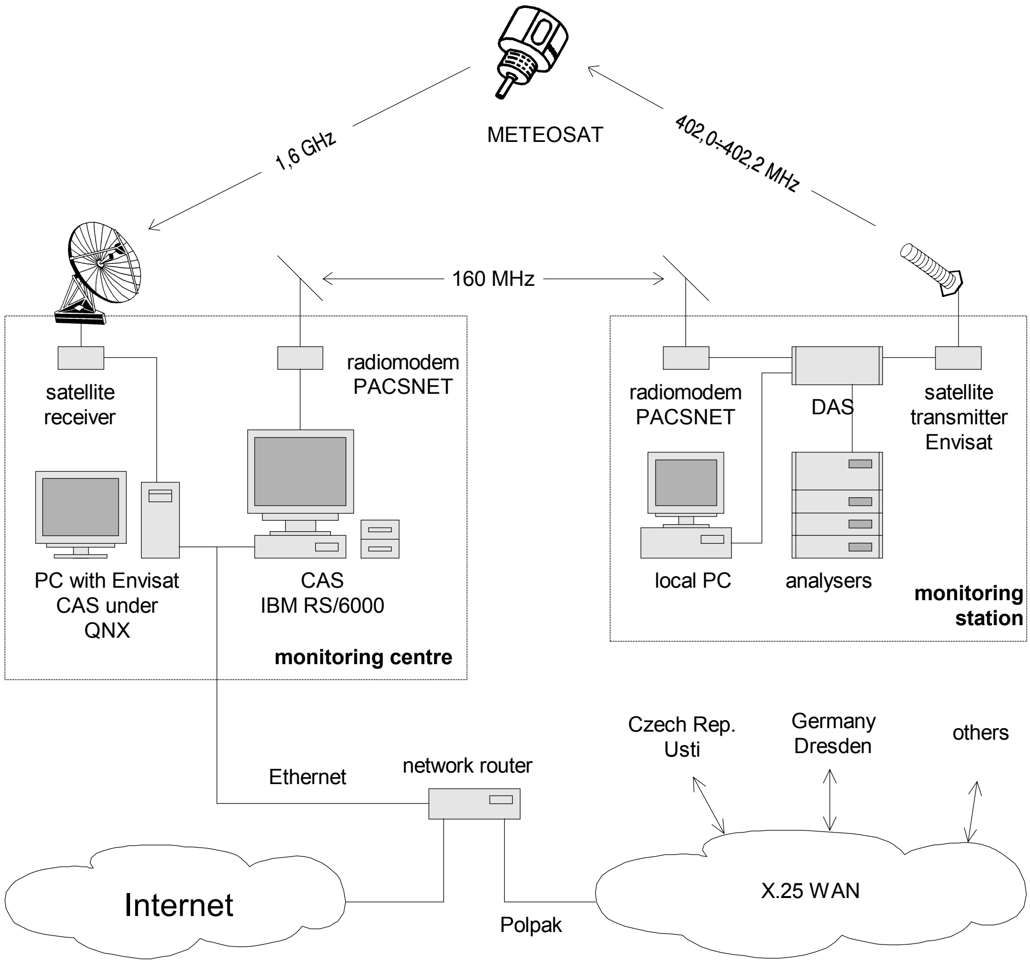

Fig 3. Schematic diagram of the Polish communication system

EXPERIENCES GAINED FROM IMPLEMENTATION

A complex system such as an international monitoring system, which must assure data flow between different sites and adhere to technical standards, always causes problems when implementing. Contractual issues has also caused some difficulties and delays. The rules of PHARE project implementation is that the EC is the contracting authority, which keeps administrative control over the tendering, contracting and implementation processes. The beneficiary has no direct commercial link with the suppliers awarded to issue the contract. All problems must be clarified between the beneficiary and the contractor with the EC acting as mediator. Problems in this respect contributed to many months delay in project implementation.

Particular care should also be taken at the stage of supplier selection. Successful implementation relies a great deal on the ability and reliability of the supplier. References should be checked carefully.

Conclusions drawn from the Polish site are that the beneficiary countries should have more influence on the execution of the contract to ensure it's proper implementation. The beneficiary country should also expect the administrative tasks to be executed by the Commission, especially since many problems deal with the technical aspects of the delivery.

Another problem was caused by the lack of a sound technical infrastructure within the beneficiary countries to establish a reliable wide area network connection. Digital data networks were only just being introduced in Poland when the tender for JAMS was made. This has resulted in the fact that the fully automatic international data exchange process is still being implemented and will only start in Autumn 1998.

TRANSFERABILITY ASPECTS

The JAMS relies on data acquisition, validation, storage, processing, visualisation, transfer and quality control. Familiarising oneself with such a system is a good example for all persons working in the field of air protection. Factors affecting the transferability of any system which might be learned from the JAMS include:

- Planning of a monitoring system (which parameters to measure and where, which methodology to use, how to organise data transfer and processing, how to communicate with the stations etc.);
- How to prepare technical tender documentation and the tender itself;
- How to organise the operation of the system;
- How to assure the high quality of data;
- How to produce reports and in what form for different users;
- How to integrate the system with other information systems and tools.

GOOD OR BEST PRACTICE ASPECTS

The cooperative efforts of air monitoring experts from Germany, the Czech Republic and Poland, supported by experts hired by the Commission was an excellent opportunity to create an international team. This group of experts cooperated not only to create the system, but also to successfully operate it. Examples of such cooperation include the exchange of standards and measurement techniques, common inter-calibration programme, meetings and exchange of data.

To ensure the long-term cooperation within the framework of the JAMS project, on September, 17, 1996 the Data Exchange Memorandum was signed in Most (in the Czech Republic) by the Polish Minister of Environmental Protection, Natural Resources and Forestry, the Czech Minister of Environment, and the German Minister of Environment and Reactor Safety. The countries declared to further exchange air pollution imission data concerning the Black Triangle region and to elaborate summary reports about the imission situation of the Black Triangle. The first report containing an elaboration of data for the entire Black Triangle has already been published for the Polish segment. (See Figure 3 for an example of air-quality data). The next report will be issued at the end of June 1998 and will elaborate data also from the western part of Poland, outside of the Black Triangle, but still impacted by its big power plants.

After the first period of JAMS operation, the Polish conclusions are as follows:

- Data processing system should be based on common standards, recognised by all;
- Common methodology for environmental assessment should be used;
- Data validation should be made in a similar way by all partners;
- A periodic inter-calibration programme should be implemented;
- The system of reporting should be commonly agreed upon, especially that data intended for the general public.

Not all of the defined objectives have yet been implemented, for example, common reporting or the full integration of systems. In the meantime, other objectives have been further clarified, for example, the decision support system.

The founders of the Polish Black Triangle JAMS idea were aware that the creation of the monitoring system is just a first step in the creation of an environmental management and support system. As the network can never be dense enough, the next step is to collect information for those places between stations. This will involve the implementation of dispersion models, typically difficult to successfully implement in complex territories like the Black Triangle Region.

The implementation of dispersion models involves the work of researchers and experts, as well as the collection of much additional data. Representative meteorological data and emission inventories are critical for further modeling.

The implementation of a geographical information system would be another milestone and benefit. All the above activities are undergoing development in neighbouring countries.

COST-BENEFIT CONSIDERATIONS

The total cost of equipment financed by the PHARE Programme was 2.2 MECU. Additional cost related to the technical infrastructure of monitoring stations was covered by the beneficiary countries. Current operational costs are covered by the countries involved.

It is very difficult to make a direct cost-benefit assessment of an air quality monitoring system. In general, the cost of monitoring does not exceed 1.5 percent of overall environmental investments. In the case of the Black Triangle region, the analysis of the monitoring data has clearly shown that the highest concentration of pollution in highly populated areas does not now come from big power plants. The elaboration of air quality data therefore confirmed that the abatement strategy which involved financing gas conversion was the correct measure.

Apart from this, monitoring results show significant decreases in air pollution concentrations during previous years, which has already been closely related to investments made in the energy sectors of the three countries.

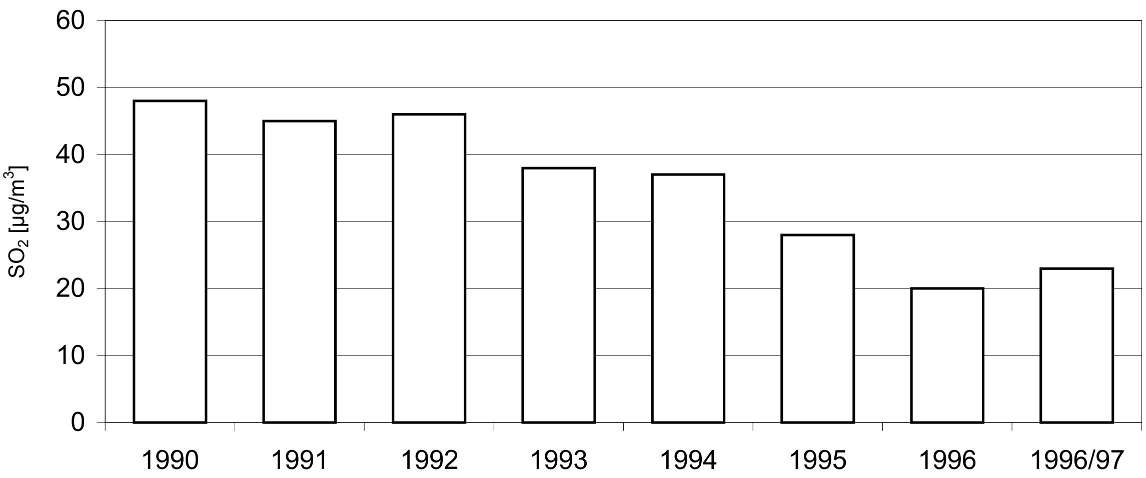

Fig 4. Changes of SO_2 concentrations at the Czerniawa station in Izera Mountains during the period, 1997 - 1998

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Real-time Monitoring and Assessment of River Basin Conditions for Drinking Water Intake Protection

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OBJECTIVES

This paper presents the EU funded Telematics Application Programme ”WaterNet” Project (EN1016); Distributed Water Quality Monitoring using Sensor Networks. During this project, two applications were developed for the demonstration of online river monitoring. These applications are based around two existing monitoring networks. The major objectives of the two applications are:

- Protection of drinking water intakes
- Minimising of monitoring of point sources;
- Monitoring general water quality

While these may appear common objectives for river monitoring, instead of using the normal procedures of sampling and subsequent analyses, which are time consuming and far from real-time, the objectives are met by the use of a geographically distributed network of automatic monitoring stations equipped with sensors and analysers.

The difficulty facing the users of existing monitoring systems is the rate and volume of data being collected, which prevents users from effectively overseeing the river state in real-time. Hence, their effective use demands real-time data handling capability in order to turn this monitoring data into useful information for operational staff. This in turn enables them to make rapid and reliable decisions regarding the state of the river water for use in the production of drinking water.

USER REQUIREMENTS

The basic needs expressed above led to specific user requirements for an online, real-time, data handling/processing system that includes the following features:

- Validation of data before use in the decision making process
- Aggregated information concerning water quality - specifically changes in state;
- Ability to access information on the basis of events or specific periods
- Prognosis modelling of pollution events (duration and concentration) at specific points of the river after a pollution incident has occurred
- Identification of possible sources for pollution incidents
- Calculation of different water quality indexes (including compliance control)

In order to meet these requirements, different data fusion/data handling methods were developed and implemented. These are summarised in Table 1.

Level	Type of Fusion	Function	Space
3	Decision Fusion	Actions on environment, treatment plants, sensors,....	
2	Feature Fusion	Detection of changes in state, classification, explanation...	Multi-parameter, spatial
1	Data Fusion Cross Validation	Geographical validation Space-time validation	Multi-parameter, spatial
0	Single Data Validation	Low level validation	One dimensional

Table 1: Data handling methods

The methods are general in the sense that they can also be applied to other systems where assessment of state and classification of quality are required. The WaterNet applications were developed to build on the existing SCADA systems using the latter systems as front-ends to the real world while extracting data from the existing databases. The application runs on an NT platform. The extracted data is converted into useful information for presentation to different users. This means that the overall functionality of WaterNet is to concentrate and handle geographically distributed data and to distribute the resulting information to users in different geographical locations. This functionality of the data handling process is structured as presented in Figure 1.

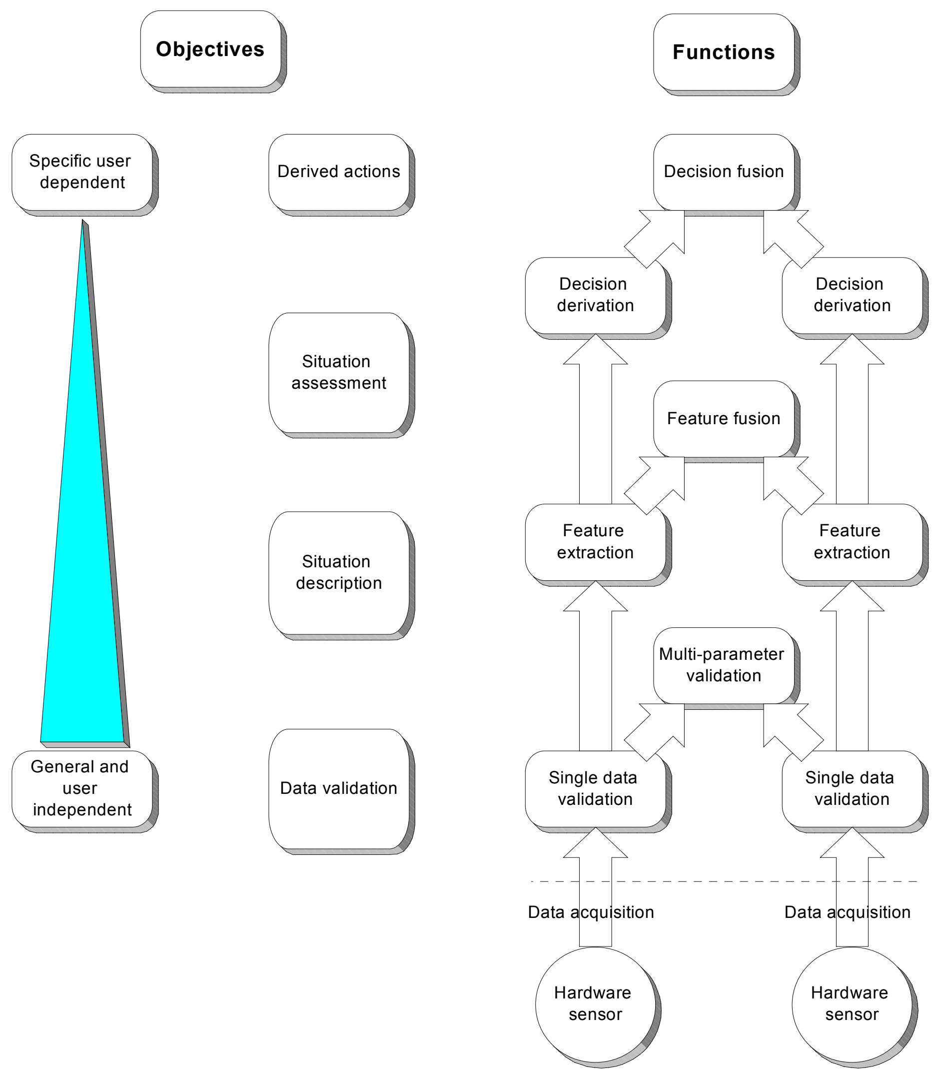

Figure 1: Fusion Hierarchy

Although data handling in WaterNet is based on the fusion of data collected from automatic monitoring stations, the higher levels of the fusion hierarchy (the data collection and analysis procedure) also require other inputs such as manual sample data, descriptions of pollution events, and physical/geographical river data etc. If this data is not included in existing SCADA systems it is necessary to extend this or extract the data from other sources.

THE APPLICATIONS

The existing automatic monitoring networks used in the project are located on the River Seine (Paris area) and on the River Llobregat (Barcelona area). The two different monitoring networks both rely on SCADA systems to collect data from automatic monitoring stations located on the riverbanks. Water is pumped into the station houses, pre-treated (for most of the necessary measurements), and pumped to the different sensors/automated analysers. All activities at each station are controlled by a local computer, which in turn can be controlled from the SCADA system’s main computer. Data is stored both locally and transmitted to the SCADA system’s main computer located in a central control room.

The Paris-based application consists of the automated monitoring network, ”APES uses five monitoring stations located in the western part of the Paris region. The Barcelona-based application is built around the ”SIAM,” automated monitoring network. It has ten monitoring stations distributed along the river and its main tributaries. These stations are operated by Grupo Aguas de Barcelona. Tables 2 and 3 define the stations and the data collected for each application site.

	Issy-les-Moulineaux	Suresnes	Villeneuve-laGarenne	Chatou	Rueil
Temperature	x	x	x	x	x
Dissolved O_2	x	x	x	x	x
Ammonia	x	x	x	x	x
Monitored Redox-pot.	x	x	x	x	x
Turbidity	x	x	x	x	x
Conductivity	x	x	x	x	x
pH elements	x	x	x	x	x
Phosphate	x	x	x	x	x
Phenol		x		x	
Hydrocarbons		x		x	
UV-Abs.		x			
Visible-Abs.		x			
Heavy Metals		x		x	

Table 2: Monitoring stations and measured parameters in the ”APES” moni toring network (France).

	Balsa-reny	Castell-gali Ca	Castell-gali Li	Abrera	Martorell	Pressa Sedo	El Papiol	Rubi	S. Joan Despi
Dissolved O_2	x	x	x	x	x	x	x	x	x
Ammonia		x	x	x	x	x	x	x	x
Suspended Solids							x		
Turbidity	x	x	x	x	x	x	x	x	x
Conductivity	x	x	x	x	x	x	x	x	x
pH	x	x	x	x	x	x	x	x	x
Phosphate		x	x		x	x	x	x	x
TOC	x	x	x	x	x	x	x	x	x
Cyanides					x		x	x	
Hydrocarbons		x			x		x	x	
UV-Abs.		x	x	x	x			x	
Total Chromium		x	x		x				
Heavy Metals							x		

Table 3: Monitoring stations and measured elements in the ”SIAM” monitoring network (Spain).

THE VALIDATION PROCESS

According to the data-fusion hierarchy, the first analysis (the collection procedure) applied to the incoming data is a stage of single data validation. However, as shown in Figure 2, the term ”single data validation” covers a series of analytical methods applied to the data. The aim is to establish a synchronised time series in which each measurement for each element of data collected is given a ”confidence value.” The result is the generation of a full input vector at each time interval for higher level fusion methods. Slope and range compliance is applied in this application in a standard way.

Data synchronisation and gap filling are carried out according to a simple concept. If a current measurement of any data element does not exist within a specified time frame around the acquisition time, then the nearest valid measurement is used. In online mode, this is the last valid reading. Within the river environment, different data elements have different dynamic characteristics. To take this behaviour into account, data elements that change slowly are allocated a ”high persistence” ranking, and those subject to rapid changes, a ”low persistence” value.

The value is arbitrarily defined as the time for the confidence in a measurement to fall to 50 percent. As a specific measurement ages, the confidence ranking in the value decreases, and if the measurement continues to age the confidence should decrease progressively faster.

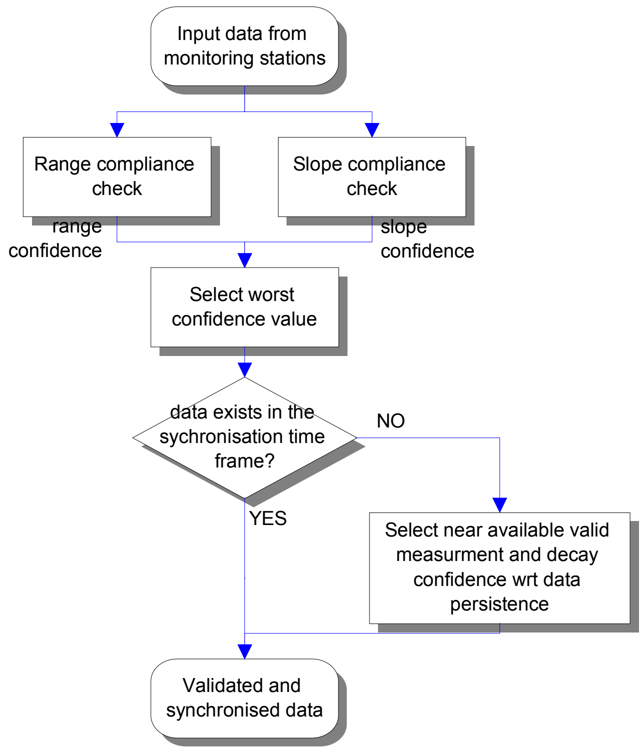

Figure 2: Low level validation train

SITUATION DESCRIPTION

Defining the situation description involves three methods of multi-parameter validation, which provide additional information to assess the confidence of the measured data by using information from other sensors. The first method is geographical validation, which compares time-series measurements of the same data element at different locations. The measurement is concerned with daily variations that are expected to be the same at different locations. The validation method yields a high confidence value when the two measurements exhibit similar trends, and lower confidence when the trends are dissimilar.

Cross validation utilises information from the time-series of two different but related data elements at the same locations. The cross validation algorithm calculates a confidence value for a measurement based on the rates of change of each of the two data elements. The rate of change for each data element is divided into three zones based on the ”slope compliance” - slope ascending and slope descending rate limits, and allocated a confidence value. Consistent with geographical validation procedures, the basis for this confidence is the correlation between the variations of the two time-series.

”Space time” validation as part of the geographical validation process compares two time-series data sets of the same data elements at different monitoring stations. However, it also takes into account the transport time between the stations. For this purpose, the transport times between two stations are simply represented by a table that contains the normal observed transport time for each week in the year. These times are used to incorporate a time shift between the upstream and downstream time-series prior to a comparison of the trends. However the actual transport delays are expected to deviate from those in the table. Hence a deviation is considered in the time shift, and the best confidence figure found in the range of the compared time is used.

SITUATION ASSESSMENT

As mentioned earlier, one of the major objectives of the project was to protect drinking water intakes. This requires the rapid assessment of water quality in the river from which the water is abstracted. The task is therefore to provide the operator with an online classification of the water quality in two or more classes and present the results in an easy to understand user-interface. This information can be used as decision aid, for example, in deciding whether to open/close the water intake or to choose the mode of operation of the drinking water treatment plant. Three different methods have been used, and the results from each of the methods are available simultaneously to the operator presented online as colour coded classes.

The approach is generally the same for each of the methods, and in practical terms defines a software sensor that gives a one or two dimensional output, which then can be compared to a table of threshold values giving the class of the water quality.

Classification

The simplest method of situation assessment is to compute a water quality index by comparing the input data for comparison with a threshold table of the type presented in Table 4. In fact, this is the normal method used for the classification of rivers. The resulting water quality is then classed in the following way: Excellent (0-25); Very good (25-50); Good (50-75); Bad (75-90); Very bad (90-).

Parameter	Class 1 Blue	Class 2 Green	Class 3 Yellow	Class 4 Orange	Class 5 Red	
Dissolved oxygen	99999	7	7	5	3	-99999
NH4+	-99999	0.5	0.5	1.5	4	99999
NO3-	-99999	25	50	50	50	99999
Turbidity	-99999	2	35	1500	3750	99999
Transparency	99999	2	1	0.1	0.05	-99999
Conductivity	-99999	2000	2500	3000	4000	99999
pH-min	99999	6.5	6.5	6.5	5.5	-99999
pH-Max	-99999	9	9	9	9.5	99999
Cadmium	-99999	5	5	5	5	99999
Chrome-total	-99999	50	50	50	50	99999
Nickel	-99999	50	55	100	400	99999
Lead	-99999	50	50	50	50	99999
Copper	-99999	1000	1000	1000	1000	99999
Zinc	-99999	5000	5000	5000	5000	99999

Table 4: Classification thresholds.

Three classification methods are configured within the Paris application. The first two of these are based on the French river and canal water classification method developed by Duport and Margat [1] (known as the "Multipurpose Scale" method which has been in use in France since 1971) and which provide the user with:

- General water quality classification based on five classes;
- Pass/fail classification that divides the five classes into two groups - water suitable for use in the production of drinking water, and that unsuitable for drinking water production.

The third classification method is based on the newly proposed classification method SEQ-eau, which divides classification into different ”use-types.” The most important of these for potable water production is the AEP (Alimentation Eau Potable). This system is more complex but can be represented in a conservative manner using the generic classification method used in the tool.

In practice, it is not possible to collect online, all of the data elements included in the classification scheme discussed. Hence, within the actual application, only those data elements that are available are used to carry out the assessments. However where additional laboratory analyses can be made, these may be used in the same way as online data to compute water class information.

Variation Detection

The second method for situation assessment provides the operator with a tool for the online detection of significant variations in input data, and thereby enables the identification of changes in the water quality. Normally these changes are identified using a simple criteria based on the trend of sensor measurements. Most SCADA systems generate an alarm when the trend of a measurement is greater or lower than a threshold value. However, there are situations where the variations at each sensor cannot be considered critical, but nevertheless still indicate an overall variation of the water quality.

The method can be regarded as a ”constant window” on quality, from which it is possible to construct an online software sensor called ”Detect” (where the values describe the variance in the data set), and compare this with another software sensor called ”Threshold.” The construction of ”Detect” is based on the co-variance, because it is considered that the co-variance represents a variation in the data. The sensitivity of the detection method automatically varies in time according to the level of variance for the input data.

Feature Maps (Kohonen maps)

The third and most complex method is based on the use of ”Self Organising Feature Maps” (SOFM) or Kohonen maps. These maps deal with high-dimensional state space (multiple time-series data) by:

- Modelling a set of input data against a given number of prototypes which represent the underlying relationship between all measurements included in the input vector;
- Mapping the prototypes from a high dimensional space state (the River state) to a two-dimensional space (the Kohonen map);
- Preserving the data topology - near neighbours in the high-dimension space will be near-neighbours in the two-dimensional map.

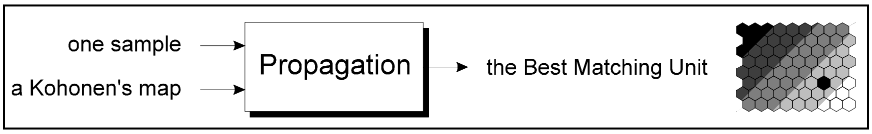

Figure 3: The propagation process of SOFM - finding the best matching unit to input data (sample).

Pollution Tracking

All of the three previous methods can be used to detect a change in monitored river state. A sudden change could very well arise from an industrial spill upstream. Since monitoring networks tend to cover quite large areas, one or other station might detect this change, and hereafter it is possible to evaluate when the pollution will arrive at the water intake and when it will subside.

Therefore the project has included a simple pollution tracking method that is able to simulate the time of arrival and the concentration of a pollutant, and compare measured values at different stations. The method makes use of a table that gives rough estimates of dilution. The dilution is estimated from the known flows (weekly figures) of the various tributaries expressed as a percentage of the contribution to the main river at the most downstream station. The arrival time is computed using a transport timetable (weekly figures) as in the case of space-time validation.

TRANSFERABILITY ASPECTS

The difficulties of dealing with large quantities of process data in real-time are common in many large process monitoring applications. For this reason, not only the methods and techniques implemented in the tool but the tool itself is largely applicable to other large scale process monitoring problems. Recent discussions with staff from water production plants in England have identified that the application is well suited to joint river and treatment plant monitoring applications.

The application of the tool to new sites is constrained only by the existing data collection infrastructure. However, where a suitable infrastructure does exist, the problems involved with implementing a new application are confined to existing database(s) and configurations.

COST BENEFIT CONSIDERATIONS

Though generally considered to be a stable process, the production of drinking water is nevertheless a critical application where human health is potentially at risk. Improving technology instrumentation and telemetry systems provide the means to improve the security of operations like drinking water production, petro-chemical and other large-scale process industries. However, economic pressure also results in either the reduction of staffing levels, or an increased monitoring burden on existing staff. This often leads to a single operator being responsible for overseeing a large quantity of real-time data from possibly several distributed applications. This places a huge burden on the operator who at best can only oversee between 10 and 20 time-series data sets effectively. Hence centralisation of monitoring operations can lead to increased risk because the capabilities of the operator to absorb and analyse information are surpassed. The application of data fusion and classification techniques allow a single operator to effectively oversee much larger data sets. Hence the WaterNet application provides a tool allowing for useful information to be derived from the investment in sensors and telemetry.

Payback periods, calculated on the basis that the application allows for one person to oversee the data which would otherwise required more staff is short, usually about six months, especially since the application is only an add-on feature designed to handle data from existing systems. The investment required to purchase hardware, installation and configuration is expected to be about 20 KECU.

Towards an Integrated Danube River Basin Information System

Water Related Information on the World Wide Web

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SUMMARY

The development of environmental information and communication-related activities within the Danube River Basin has been influenced by three important events. These are the establishment of the Environmental Programme for the Danube River Basin (EPDRB), the Environmental Action Programme (EAP), and the Danube River Protection Convention (DRPC). The goals of the EPDRB are to coordinate and support water quality monitoring, data collection and assessment, and emergency response systems. Following the ratification of the DRPC, the International Commission took the responsibility for all Danube programmes. To establish efficient information flow in the Danube region, modern Telematics applications and a multi-dimensional information structure model has been introduced, enabling the development of a distributed information system within individual countries. In order to achieve this, a Danube Information System has began to be implemented using Internet technology, state-of-the-art Intranet, Extranet and open Internet information exchange on the World Wide Web.

INTRODUCTION

The Danube River Basin covers 817,000 km^2 and 17 countries. It lies at the heart of Central Europe (see Figure 1).

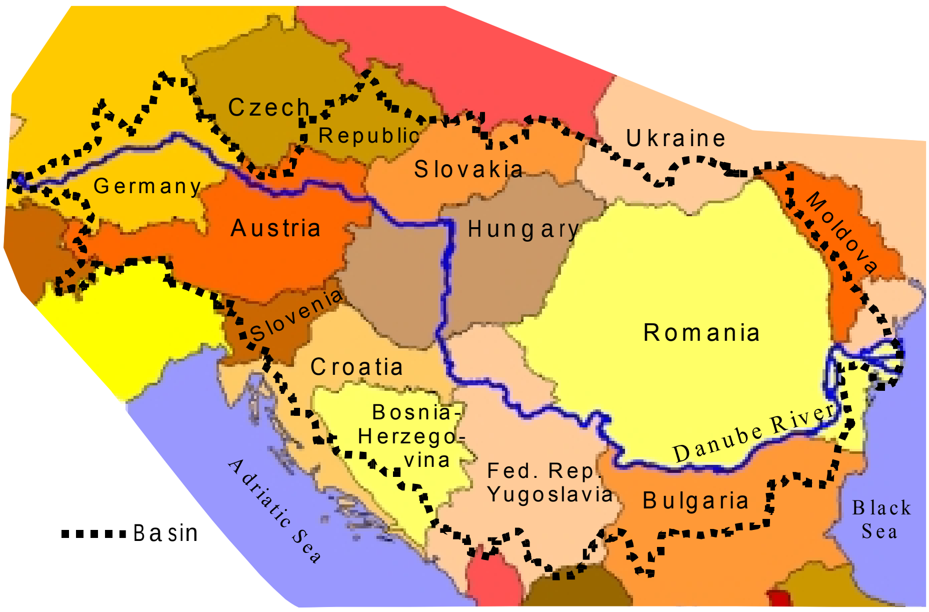

Figure 1: The Danube River Basin (Source: City Council of Vienna)

The cumulative inflow of nutrients to the Danube River has led to the eutrophication of the river and to the pollution of its groundwater, as well as adding to the degradation of the unique Danube delta and the north-west shelf region of the Black Sea.

To reduce the pollution load, the international Environmental Programme for the Danube River Basin was established. Within this Programme, a prototype Danube Information System (DANIS) was developed and the Danube River Information Network (DRIN) for the management of water quality initiated. The development of these and other environmental information and communication activities were influenced through the establishment of the:

- Environmental Programme for the Danube River Basin (1997);
- Danube River Protection Convention (1994);
- Environmental Action Programme (1995).

An early step in the implementation of the EPDRB Programme was to coordinate and support monitoring, data collection, assessment, emergency response systems and pre-investment studies. For this purpose, the Danube Task Force (see Figure 2 below) was established, with sub-groups for:

- Monitoring, Laboratory and Information Management (MLIM);
- Accident Emergency Warning Systems (AEWS);
- Data Management (DM).

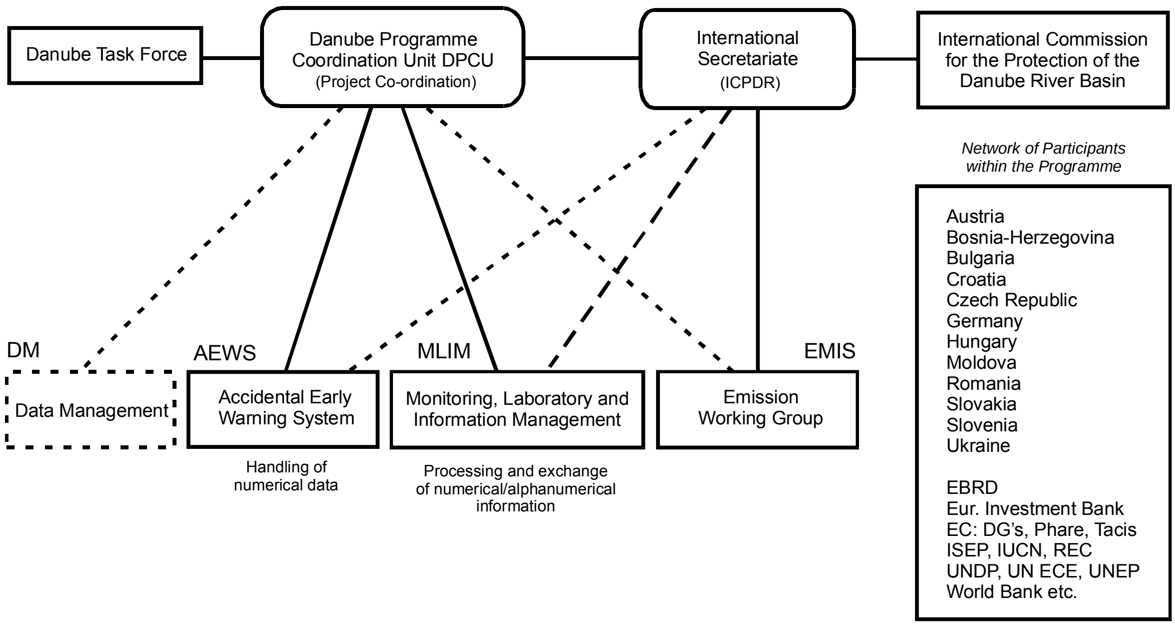

Figure 2: Organisational structure within the DRB Environment Programme (May 1998).

In addition to this, a trans-national network of water quality monitoring stations (TNMN) was established. This was followed by an Emission Working Group (EWG) and a special ad-hoc Working Group which was formed to assist in transferring activities from the Task Force and the Danube Programme Coordination Unit (PCU) to the International Commission for the Protection of the Danube River Basin (ICPDR) and its (Interim) Secretariate (which will be permanent from October 1998). Furthermore, 13 Applied Research Programmes (ARP) were initiated to provide reliable scientific information in order to help define future environmental policies. Individual working groups have also established additional ARPs with the assistance of international consortia.

The involvement of nongovernmental organisations was realised through the establishment of the Danube Forum and NGO Grants Programme managed by the Regional Environmental Center, and respective NGO Information Systems. In an effort to raise public awareness, the brochure, *Action for a Blue Danube (1995)* and the *Danube Watch* newsletter were created. Further references to the EPDRB can be found in *Fleckseder (1997), Protecting Danube River Basin Resources (Murphy,1996,* and *Wingard,1997).*

BASIC PRINCIPLES OF THE DANUBE RIVER BASIN INFORMATION SYSTEM

During the Danube Applied Research Project Conference held in Sinaia, Romania in September 1997, the development of a Basinwide Information Management Project was proposed (*Ruzic, Pecar-Ilic 1997*). The outcome of these discussions is presented in Table 7.

Users of Information	*Types of Information Needed*	*Sources of Information*	*Processing Required*	*Methods and Techniques*
o Experts and scientists o Decisionmakers and managers o Mass media and the general public	o Primary information, monitoring o Interpreted, summary information o Selected interpreted information	o Scientific studies, applied research projects o Monitoring TNMN, AEWS, EMIS o National statistics; o Other sources	o Validation of primary information o Introduction of metadata o Quality assurance; updating o Statistical evaluation; data analysis o Modelling	o Information updatability o Electronic multi-media o High-level integration of new technologies o Statistical methods o Mathematical models, visualisation

Table 7: Danube Applied Research Project Conference: Summary of Discussions (Sinaia 1997).

In identifying the current and potential users of environmental information from within the Danube River Basin, all kinds of interested persons, groups, and organisations must be taken into account. In addition, the persons and groups using information and those providing information on Danube related matters are often identical. A large number of users exist in those countries where access to environmental information and public participation in environmental decisionmaking is established. Therefore we can expect that the situation may be different in individual countries.

Access to information from within an environmental information system should be as wide as possible taking into account eventual restrictions on information availability. There is a need for information concerning institutions, organisations, experts, publications, reports, projects and programmes, and standards. Monitoring information and applied research project data should include: metadata for those programs and projects from which the data is generated; financial sponsors; and be broadened to related environmental issues. In addition, spatial references should be made available, if linking with a geographic information system (GIS).

The following information is considered to be of interest with regards to DRP Convention:

- Immission assessment (in-stream water quality, through MLIM-EG);
- Emission assessment (pollution loads discharged into receiving waters, through EMIS-EG, in accordance with the Action Program for the Reduction of Pollution Loads);
- Accident and emergencies, the warning system (through AEWS-EG, for minimising risks through preventive and control measures);
- Water balance of the Danube River Basin;
- Interaction between the waters (stretches of rivers, ponds and lakes);
- Risks caused by floods and ice hazards;
- Sustainable use of waters (through the construction and operation of hydraulic plants, transfer of waters, erosion etc.);
- Results of research and development.

In general, the following sources of information could be identified: minutes of coordinating bodies and expert groups (for example MLIM, AEWS, DANIS, EMIS, ARPs), integrated environmental studies, Strategic Action Plans (SAP), Strategic Implementation Plans (SIPs), Environmental Action Plans (EAPs), information from international institutions (UNEP/GEMS, UNEP/GRID, WMO, UNESCO), national reports and studies (such as questionnaires, national reviews, National SAPs, National SIPs and National EAPs), national statistics, scientific papers, workshop and conference reports, pre-investment and pre-feasibility studies and other information sources, especially those generated by NGOs and the public media.

How and whether the information is used, depends largely on the user. But in reality, there may be significant differences in individual countries from a providers point of view. In some cases, serious problems may arise from inefficient collaboration between different government sectors. Sometimes, national focal points, country programme coordinators (CPCs) or national delegations receive insufficient government support for their activities.

INFORMATION INTEGRATION AND PRIORITIES

After the GEF/UNDP Implementation Inception Workshop (Krems, Austria 1997), a framework for the development of a Danube Information Network was initiated. On the basis of this workshop, a special study of information needs and suggestions for the integration of reliable data in a Danube river basin information system was prepared (Pillmann, Ruzic 1998). The results of this study were presented at the GEF/UNDP Danube River Basin Information Systems Workshop (Baden, Austria 1998), where the use of, and interdependencies between the information components were discussed. Furthermore the importance of communication on environmental issues and reinforcement of public awareness was recognised. An agreement concerning the priorities for the development of the Danube River Basin Information System was reached within the *Framework for the Development of an Information Network*, *1998*). Some of the priorities include:

- Identifying the internal, external, and general components of the information system (preparatory work for the EIONET organised by the European Environmental Agency serves as a good example);
- Establishing efficient communication between the International Commission, MLIM, AEWS and EMIS expert groups and the Danube Water Quality Management Programme (DWQM) to avoid duplication and promote cooperation;
- Establishment of an 'INTRANET' for the ICPDR's information system, which should not only serve the Secretariat in its cooperation with the respective delegations, but also all other expert bodies. *(Framework for the Development of an Information Network, Fleckseder, 1998).*
- Improvement of the textual information system and its efficient management (DANIS and/or other existing information systems should be updated and further improved);
- Establishment of dynamic WWW theme pages with downloadable information concerning the DRB including maps on different scales and selected technical information, including elements of interactive communication with users;
- Establishment of training missions/courses for national information managers;
- Establishment of efficient communication with the European Environmental Agency (EEA) and the Black Sea Information System (access to the EIONET should be negotiated for the Chairperson of Working Groups);
- Participation at conferences including Ecoinforma, and Environmental Computer Science etc. should be planned in order to ensure access to information concerning the latest developments in information and communication technology
- Preparation of a concept for accessing projects results (e.g., ARPs);
- Testing of an ISDN infrastructure for the improvement of electronic communication between CPCs, national data managers and PCU-PHARE/GEF offices.

EVALUATION OF EXISTING INFORMATION SYSTEMS

One of the major achievements of the Baden Workshop in 1998 was the evaluation of existing information systems and those newly developed. The workshop participants evaluated the strengths, weaknesses, costs of implementation, and maintenance of existing and planned systems. Among existing systems enlisted were:

- DANIS – a textual information system, established within the Environmental Programme for the Danube River Basin (http://www.ceit.sk/wwwisis/danis.htm);
- DBIN – a collaborative project for the development of a prototype information network for the Danube River Basin (http://www.syslab.ceu.hu/... (not accessible to the public). This project is based on Infodanube – the first prototype of an environmental information system, developed by the Regional Environmental Center for Central and Eastern Europe;
- GRID Hungary – the regional GRID centre for Central and East European countries which serves an example of a national water quality information system (http://www.gridbp.meh.hu);
- AUSTRIAN Water Quality Information System – available on the Internet Web page of the Federal Ministry of Agriculture and Forestry and the Federal Environmental Agency; and an example of a complete national water quality information system (http://www.ubavie.gv.at/info/wasser/Was_home.htm);
- CROATIAN Water Quality Information System – a new information system with TNMN-DRB detailed data from Croatia available under: http://faust.irb.hr/~pecar/danube/danube.htm. Croatia is currently acting as a central point for integrating and maintaining basin wide TNMN data for water quality;
- CEDAR – The Central European Data Request Facility http://www.cedar.univie.ac.at

A wide variety of national information centres exist within the different Danube countries. Water quality and water quantity data in different countries are the responsibility of different authorities. In general, individual countries develop their own information systems. As a result some countries have difficulties in transferring their national data to international and harmonised systems. Several national, regional, and inter-regional organisations are also involved in the development of environmental information systems, some of which are involved in other trans-national river basin networks (e.g., The Rhine, Elbe and Odra).

Additional projects proposed within the Danube region include:

- ARGE Donauländer - proposal for a Water Management Information System;
- DAKOWAMIS - a study which will prepare a water management information system for the Danube countries with particular emphasis on GIS;
- ADONIS - a Geo-information system for waterway administrative authorities (to be launched in Germany, Austria, and Slovakia).

INFORMATION SYSTEM MODEL

Ideally, every information system should be developed on the basis of a conceptual model. The conceptual model should then be mapped into a logical structure and, the relational physical representation could be designed based on the available information and communication infrastructure. Such an approach has been initiated within the EPDRB Programme for collection, exchange and management of transnational monitoring data using the DEFF System (Lack, 1997).

The comprehensive information system for the Danube River Basin is complex because it includes administrative data, as well as data covering Programme management, project organisation, results, and the dissemination of information to interested parties.

In defining a structure for a comprehensive information system for the Environmental Programme of the Danube River Basin, (which could be applied to other international river basins) a multi-dimensional diagram has been developed (Ruzic, Pecar-Ilic, 1998)

The top level of this multi-dimensional diagram (see Table 2) represents the general organisational structure within which the information flow is conducted. This structure is based on the following rationale: countries are exposed to environmental problems which can cause harmful consequences. In order to resolve these problems, governments make decisions and raise public awareness. At the same time governments ask their official representatives (for example, ministries) to take some measures to deal with those problems. They form coordinating bodies to design action plans in an attempt to resolve such problems. Coordinating bodies select managers and experts for their support in designing and implementing action plans through concrete projects. Managers and experts support coordinating bodies and each other in preparing action plans, as well as in implementing and executing concrete projects, thereby producing results which are then reported and documented. The elements of the information system structure can be visualised as individual fields represented by the top level of the multi-dimensional diagram. The detailed structure of every field can then be expanded into further dimensions. This method was developed to define the structure of the Danube River Basin Information System.

Countries	*Environmental Problems*	*Harmful Consequences*
Governments	Decisions	Public Awareness
Representatives	Coordination Bodies	Action Plans
Managers	Experts	Projects
Support Activities	Reporting and Documentation	Results

Table 8: Organisational Structure of the DRB Information System. (I. Ruzic and J. Pecar-Ilic, 1998).

TECHNICAL REQUIREMENTS

Information Dissemination and Electronic Communication

Dissemination of information is always subject to certain rules and restrictions. Therefore the information system should be designed as a system of layers with different levels of confidentiality (internal, external, and general components). An example of such a development is the EIONET of the European Environmental Agency, where users are grouped in distinct levels with different rights of information access (Saaremaa, 1997).

Some of these aspects are defined by the Danube River Protection Convention and were clearly expressed by the International Commission and its Secretariate. A new approach could be proposed under the aegis of the *Convention on Access to Environmental Information and Public Participation in Environmental Decisionmaking,* which was signed in late June, 1998 at the Environment Ministerial Conference in Aarhus, Denmark (Zirm, Pillmann 1996).

High demand for relatively small amounts of information can be serviced by a centralised system which can be commonly updated. However, distributed systems cannot be avoided in the long run. For this reason, advanced software tools could be utilised which can integrate distributed relational databases (RDBMS) and geographic information systems (GIS), with efficient access to WWW facilities. For example: the distributed system of the EIONET, or the integration of environmental information in the Environment Agency, Austria.

Given the present state of information technology, dynamic implementation should be used wherever possible. Static implementation on a WWW infrastructure requires that every new element must be constructed by re-linking all individual components once again (even if they have not all been changed). In dynamic systems, the editing and updating of information can be performed on individual components only where changes are necessary.

To ensure the protection of original information and the internal components of the integrated information system, it should be connected via an Intranet (physically isolated system), while the external components should be connected via an Extranet (program control isolated system). In this case, individual nodes could be accessed through a system of passwords and other program tools. The general components of the information system should be connected via standard open Internet facilities. The efficient use of these technologies is limited by the speed of communication. A suitable solution would be the ISDN (Integrated Service Digital Network) system which in the future will be upgraded to an ATM (Asynchronous Transfer Mode) high speed network. The use of satellite communication could also be considered, and is already utilised by the AEWS system.

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SNIRH: Globally Accessible Water Resources Data

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INTRODUCTION

Portugal is the most western country of the European Union. Situated in the Iberian Peninsula, the country has an area of 92,000 km^2, it is occupied by a population of about 10 million. With an average yearly rainfall of 910 mm, and average run-off of 700 mm/year (50% of which originates in Spain), Portugal is heavily dependent on Spain for its water resources. Attention to water resources has a long tradition in Portugal, with the first Water Law having been published in 1919. INAG, the Water Institute, is the body responsible for water resources planning and coordination in Portugal, together with the Regional Planning Offices based within Portugal's five main regions.

Following the guidelines of the new EU Water Resources Framework Directive, there is currently a major initiative underway in Portugal to develop the National Water Resources Plan and River Basin Plans for each of the basins in Portugal.

OBJECTIVES

Hydrological data, including both surface and groundwater hydrology, quality and quantity, are the cornerstones of all water resources management activities. With this in mind, the law underlying the creation of the Portuguese Water Resources Institute (INAG), establishes the creation and maintenance of a Water Resources Information System, capable of providing the data and information required for water resources management as one of its responsibilities. In fact, collecting hydrological data and publishing it has been the responsibility of INAG's predecessor institutes since the beginning of the century.

SNIRH (Sistema Nacional de Informação de Recursos Hídricos), is the Portuguese Water Resources Information System. The ultimate goal of SNIRH is to improve the technical performance of INAG, thus contributing to:

- Improved water resources management in Portugal, and;
- Concrete implementation of EU Directives related to water resources, with special emphasis on the Water Framework Directive (to be published) and the Integrated Pollution and Prevention Control Directive.

To fulfil this goal SNIRH must be capable of:

- Storing, processing and displaying water resources information, both internally within INAG, based on the SNIRH Intranet, and to external entities (namely consultants, other government agencies and research institutions, and EU institutions through the SNIRH Internet site, http://www.inag.pt/snirh);
- Making available the required planning tools, including models and data processing tools;
- Integrating the geographical dimension of hydrological data;
- Transparently merging these tools with the collected data.

DATA COLLECTION AND DISSEMINATION

The Portuguese Water Resources Information System, SNIRH, collects data on climate, hydrology (quantity and quality), and groundwater through over 2000 measurement stations, from within ten different networks in the country. It also gathers data related to the day-to-day management tasks of the Institute. A second stage involves the processing and storage of this data by SNIRH in a complex database system. Besides the data collected by INAG, SNIRH stores other data required for water resources planning, namely geographic information including elevation data (Digital Terrain Models, slopes, aspect), hydrographic data (rivers, drainage basins, aquifers), information concerning water use (wells, dams, pipelines), and administrative data. This is used as a framework for analysis.

In a final stage, SNIRH makes this data available to the Institute as a whole and to the outside world, providing the data analysis capabilities required to support hydrological studies and the development of water resources plans.

Aware of the importance of promoting and raising awareness to SNIRH, INAG has produced considerable documentation on the system, organised special sessions and conferences, and undertaken countrywide presentations. Numerous newspaper articles have been published and its usage has quickly spread to universities, eager to access the available data. As confirmation of public interest in the SNIRH-Internet project, the public interface to the system was awarded the Descartes in Prize 1997, the most significant prize for Public Administration Information Technology Projects in Portugal.

USERS AND USER NEEDS

INAG was responsible for the start-up of the SNIRH project. As such, the first group of users belonged to the Institute. INAG makes all data available free of charge, and two concrete initiatives were launched based on the explosive growth in the number of users during the past 6 months. The first initiative was to ensure that all data supporting the River Basin Plans currently being prepared, would be made accessible through SNIRH, thus allowing/compelling consultants to access the system. The second initiative was designating the National Water Plan to draw on the system, both for data, procedures and models.

So, at present, five categories of users may be identified:

1. Water resource planners, who within INAG and the regional planning offices, access the system through its INTRANET;
2. Consultants involved in developing water resources plans, who must obtain all their data through the system and provide the results in a format compatible with the system;
3. University researchers and students looking for reliable data;
4. EU technicians looking to obtain data on Portugal;
5. The public in general, looking to obtain information of general interest, ranging from simple climate analysis to water quality along beaches.

PROJECT DEVELOPMENT

The strategy involved the development of an early prototype (after 6 months), followed by full-scale implementation at the national level (within two and a half years). Regional deployment is under current analysis, based on concrete experiences.

The main activities in the project were:

1. Definition of objectives;
2. Functional analysis, including a detailed user needs assessment, analysis of the information products needed, the information system and geographic information system, operations required, etc.;
3. Implementation plan (including specifications, general design, and application specification);
4. Database, client-server software and INTRANET development;
5. Procedural development;
6. INTERNET access development;
7. Training.

One of the major concerns was the definition and implementation of specific procedures for each of the regular tasks being performed when using the system. For simple cases, like computing rainfall for a given hydrographic basin, the procedure may be totally built into SNIRH. For more complex cases, like validating rainfall stations, the validation steps can be built into SNIRH, however, expert intervention is always required. Precise procedural definition, therefore, becomes an important tool not only for experts but also in terms of staff training, and even for the outside world, especially when consulting companies winning new contracts are issued precise rules and directives rather than having themselves to re-invent the wheel at high cost each and every time.

TECHNICAL ASPECTS

SNIRH was designed as a database server, to continuously receive data from many different sources, and to simultaneously reply to requests from many different clients. INAG selected ORACLE as the database server. The system is installed as a network and includes workstations and PC's, both at the Institute and in the country's regions. The database server concept was taken as far as possible, with the central database storing not only the usual time-series and alphanumeric data, but also complex data, such as images. ORACLE's Binary Large Object (BLOb), was used to support this implementation. The Environmental Systems Research Institute's (ESRI) Spatial Database Engine (SDE) is being used to extend the database server to maps. Appropriate client programs were developed to fulfil the multiple tasks being supported by SNIRH. The following client interface programs currently operate:

1. SQL command line interface, for low level system administration tasks;
2. General Purpose Client Interface, used for the measurement network management, database update, and to produce regular data reports, TSF-NetManager;
3. Water Resources Analysis Client Interface, SNIRH-SER, used to support most studies;
4. SNIRH System Management Client Interface for internal system management, TSF-MANAGER;
5. Generic Data Input Client Interface, for time-series data input, TSF-LOADER;
6. GIS Data Client Interface, to combine time-series with GIS, ArcView-TSF;
7. WWW Interface, for both INTRANET and INTERNET access, SNIRH-WWW.

SNIRH was tailored to satisfy INAG's existing requirements, however, changes are introduced as these requirements evolve.

The database server is an ALPHA 4000, UNIX, while the web server is an ALPHA 600. The network includes workstations, Win95 PC's and NT Workstations. The basic software includes an Oracle Database Server, Apache Web Server, Arc/Info and ArcView GIS software, and original software developed by Chiron.

EXPERIENCES OF SNIRH

The implementation of a major information system does introduce considerable institutional changes, power-shifts, etc. Upper management support and clear objectives, associated with robust technical competence in information system development, are two crucial items for a successful project. The main difficulty experienced has been funding the support staff with enough database management competence to actually manage on a day-to-day basis a large and complex database system.

As far as offering practical suggestions for other agencies looking to implement similar systems, it is worth recommending:

1. Clearly define your goals and objectives;
2. Find the right project director;
3. Prepare a realistic budget;
4. Find the correct partnership for system development and implementation;
5. Give enough attention to training.

TRANSFERABILITY

SNIRH is a general water resources information system, which can be applied to any region. Besides the software, the underlying functional analysis and theoretical concepts enjoy a broad based application in any environmental project. Potential user groups include water resource and environment agencies. INAG is keen on assisting other regions and countries implement SNIRH-like systems. Efforts are under way to implement such a system in Madeira, the Azores and Mozambique.

CONCLUSIONS AND FUTURE WORK

INAG was the first public administrative entity to clearly define a data dissemination policy, that was free of charge and comprehensive. This approach has had a major impact on the information society in Portugal. At present, every citizen may access the water resources data collected by the Water Institute on a cost-free basis. Communication with other government institutions is optimised and internal resources at INAG are better allocated. Communication with Europe, namely the European Environmental Agency, is facilitated, as all data is transparently available.

The ongoing planning process aimed toward developing the National Water Resources Plan and the River Basin Plans, is directly associated to SNIRH. SNIRH has become the foundation of the plan and the axis for the development of all planning scenarios. This planning effort is being fully coordinated with the practical implementation of the Water Resources Framework Directive, to guarantee the successful adoption of European Legislation.

As long as the system is in use, SNIRH will be under continuous development. At present, Geographical Analysis and Storage capabilities are being added, namely to check-in and store over 50,000 digital maps being produced as part of the planning effort. New procedures are also being added on a regular basis, to cope with the various areas of responsibility of INAG.

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Water Quality Monitoring and Accident Emergency Warning Systems in the Danube River Basin

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INTRODUCTION

Recognising the growing regional and transboundary character of water management and related environmental problems, the Danubian countries together with interested members of the international community met in Sofia in September 1991 to consider a new regional initiative to support and enhance national actions for the protection of the Danube River. The countries agreed to develop and implement a programme of priority actions aimed at the restoration and protection of the Danube River Basin. The countries also agreed to form a Task Force to oversee this programme, and the Commission of the European Communities (CEC) agreed to provide support and coordination. A Programme Coordination Unit (PCU) was established.

The main objective of the Environmental Programme for the Danube River Basin (EPDRB) is to strengthen the operational basis for environmental management in the Danube River Basin. The international community agreed to assist the countries develop a three year programme of pre-investment activities, data collection, studies, and fact finding missions to support the development of a Strategic Action Plan. Among others, the main actions were focused on the development of international systems for monitoring, data collection and assessment, and emergency response systems. Two special projects were set up:

- Monitoring, Laboratory and Information Management and the;
- Accident Emergency Warning System.

The work has been carried out with financial assistance from the Commission of the European Communities under the Phare Multi-Country Environment Programme, and is coordinated by the Danube Programme Coordination Unit.

MONITORING, LABORATORY AND INFORMATION MANAGEMENT

The Monitoring, Laboratory and Information Management Group (MLIM) has seen significant activity within the EPDRB since December 1992. The aim of the activity is to strengthen national and international capacity to provide reliable information on surface water quality in the Danube River Basin.

The work has been designed and carried out by the MLIM-SG with the technical support of the WTV (WRc-UK, TNO-NL, VKI-DK) consortium. The overall objective of the MLIM-SG (Support Group) is to create a strengthened and more strategic approach to environmental information management for the Danube River Basin. In this respect, the following objectives were identified:

- Assist in the improvement of environmental management through the strengthening of existing environmental networks;
- Improve the comparability of sampling techniques and laboratory analysis;
- Develop and implement compatible information management systems capable of providing for the needs of managers at the national level as well as permitting the exchange of information at international levels.

In order to achieve the above mentioned objectives, the following tasks were implemented:

- Establishment of three Working Groups (WG) to carry out the specific tasks coming from the Implementation Plan;
- Implementation and consolidation of the Trans-national Monitoring Network (TNTM), including data collection for the main tributaries;
- Technical support for equipment procurement;
- Technical support for the Integrated Training Programme;
- Exchange of information, and liaison with other similar systems from other areas.

Three MLIM-Working Groups (WG) were established. The main task of the Monitoring WG was to develop a Transnational Monitoring Network. The Laboratory Management WG established links with National Reference Laboratories and helped coordinate their work. While the Information Management WG was oriented towards the establishment of links with National Information Centres through responsible data managers.

The following activities have therefore been undertaken:

- Creating a National Reference Laboratory Network with equal technical and methodological capabilities;
- Creating a National Information Centres Network for the exchange of data between countries;
- Supporting reliable and consistent trend analysis for concentration and loads of priority pollutants and for the evaluation of transboundary transport;
- Supporting the assessment of water quality for water use and identification of major sources of pollution;
- Development of data quality control systems at all levels.

Resources

The monitoring network is designed to provide outputs compatible with other major international river basins in Europe such as the Rhine, Elbe, Oder etc., and to comply in future with the standards used in EU countries. The existing "Bucharest Declaration" monitoring network comprises eleven stations on the Danube River. The further development of the TNTM was planned in two stages:

- Phase I: A network of 70 monitoring stations; consisting of 11 Meteorological Stations, and 59 Water Quality and Quantity Stations (including 43 for Sediment Monitoring);
- Phase II: A network of 114 monitoring stations; consisting of 21 Meteorological Stations, and 93 Water Quality and Quantity Stations (including 59 for Sediment Monitoring).

The recommended number of stations for the TNTM currently exist as part of the respective national monitoring networks. The current Phase I should be implemented within two years and the Phase II during the following years.

A list of data elements (including physical, chemical and biological components) was agreed and the subsequent calculation of contaminant loads implemented. Assistance to laboratories in providing equipment and improving analytical quality control management, including the inter-calibration of laboratories and performance testing is currently being undertaken.

A Data Exchange File Format (DEFF) was agreed by the Danube countries for interfacing with the existing National Information Systems. The DEFF is used in the collection, exchange and management of TNTM data. DEFF enables the export of data in an appropriate format such as time-series data for statistical analysis in an AARDVARK (Analysis Any Routine Data; Visually Acquire Real Knowledge) environment software package. This software was distributed in 1996 to assist Danube riparian countries. The AARDVARK is used to process data into useful information, i.e. trend and decision support analysis. The organisation and information flow is shown in Figure 1.

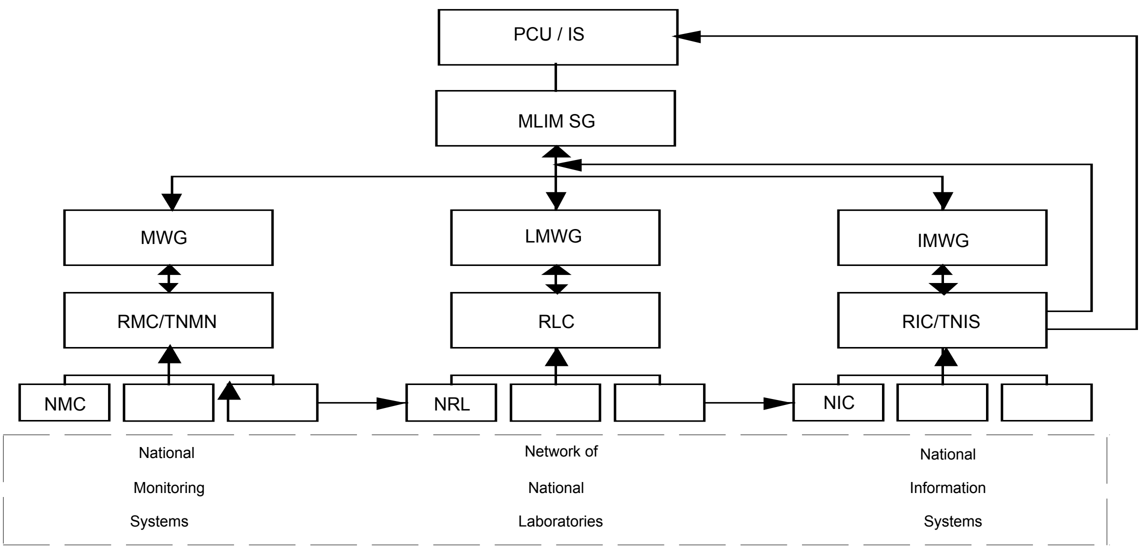

Figure 1. Organisation and Information Flow Diagram of Transnational Monitoring Network.

A draft of the first Year Book analysing the data collected by TNTM in 1996 was prepared and discussed by the MLIM SG. The official inauguration of TNTM will take place in January 1999. The following two years will see the development of the system towards: improvement of the management of data processing and information dissemination; assessments of transboundary pollution loads and trends; implementation of an effective analytical water control programme; and training and strengthening of the system operation.

THE ACCIDENT EMERGENCY WARNING SYSTEM

Establishing an Accident Emergency Warning System (AEWS) was identified by the Task Force as a priority action in February 1992 at the beginning of the Danube Environment Programme. The System's design was subsequently agreed upon by the Sub-Group experts and the Task Force.

The concept of the system was developed by the AEWS Sub-Group with support from Delft Hydraulics in collaboration with the Dutch Institute for Inland Water Management and Waste Treatment (RIZA). The experience gained within the Rhine river system and also the recently developed Elbe alarm system has provided a sound basis for the set-up of the Danube AEWS. It should be stressed that the initial design and implementation of the Danube AEWS focuses on the organisation and operation of international and national alerting procedures which are activated once notice of an accident has been received. The main objective of the System is to increase the safety of the population from emergencies, and to protect drinking water resources in particular, should accidents which have an impact on the Danube River or its tributaries occur. The system also exists to protect the environment against the effects of such incidents. Especially in those cases where incidents have a transboundary character, there is a clear need to improve the flow of information concerning the event.

The main requirements agreed to in the setting up of the AEWS are that:

- The system should communicate information about sudden changes in water characteristics (for example, caused by accidental pollution or unpredictable changes in water level), particularly where a significant adverse transboundary impact threatens;
- All riparian countries and in principle, all tributaries within the river catchment are incorporated.

A fundamental element of the proposed AEWS is the establishment of Principle International Alert Centres (PIAC) in each of the Danube riparian states. Such a PIAC will be the sole responsible operational unit, in charge of all (international) communications. PIAC operations are triggered by the reception of a message about a potentially serious, sudden pollution event or accident.

In the Danube AEWS, the riparian country PIAC's are at the top of an organisational structure formed by the various national, regional and district levels. The main tasks of the PIAC are:

- Communication concerning a sudden reported pollution event of the Danube River Basin waters;
- Expert involvement to assess the effects or impact of the reported accidental pollution;
- Decisionmaking on the action to be taken.

A PIAC operates when a message about a sudden potentially serious pollution event or accident is received. The initial message may be received from:

- The national, regional or district authorities if pollution was observed on the Danube River or its tributaries within the PIAC’s country borders;
- A PIAC in one of the other riparian countries.

A crucial function of the PIAC is to coordinate emergency warning at an international level. This should also cover the regional, district and local levels in cases of transboundary impact on all tributaries as well as for the Danube River. This cannot be achieved effectively at the lower levels only. Within an integrated approach it is assumed that information flows based on existing regulations or alarm plans will remain effective, including the transboundary information flow. However, additional reports will be made to a country's own PIAC in case of major incidents, or incidents with an unknown impact. The PIAC must receive and handle without delay messages on a 24 hour basis using a reliable communication system.

Resources

The basic technology used in the AEWS comprises the setting up of a satellite-based communication network for international communications, the use of a uniform system for information on hazardous substances, and a model

- the Danube Basin Alarm Model (DBAM) - with which the propagation of pollutants can be simulated.

Therefore the following phases for the development of the Danube AEWS were adopted: Phase I: AEWS implementation; Phase II: development of DBAM; Phase III: extension of the AEWS.

The financial support from the Phare Multi-Country Environment Programme funded:

- Satellite equipment and provision for its maintenance over a 3 year period;
- Databases of hazardous substances and related data-processing;
- Training for PIAC units, testing, and operations manual;
- Development of the Danube Basin Alarm Model (DBAM);
- Continued consultancy support to the AEWS Sub-Group;

The inauguration of the AEWS took place in April 1997 in Vienna. The systems, even on a minimal start-up level, already contributes to a reduction of the risks from spills of hazardous substances. At such a level, the system also shows its potential effectiveness and demonstrates the need to extend it to a fully operational AEWS. The organisational structure and information flow are shown in Figure 2. The current and future development of the AEWS includes: operational improvement and calibration of DBAM; pilot AWQMS; risk inventories; accident prevention measures; exchange of experiences; and coordination with hydro-meteorological systems.

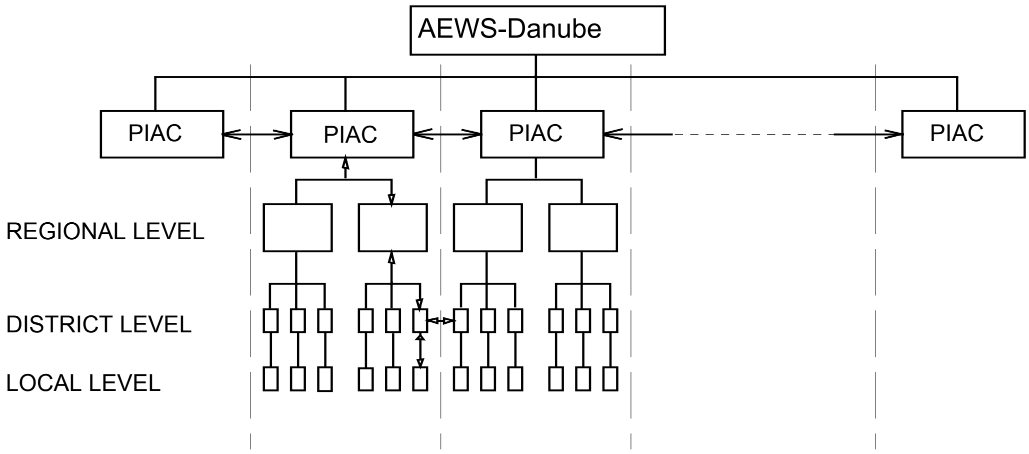

Figure 2. Structure and Information Flow of the Accident Emergency Warning System.

Use of Telematics in Water Quality Management and Monitoring in Hungary

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SUMMARY

Reliable information concerning water quality is a prerequisite for water quality management. The necessary information is collected primarily by systematic measurement. Water quality monitoring of Hungarian surface waters started four decades ago. Within the present monitoring system, samples are typically taken on a fortnightly basis from 150 sampling sites. Samples are analysed for major physical, chemical and hydrobiological components. The data collected is processed in the "VM" database. The water quality monitoring data system is an integral part of the complex information network which includes water quality and hydrology.

WATER QUALITY MONITORING

Sound water quality management relies on up-to-date information concerning the physical, chemical and biological characteristics of water resources. Water quality monitoring is the effort undertaken to obtain quantitative information on the above mentioned characteristics of water via statistical sampling. The objectives of water quality monitoring are: the identification of water quality state and water quality trends, identification of pollutant loads, testing of compliance with standards and classification systems, early warning and detection of pollution.

Long term standardised measurement, observation, evaluation and reporting of the quality of surface waters started in the 1950's in Hungary. The evolution of the monitoring network of surface water quality is illustrated in Table 1. The number of sampling sites has decreased appreciably, accompanied, however, by an increase in sampling frequency.

Year	Number of sampling sites	Number of samples per year
1954	1400	1
1956-1959	800	4
1960-1967	800	2-112
1968-1984	300	12-26-52
1985-1993	250	12-26-52
1994-	150	12-26-52

Table 1. Historic development of the water quality monitoring network in Hungary.

Actual monitoring practice, regulated by the National Standard: MSZ 12749, invovles samples being taken normally at bi-weekly intervals, but in the key cross-sections on a weekly basis. The total number of sampling sites is 150. The samples are analysed for the main cations, anions, nutrients, trace elements, organic micropollutants, radiological components, bacteriological and hydrobiological parameters.

The monitoring network, (operated by both the environmental and public health authorities) is required to perform the following functions:

- Provide the necessary data for the general assessment of the quality of surface waters;
- Build a database suited to monitoring any changes in the quality of surface waters, and in particular to detect and identify pollution impacts originating from industrial and consumer-based activities in Hungary and abroad, as well as from natural sources;

- Produce the data series necessary for international water quality assessments and as background material for negotiations on boundary streams;
- Produce data series for research and planning purposes.

The standard sampling stations of the surface water quality monitoring network are situated:

- In the boundary cross sections of streams entering or leaving the country;
- Upstream and downstream of discharges affecting water quality in streams, and;
- In cross sections of special importance (e.g. water intakes).

Other important considerations in selecting sampling sites were:

- Operating in parallel with a station of the hydrological observation network, or where not feasible, the possibility of establishing valid correlation with the nearest gauging station;
- Accessibility.

Sampling points are normally located in the stream's centreline or in the line of the main current.

The factors involved in deciding upon the frequency of sampling were:

- The level of data required for statistical processing;
- The variability of water quality over time;
- The importance of the sampling site, and;
- The capacity of the analytical laboratory facilities.

The samples are analysed for its chemical and hydrobiological components in laboratories of the 12 District Environmental Inspectorates. These laboratories are technically not able to analyse all the monitored micro-pollutants. Specific organic micropollutants are mainly analysed in appropriately equipped central laboratories. Microbiological parameters are measured by the Public Health Laboratories of the country's 20 counties. The applied analytical methods are also regulated by the MSZ 12749 Standard. Special attention is paid to quality assurance of the analytical work of the laboratories by running an inter-calibration programme.

The measured data are sent from the laboratories to the Institute for Environmental Management (KGI). The data is sent on diskette generally at monthly intervals. The collected data is checked and stored with the national database. "VM" is a software that was developed to process the database. VM provides statistical evaluation of the data in accordance with the classification system under MSZ 12749.

The water quality monitoring data system is an integral part of the complex information network that includes water quality and hydrology.

TRANSBOUNDARY WATERS

Hungary is a typical downstream country within the Danube basin. The major part of its surface water resources originate abroad. The national boundaries are crossed by 90 separate water courses. As a consequence of this hydrological character, Hungary has great interest in the water quality monitoring of transboundary rivers. Bilateral agreements with neighbouring countries ensure the legal basis for regular joint water quality investigations, water quality evaluation of transboundary rivers, and water quality data sharing across national boundaries. Joint Commissions on Transboundary Waters are responsible for this collaboration, and regular joint water quality investigations, water quality evaluation, and joint- measures concerning accidental pollution events began as early as the 1960s and 1970s. Some technical details concerning bilateral transboundary monitoring practices are summarised in Table 2.

Countries	Austria-Hungary	Slovakia-Hungary	Ukraine-Hungary	Romania-Hungary	Yugoslavia-Hungary*	Croatia-Hungary*	Slovenia-Hungary*
Number of sampling sites	11+8** =19	10+1x3**=33	2	7	3	3	1
Sampling procedure	In odd months: Austrian sampling In even months: Hungarian sampling	Joint sampling	Joint: 4 Ukrainian: 4 Hungarian: 4	Romanian: 12 Hungarian: 12	Joint: 4 Yugoslavian: 4 Hungarian: 4	Joint: 4 Croatian: 4 Hungarian: 4	Joint: 4 Slovenian: 4 Hungarian: 4
Sampling frequency (per year)	12	12	12	24	12	12	12
Frequency of analysis (per year)	Usually: 12 Special components: 6	Usually: 12 Special components: 6	12	24	12	Usually: 12 Special components: 4	Usually: 12 Special components: 4
Laboratory site of analysis	Odd months: Austria Even months: Hungary	Slovakia: 12 analysis Hungary: 12 analysis	Ukraine: 8 Hungary: 8	Romania: 12 Hungary : 12	Yugoslavia: 8 Hungary: 8	Croatia: 8 Hungary: 8	Slovenia: 8 Hungary: 8
Number of yearly data agreement meetings	1	2	1	Results accepted without data agreement meeting	1	1	1
Data exchange	Direct exchange of hard copy data	Direct exchange of hard copy data	Direct exchange of hard copy data	Data exchange by fax	Direct exchange of hard copy data	Direct exchange of hard copy data	Direct exchange of hard copy data
Evaluation method for the measured data	Statistical parameters biannually	Statistical parameters biannually	Statistical parameters for every year	Statistical parameters for every year	Statistical parameters for every year	-	-
Trend analysis	Once in 10 years	Once in 5 years	-	Once in 5 years	-	-	-
Spreadsheet software	EXCEL 5.0	EXCEL 5.0	-	EXCEL 5.0	-	-	-
Water quality criteria	National standards	CMEA system (six classes, 1984)	CMEA system (three classes, 1963)	-	CMEA system (three classes, 1963)	CMEA system (three classes, 1963)	CMEA system (three classes, 1963)
Frequency of inter-laboratory calibration	One per 12 samples	-	One per 12 samples	One per 12 samples	-	-	-

Table 2. Water quality monitoring of transboundary waters. Details of cooperative monitoring practices.

* Situation in 1991
** Lake Fertő: longitudinal and cross-sectional sampling sites
*** River Danube at Szob: cross-sectional sampling sites

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Panel Discussion Summary (day one):

Constraints and Problems in the Transferability of Telematics Applications and their Implementation

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INTRODUCTION

The goal of the first day's panel discussion was to identify the constraints and problems related to the implementation and transferability of Telematics projects. The session intended not only to focus on the problems and obstacles that might be faced in implementing projects in new regions such as Central and Eastern Europe (CEE), but also to present some examples of how Telematics applications have been successfully transferred. Having examined the constraints, the panel discussion looked to determine how these various problems can or might be overcome, in order to further facilitate the uptake of Telematics Applications Programme (TAP) projects in CEE.
The session was chaired by João Ribeiro da Costa, a Professor in Water Resources and GIS at the New University of Lisbon, Faculty of Sciences and Technology, Portugal. Mr. Ribeiro da Costa was invited to chair the session based on his experience in the Telematics field with water quality resource management and involvement in a European Union (EU) accession process not unlike that of Central and Eastern Europe. Portugal and Spain joined the EU in 1986 as one of its less well-developed regions, requiring considerable infrastructural investment and EU support, a parallel which can be drawn today with some of the prospective EU members from CEE. By bringing this experience to the discussion, Mr. Ribeiro da Costa was able to relate some of the problems experienced by his country, and raise questions and issues central to how these obstacles can be overcome. The session was co-chaired by Jerome Simpson of the Regional Environmental Center for Central and Eastern Europe and DETERMINE project manager.

SPEAKER PRESENTATIONS

Speaker presentations were limited to five minutes in order to allow time for a full discussion involving the conference floor. During the course of the presentations, the key issues and constraints raised by presenters were identified by the panel-chair and co-chair, and listed on-screen for the audience to identify with and later refer to during the discussion.

Susanna Azzali, rapporteur for the Environment Telematics for Water and Air Pollution Management (ENWAP), Expert Group of the ANIMATE project, ARTTIC, Belgium, briefly presented the activities of the ENWAP user forum. The objective of the forum is the exchange of information on developments and applications emerging from Environment Telematics (EN-TAP) and other related projects in air and water pollution management. Issues such as common user requirements, best-practices, transfer of know-how, and experiences are exchanged within the group which includes actors both from EU and CEE countries. Supporting this objective, two working documents on common user requirements and good practices are currently under elaboration and some preliminary results were presented (see attached presentation in the Appendix). Particular emphasis was given to the Good Practice document, consisting of a survey of EN-TAP and other related projects in the air and water pollution sector. The survey aims to identify particularly interesting and efficient telematics systems which could be applied in similar sites elsewhere in order to maximise the benefits of the research among the users. Based on a comprehensive evaluation of the approach, the application site, objectives, technical profile, environmental requirements and the transferability of the product, the best and most cost-effective methods for dealing with environmental problems are presented with information on how the application might be successfully transferred to other similar sites across Europe and the CEE countries.

Ivelin Roussev, of the Regional Environmental Center for Central and Eastern Europe briefly summarised the key constraints to the effective implementation and use of Telematics in CEE (see attached presentation in the Appendix). Among those constraints listed were institutional issues such as poor cooperation and privatisation of research institutions, inadequate infrastructure, lack of financing, and limited local experience and knowledge. As a solution to these problems, Mr. Roussev suggested increasing financial support, offering training and closer cooperation with the EU.

Gary McGrogan, Head of Environment and Regulatory Services at Sheffield City Council, presented his experiences within a multi-national project that looked to utilise Telematics in improving the management of, and raising awareness to local air quality problems. The main obstacles in his experience were local/regional bureaucracy, and the lack of proper infrastructure and equipment. Some of these problems can be overcome through improved public participation in the decisionmaking process, while improved awareness of environmental problems, and demand for better access to information could further serve as vehicles for driving the implementation of Telematics-like applications in CEE. Gary McGrogan's presentation is also included in the Appendix.

Kestutis Kvietkus, Head of Lithuania's Air Quality Management Department, has been involved in successfully upgrading Vilnius' air quality monitoring network to comply with EU standards. Using the Swedish AIRVIRO System, data is now disseminated in near real-time through the Internet. Kvietkus explained how these best-practice experiences could be successfully adapted to other large cities and regions with the minimum of investment. He also stressed the importance of cooperation in integrating monitoring activities at the municipal, regional and state level with similar activities within the EU. Kvietkus defined discrepancies between CEE and EU priorities as a main constraint to improving closer collaboration.

Elemer Szabo, Senior Officer within the Informatics Department at the Ministry of Environment, Hungary summarised the main constraints to the implementation of Telematics applications as being the standardisation of data quality and data collection at the local and national level. A lack of cooperation on a local and regional level is seen as a cause of this, which also results in the duplication of data gathering. Successful cooperation with the EEA/EIONET has helped to overcome some of these problems.

Ilia Natchkov, Deputy Team Leader of the Danube Environment Programme (EPDRB) relayed his experiences concerning the transboundary implementation of an international surface water quality monitoring, data collection and assessment system, and Accident Emergency Warning System (AEWS) across the Danubian countries. Describing constraints to the implementation of these programmes, Natchkov mentioned the issue of data accessibility and sharing of information, which should be optimised. Furthermore, he suggested a strategic approach through a common action plan and national support, as instruments to overcoming problems with the harmonisation of methodologies among stakeholders. Ensuring the sustainability of projects, new sources of financing, and securing the participation of younger generations are key future constraints which, according to Natchkov, could be overcome through the extended transfer of expertise at the international level.

Finally, Tonu Otsason, Chief of the Board of The Estonian Association of Telecottages in the small community of Palade on Hiiumaa Island, presented the successful establishment of a Telecottage network that provides local information services including environmental information. While illustrating the advantages of the network such as social mobilisation and improved access to environmental information, he stressed the major constraints were local bureaucracy, outdated legislation and the lack of technical expertise.

FLOOR AND PANEL DISCUSSION SUMMARY

It is interesting to note each of the presenters identified similar constraints and issues. As the table below shows, cooperation, financial sustainability, bureaucracy, data quality and the lack of technical equipment can be summarised as the main problems. These issues were complemented throughout the second part of the discussion by reaction from the floor and panel members. P1 through to P7 represents panelist issues and constraints, in order of appearance, while floor reactions are summarised in the column, "Floor".

Inviting the floor and panelists to further discussion, João Ribeiro da Costa reiterated the final goal was to identify constraints and problems to the transferability of Telematics applications, namely in light of the future cooperation opportunities between the CEE and the EU.

Johannes Mayer of the Austrian Federal Environmental Agency, whose responsibilities include managing the environmental Internet web server for national environmental information, stressed the necessity to convince public authorities at all levels that better use of Telematics solutions and open electronic environments and the broad, liberal, and proactive provision of information to citizens would improve communication and cooperation. Recognising Neno Dimov's earlier presentation, he agreed that cooperation and dialogue among all levels of responsibility should became a priority. Underlying the importance of cost-free Internet access, he suggested the modification of European telecommunications services similar to the North American approach, in order to improve the competitiveness of European institutions and the widespread availability of environmental information.

Issues and Constraints	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**Floor**
Standardization/Data Quality	x	x		x	x	x	x	x
Complexity of EU Bureaucracy	x							
EU vs. CEE Priorities (too many feasibility studies and to little action?).	x			x		x		
Success Stories	x							x
Public Participation			x	x				
Economic Impact							x	
Environment: a Priority?				x			x	
Monitoring vs. Managing							x	
Need to Improve Legislation and Regulation							x	
Data at a Price?								x
Local/Regional Bureaucracy (Senior)	x	x	x	x			x	x
Public Internet Access		x	x	x		x		x
Agreements/Cooperation (at the Local/Transboundary, and EU level). Clear Mission and Goals	x	x	x	x	x	x		x
Benefits from the use of Sophisticated Devices/Technology		x						x
Expertise/Training	x	x			x			
Sustainability Issues - Financial Support	x	x		x	x		x	x
Technological Equipment	x		x	x	x			
Transfer of/Access to Results	x	x		x				
Tools as a Target or Means to Achieving a Target						x		x
EU Accession					x			
Language Barrier					x			
Ability to Compete/Private Sector Accountability/Raw Data Dissemination								x

Ivica Ruzic, Environmental Specialist at the Ruder Boscovic Institute, Center for Marine and Environmental Research in Croatia, and Chairman of its Information Working Group stated the dissemination of information to public in the form of raw data would require considerable effort. Raw data should rather be aggregated and presented in a form that is understandable and useful to the public. Ruzic inquired as to whether commercial benefit may be gained from the release of environmental data, based on the North American experience. This would serve as a source of financial support for research institutions.

Adrian Pascu, Senior Expert from the Office for European Integration Ministry of Research and Technology, further stressed the importance of the dissemination of information for public use as a vehicle for facilitating the implementation of Telematics applications. He outlined two types of constraints to this process, one being financial constraints, especially in the initial phase of implementing Telematics projects, and second, the lack of efficient telecommunication networks to disseminate information in the final phase.

Addressing the constraints associated with the decisionmaking process, (limited interest and support to TAP uptake), Zigmas Bigelis, Director of the Center for Information Technologies at the Joint Research Center, Ministry of Environmental Protection in Lithuania, referred to the then forthcoming Environment Ministerial conference in Aarhus, Denmark (which took place in late-June 1988) as an opportunity to influence the attitude of top officials and decisionmakers. He stressed a change in management procedures in order to secure administrative support for Telematics projects was required. In responding to Bigelis' remarks, Miroslav Spasojevic, Senior Counselor and Coordinator for International Cooperation at the Federal Ministry for Science, Development and Environment in Yugoslavia stated that in many cases decisionmakers have limited funds, and in his experience many of the objectives which Telematics applications target, can be achieved through other means. He stressed that proposals should be sound and justifiable, and that access to best-practice examples could serve as a useful tool to influence uptake among authorities.

PANEL REACTION

Gary McGrogan mentioned the many constraints related to technical barriers, and that these could be easily overcome with the wider implementation of advanced Information Technology. He also mentioned that awareness among the general public to environmental problems can serve as a driving force behind the uptake of Telematics applications at the local level. Ivelin Roussev suggested concentrating on the success stories as there are many best-practice examples available to all users. Mentioning that the 5th Framework Programme will be opened to the Ten accession countries, he also recommended closer cooperation among these countries in light of the opportunities available. Susanna Azzali supplemented Roussev's statement on issue of best-practice by describing her experiences. Referring to the issue of cooperation with decisionmakers, she illustrated West European bureaucracy as being similar to CEE. Relaying the success of the Danube projects, Ilia Natchkov, reminded the floor of the importance of ensuring both legal and political support for the sustainability of projects. Kestutis Kvietkus emphasised the importance of the Internet as a means for disseminating environmental information, however, suggesting that raw data should be primarily available for expert use. Furthermore, he accentuated the importance of cooperation among experts and decisionmakers. Tonu Otsason complemented Kvietkus' assertion regarding raw data by suggesting its commercial use as an additional source of income that could be reinvested at the local level.

Following Otsason's remarks, João Ribeiro da Costa summarised the discussion by referring to his experience and involvement with Portugal's EU accession process. Although similar to the problems in CEE, Portugal's accession was simplified through close cooperation with Spain. Highlighting the cooperation issue, he observed that a common goal such as accession to the EU can help facilitate partnership among CEE countries. Closer partnership between the EU and CEE is also desirable. Pertaining to the funding of Telematics projects, Mr. Ribeiro da Costa elaborated on the management of public money by decisionmakers which is expected by society to become more and more transparent. He indicated that all projects should have a sound economic basis as well as beneficial impact on the decisionmaking process. Telematics projects do have a viable economic impact and analysis should also be conducted in light of their financial viability. Addressing the issue of data quality and raw data availability, he reminded the floor that the end-user is the public, hence, raw data should be made available regardless of its complexity. Closing the discussion, João Ribeiro da Costa advised concentrating on the long term goals, best-practices and cooperation.

A number of other significant issues were raised by conference delegates prior to the meeting through their registration forms, which prompted participants to list key questions relating to the topic of discussion. These are listed as follows:

- The state of the telecommunications infrastructure (High Speed Data Networks) as a constraint the development of Telematics applications.
- Transferability of data to Internet and its subsequent dissemination.
- Environmental data processing. Access, dissemination, and quality assurance.
- Availability of technical support and 'spare parts' when equipment for Telematics applications becomes dated or worn.
- Integration of Telematics projects, compatibility between national and EU programmes.
- Concerning the implementation of Telematics projects in new locations, the identification and definition of problems, and presentation of solutions relying on previous experiences (good and bad practice guides).
- Emergency warning systems, problems with their implementation, and funding.

APPENDIX

1. Susanna Azzali: Constraints and Problems in the Transferability of Telematics Applications and their Implementation.

Constraints and problems in the transferability of Telematics applications and their implementation

The lesson learnt through the ENWAP activity

Susanna Azzali, ENWAP rapporteur
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Szentendre, June 4, 1998 PD - Determine 1

ENWAP
(ENvironment telematics on Water & Air Pollution management)
User Forum

OBJECTIVES

- exchanges & share experiences
- common user requirements
- Good Practices

TAP projects & related prj.
new potential users

ACTIVITIES

- Expert Group (EG) work
- preparation/support to disseminate results and 'end-products' at Conferences
-

Szentendre, June 4, 1998 PD - Determine 2

ENWAP User Forum results

- Working documents
- Newsletters
- web pages
- closed ENWAP chat e-mail group to exchange ideas and docs
- Conference and Seminar

Szentendre, June 4, 1998 PD - Determine 3

User typology and user requirements in air and water pollution management systems

- Elaboration of synthesis of common user requirements from on-going TAP EN projects and other related projects
- To identify
  - potential new user groups (EU & CEEC), who may show interest in the 'end-products'
  - the requirements of the new user group
  -

Szentendre, June 4, 1998 PD - Determine 4

User typology and user requirements - results

- **Involvement of stakeholders** (authorities different levels, decision makers, leading professionals in operational sectors, public)
- **Environment Information and Decision Support Systems**
- **data interchangeability and quality standards** in transboundary and national partnerships, ISO standards
- **training and sustainable development**

Szentendre, June 4, 1998 PD - Determine 5

Good Practices in the ENWAP activity

initiatives as improvements of the environment (air and water pollution) by means of telematics in the EU and CEE countries

- elements of GP form
- analysis and synthesis of elements to elaborate a set of recommendations on common GP in air and water pollution management by the use of telematics
- not a single GP but several solutions
- define priorities
- promoting partnership, sharing know-how

Szentendre, June 4, 1998 PD - Determine 6

Results of Good Practices

- Obstacles encountered
  - bureaucracy in public administration, availability of data and rights of the providers, agreements on models and indicators, lack of skill for system users, continuity of financial support
- Lesson learnt
  - need of harmonized methodology for user requirement analysis, early demonstrators, more time at the decision levels, compliance of ISO standards and data provider issue

Szentendre, June 4, 1998 PD - Determine 7

2. Ivelin Roussev: Constraints to Effective Implementation and Use of Telematics in CEE.

Constrains to Effective Implementation and Use of Telematics in CEE

"Innovative Services And Solutions For The Citizen" International Conference

Szentendre, June 4-5, 1998

Ivelin Roussev
Regional Environmental Center

Major constrains to effective implementation

- Institutional
- Infrastructure
- Project financing and investments
- Experience and technical knowledge at local level
- Other

Constrains I: Institutional

- Lack of cooperation among users
- Privatization of some organizations and strong focus on revenue-generating
- EU/CEE partnerships
- Public-private partnerships

Constrains II: Infrastructure

- Inadequate or even absent
- Lack of reliable communication networks
- Limited electronic equipment to build on
- Low level of standardization and interoperability
- Large local differences within the CEE region

Constrains III: Project Financing

- Graduate elimination of state financing
- Inadequate funding available for RTD in CEE
- Lack of methodology to conduct cost-benefit analysis
- Complex EC RTD application and participation procedures

Constrains IV: Local Experience and Knowledge

- Training for technical personnel in local authorities
- Access to Telematics applications and Best Practices information
- Understanding of local decision-makers
- Relevant education and training to all users and stake-holders

Constrains V: Other

- Better synergy between EU TAP and CEE national RTD fund priorities
- Dissolution of former RTD institutions
- Substantial reduction of employees
- Successful implementation requires the involvement of all parties

Conclusions

- Telematics RTD strongly depends on funding
- Private-public partnerships foster development and implementation
- Limited infrastructure can slow down implementation
- Education and training needed

3. Gary McGrogan: Air Quality Telematics

Air Quality Telematics

Gary McGrogan

Determine Conference Szentendre June 4-5, 1998

Introduction

- European Urban Air Quality Management Project
- Tacis Project

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European Urban Air Quality Management Project

- Raising Awareness
- Public Information Systems

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EUAQMP - Raising Awareness

- Who Delivers the Message
- Shared Responsibility
- What is the Target Audience
- Reality and Perception
- Participation
- Barriers and Constraints

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EUAQMP - Public Information Systems

- Methods Used in Partner Regions
- An Information Strategy
- Deciding Who is the Target Audience
- Content of the Information
- Communication Methods
- Barriers and Achievements

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Tacis Project - Constraints

- Lack of Co-operation
- Funding
- Slow Progress
- Interpretation of Results
- Access to Telematic Applications

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Conclusions

- Better Application
- Committed Funding
- Sharing of Best Practice

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