



# Commission of the European Communities Environmental Research

# Newsletter

No 9 June 1992

SP-I.92.24

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## Editorial

After the CFCs-Ozone affair, in these years the atmosphere is once more seat of what is most probably the most worrying environmental issue ever experienced by man: the Greenhouse Effect.

If we go back with our mind to the harsh controversy that shook in the seventies the scientific community and the public on the stratospheric ozone depletion, strong similarities are evident with the present debate on global warming. Now as then, the problem arises from the fact that the scientists cannot predict exactly what will happen, when and how severe will be the consequences. In the controversy on CFCs, this situation implied public relations as much as science, emotion as much as logic; the same is even more true in the present debate on the global climate change. Indeed, the characteristics of this last issue are such that, in addition to scientists, the public, industry and governments are all badly needed to win the challenge of an environment-sustainable development.

From 1950 the world population has doubled, but at the same time the energy consumption has increased by a factor of four. In these decades, the fast race to "civilization" has been felt as an increase of conveniences in the developed countries and the introduction of disparate technologies in the less developed regions disrespectfully to the environment regional and global problems. It is increasingly evident that the possible consequences of a global climatic change, whether or not the scientists are able to quantify precisely time and magnitude of them, must be brought in the best way to all the interested bodies.

The violation of the principle "innocent until proven guilty" was claimed at the time of the ozone controversy, when a first ban to CFCs was decided; something similar is frequently occurring in the present debate on the greenhouse effect. Now as then the argument is that the error that would have the most serious consequences for the society has to be avoided. In this regard we cannot afford to give chemicals or anthropogenic technologies the same rights that we enjoy under the law, in front of the danger that their immoderate use might represent for the human community (this aspect was clearly discussed by L. Dotto and H. Schiff in their book "The Ozone War", Doubleday, 1978).

In conclusion, the need for an efficient communication between the scientific community and the public is strongly impelling. The efforts of the social and human dimensions related scientists to respond to this need have been rather weak up to now. This situation, however, appears rapidly changing; it is, I believe, a very important innovation.

An increasing number of national programmes dealing with the human dimensions of global change have been recently undertaken, also supported by international initiatives. The "Research on Economic and Social Aspects" of the 1991-94 R&D Programme of the CEC in the field of Environment fits into this new trend.

On the side of natural sciences, the start in November 1991 of the European Arctic Stratospheric Ozone Experiment (EASOE), as most powerful successor to the previous European campaigns, seems worth of note.

Over 200 European scientists, organized by the European Ozone Research Coordinating Unit and financed by the national funding agencies and by the European Community, are trying to gain further insight into the fate of the Ozone layer over Arctic. It took many years after the first warnings to get a clear evidence of a strong damage to stratospheric ozone. The qualitative interpretation of the phenomenon observed over Antarctica in terms of CFCs and Halons induced photochemistry was comparatively fast. It is certainly merit of the research efforts by the scientific community in matter of physical-chemistry of atmospheric pollutants, supported by industry and public organizations, and continued even when the public concern on the ozone problem faded.

It might be a precedent to remind in the present case of the Global Change issue.

### Editor

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# Programme News

## JRC-Programme 1992 - 1994 Council Decision adopting specific research programmes to be implemented by the JRC (1992 - 1994)

The specific R&D programmes to be executed by the Joint Research Centre in the fields of industrial and materials technology, measurement and testing, environment as well as in the field of human capital and mobility have been adopted by the Council of the European Communities on 29 April 1992 for a period running from 1st January 1992 to 31st December 1994 (OJ N° L 141 of 23 May 1992).

The JRC Research Programmes are aimed at:

- contributing to the strengthening of the scientific and technological basis for European industry and to the development of its international competitiveness;
- contributing to the enhancement of the quality of the human and natural environment;
- contributing to the improvement of public safety aspects of new technologies;
- contributing to the reduction of scientific and technological disparities between the Member States of the Community;
- provide scientific and technical services to Community Institutions and making competences and scientific and technical installations available to public and private bodies.

As far as it concerns the Environment, the objective is to provide a contribution to the scientific knowledge, technical know-how and data needed by the Community, in particular to carry out its role with regard to the environment with special emphasis on prenormative work.

The JRC will contribute to the implementation of Community environment policy in three areas:

- Participation in Global Change Programmes;
- Technologies and Engineering for the Environment;
- Research on Industrial Hazards.

For this purpose, the programme will emphasize on:

- Modelling and Air Pollution Transport;
- Air Chemistry linked notably to the fate of biogenic and anthropogenic emissions;
- Atmosphere-Biosphere Interactions;
- Related applications of remote sensing, which will focus on the interactions between land and ocean surface parameters and climate.

Activities under the heading of Technologies and Engineering for the Environment will mainly concern:

- Environmental chemicals and their impact on the various ecosystems; emphasis being given to chemical waste problems;
- Further development of techniques and systems to protect the environment;
- Environment monitoring by remote sensing by means of advanced techniques.

Research on Economic and Social Aspects will relate essentially to risk management and conventional industrial safety such as the development of decision support systems for plant safety, plant emergency management and territorial risk management.

Further information can be obtained from:

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## Call for expressions of interest in Research Area II. 2 "Technologies for protecting and rehabilitating the environment of the specific programme for R&D in the field of Environment 1991-1994"

Following the Council Decision 90/211/Euratom, EEC (OJ N° L 117 of 8 May 1990) on the Third Framework Programme for Community Research and Development, and Council Decision 91/354/EEC (OJ N° L 192 of 16 July 1991) on the specific programme in the field of

Environment, the Commission of the European Community has invited expressions of interest for research and technological development projects in the research area "technologies for protecting and rehabilitating environment" (OJ N° C 291 of 8 Nov. 1991).

The call for expressions of interest was followed by a special call for proposals (OJ N° C 116 of 7 May 1992). This two-step procedure is aimed at better defining priorities, identifying the appropriate mechanisms (e.g. cost shared research, coordinated activities) to optimize the use of funds available for this area and to facilitate the creation of contacts between potential applicants.

Expressions of interest were requested to arrive not later than 31/12/1991. More than thousand expressions of interest were received which could be classified in the following topics from the work programme :

1. Cleaner technologies:	7,5 %
2. Abatement of emissions to atmosphere:	9,5 %
3. Waste water treatment and reuse:	21,5 %
4. Recycling:	16,5 %
5. Treatment and disposal of wastes:	16,5 %
6. Risk assessment and rehabilitation of abandoned disposal sites:	18,0 %
7. Not relevant:	10,5 %

Among these, 22% having a confidential character, have not been included together with the not relevant proposals, in the catalogue of expressions of interest to be added to the information package with the background material on research topics.

Further information can be obtained from:

P. L'Hermite, DG XII/E-1, 200, Rue de la Loi, B-1049 Brussels,  
Tel. +32 22355163.

## Financial support for demonstration projects - NORSPA

The **Northern Seas Action Programme** "NORSPA" regulation was adopted on 21st December and published in Official Journal N° L 370 on 31/12/1991 ref. 3908/91. It was established in order to grant financial support for demonstration projects and technical assistance schemes for the protection of the environment in the coastal areas and waters of the Irish Sea, North Sea, Baltic Sea and North-East Atlantic Ocean. A tender for offer (NORSPA-92-1) was published in the OJ N° C 289/10 of 7/11/1991.

Priority areas for action were selected from the following themes:

- Nutrient abatement measures including agricultural measures
- Advanced wastewater treatment and pollution prevention technologies ("clean technology")
- Integrated ecological management
- Alternatives to biocide use
- Localized marine problems.

Technical assistance projects relating to the non-Community coastal states of the area concerned were also eligible for funding.

The term "demonstration projects" refers to the setting up and operation of a full-scale installation, process or technique to gather all the data needed to assess its economic and technical viability in order to proceed to larger-scale applications.

The programme does not include research proposals or studies unless they are directly linked with such a project, nor does it include land purchase or investment in infrastructure.

The rates of financial support were set at 50 % of total cost in the case of public investments and of pilot or demonstration experiments, and at a maximum of 30 % of the total cost in the case of private investment for non-commercial purposes.

Before the closing date (7 February 1992), over 100 proposals were submitted from Member States. A list of selected projects will be published in the Official Journal in due course.

Further information can be obtained from:

C. Pleinevaux or M. Zampetti, DG IX/C.2, CEC,  
200, rue de la Loi, B - 1049 Brussels, Tel. + 32.2.236.95.19.

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## A New Financial Instrument - LIFE

A proposal for "LIFE" - a new financial instrument for the Environment - was discussed by the Council during 1991. At the end of December 1991, the Council adopted the principle of this new financial instrument. LIFE is now on the agenda of the Council for final adoption during the month of May 1992. Funding objectives under LIFE can be condensed into five streams:

- 1) defining and promoting models of production and behaviour which are in line with the principles of sustainable development;
- 2) protecting habitats and nature;
- 3) supporting specific demonstrations and pilot projects, and horizontal information, education and training aiming to activate the economic actors through the use of practical examples;
- 4) strengthening of administrative structures;
- 5) providing technical assistance to third countries in the Mediterranean regions or bordering the Baltic.

The priority areas of funding will be drawn from the themes set out in the proposal for a regulation. It is expected that an information brochure on LIFE will be available once the regulation has been finally adopted. A Management Committee for LIFE will meet following final adoption of the regulation. The Committee will comprise representatives of all 12 Member States and will decide upon fields of application to be financed by future programmes.

Further information can be obtained from:

Mr. C. Pleinevaux, DG XI/C.2, CEC, 200, rue de la Loi,  
B - 1049 Brussels, Tel. + 322 236 95 19.

## EC Programme of Policy and Action in relation to the Environment and Sustainable Development: TOWARDS SUSTAINABILITY

On 18 March 1992, the Commission agreed on the fifth programme in the Environment sector. This document "Towards Sustainability" describes the working programme of CEC's Directorate General XI for 1992 onwards. It is a political and not a technical document and has now been submitted to the European Parliament and the Council.

Selected target sectors are industry, energy, transport, agriculture and tourism. The programme comprises themes and targets like climate change, acidification and air quality, protection of nature and bio-diversity, management of water resources, the urban environment, coastal zones and waste management.

This programme itself constitutes a turning point. It sets out for the first time both a strategy and timetable for the actions necessary to ensure that the Community itself moves towards a sustainable economy, and for assisting less-developed neighbours to do so also. The programme is not merely a task for the Community institutions: it will require the full partnership and full support of all the actors necessary to make it work. The Community can only provide the framework.

Further information can be obtained from:

DG XI, CEC, 200 rue de la Loi, B-1049 Brussels,  
Tel. +32 2 2392254.

# Environmental Protection

## Air

### EC Research Programme and Support Activities to the Commission

Past issues of Environmental Research Newsletter (see in particular N° 5 of June 1990 and N° 7 of June 1991) have already reported detailed information on EC programmes covering this area, both managed by DG XII/E and performed by the JRC.

This issue deals in particular with the contribution from the just concluded four-years' programme of the JRC, proper emphasis being given to the activities in support of DG XI for the implementation of the regulatory action.

#### 1. Tropospheric Chemistry - Analysis, Sources, Transport, Transformation and Deposition of Pollutants

##### Air Quality Research at the Environment Institute of the JRC Ispra

The most recent progress accomplished in the experimental researches performed at the Environment Institute of the JRC is summarized in the following:

##### Mechanism and kinetics of gas phase reactions in the polluted troposphere

The studies undertaken in the previous years (see Environmental Research Newsletters N° 2, 5 and 7) on the nighttime reaction of the nitrate radical  $\text{NO}_3$  have been continued with special regard to the chemical fate of biogenic emissions relevant on a global scale. In particular attention has been focussed on processes likely to affect the nitrogen oxides budget, the oxidative capacity of the troposphere and the Earth's radiation transfer via aerosol/clouds formation.

##### Oxidation of isoprene by the nitrate radical

The research performed on alkenes and butadiene has been finalized to the study of the nighttime oxidation of isoprene by the  $\text{NO}_3$  radical.

Isoprene is emitted from vegetation in amounts that on a global scale considerably exceed the emissions of anthropogenic non-methane hydrocarbons: ca. 450 Tg/year against ca. 100 Tg/year.

Its main fate in the troposphere is the daytime oxidation by the hydroxyl radical, but since isoprene is also measured at nighttime, the reaction with the nitrate radical is of importance under some conditions.

According to the result of studies performed in a 480 l reaction chamber using in-situ spectroscopic analytical techniques, the nighttime oxidation of isoprene by  $\text{NO}_3$  appears to lead to the predominant formation of organic nitrates. This is contrary to the daytime OH initiated degradation of isoprene, which has unsubstituted carbonyl compounds as principal products. To clarify the relative reaction pathways, informations about the structure of the products has been obtained through synthesis of isotopically labelled (partially deuterated) isoprene and other dienes. By reacting these species with  $\text{NO}_3$  the position of functional groups could be clarified by IR spectroscopy. In conclusion, in the reaction with isoprene the nitrate radical adds preferentially to the 1-position and 3-methyl-4-nitroso-2-butenal appears to be the main reaction product. The addition to the 4-position appears to be a minor, but not negligible (about 20%) pathway. The oxidation of isoprene may then have consequences for the tropospheric  $\text{NO}_y$  budget, considering the high yield of organic nitrates obtained in the reaction with the  $\text{NO}_3$  radical in air.

##### Reaction between $\text{NO}_3$ and reduced organo-sulphur compounds

Studies on the tropospheric reactions of biogenic organic sulphur compounds with main emphasis on the reactions with the  $\text{NO}_3$  radical

were started some years ago in this laboratory. The species of main interest is dimethylsulphide (DMS), emitted in large quantities from marine phytoplankton and accounting for about one quarter of the total, natural plus anthropogenic, sulphur flux to the troposphere. Its oxidation by the  $\text{NO}_3$  radical has been subject of previous studies. To get a better insight into the mechanism controlling the degradation of dimethylsulphide, the reaction of the  $\text{NO}_3$  radical with a series of compounds with the structures RSH, RSR and RSSR has been investigated for R being  $\text{CH}_3$  or  $\text{C}_2\text{H}_5$ . All the compounds follow a similar degradation mechanism producing  $\text{SO}_2$ ,  $\text{H}_2\text{SO}_4$ , alkylsulphonic acids (R- $\text{SO}_3\text{H}$ ),  $\text{CH}_2\text{O}$ , R-CHO, R- $\text{CH}_2\text{ONO}_2$  as main reaction products. In addition, the formation of relatively stable peroxyxynitrate-intermediates with the tentative formula  $\text{RS(O)O}_2\text{NO}_2$  was always observed. After the initial reaction step, which may be H-atom abstraction (R-S-R, R-S-H) most probably following  $\text{NO}_3$  addition, or addition followed by decomposition (R-S-S-R), the degradation proceeds through the reactions of the three key intermediates, R-S°, R-S(O)°, R-S(O<sub>2</sub>)°. Kinetics, products and mechanisms of the reaction of these species with their potential tropospheric reaction partners ( $\text{O}_2$ ,  $\text{O}_3$ , NO and  $\text{NO}_2$ ), as well as the rates of the unimolecular thermal dissociation, determine the yield of oxidized sulphur products. It must be stressed that this observation holds also in the case of the OH initiated daytime degradation of these species.

The interaction between chemistry and aerosol dynamics of this species is of importance to achieve an exhaustive description of the processes involved. A series of experiments were then performed using large teflon bags as reaction chambers, studying the formation of particles by DMS oxidation products. A particularly interesting result of these experiments is that the peroxyxynitrate intermediate apparently reacts with liquid water to form methane-sulphonic acid (MSA) as the main product.

##### Reaction of $\text{NO}_3$ with aromatics

The gas-phase reaction of  $\text{NO}_3$  with aromatics has been subject of continuing study in collaboration with the University of Milan. Methyl-substituted benzaldehydes, benzyl-nitrate and benzyl-alcohols were observed and quantified by gas chromatographic analysis; only aldehyde groups were positively identified by infrared spectroscopic analysis of the reaction mixture. The results of the experiments aimed at clarifying the mechanism holding in the gas phase reaction do not allow to conclude in favour of a predominant mechanism between direct atom abstraction from the methyl group or  $\text{NO}_3$  addition to the aromatic ring followed by elimination of  $\text{HNO}_3$ . A third mechanism consisting of electron transfer with formation of a radical cation appears to be excluded.

##### Study of the reaction $\text{NO}_3 + \text{HO}_2$

A novel technique, based on the use of a tunable diode laser spectrometer, operated in second derivative mode and isotopic labelling, have been applied to the study of the fast radical-radical reaction between the nitrate radical and the hydroperoxyl radical. In particular the branching leading to the formation of OH radicals was investigated.

In the chemical reactions system which controls the formation and the fate of the nitrate radical, a considerable importance has been recently attributed to the reaction between the nitrate radical and the hydroperoxyl radical:



and in particular to the second branching reaction.

This reaction has been reported to be fast and in a recent paper (Platt et al., Nature, 1990, Vol. 348, 147) it has been suggested that it may be an important source of OH radicals in the troposphere at night. The only previous determination of the rate constant has, however, been performed at low pressure.

A study has been performed at atmospheric pressure reacting in a 480 l chamber HO<sub>2</sub> and NO<sub>3</sub> obtained by the thermal dissociation, respectively, of HO<sub>2</sub>NO<sub>2</sub> and of N<sub>2</sub>O<sub>5</sub>. The OH radical was determined from the oxidation rate of isotopically labelled carbon monoxide, C<sup>13</sup>O<sup>18</sup> added to the system and forming O<sup>16</sup>C<sup>13</sup>O<sup>18</sup>, measured by second derivative tunable diode laser infrared spectroscopy. Preliminary results of this study appear to indicate that the reaction is slower at atmospheric pressure (by one order of magnitude) than under the low pressure condition hitherto applied.

Further information can be obtained from:

- J. Hjorth, Tel. +39 332 789076
- G. Restelli, Tel. +39 332 789225  
Environment Institute, CEC-JRC Ispra, I-21020 Ispra.

## Application of Analytical Spectroscopic Techniques

### *Infrared absorbing properties of halogenated alkanes*

HCFCs and HFCs, likewise CFCs, strongly absorb radiation in the 8-12 mm atmospheric window. Their global warming potential must then be evaluated to provide correct inputs to the atmospheric radiative transfer models. A study has been performed to increase the scarce number of data available in the literature for the absorption cross-sections of these compounds, in particular concerning their temperature dependence. The absolute infrared absorption strengths of five hydrohalocarbons (HFC-152a, HFC-134a, HCFC-22, HCFC-123 and HCFC-142b) have been measured in the wavenumber region 600-1500 cm<sup>-1</sup> at 293K, 273K and 233K. A weak temperature dependence is apparent for all the halocarbons investigated, showing a slight increase of the band strengths at decreasing gas temperature.

Further information can be obtained from:

- F. Cappellani, Environment Institute, CEC-JRC Ispra, I-21020 Ispra, Tel. +39 332 789228.

## Monitoring of atmospheric pollutants

### *Historical ozone data*

In collaboration with the CNR - Turin (Italy), a 26-year (1868-1893) data series of daily ozone observations made by the Schönbein technique at Moncalieri, near Turin, has been discovered. Data have been converted to present-day concentration following an ad-hoc developed procedure. From these data it could be stated that, in agreement with the Montsouris data series, the present-day levels are 2-3 times as large as one century ago and that an increase of the same order of magnitude is observed in the free troposphere.

The analysis of historical data has been expanded to observations made around 1880-1890 in South America. From this study it could be derived that one century ago at 30-40°S the surface ozone level was comparable to that observed at Montsouris and Moncalieri. Furthermore, the present-time ozone level observed at remote sites of that latitude of the southern hemisphere is ca. twice as large as one century ago; this increase is lower than that observed at ca. 45°-49° latitude (Turin, Paris) in the northern hemisphere.

Further information can be obtained from:

- S. Sandroni, Environment Institute, CEC-JRC Ispra, I-21020 Ispra, Tel. +39 332 789203.

### *Air-Surface Exchange Observations*

The exchange of minor atmospheric constituents between the air and the earth surface has been neglected in the past. Investigations were mainly interested in pollutant concentrations, which are a measure of the cleanliness of the air. The role of air-surface exchange of pollutants was raised by the discovery of the acid rain phenomenon, causing the transfer of air pollutants to the earth surface. The transfer occurs also without rain, through the gas phase (dry deposition).

With the aim of improving our understanding of these processes, the JRC organized a field observation campaign in May 1991 at the agrometeorological site of S. Pietro Capofiume, in the eastern Po plain.

Several groups from various European countries (Germany, Belgium, France, Italy) participated in that exercise.

Vertical fluxes of ozone, nitrogen oxides and aerosol particles were measured by the eddy-correlation method. The interpretation of data obtained requires the knowledge of the characteristics of atmospheric turbulence; for that reason the vertical heat fluxes and other turbulence parameters were measured.

Examination of the data reveals several features of interest. Ozone always undergoes deposition during daytime and the evolution of that process follows the behaviour of the turbulent heat fluxes. Further, the experiment took place on bare soil and it proves that ozone deposition occurs also in the absence of vegetation.

The vertical NO<sub>2</sub> fluxes were bidirectional, but mostly directed upwards; this is due to the emission of NO generated by denitrification processes in the humus layer. The NO molecules are rapidly oxidised to NO<sub>2</sub> by the ozone present, resulting in the upward fluxes observed at the 7.5-m level.

A full analysis and interpretation of the data is still underway.

Further information can be obtained from:

- S. Cieslik, Environment Institute, CEC-JRC Ispra, I-21020 Ispra, Tel. +39 332 789567.

## Atmospheric oxidation of biogenic emissions (monoterpenes)

### *Formation of ozone in the NO<sub>x</sub>-photochemicals system*

Various aspects on the impact of biogenic compounds on atmospheric chemistry have been investigated (see ERN N° 2 and N° 5). In continuation of the previous work current activities are focused on studies of selected terpenes ( $\alpha$ -,  $\beta$ -pinene) with regard to their ability to form ozone in the NO<sub>x</sub>-photochemical system.

The specific question addressed is whether the terpenes generate ozone under simulated atmospheric conditions (using teflon bags as chemical reactors and sunlight).

An approach to show the efficiency of the selected biogenic compounds in generating O<sub>3</sub> is to ratio the [O<sub>3</sub>] max concentration to the concentration of the monoterpenes reacted to that point. For e.g.  $\beta$ -pinene the ozone formation efficiency (ppb O<sub>3</sub> produced to ppb terpenes reacted) varies from 0.4 to 0.72 and is higher at lower HC/NO<sub>x</sub>-ratios. For the concentrations used in our studies (terpenes: 80-250 ppb, NO: 10-20 ppb), we found that terpenes suppress ozone formation.

Changes in the initial NO concentration influence significantly the formation of ozone rather than changes in the concentration of the hydrocarbons used in our experiments. The results also show that changes in the relative humidity had a small effect on the amount of the O<sub>3</sub> formed during the irradiation of the terpene/NO mixtures.

Comparing the data obtained for the terpenes ( $\alpha$ -,  $\beta$ -pinene) with those for other hydrocarbons of anthropogenic origin (e.g. toluene) obtained under similar experimental conditions, preliminary results show that the compounds with the highest reactivity towards ozone (e.g.  $\alpha$ -pinene) are the most effective at suppressing ozone build up.

Further information can be obtained from:

- D. Kotzias, Environment Institute, CEC-JRC Ispra, I-21020 Ispra, Tel. +39 332 789647.

## 3<sup>rd</sup> International Symposium on Monitoring of Gaseous Pollutants by Tunable Diode Lasers

On 17-18 Oct. 1991, a Symposium dealing with different aspects of the application of infrared tunable diode lasers was held in Freiburg (D), organized, as for the previous edition, by the Fraunhofer Institut für Physikalische Messtechnik, with the sponsorship of the German Federal Ministry of Research and Technology and of the Commission of the European Community, GD XII/E.

The Symposium, preceded by a discussion meeting on the technological aspects of Infrared tunable diode lasers, was attended by over 100 scientists, with 38 papers (oral and posters). The presentations were organized in four sessions: Atmospheric trace gas detection; Spectroscopy; Techniques, systems components; Special applications. A round

table discussion and the semiannual meeting of the Eurotrac subproject JETDLAG, were also part of the Symposium.

The proceedings will be published by the CEC as Nr. 36 of the Air Pollution Research Reports.

Further information can be obtained from:

- J.H.Büsing, DGXII/E1, CEC, 200, rue de la Loi, B-1049 Brussels, Tel. +32 22355625
- G.Restelli, Environment Institute, CEC-JRC Ispra, I-21020 Ispra, Tel.+39 332 789225.

## 2. Stratospheric Chemistry and Ozone Depletion

### European Arctic Stratospheric Ozone Experiment (EASOE)

The European Arctic Stratospheric Ozone Experiment (EASOE) has completed its main measurement phase at the end of March 1992. From November 1991 to March 1992 over 800 ozone sonde measurements have been made specifically in this campaign. The results can be combined with the regular column measurements of many stations. Both these techniques show, how is accounted by the Commission of the European Communities, that ozone values have been anomalously low this winter. Many stations have reported their lowest ever mean values of column ozone for winter months. The mid- and high latitude ozone values in January and February have been lower than would be expected from simple extrapolation of recent analyses of ground and satellite measurements. These results are in broad agreement with the satellite data from the NASA Total Ozone Mapping Spectrometer.

However, the EASOE researchers conclude that no feature was shown in the northern hemisphere this winter which could appropriately be called an ozone hole.

The CEC and various national organizations involved in the EASOE project have published the following summary of the major findings:

- The atmosphere in the northern hemisphere has been highly perturbed this winter. Into an atmosphere already loaded with man-made chlorine compounds, large amounts of aerosol have been injected following the eruption of Mt. Pinatubo. This is an unprecedented situation in which there may have been important interactions between the aerosol and the chlorine.
- Stratospheric aerosol has been measured throughout the EASOE study by various techniques. As a result of the eruption of Mt. Pinatubo, there is about a tenfold increase in stratospheric aerosol compared with recent years, both in middle and high latitudes.
- Measurements of chlorine compounds in the Arctic lower stratosphere indicated that much of the chlorine, which has been released from the chlorofluorocarbons, was in forms capable of destroying ozone during January and February. These levels of active chlorine had decreased in March.
- Measurements of NO<sub>2</sub> both inside and outside the polar vortex, were anomalously low between November and February. In the region of the volcanic aerosol both NO and NO<sub>2</sub>, which normally inhibit the destruction of ozone by chlorine, were severely depleted. NO<sub>2</sub> levels recovered somewhat in March.
- Ozone amounts in the European Arctic and middle latitudes have been anomalously low during the campaign and are less than expected from simple extrapolations of ground-based and satellite ozone measurements. The low ozone amounts can be partly explained by the unusual tropospheric weather patterns this winter.
- Rates of ozone loss, calculated using models which simulated the observed high levels of active chlorine and low levels of nitrogen oxides, were large at times during January and February in many of the air parcels studied. The subsequent rise in temperatures, which led to a decrease in the levels of reactive chlorine compounds, precluded a major ozone loss (an "ozone hole").
- The measurements this winter indicated the potential of the chlorine already in the stratosphere to cause large ozone loss. With the inevitability of increased chlorine loading during the rest of this decade and the possibility in other years of lower temperatures (and hence higher levels of reactive chlorine) later in the winter, this potential for ozone destruction could be realized in the future.

Further information can be obtained from:

J. Büsing, DG XII/E, CEC, 200 rue de la Loi, B-1049 Brussels, Tel. +32 2 2355625.

## 3. JRC-Ispra Support Activities

### Central Laboratory of Air Pollution (CLAP) at the Environment Institute of the JRC Ispra

In 1991, the coordination capabilities of the Central Laboratory at EC level have resulted in the management of an intercomparison exercise on Volatile Organic Compounds (VOC) and the edition of instruction manuals. The harmonization tasks for the NO<sub>2</sub> directive have taken further important steps and the combination of passive samplers and mobile measurements has been demonstrated to be a worthwhile tool for the design of urban monitoring networks.

### Harmonization programmes for current directives

#### a) SO<sub>2</sub> Directive: Instruction Manuals

The implementation of harmonized procedures in the EC networks will be promoted by the publication of instruction manuals for sulphur dioxide and black smoke (BS) measurements. The two working groups involved in this task agreed on the adoption of identical contents, for SO<sub>2</sub> as well as for BS manuals, defined by the following section headings:

- Purpose and overview
- Monitoring systems (monitoring station, measurement and calibration systems)
- Monitoring procedures (for sample collection, determination of air flow and concentration value, data acquisition and treatment)
- Quality control (instrumentation maintenance and performance tests procedures)
- Quality assurance (intercomparison programmes and compliance test procedures)
- Recommended strategy for EC monitoring networks.

The final draft document has been prepared and the publication is foreseen for 1992.

#### b) NO<sub>2</sub> directive: Common Measuring Programme (CMP)

A CMP for the harmonization of the Directive 85/205/EEC had been launched in 1990 in collaboration with the Member States. The four actions of this programme consist in:

- 1) the definition of a common EC performance test procedure for NO<sub>2</sub> analysers;
- 2) the intercomparison of different NO<sub>2</sub> primary calibration standards;
- 3) a quality assurance of NO<sub>2</sub> calibration procedures implemented in the EC;
- 4) a quality assurance of routine NO<sub>2</sub> measurements in the EC networks

and showed in 1991 the following progress:

- For action (1): the ad hoc working group has decided to compare the different performance test procedures existing at EC level. It is expected that the practical outcome of this intercomparison will result in the agreement on a common test procedure for submission to the European Committee for Standardization (CEN).
- For action (2): an intercomparison has been performed among the following primary calibration standards: permeation method (ISO 6349-1979), Griess-Saltzman wet chemical method (ASTM D 1607-1976), Griess-Saltzman wet chemical method (VDI 2453-1989), static volumetric dilution method (VDI 3490-1985). The permeation method (directive's reference calibration method) has been tested over a period of 6 months on a sample of 11 permeation tubes currently in use in the Member States. From the results obtained, it appears that permeation and static volumetric dilution methods match very closely, confirming the validity of the directive's calibration method, whereas the ASTM and VDI Saltzman methods must be rejected because of the variable stoichiometry of the reaction (Saltzman factor).
- For action (3): a first intercomparison (for northern European countries) between the calibration procedures implemented in the Member States has been performed in May 1992 at the Landesanstalt für Immissionsschutz (Essen, G).
- For action (4): the test atmosphere generator developed to evaluate the efficiency of the station sampling collectors has been tested in field condition in two stations of northern Italy. By the introduction of

a control gas mixture at the level of the sampling collector, the instrument allowed to show, for NO<sub>2</sub> and SO<sub>2</sub> measurements, absorption effects along the sampling line of respectively 5% and up to 40%.

### **Preparatory actions for future directives Photochemical Pollution Measurement Techniques**

Mainly directed towards the control of ozone levels, the future directive also recommends to measure VOCs in some stations of the networks. As a first step towards harmonization of VOC measurements, an EC wide intercomparison exercise has been designed to answer important questions related to the determination of VOCs in ambient air, such as:

- the current state-of-the-art of VOC measurement technology in the EC;
- the performances of the available VOC measurement techniques;
- the reliability of the implemented calibration standards?

The intercomparison exercise was organized in collaboration with the National Physical Laboratory (UK) which provided the standard hydrocarbon mixture. The exercise took place in September-October 1991 and involved 21 participants selected among leading laboratories in the field of VOC measurements. The participation was also extended to scientific organizations outside the EC, currently dealing with VOC measurements in Europe, such as EMEP and TOR. The exercise consisted in the measurement of a dilute mixture of hydrocarbon gases prepared to simulate an urban atmosphere. This mixture contained 26 individual hydrocarbons (C<sub>2</sub> to C<sub>9</sub>), with concentrations ranging from 5 to 100 ppb by volume. The list of hydrocarbons largely comprised the compounds relevant for the formation of photo-oxidants according to the indications given by the VOC working group. The final evaluation of the results has been presented in April 1992 to the VOC experts working group.

### **Monitoring network design**

In the frame of the convention between CEC-DG XI and the Madrid City Hall (Ayuntamiento), an evaluation of the Madrid air quality survey network was performed by means of passive NO<sub>2</sub> samplers and mobile measurements. Passive diffusion tubes were exposed in 200 sites for two week periods, in summer 1990 and in winter 1990-91, and mobile

laboratory measurements were performed from 14 to 25 November 1990.

The diffusion tube measurements allowed the plot of iso-concentration curves with intervals of 10 g NO<sub>2</sub>/m<sup>3</sup>. The areas of the "iso-curves" gave evidence of higher average concentration in winter, but peaks higher than 75 g NO<sub>2</sub>/m<sup>3</sup> in summer were explained by increased photochemical activity. The values have been compared to the limit value of the directive, reported to the annual average for the passive measurements and to the 99th percentile for the mobile measurements. The results showed, for a 8/10 days pollution episode, the breach of the 99th percentile Directive's limit value (230 g NO<sub>2</sub>/m<sup>3</sup>) at the kerbside of roads carrying heavy traffic. Even if no background site showed the breach of the annual limit value (80 g NO<sub>2</sub>/m<sup>3</sup>), 11 sites at risk, i.e. between 60 et 80 g/m<sup>3</sup>, were numbered. The study concluded on the necessity of NO<sub>2</sub> abatement measures, the revision of the siting of some stations and the survey of the airport area, where the guide value was exceeded.

The measurements made along selected circuits using the mobile laboratory, allowed the elaboration of detailed maps of pollutants distribution under different meteorological conditions and led to the following conclusions:

- SO<sub>2</sub> was more or less uniformly distributed over the city with higher levels near tall buildings and in some ground depressions in the morning in the presence of thermal inversion;
- NO, NO<sub>2</sub> and CO levels were highest near high traffic points, in particular at the entrance gates of the city and along the N-S large paseos;
- recreation and residential areas were polluted nearly as much as some other areas;
- in the pedestrian-commercial centre, the pollution level on working days was 1,5 - 2 times as large as during weekends, these differences being related to heating systems and traffic;
- no industrial emission able to give a significant contribution to the air pollution in the investigated area was observed;
- the results of some calibration checks showed that the instruments of the Madrid air quality network were well calibrated.

Further information can be obtained from:

M. Payrissat, Environment Institute, CEC-JRC Ispra,  
I-21020 Ispra (Va), Tel. +39 332 789118.

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## EC Regulatory Action

EC Regulatory Actions concerning air quality managed by DG XI have been reviewed in past issues of Environmental Research Newsletter (see N° 2, N° 5 and N° 7). The following information update the most recent progress of the actions related to pollution prevention and control and to the quality of the urban environment.

### Integrated Pollution Prevention and Control

One of the policy measures currently being developed within the Commission to help give effect to the 5th Action Programme's goal of "towards sustainability" is integrated pollution prevention and control. The aim of the directive being drafted is to prevent emissions to the environment (air, water and land) wherever it is practicable to do so through the use of "best available techniques" (BAT). If it is not possible to prevent emissions, the next step must be to minimize them and permit releases in such a way as to achieve the highest level of protection for the environmental as a whole (e.g. considering the possible impact of air emissions on water and land). In parallel to the technological approach the directive makes it clear that environmental quality requirements must also be respected and that measures beyond BAT will have to be taken if this is necessary to meet those requirements. Industrial installations coming under the directive will need a prior permit to operate; primarily the permit will set conditions based on the application of BAT and environmental quality requirements. As BAT is dynamic and will change over time the directive also provides for a regular review procedure and a requirement on Member States to ensure that emission limits based on the use of BAT are upgraded every ten years. The directive also encourages public involvement before decisions about a permit are made, and in the monitoring of emissions from the installation.

Further information can be obtained from:

P. Stief-Tauch, DG XI/A3, CEC, 200 rue de la Loi, B-1049 Brussels, Tel. +32 2 2392269.

### Quality of the Urban Environment

#### *Air Quality*

The Commission's Proposals for a Directive concerning the sulphur content in gasoil is currently discussed in the European Parliament and recently introduced in the Environment Council. The adoption is foreseen by the end of 1992.

#### *Permanent technical EC/US working group on air issues*

In the EC/US Environmental high level meeting at the Plenary Session in October 1991 it was decided to establish a permanent technical

working group on air issues to be operational in the bilateral EC/US discussions, in order to improve a closer EC/US cooperation and exchange of information.

The point of coordination of this very important work to which DG XI is giving high priority is with Mr. Prudencio Perera and Mr. Frank Lamberts of DG XI/B/3.

#### *Air pollution from motor vehicles*

By the end of 1991, a financial contribution of 100.000 ECU was given to a study for the development of an environment-oriented transportation strategy for the Dresden/upper Elbe Valley Region. This study will be done for the (new) Bundesland Sachsen by the Ludwig-Bölkow Foundation in cooperation with Global Challenge Network and the Hochschule for Traffic "Friedrich List" in Dresden. In this pilot case the action lines as called for in the "Green Paper of the Urban Environment" concerning traffic and transport will be followed.

Thanks to the work performed by DG XI/B/3, a Directive could also be adopted by the Transport Council. This was the long and eagerly awaited proposal on aircraft noise, itself a logical and coherent continuation of EC ongoing policy in this important field.

#### *New developments of the Urban Environment Policy*

Following the success of last April's conference on the Green Paper on the urban environment, progress has been made with bringing forward the ideas and actions it has set out. An expert group comprising both national and independent experts has now been set up to serve as a useful sounding board for ideas as well as to advise the Commission on priorities for future actions.

In the meantime a range of follow-up studies have been launched. The interest of towns and cities in the Green Paper has been considerable and a major part of the follow-up involves co-financed studies on particular aspects with towns including Copenhagen, Madrid, Lisbon, Dresden, Genova, etc.

Another new initiative which may also prove a useful way of promoting good practice is the agreement to provide some support for the creation of the European Academy of the Urban Environment; an initiative of the Senate of Berlin in conjunction with the Länder of Rhineland Westphalia and Brandenburg, this academy is setting itself the task of promoting good practice and exchange of experience between Community cities and also those of Eastern Europe. A Community wide steering group has been created for the purpose.

Further information can be obtained from:

P. Perera, DG XI/B3, CEC, 200 rue de la Loi, B-1049 Brussels, Tel. +32 2 2361670.



# Industrial Risk

## EC Research Programme and Support Activities to the Commission

Although this theme comprises also activities related to Major Technological Hazard managed by DG XII/E, in the following are presented only the most recent progress achieved at the Institute for Systems Engineering and Informatics (ISEI) of the JRC Ispra within the framework of the Industrial Hazard activity. It is recalled here that the main features of the two closely linked programmes have been already presented in preceding issues of the Environmental Research Newsletter (N° 5 of June 1990 and N° 7 of June 1991).

### 1. Industrial Hazard Researches at the Institute for Systems Engineering and Informatics of the JRC Ispra

#### Information Technologies for Environmental Protection: Decision Support Systems

The EC's institutional tasks include regulatory and promotional activity on matters at the interface between science, technology and society. This leads the Joint Research Centre to use its technical and scientific knowledge to support these tasks by mainly collecting, analysing and processing information which are useful in the adapted decision process to risk management and **Environmental Protection (EP)**.

The modern society requires aid to be drawn from different sciences, information technology, and computer techniques for both the decision and policy makers, in the field of environmental resources optimal assessment and protection management. However, complex problems emerge from EP. These problems cannot be solved on the basis of one criterion of choice, i. e. by the optimization of just one criterion. Therefore, the **Multiple Criteria Decision Aid (MCDA)** approaches have been chosen to fit into a **Decision Support System (DSS)**.

The developed DSS consists of a set of relevant components (specialistic models and data bases) integrated by means of two different tools: the up-to-date operational research (MCDA) and the latest **Information Technologies (IT)**. Furthermore, the development is carried out by different specialistic disciplines allowing the integration to be as large as possible.

The implementation of DSS by using the MCDA approaches for EP is reported. A summary of relevant applications at the ISEI is presented.

#### DSS Development

The decision procedures included in the DSS make use of different MCDA approaches. In particular, according to the well known taxonomy, a choice can be done among (1) continuous and discrete methods and (2) qualitative and quantitative methods.

The DSS is characterized by the handling of a large amount of information; by the integration of diverse and multi-models; by big computing power and by a synthetic presentation of complex analysis. By using Information Technologies, the DSS requirements could be satisfied.

Furthermore, IT provide new services, i. e. high computing performance in information processing; communication networks; dedicated computer systems for data management; sophisticated graphical representation and friendly user interfaces.

Moreover, all EP problems are concerned with spatially distributed phenomena. Now, **Geographic Information Systems (GIS)** provide the natural means for supporting and analysing spatially referenced information. The combination of computer graphics for mapping and displaying, together with linked databases for storage and retrieval of relevant information, has already proved to be very powerful.

The combination and the integration of GIS with DSS is employed as aid to decision making in EP. The application of new IT methodologies (e. g. object oriented programming, object linking, windowing systems) allows for a smooth integration to be achieved of different DSS items (e. g. database management systems, linking modules, specific kernels, computing environments).

Two applications, MAPO and RITO respectively, have been already prototyped within the framework of the activity for third parties (see also Environmental Research Newsletter N° 7 and 8).

The scope of **MAPO (Masterplan of the PO river)** is to provide scientific support to decision makers for the assessment of different plans and strategies in the decision process in order to let them choose the compromise alternatives.

MAPO has been prototyped on a SPARC workstation - under UNIX operating system -, in C and Common Lisp programming languages by using the X Window System - MIT version 5 - libraries and interfaces. It has been interfaced to communicate with the remote central information system of the territory containing knowledge elements necessary for structuring and assessing alternative actions. The first version of this prototype has been delivered in March.

The collection and organization of the full set of information for the Po river is still under way. When completed, the prototype will be fully exploited and an updated version is expected to be delivered.

**RITO (Rifiuti Industriali Tossici, i. e. Toxic Industrial Wastes)** is aimed at providing scientific support to decision makers for siting of disposal plants and conciling best available technologies (e.g. incinerators, controlled landfills, etc.) with the constraint of disposing all produced waste in the region of production.

RITO is currently prototyped on an IBM-PS II personal computer - under MS-DOS operating system -, using C programming language by using a windowing system - Microsoft version 3 - libraries and interfaces. RITO is interfacing with GEOSCOPE GIS which provides a powerful combination for data preparation, pre-ordering, making preliminary calculation and analysis. Moreover, the GEOSCOPE GIS supports the dialogue with users and the display of data and results.

In addition, two new applications are in progress: Water Resources Management and Management of Urban Areas.

**Water Resources Management** application aims at developing an information system as aid to decision makers for hydric resources territorial planning. The system is based on the mapping of the following three components: different water uses, the requests missing, and existing supplies. It is intended to aid the rational planning of interventions for the improvement and the management effectiveness of the water resource at the regional scale.

**Management of Urban Areas** application is aimed at developing a DSS for the abatement of atmospheric pollution in urban areas. This DSS is based on a GIS of the relevant area. It contains databases on transportation (cars traffic, goods traffic, etc.), and databases on other spatially distributed sources of pollutants (e.g. industrial, housing, agriculture). By using different urban models, the system is intended to simulate the territorial intervention consequences, and then to investigate the compromise alternative composed of traffic paths, industrial and in-house heating change, industrial production reorganization.

Further information can be obtained from:

M. Paruccini and A. Zenié, ISEI, CEC-JRC Ispra,  
I-21020 Ispra (VA), Tel. +39 332 789302.

## Risk Assessment and Environmental Impact Assessment Procedures

### Environmental Impact Assessment (EIA)

A Eurocourse on "Environmental Impact Assessment" has been organized at JRC Ispra (30 Sept. - 4 Oct., 1991). Five contributions were presented by ISEI concerning EC directives on environmental hazards, methods for EIA studies, risk analysis on environmental impact studies, environmental indicators and measurement scales, and pollution abatement in chemical industries.

The proceedings of the course will be published by Kluwer Academic Publishers.

A Workshop on "Environmental Indicators" has been organized at JRC Ispra on 2 Dec. 1991, in collaboration with the Association of the Italian Environmental Analysts.

The proceedings of the workshop will be published as EUR Report.

### Review of models for consequence estimation in environmental impact assessment of major hazard industrial installations

A project for the classification and review of models, currently applied in risk analysis and environmental impact assessment, has been started with the aim of preparing the theoretical bases for the future development of knowledge-based systems to be implemented into integrated systems for EIA.

At first the activity will be focussed on the classification system and on models for fire, explosion, and release of pollutants into air and water. In this phase, the widely used models will be considered.

Further Information can be obtained from:

- G. Colombo, Tel. +39 332 789406 and
- S. Contini, Tel. +39 332 789217  
CEC-JRC, Institute for Systems Engineering and Informatics/SER, MTR - TP632, I-21020 ISPRA (VA),  
Fax +39 332 789007.

## 2. Support Activities

### Support to the Implementation of the "SEVESO" Directive (82/501/EEC)

#### The Community Documentation Centre on Industrial Risk (CDCIR)

The CDCIR is publishing on a regular basis a bulletin with the inventory of the documents collected, and has started publishing a series of studies concerning national regulations and lessons from accidents and emergency interventions.

CDCIR may provide upon request different services, such as copies of bulletins, publications, documents not covered by copyright. These are free of charge only for the Commission and the national competent authorities.

Studies already published concern:

- National Approaches to the Safety Reports: A Comparison, CDCIR SP-I-91-07, January 1991 (Amendola and Contini);
- Major Accidents Reporting System. Lessons Learnt from Accidents Notified, CDCIR, EUR 13385 EN, 1991 (Drogaris);
- Lessons Learnt from Emergencies after Accidents in the United Kingdom Involving Dangerous Substances, CDCIR, EUR 13322 EN, 1990 (Smith & Purdy);
- Lessons Learnt from Emergencies after Accidents in the Federal Republic of Germany Involving Dangerous Substances, CDCIR, SP-I.91.23, July 1991. (Drogaris & Mueller);
- Comparison of LPG Related Regulations, CDCIR, EUR 13699 EN (1991) (Harris et al.);
- Review of Environmental Incidents and Accidents, CDCIR, EUR 14002 EN (1992) (Lindgaard & Bender).

### Major Accident Reporting System (MARS)

The main objective of the MARS system is a structured exchange of information among the competent authorities, useful for improving the accident prevention policy.

The lessons learnt from the accidents notified have been made available to the interested parties by the publication of the MARS study in the CDCIR series quoted above. The study shows the predominance of organizational factors among the underlying causes of accidents.

Another relevant result linked with the analysis of accidents shows a rather antropocentric application of the directive, i. e. little attention has been paid until now to the environmental effects of accidents. Therefore a study devoted to the analysis of environmental accidents has been promoted, which confirms how scarce and unreliable are data on environmental damages (see CDCIR EUR 14002 EN), even if in recent years a somewhat new tendency has to be registered. The introduction of the "accident gravity scale" (CDCIR EUR 13385 EN) which also attempt to classify severity of accidents according to their consequences for the environment may be useful to promote better data collection on environmental damages.

Furthermore in view of enlarging the knowledge on accidents causes and consequences, studies based on retrieval of accidents case histories from publicly available sources for ammonia, chlorine and runaway reactions are being finalized.

### Other results

In order to enhance exchange of information on national implementation, directed towards a harmonized approach within EC, several studies on emergencies responses, risk communication with the public, approaches to the safety report, comparison of safety regulation have been performed or have been sponsored. The studies are being published in the CDCIR publication series.

Further information can be obtained from:

- A. Amendola, Tel. +39 332 789208, Fax +39 332 789007
- P. Wiederstein (regarding CDCIR), Tel. +39 332 789244,  
Fax +39 332 789007  
CEC-JRC, Institute for Systems Engineering and Informatics/SER,  
TP 632, I-21020 ISPRA (VA).

### Support to the implementation of the Directives (90/219/EEC and 90/220/EEC) on the Control of Biotechnology Hazards

The two Directives regulating the contained use of Genetically Modified Microorganisms and the deliberate release of Genetically Modified Organisms have been adopted on April 23rd 1990 and implemented in the Member States on September 23rd 1991.

Since the adoption, ISEI has cooperated with DG XI on the clarification of relevant technical issues which need to be solved for a sound implementation of the Directives.

As such, ISEI has a function as an information centre for safe biotechnological practices. Its role was strengthened when a mandate was received for setting up a register of accidents as well as a documentation centre containing information relevant for accident prevention. This information should allow the competent authorities to better assess biotechnological risks in the Member States.

In June 1991, a very successful Eurocourse has been organized in Ispra with participants and invited speakers from the Commission, universities and industries. At present the proceedings are being prepared (F. Campagnari and V. Scaramella eds.) to be published by Kluwer Academic Publisher with the title: "Scientific-Technical Backgrounds for Biotechnology Regulation".

Further Information can be obtained from:

- G. Van den Eede, Institute for Systems Engineering and Informatics/SER, CEC-JRC, TP 633, I-21020 ISPRA (VA),  
Tel. +39 332 785239, Fax +39 332 789007

# Other Activities relevant to EC Environmental Programmes

## Conservation of works of art: diagnostic methods by laser techniques

Conservation and restoration of works of art can greatly profit of techniques based on the use of laser light. Two types of measurements are possible:

- **experimental strain analysis**, which allows the detection of fissures, peeling areas, decohesion zones etc. with a resolution of the order of fractions of micrometre; it allows also the identification of stress concentration points, the determination of the effectiveness of a repair work, the real time control of the monument under ambient stress;
- **geometrical characterization of the surface** which allows the dimensional mapping of the surface with resolutions depending on the technique employed and ranging from few tenths of millimetre to fractions of micrometre.

The Diagnostics and Reliability Sector of the ISEI at Ispra has reached quite a considerable experience in both the above types of measurements.

**Double exposure holographic interferometry; real time interferometry and time average interferometry** have been studied and applied in the Framework Programme on Reference Methods for the stress and strain analysis of structures.

The geometrical characterization of surfaces has been tackled in the same Framework Programme and, in particular, studied in the Exploratory Research (1991) "Surface State Identification by Laser Light".

Objective of the research was the development of laser light methods for the identification and quantification of the deterioration mechanisms affecting historical artworks and monuments. Experimental work has been devoted to the assessment and the development of techniques able to measure the shape and the roughness of the surface of stone materials. The theoretical work and the laboratory tests carried out on stone specimens (from the Dome of Milan) have shown that an object-dependent, properly fitted combination of the **holographic contouring and optical correlation techniques** can lead to the correct geometric characterization of a surface. Holographic contouring is a powerful method to record the shape of a surface with a resolution of the order of a few tenths of millimetre. Holographic fringes, containing

the shape information, are analysed to obtain the quantitative map of the surface profile. Better resolutions, of the order of microns, will be achieved in the future using heterodyne methods.

For roughness measurements, needing higher resolution, optical correlation methods have been considered. The principle is based on the correlation of two speckle fields, which depends on the roughness of the surface. Optical fibres were successfully used to simulate field test conditions where the direct illumination of the monument may not be possible.

Particular efforts are at present being devoted to the development/improvement of the ESPI (**Electronic Speckle Pattern Interferometry**) technique. This technique allows the direct recording of the holographic information by a videocamera. Traditional recording media (holographic emulsion or thermoplastic material) are consequently no more necessary and the whole procedure is much simpler and faster, although the image noise is a little higher. ESPI is particularly useful for field measurements on historic buildings and monuments, where the reliability and the velocity of the method are more important than an extreme resolution.

It is worth mentioning that all the results obtained (for strain analysis as well as for surface characterization) are numerical, all data being stored in computer mass memory and ready for analysis, comparison and even treatment by other informatics tools like Finite Element Method for theoretical stress and strain analysis (e.g. for the prediction of the future behaviour) or for the reconstruction of the original geometry starting from the deteriorated one.

All the above methods are non contact and can be applied remotely: this constitutes quite an important feature in field applications.

The many contacts with external laboratories are leading to the creation of a network of laboratories on Application of Optics and Related Methods for the Protection of Cultural Heritage.

Further information can be obtained from:

A.C. Lucia, Institute for Systems Engineering and Informatics,  
CEC-JRC Ispra, - T.P. 210, I-21020 Ispra (VA), Tel. +39 332 789155,  
Fax +39 332 789156.

## Preservation of the European Architectural Heritage

### **Pilot Projects for the Conservation of European Architectural Heritage**

For the past eight years the Commission of the EC has been active in supporting the conservation of European architectural heritage (see also Environmental Research Newsletters N° 2, 4, 5 and 7).

The initiative originally came from the European Parliament, reinforced by the Council Resolution of 13th November 1986. It was recognized that anything done to preserve our architectural heritage would be beneficial not only culturally, but also would be an investment in economic, social and regional terms throughout Europe.

In order to highlight aspects of conservation of this heritage and to make better and more effective use of its resources, in 1988 the Commission began to concentrate on annual themes, the first of which have already proved to be of great success.

The theme chosen for 1991 was the conservation of monuments and sites which have served as workplaces and whose importance for the European heritage is clearly established. Of the 433 conservation projects submitted to the Commission, 37 were selected to receive financial aid. The overall budget was 2 600 000 Ecus. The chosen projects illustrate the extreme richness and diversity of the European

heritage in agricultural production, industry, crafts and other fields. (A catalogue "Sauvegarde Du Patrimoine Architectural Européen" is available from DG X "Cultural Action").

The theme for 1992 is: Conservation projects in towns and villages intended to rehabilitate, through an integrated approach, monuments and their immediate environment within their surrounding public space: In particular, the scheme was looking for proposals which seek to improve perception of monuments in their historic context, making use of treatment and eventual function adapted to the architectural character of the whole site.

The rules to apply to the 1992 scheme are given in the Official Journal of the EC N° 28431/1991. The Commission has received nearly 1000 applications for this year.

The announcement concerning the specific theme, rules and procedure for 1993 will appear in the Official Journal of the EC before summer 1992.

Further informations can be obtained from:

Enrica Varese, DG X/C-1, 200 Rue de la Loi, B-1049 Brussels,  
Tel. +32 2 2359946, Fax +32 2 2364255.

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## Software for Environmental Science

### ***Maksi: An Object-Oriented Approach to Ecosystem Modelling***

Maksi was developed to create a highly interactive graphical tool for the model builder allowing construction, testing and tuning of models with the maximum feed back possible to shorten model prototyping and verification time. In its actual version it is limited to solving systems of ordinary differential equations but the underlying concepts can be applied to a larger class of systems. Smalltalk was chosen because of its powerful programming environment and its availability on a large number of platforms. One extremely important feature is the portability of smalltalk applications between different platforms.

### ***Concepts***

Systems are graphically represented as a network of interconnected objects (nodes). Nodes can be of different type. In the actual version of Maksi there are two types available. Each node shows a "behaviour" which is expressed as a (Smalltalk) code fragment. This code fragment defines the transition of the node from one time step to the next one. Building a model is done by adding nodes and connections to the network and by defining the nodes. Every node is identified by a unique name which is also used to reference the state variable associated with it. This name can be used in the behaviour code to reference the actual value of the node. Connections (arrows) between nodes show the dependency between nodes, e.g. a nutrient flow in the directions of the arrow. This graphical definition is checked during the compilation of a node. In the current version of Maksi the state of a node is represented as a numerical value, but plans for future enhancements foresee that node represents more complex objects (logical variables, distributions, signals, images).

### ***The Interaction***

The interface exists in three subviews where the timer subview is controlling the simulation time. The graphical network view/editor is complemented by a selection list which allows inspection of states and additional parameters. Local and global pop up menus are distinguished. Local menu items invoke operations on the selected node, e.g. edit, delete, compile, show. The local menu item "show" displays the time series of the node as a subwindow of the node icon.

This feature is extremely useful giving an immediate intuitive feel of the "behaviour" of the node during the simulation phase. The global menu which pops up when the menu selection button is pressed in the background of the node network view is a cascaded menu whose items manipulate the node network as a whole (compile, file in, file out, etc.).

The following phases can be identified in the interaction process:

- model design
- behaviour formulation
- simulation run
- parameter tuning.

Actually Maksi has no strict border line between those phases as the model can be modified while the simulation is running by adding/deleting nodes and/or modifying node behaviour. Due to the choice of having the simulation run as a separate process the user maintains control of all the features of the interface.

### ***Applications***

This system has been used to simulate the nitrogen cycling in a marine plankton community and to describe the cycling of dissolved dimethylsulphide (DMS) in surface water during a phytoplankton bloom episode.

Further information can be obtained from:

M. Kohl and G. Realini, Environment Institute, CEC-JRC Ispra, I-21020 Ispra, Tel +39 332 789561-789678.

# Information

## Eurocourses at the JRC Ispra

The Joint Research Centre of the CEC organizes courses for the training of scientific and technical staff in advanced sectors of science. The training courses are linked with the R&D programmes and based on the specific competences of the individual institutes of the JRC (see also previous Environmental Research Newsletters).

The programme scheduled for the second half of 1992 includes:

### Chemical and Environmental Science

21 - 25 September 1992: *Technologies for Environmental Clean up: Soils and Groundwater*

Topics: Current legislation - Characterization of contaminants, identification of contamination level - Underground transport and fate of contaminants - Clean up technologies - Cost-benefit and risk assessment - Future of soils and groundwater clean up.

### Remote Sensing

7 - 8 September 1992: *The Use of ERS-1 Synthetic Aperture Radar Imagery*

Areas of particular interest are oceanography, ice monitoring, forestry and agriculture. Experts in their fields will cover these application areas as well as properties of the ERS-1 satellite, how to obtain data, data structure, basic properties of radar imaging and radar scattering. ERS-1 SAR images will be used as illustration of the different application areas.

23 - 27 November 1992: *Imaging Spectrometry as a Tool for Environmental Observations*

Looking back through a decade of instrument developments and experimental campaigns that have covered a wide range of applications, it now seems appropriate to summarize the achievements in imaging spectrometry that may contribute to future scenarios of environmental observations in Europe.

### Training and Education

5 - 6 October 1992: *COMETT II - Demarrage: a Project for the Development of Multimedia Training Materials in the Field of Remote Sensing, Risk Assessment, Geography and Environment*

Topics: EEC directives on risk protection - Reliability and risk assessment methods - Fire analysis and reliability of fire fighting equipment - Safety analysis in industrial applications - data base on industrial components - Introduction to atmospheric pollution monitoring - Techniques of atmospheric surveillance and monitoring - Remote sensing and earth observation satellites - Processing and interpretation of satellite data - Applications of geographic information system - Modelling of forest fires - Remote sensing application: land use planning and agricultural statistics; sea pollution surveillance.

Further information and documentation on the courses can be obtained from:

Secretariat EUROCOURSES, JRC, I-21020 Ispra (VA).  
Tel. +39 332 789308, Fax +39 332 789839.

## Course announcement

### Environmental Bioprocesses - Modelling and PC Simulation

Swiss Federal Institute of Technology Zurich  
28 June - 4 July 1992, Braunwald, Switzerland

The objective is to teach the application of chemical engineering methods to environmental biological systems. The course is designed to benefit engineers and scientists from a wide variety of backgrounds. A careful presentation of mass balancing and kinetic fundamentals provides the basis for understanding highly complex dynamic models. The simulation examples cover a broad range of engineered and natural system dynamics.

For registration and details contact:

Dr. Irving J. Dunn, Chemical Engineering Department, ETH,  
CH 8092 Zurich, Tel. +41 1 256 304, Fax +41 1 252 1827.

## The European Microwave Signature Laboratory (EMSL)

The sense of urgency which is clearly felt by human society in the examination of such questions as climatic warming, ozone holes, food production, tropical deforestation, desertification is mainly due to the recognition that these are global issues potentially affecting everyone. Current interest in these questions can also be linked to the fact that the connections between various parts of what may be called the "system earth" are extensive and must be operated over a wide range of scales.

To reach the overall goal to protect this system earth at its different scales, objective and actual information about the ecosystems at different geographical scales, the environment, the impact of human activities on it, the impact of climatic changes are required. Throughout the last twenty years it has become evident that remote sensing techniques can provide unique facts in a synoptic, frequent and economic way.

The community of environmental engineers making use of remotely sensed data of the "system earth" progressively recognized the need for having access to data without recognizing prevailing weather and illumination conditions. Microwaves do have this inherent capability. With the successful launch of the first European Remote Sensing Satellite ERS-1 by the European Space Agency (ESA) in July 1991 it can be stated that microwave remote sensing of the earth's surface from space will become of increasing importance.

In support of new sensor type the JRC inaugurated in April 1992 a new and unique facility, named European Microwave Signature Laboratory (EMSL). This laboratory is primarily ment to serve researchers and users in the field of land oriented remote sensing tasks as a central facility and tool. However, since the laboratory is very flexible in the various measurement modes it offers and it will therefore be used for other purposes, particularly industrial applications.

More information can be obtained from:

A.J. Sieber, CEC-JRC Ispra, I-21020 Ispra, Tel. +39 332 789089.

## The ESA/CEC Environment and Earth Observation Working Group (EEO-WG): Activities in the field of Space Application

In the framework of the cooperation agreement between the European Space Agency (ESA) and the CEC a joint ESA/CEC Environment and Earth Observation Working Group (EEO-WG) was established in 1989. The Working Group is co-chaired by Mr. Ph. Goldsmith, Director of Observation of the Earth and its Environment, ESA and Mr. J.P. Contzen, Director-General of the CEC Joint Research Centre.

The objectives of the EEO-WG are:

- to better coordinate action and prepare joint activities in the field of environment and earth observation;
- to contribute to the earth observation and environment programmes formulated e.g. under the 3rd Framework Programme of the European Community (1990-1994);
- to provide joint contributions to the International Geosphere Biosphere Programme : a study of Global Change (IGBP) and the International Space Year (ISY).

The Working Group has met 9 times since April 1989, at different premises of ESA and the CEC. Several joint projects have been prepared which are now in the implementation phase, these are:

- **Tropical Ecosystem Environment observations by Satellites (TREES)**
- **European Airborne Remote Sensing Capabilities (EARSEC)** ;
- **Ocean Colour European Archive Network (OCEAN)**.

Brief summaries of the projects are provided below:

TREES:

The project utilizes a multi-satellite based methodology for a continuous monitoring of tropical ecosystems (e.g. rate of change in forest cover, biomass burning) based upon NOAA/AVHRR, ERS-1/SAR and SPOT

satellite data, for an improved scientific assessment of their impact on the Global Change issues such as the greenhouse effect.

#### EARSEC:

A European capability for undertaking airborne remote sensing campaigns is being demonstrated. The capability incorporates sensors, processors and aircrafts, and their further development according to the European scientific needs. The aircraft observations are to be used for validation and calibration of spaceborne data, for example, the observational data from the ERS-1 satellite.

#### OCEAN:

The project aims at a thorough reappraisal of all ocean colour data derived from the Coastal Zonal Colour Scanner (CZCS), aboard the Nimbus 7 satellite (1978-1986), on the European marine regions. These data are to be exploited for an improved understanding of the marine environmental issues. The research includes studies of temporal and spatial variability of the sea-surface temperatures, ocean colour and biological productivity including numerical modelling approaches.

A new initiative of the EEO-WG is:

#### **Proposal for a ESA/CEC Centre for Earth Observation (CEO)**

The overall objective is to provide an effective network for the exploitation and maximum utilization of the earth observation data, in particular that obtained by the space-borne sensors.

A feasibility phase shall start in 1992 and it is intended to devote 1993-1994 to the pathfinder phase, with prototype studies based on thematic applications (e.g. the European projects **TREES, OCEAN, MARS** (Monitoring of Agricultural Statistics by Remote Sensing) and other relevant national/European projects).

Further information can be obtained from:

A. GHAZI, CEC-JRC, 200, Rue de la Loi, B-1049 Brussels  
Tel. +32 2 2358445

#### **EUROCOAST-Association**

EUROCOAST is a European association of scientists, engineers and decision makers within the European Community that provides a forum for multidisciplinary exchange between those working on the many aspects of the coastal zone. It was established in 1989 and arose from the joint work of a small team that cooperated to complete the CORINE "coastal erosion project" supported by DG XI. This project produced a database for the coastline of the 11 maritime nations of the EC.

The objectives of the association EUROCOAST are:

- to create a European network for scientific and technical co-operation and exchange, both within and outside Europe, on subjects

relating to the protection, development and management of the coastal zone and to thereby improve existing inventories and knowledge;

- to establish a data base and reference library on all aspects of the coastal zone;
- to promote the wider dissemination of information on the above themes;
- to generally take all initiatives and actions which will advance the realisation of these objectives.

At present the following five working groups are in the process of being established:

- Coastlines of Europe: a guide for the general public;
- Databases/GIS: application, implementation and training; Coastal Management: frameworks and policies;
- Standards: definitions, measurements and validation;
- Coastal Cities/communities: urban development and coastal zone protection/rehabilitation.

In spring 1993 (date still to be confirmed) the ANTALYA Seminar on "Coastal Protection and Management in the Mediterranean" will be held in Turkey.

Further information can be obtained from:

Association EUROCOAST, BP 30 - Site "Marepolis" (La Rotonde).  
Bd Toussaint Merle. F-83501 LA SEYNE CEDEX.  
Tel. (33) 94 30 03 01. Fax (33) 94 30 03 33.

#### **HUMOR**

The CEC-STEP Project "Humic substances, modifiers of the response of aquatic ecosystems to acidification"; called HUMOR (contract STEP-CT 90-0112, see Environmental Research Newsletter Nr. 6) has started in 1989 and deals with following subjects:

- The role played by Humic Substances in soil and water to the effects of acid rain on surface waters
- The role played by acid rain for the chemical and biological properties of Humic Substances.

According to the goal of an interdisciplinary approach 9 countries today are involved in the HUMOR-project and more than two dozen scientists are sharing their expertise and knowledge with this project.

The Norwegian Institute for Water Research (NIVA) in Oslo has recently started to publish and distribute the "Newsletter HUMOR/HUMEX".

Editor: Egil Gjessing. Norwegian Institute for Water Research, NIVA.  
P.O.Box 69, Korsvoll, 0808 OSLO 8, Norway.

# Conferences

## CONFERENCE REPORT

### 13th International Symposium on Polycyclic Aromatic Hydrocarbons (sponsored by the CEC (BCR, DG XII))

The 13th International Symposium on Polycyclic Aromatic Hydrocarbons (PAH) was held in Bordeaux, 1 - 4 October 1991.

It was the first time that a colloquium of this series was organized in Europe. Previous ones were held in USA and accordingly we were conscious that many European scientists may not be aware of the interest of such a colloquium. Nevertheless, more than 250 participants from about 25 countries have taken part to the scientific sessions. Scientific material was displayed by 20 manufacturers.

During the two sessions held in parallel, one in biology and one in chemistry, 120 oral communications and more than 100 poster communications were presented.

The subjects of the communications were devoted to the chemical as well as to the biological aspects of the PAHs: transformation and degradation, synthesis and analysis, detection in the aquatic and atmospheric environment, reference material and methods, metabolic activation, carcinogenesis, etc.

Selected communications will be published after being referred in a special issue of the Journal "Polycyclic Aromatic Compounds".

Because of the interest expressed by the participants, the International Committee has suggested that the Colloquium be organized alternatively in the USA and in Europe. The importance of the PAHs in the environment, the fact that it is the only colloquium on this subject and the very probable increase of the number of advertized scientists, lead to expect a growth of the number of participants for the next Colloquium.

Further information can be obtained from:

Dr. Ph. Garrigues, President of the Organizing Committee,  
Université de Bordeaux I, F 33405 Talence Cedex, Tel. 56 84 63 05.

## CONFERENCE ANNOUNCEMENTS

### Innovation and Technology Transfer in the 1990s 22 - 23 June 1992, Brussels

A major conference, organized by the SPRINT programme to discuss the issues involved in innovation and technology transfer through to the end of the century, and to present some of the achievements of SPRINT. The conference will be of interest to decision makers and to all participants in the innovation and technology transfer process.

For further information please contact:

Ms. Christine Nicasi, CEC, DG XIII/C-4 (SPRINT Programme),  
L-2920 Luxembourg, Fax (352) 4301-4544.

### EUROSOL: European Conference on Integrated Research for Soil and Sediment Protection and Remediation

6 - 12 September 1992, MEEC, Maastricht

Organizers: CEC, DG XII (Science, Research and Development), The Netherlands Integrated Soil Research Programme.

Conference themes: Soil policies and the need for integrated soil research; Assessment of soil quality and soil vulnerability; Approaches of soil quality and soil research; Managing problems of soil and sediment pollution; Soil quality: burden or business opportunity.

Workshops on related topics. Midweek excursion to soil and sediment contamination and remediation sites.

For further details please contact:

IAC-SOCC, PO Box 88, NL-6700 AB Wageningen,  
Tel. +31 8370 90111, Fax +31 8370 18552.

### Underwater Acoustics

14 - 17 September 1992, Luxembourg

Topics: Acoustical oceanography, propagation, imaging, acquisition and processing of data, wideband signal processing, noise, reverberation, scattering, Arctic and Antarctic acoustics, large scale models, shipboard noise reduction, use of sonar in fisheries, acoustics in marine geology and geophysics, transducers and instrumentation, etc.

For further information please contact:

Commission of the European Communities,  
DG XII/E /MAST Programme, Conference Secretariat SDME 3/46,  
200, rue de la Loi, B-1049 Brussels.

### 1) Remediation Technologies for Contaminated Land 24 September 1992, London

### 2) Advances in Technology for Lining and Capping Landfill Sites

9 December 1992, London

2 Seminars of the  
IMPERIAL COLLEGE Centre for Toxic Waste Management

For detailed information please contact:

Prof. Roger Perry, Imperial College Centre for Toxic Waste Management, Imperial College Road, London SW7 2BU, UK.

### The State of the Art in Ecological Modelling International Conference

28 September - 2 October 1992, Kiel (D)

Specific themes of the conference:

Modelling and ecosystem theory - Models as parts of integrated systems - techniques and concepts - Models of specific problems and ecosystems - Practical use of models - Global modelling - Ecological engineering.

For further information please contact:

Dr. F. Müller, Projektzentrum Ökosystemforschung (Christian-Albrechts-Universität zu Kiel), Schauenburger Straße 112,  
D-2300 Kiel, FAX +49/431 880 4083.

### Risk Assessment

International Conference

5 - 9 October 1992, London

A coherent approach to risk assessment is essential for decision-making on health, safety and environmental issues in order to achieve a proper balance between the well-being of people, the environment and the economy. Wrong decisions can have disastrous consequences which do not respect national boundaries, as Chernobyl and the Sandoz/Basle Rhine pollution incident have shown. Moreover, incidents which have more gradual consequences, such as sulphur dioxide poisoning, can prove equally traumatic. The conference will aim to establish the coherence of current risk assessments in a wide variety of fields and how such risk assessments might be restructured to improve decision-making.

For further information please contact:

John Price, HSE/NSD fi, Baynards House, 1 Chepstow Place,  
London W2 4TF, UK, Tel. +44 71 243 6266, Fax +4471 727 2254.

## Energy Efficiency in Process Technology

International Conference  
19 - 22 October 1992, Vouliagmeni (Athens)

Organized by the Commission of the European Communities, with the participation of The Centre for Renewable Energy Sources, The European Federation of Chemical Engineering, The European Chemical Industry Council, The Aluminium of Greece, Eurotherm.

Papers cover the following topics: Energy efficient unit operations and components; System models; Other topics: New energy efficient process routes; Energy analysis including exergy; New thermodynamic cycles; Refrigeration; Catalytic combustion; Efficient use of electricity in industry; Sensors and instrumentation).

For further details please contact:

Dr. P. A. Pilavachi, CEC-DG XII - SDME 3/34,  
200, Rue de la Loi, B-1049 Brussels.

## Environmental Industrial Catalysis

First European Workshop Meeting  
9 - 10 November 1992, Louvain-la-Neuve (B)

Organized under the auspices of the European Federation of Chemical Engineering and supported by the "Fonds National de la Recherche Scientifique" (FNRS, Belgium) and the Catholic University of Louvain.

Topics which will receive particular attention are: New catalytic clean-up technologies, new catalytic and photocatalytic degradations of pollutants; Study of heterogeneous catalytic phenomena taking place naturally in the environment (e.g. in smog, soil, water, etc.).

For further details, please contact:

- Dr. F. Thyrión, Chemical Engineering Institute, Voie Mincheleers, 1, B-1348 Louvain-la-Neuve, Belgium, Tel. (32)10/47 23 27, Fax (32)10/4723 21 or
- Dr. Patricio Riuz, Unité de Catalyse et Chimie des Matériaux Divisés, Place Croix du Sud, 2/17, B-1348 Louvain-la-Neuve, Tel. (32)10/47 35 97, Fax (32)10/47 36 49.

## Biological & Physico-Chemical Indicators

International Colloquium  
20-22 November 1992, Carry-le-Rouet (Bouches-du-Rhône, France)

Organized by the Association de Protection de l'Environnement et de Développement de la Côte-Bleue, le Parc Régional Marin de la Côte-Bleue, Continent Bleu et le GIS Posidonie.

For further information please contact:

GIS Posidonie, Faculté des Sciences de Luminy,  
F-13288 Marseille Cedex 09, Tel. +33 91 26 91 35,  
Fax +33 91 41 1265.

## Geopolitics of the Environment and the New World Order: Limits, Conflicts, Insecurity?

International Conference  
6 - 9 January 1993, Chantilly (Les Fontaines) (F)

General themes of the conference: 1) The Geopolitical Turning Point Towards a New World Order and Environmental Management. 2) Security and Insecurity Linked to the Environment in the New Geopolitical Context.

Four workshops are foreseen:

Global models, environmental constraints and the new world order. The passage between global and local. The environment and political implications of "proximity". The environment and discourses of control and the status of scientific discourse. Beyond insecurity: the environment as a symbol of a vulnerable human world and as an indicator of new types of prevention and protection of human and natural potential.

Conference coordination: SORISTEC-CNRS,  
16 rue Moreau, F-75012 Paris.

## Safety, Health and Loss Prevention in the Oil, Chemical and Process Industries

International Conference and Exhibition  
15 - 19 February 1993, Singapore

Organized by Society of Loss Prevention in the Oil, Chemical and Process Industries (SLP, Singapore), in cooperation with National University of Singapore, Center for Chemical Process Safety, American Institute of Chemical Engineers.

For further details, please contact:

The Conference Secretariat, SLP CONFERENCE 1993, c/o Manfield International, 71 Robinson Road,  
PO Box 1711, Singapore 9034, Republic of Singapore.

## Novel Aspects of Crop Nutrition

30 March 1993, Newport, Shropshire (UK)

Several aspects of crop nutrition, previously considered to be of little importance, have received increasing attention in research and/or in commercial application in recent years in the UK. The organisers of this conference invite offers of papers on any novel aspects of crop nutrition which have not been major subjects at recent or planned UK conferences. Offers are especially welcome in the areas of foliar nutrition, sulphur nutrition, measurement and prediction of crop nutrient demand, seaweed extracts.

For further information please contact:

Peter Kettlewell, Crop and Environment Research Centre, Harper Adams Agriculture College, Newport, Shropshire, TF10 8NB (UK).

## Safety and Reliability Assessment - an Integral Approach

First European Safety and Reliability Conference ESREL '93 and 17th Biannual German Conference on Technical Reliability TTZ '93  
19 - 21 May 1993, Munich (D)

Organized by Verein Deutscher Ingenieure, VDI-GIS, Ausschuss Technische Zuverlässigkeit (VDI-GIS/ATZ) and supported by European Safety and Reliability Association (ESRA) and national Reliability and Safety Organisations in different European Countries.

The conference will cover the following main areas: Reliability, Availability, Maintainability, Safety (RAMS) as a prerequisite in the Integrative process of economical, technical, organizational, environmental and safety considerations; RAMS of systems and components, experiences in different fields; RAMS as strategy, methods and applications.

For further details please contact:

Verein Deutscher Ingenieure, VDI-GIS,  
PO Box 10 11 39, D-4000 Düsseldorf 1,  
Tel. +49 211/6214-262, Fax +49 211/6214-575.

## GEO CONFINE 93

### Geology and Confinement on Toxic Wastes

International Symposium  
8 - 11 June 1993, Montpellier (F)

This symposium is organized by the French Committee of Engineering Geology (CFG) and the Bureau de Recherches Géologiques et Minières (BRGM), under the patronage of the International Association of Engineering Geology (IAEG).

Proposed themes: Natural geological barriers; Improvement of containment with treated geomaterials; Cover and surface isolation for disposal sites; Monitoring systems and safety of confinement; New confinement concepts.

For further details, please contact:

Michel Barres, BRGM - Department "Environment",  
BP 6009, F 45060 Orléans Cedex, France,  
Tel. (33) 38 64 34 14, Fax (33) 38 64 30 13.



## **GREEN '93**

A Symposium on Geotechnics Related to the European Environment  
Waste Disposal by Landfill  
28 June - 1 July 1993, Bolton, U.K.

Objectives: To provide an overview of current Geotechnical Engineering practice with regard to waste disposal by landfill - To create a European forum for interchange of ideas and concepts to promote developments and improvements - To point way for future research, design development, investigation/monitoring, legislation, training etc.

Content: Basic principles - Engineering behaviour of waste - Engineered waste disposal - Treatment of old sites - Case histories.

For further details, please contact:

Prof. R. W. Sarsby, Chairman of the Organising Committee, Bolton Institute of Higher Education, School of Civil Engineering and Building, Deane Road, Bolton BL3 5AB, UK.  
Tel. + 0204 28851; Fax: + 0204 399074.

## **Noise & Man '93**

The 6th International Congress on Noise as a Public Health Problem  
6 - 9 July 1993, Nice (F)

Organizers: The French National Institute for Transport and Safety Research (INRETS, Lyon-Bron), on behalf of the International Commission on the Biological Effects of Noise (ICBEN) and the support of several French Ministries and International Organizations.

Themes to be treated: Noise-induced hearing loss; Noise and communications; Non-auditory physiological effects induced by noise; In-

fluence of noise on performance and behaviour; Noise disturbed sleep; Community response to noise; Noise and animal life; Noise and combined agents; Regulations and standards.

For further details please contact:

NOISE & MAN '93, INRETS-LEN, Case 24, F-69675 BRON Cedex, France, Tel. (33) 72 36 23 00,  
Fax (33) 72 37 68 37.

## **Environmental Pollution - Science, Policy and Engineering**

International Conference

28 Sept. - 1 October 1993, Barcelona

Objective: What is the state of current scientific, technological and policy research in the topical and emerging environmental pollution issues, and how well is research responding to real needs? - Does the current level of interaction between scientists, engineers, economists, lawyers, industry and policy-makers lay an adequate basis for an integrated approach to the alleviation of environmental pollution and its often far-reaching consequences? If not, what should be done to improve the situation? - If sustainable development is feasible as a long-term strategy, what are the possible and preferred routes to its realization, what would be the trade-offs, and how can objective scientific research play an optimal role in this process?

For detailed information please contact:

ICEP Conference Office, ICTR Secretariat,  
11 - 12 Pall Mall, London.

# Publications

(All scientific and technical reports published by the Commission of the European Community (CEC) are available at the Office for Official Publications of the EC, L-2985 Luxembourg)

## Global Change Report N° 19

The PAGES Project: Proposed Implementation Plans for Research Activities

Edited by John A. Eddy

Stockholm, 1992

Distributed by IGBP Secretariat, The Royal Swedish Academy of Sciences, Box 50005, S-104 05 Stockholm, Fax (+46-8) 16 64 05.

## Global Change Report N° 20

Improved Global Data for Land Applications

A Proposal for a New High Resolution Data Set

Report of the Land Cover Working Group of IGBP-DIS

Edited by John R. G. Townshend

Stockholm, 1992

Distribution see above.

## Global Change Report N° 21

Global Change and Terrestrial Ecosystems

The Operational Plan

Edited by W. L. Steffen, B. H. Walker, J. S. Ingram

and G. W. Koch

Stockholm, 1992

Distribution see above.

## A Directory of European Environmental Organizations

A comprehensive guide to the major environmental organizations currently operating within the European Community. Foreword by Carlo Ripa di Meana.

By Mireille Deziron and Leigh Bailey

Edited by Blackwell Publishers, 108 Cowley Road, Oxford OX4 1JF, UK.

## Radiation: Doses, Effects, Risks

United Nations Environmental Programme (UNEP)

A fully revised and updated edition, essential reference tool for all: ecologists, environmental scientists, researchers, journalists, policy makers, health care workers.

Edited by Blackwell Publishers, see above.

## Environmental Data Report 1991-92

United Nations Environmental Programme.

Contains new data on global consumption of CFCs and halons never before published, fully updated 3rd edition.

Edited by Blackwell Publishers, see above.

## Hydrological Data UK - 1990 Yearbook

In common with earlier editions, the 1990 Yearbook brings together the principal data sets relating to river flow, groundwater level and areal rainfall for the UK; water quality data are also included for a representative network of monitoring sites.

Can be ordered from Surface Water Archive Office, Institute of Hydrology, Maclean Building, Crowmarsh Gifford, Wallingford, OXON OX10 8BB, UK.

## Forest Damage and Air Pollution

Report on the 1990 Forest Damage Survey in Europe.

Can be ordered from Institut für Weltforstwirtschaft und Ökologie,

IGP-Forests, Programme Cooperating Centre West, Leuschnerstr. 91, D-2050 Hamburg 80.

The next report (for 1991) will be jointly published in cooperation with CEC-DG VI and can be ordered in Luxembourg.

## Control of Emissions of Volatile Organic Compounds from the Large-Scale Varnishing of Car Bodies

by E. K. Macdonald, I. T. Marlowe, M. J. Woodfield

ISBN 92-826-2867-1;

EUR 13568.

## INFOGUIDE

### Guide to sources of information on European Community Research

The book was compiled as part of the European Community's VALUE programme for the dissemination and utilization of scientific and technical information, and is published by the CEC Telecommunications, Information Industries and Innovation, Dissemination of Scientific and Technical Knowledge Unit (DG XII/C-3).

EUR 14120, ISBN 92-826-3647-X.

## Forest Health Report 1991 - Technical report on the 1990 survey

Published by the CEC DG IV (Agriculture).

For further information please contact:

CEC-DG VI Fil 2, att. Mr. F. Kremer, 200 rue de la Loi, B-1049 Bruxelles.

## De werking van het Nederlandse beleid inzake in-, uit- en doorvoer van gevaarlijke afvalstoffen

(in Dutch with English summary)

E. J. A. Mulleneers, second edition, March 1992.

Edition: Information Centre of the State University of Leiden, NL.

## Biological Recording of Changes in British Wildlife

Proceedings of a Conference held on 13/3/1990 to celebrate the 25th anniversaries of the Biological Records Centre and the Natural Environment Research Council.

Edited by Paul T. Harding.

For orders please contact Mrs. S. Adair, Gifts and Exchanges, Institute of Terrestrial Ecology, Edinburgh Research Station, Bush Estate, Penicuik, Midlothian EH26 0QB, Scotland.

## NEW PERIODICALS

### Fresenius Environmental Bulletin (FEB)

#### The International Journal for Rapid Communication and Updating in the Field of Biotic and Abiotic Systems

The aim of the journal is to inform its readers quickly and in a condensed form about the latest developments and findings in this fast-growing field.

All manuscripts will be selected by an in-house review and/or rapidly referred by international experts within one week. Every effort will be made to publish the contributed papers within 4 - 6 weeks from the date of acceptance.

For more details or subscription please contact:

Birkhäuser Verlag AG, P.O. Box 133, CH-4010 Basel, Fax +41 61 271 7666.

### **Greensleeves - EC Environmental Update**

This is a new monthly covering Community developments in the environmental area and of those touching upon consumer protection and health care. It contains clear and precise information, an impeccable presentation and a publication frequency adapted to an often over-loaded work schedule.

An annual subscription entitles both to the monthly issues (10/year) and to the Special Issues, published after each EC Council Environment or Consumer Affairs Ministers and covering in detail the decisions taken and policy guidelines reached by the Member States.

"Greensleeves" (first issue: April 1992) has a sister edition in French: "La Filière de l'Environnement - Actualités européennes" (first issue: January 1992).

For more details please contact:

Sidhe Press, Rue de la loi, 235, B. 11, B-1040 Brussels,  
Tel. +32.2.230 85 95, Fax +32.2.230 86 55.

### **IEA Coal Research Newsletter**

Established in 1975 under the auspices of the International Energy Agency (IEA), there are three issues each year. The service is governed by representatives of 14 Member Countries and the CEC. The aim is to provide an impartial and objective information and assessment service on all aspects of coal-related technologies and economics.

More information can be obtained from:

John Trubshaw, Gemini House, 10 - 18 Putney Hill, London SW15 6AA,  
UK, Fax (44) 81-1746.

### **Greenhouse Issues**

is the newsletter of the **IEA** greenhouse gas R&D programme. The programme is the result of the IEA CO<sub>2</sub> Implementing Agreement, for which British Coal is the Operating Agent. Greenhouse Issues aims to keep readers up-to-date on worldwide developments in the field of greenhouse gases and fossil fuels and also on the work of the programme.

More information from:

Deborah Norman, IEA greenhouse gas R&D programme, IEA Coal Research, Gemini House, 10 - 18 Putney Hill, London SW15 6AA,  
UK, Fax (44) 81-780 1746.

### **IEA-ETSAP News**

This Newsletter is published under Annex IV of the 'Implementing Agreement for a Programme of Energy Technology Systems Analysis'. Operating Agent is the Netherlands Energy Research Foundation, acting through ESC/Global Issues, Petten.

More information on ETSAP Activities from:

Tom Kram, ESC/Global Issues, Neth. Energy Research Foundation,  
P.O. box 1, 1755 ZG Petten, NL.

### **Newsletter HUMOR/HUMEX** (see Chapter "Information")

Editor: Egil Gjessing. Norwegian Institute for Water Research, NIVA.  
P.O. Box 69, Korsvoll, 0808 OSLO 8, Norway.

#### **Note from the Editor**

The information contained in this Newsletter has been drawn from material supplied by the same persons indicated in each chapter as possible correspondants for further information.

Text have been checked and apologies are given for omissions or errors.

# EC opens to the EAST

## Community actions in the field of environment: assistance, training, scientific and technological cooperation\*

The opening-up of EC, firstly directed towards EFTA countries with the creation of a European Economic area, is now proceeding towards Central and Eastern Europe. Such initiative involves, besides the signing of political and economic agreements, a necessary phase of assistance in the process of reform and economic reconstruction in these countries. The EC institutions and Member States play a major role in the concerted "G24" assistance efforts which the Commission coordinates. The assistance programme provides for loans from the "European Bank for Reconstruction and Development" and from the "European Investment Bank" to support investments in Central and Eastern Europe as well as non-reimbursable grants to finance reconstruction programmes in the framework of the PHARE Programme\*\*.

Complementary to the actions in the political and economic field, the Community is also supporting actions in science and technology, including not only assistance but also cooperation activities, as foreseen in the new scheme of actions for scientific and technological cooperation between the European Community and Central and Eastern Europe.

### PHARE: Assistance for Economic Restructuring in the Countries of Central and Eastern Europe

PHARE Programme (French acronym for "Pologne et Hongrie: Assistance pour la Reconstruction Economique") was brought into being at the G24 Paris Summit in June 1989. The programme represented the European Community's response to the changes in the power structure of former communist Central and Eastern European countries. In terms of PHARE's basic legal text (*Council Regulation EEC No 3906/89, OJ No L 375, 23.12.89*) aid must be used primarily to support the process of reform in the beneficiary countries, in particular by financing or participating in the financing of projects aimed at economic restructuring in certain priority areas: agriculture, industry, investment, energy, training, environmental protection, trade and services.

In a political and administrative level dialogue between the Commission and the respective governments, annual "indicative programmes" set out the priority areas of PHARE funding, on the basis of which specific sectorial, regional or multilateral programmes are then identified and appraised, and the necessary funds committed. The subsequent implementation phase is managed by the responsible national authorities, and provides the supplies and technical assistance the agreed programmes call for through normal procurement procedures.

As the name PHARE implies, the only original beneficiaries were Poland and Hungary, although in mid-1990 the programme was extended to include Bulgaria, the Czech and Slovak Federal Republic, Yugoslavia, Romania, and at least initially the ex-German Democratic Republic (*Council Regulation EEC No 2698/90, OJ No L 257, 21/09/90*). Successively, Albania and the Baltic States (Estonia, Latvia and Lithuania) have also been accepted as PHARE Programme members (*Council Regulation EEC 3800/91, OJ No L 357, 28/12/91*).

The PHARE programme is financed from funds specifically provided for this purpose in the annual general Community budget. In 1990, 300 MECU was granted to Poland and Hungary, and a further 200 MECU was set aside for the subsequent beneficiary countries. By 1991 the budgeted amount allocated had risen to 785 MECU, and this year the Council allocation is worth 1 billion ECU.

Information about the procedures and conditions applied by the Commission to disburse this money can be obtained from:

- Information Unit, PHARE Operational Service, DG I, CEC, 200 rue de la Loi, B-1049 Bruxelles, Tel. + 32 2 2350026, Fax + 32 2 2355387.
- CEC Offices in the EC countries and Delegations in the PHARE countries

### TEMPUS: a PHARE Programme for Higher Education

TEMPUS (Trans-European Mobility Scheme for University Studies) which was adopted on the 7th May 1990 by the Council of Ministers of the European Community forms part of the overall programme of Community aid for the economic restructuring of the countries of Central and Eastern Europe (PHARE), within which training is one of the priority areas for cooperation. The eligible countries originally identified in 1990 were Poland, Hungary and Czechoslovakia (and for the first year the DDR) with an extension to Bulgaria, Roumania and Yugoslavia during the academic year 1991/92 and to Albania, Estonia, Latvia and Lithuania during the academic year 1992/93. The budget, which amounted to 25 MECU in 1990 and 70.5 MECU in 1991, will be around 100 MECU in 1992.

The double objective of TEMPUS is to promote the quality and support the development of the higher education systems in the countries of Central and Eastern Europe designated as eligible for economic aid and to encourage their interaction and cooperation with partners in the European Community.

The main vehicle for cooperation consists of **Joint European Projects (JEP)** which involve the participation of at least one university from an eligible country, and partner organisations, of which one must be a university, in at least two EC Member States. The JEPs concern cooperative education and training actions such as student and staff mobility, retraining and updating curriculum development and intensive programmes, structural development of higher education and sector specific actions. Alongside this based support project, **mobility grants for staff** (teaching assignments, practical placements, staff retraining and updating, and visits) **and for students** (periods of study or practical placements) are also provided for. Limited support is also available for **complementary activities** such as extension to the eligible countries of European associations in higher education, publications and other information activities related to the TEMPUS Programme, surveys and studies to assist monitoring and evaluation as well as youth exchanges and related activities.

TEMPUS concentrates on priority subject areas of particular importance to the different eligible countries as part of the process of economic and social change and the transition to a market economy.

Further information on TEMPUS can be obtained from:

EC TEMPUS Office, 14 rue Montoyer,  
B-1040 Bruxelles, Tel. + 32 2 5040711,  
Fax +32 2 5040700.

### Scientific and technological cooperation between the European Community and Central and Eastern Europe

The European Community is committed to widening its activities to promote Eastern European science as a full partner in Europe's scientific progress. To that end, a special action has been created in 1992 to stress scientific and technological cooperation between the Community and Central and Eastern Europe. In addition, it has been decided to promote the progressive opening of the Third Framework Programme for Research and Technological Development (1991-1994) to the participation of organisations and firms from the East as well as the enlargement of COST Membership to eastern partners. At the present time, the countries of Central/Eastern Europe allowed to participate in the framework programme and in scientific and technological cooperation actions are: Albania, Bulgaria, Czechoslovakia, Estonia, Latvia, Lithuania, Poland, Romania and Hungary. The overall budget for the implementation of these actions amounts to 55 MECU.

\* (by Myriam Borlé-Talpaert, JRC Ispra (present address: MURST, Rome) and Marek Svoboda, PHARE Unit, DG XI.Brussels)

\*\* A separate programme of technical assistance for the countries of the former Soviet Union has been set up in July 1991. The programme has a budget of 400 MECU ca. and focuses on the following priority areas: training, energy, financial services, transport and humanitarian aid.

## Special action for cooperation activities in science and technology research

The Community has set aside 40 MECU in 1992 for special cooperation activities in science and technology research between EC countries and the above-mentioned countries of Central/Eastern Europe. This budget will be distributed between research fellowships and European chairs at scientific institutions in Central and Eastern Europe (15 MECU); networks, conferences and seminars (5 MECU); research projects specifically oriented towards the needs of Central and Eastern Europe (20 MECU).

## Collaboration in research projects under the Third Framework Programme

A budget of 10 MECU has been provided to support the participation of organizations in Central and Eastern Europe in five specific programmes: environment, biomedical and health research, non-nuclear energies, nuclear fission safety and human capital and mobility.

## Participation in COST projects

In 1991 it has been decided to accept Czechoslovakia, Hungary, Poland as full members of the COST action (these countries as well as

Yugoslavia and the ex USSR were already involved in several projects of the COST activities). A budget of 5 MECU has been allocated to support the participation of Eastern organizations to some COST actions.

Detailed information on this programme and on the procedure of participation have been published in the EC Official Journal No C 111, 30/04/92.

For more information about these actions, please contact:

- Special action for 1992, Information Office, CEC, 75 rue Montoyer, B-1040 Bruxelles, Fax + 32 2 2363308.
- Third Framework Programme for Research and Technological Development, Information Office, DG XII, CEC, 200 rue de la Loi, B-1049 Bruxelles, Tel. + 32 2 2355369, Fax + 32 2 2358865.
- COST, DG XII, CEC, 200 rue de la Loi, B-1049 Bruxelles, Tel. + 32 2 2354106, Fax + 32 2 2364289.

## Environmental actions in the framework of the EC Commission's PHARE Programme

The main aspects of the Community actions for Central and Eastern countries assistance in the field of environment have been outlined in the editorial of ERN N° 8 by Ph. Bourdeau, Head of the European Environment Agency Task Force.

As previously mentioned, the Commission accords EC external aid by means of a national programme which is signed directly with the beneficiary government. The government is then responsible for implementing the concrete projects under that programme. The environmental sector programmes are not different in this sense.

The environmental projects, currently financed by the EC in Central and Eastern Europe from the beginning of the PHARE programme, are presented below.

### The "shopping-list" approach to assistance (1991)

Environmental projects accounted for over 20% of the total PHARE budget for Poland and Hungary in 1990, largely as a result of the fact that EC environment ministers were the first to come up with viable project proposals for Brussels.

Nevertheless it was only in mid-June 1990 that the Commission signed, with the beneficiary governments, indicative programmes setting out the priority sectors for financing. This meant that there was insufficient time in the first year of PHARE to develop a strategy within each national programme on which allocate the funds. Consequently environment ministries were permitted to propose only a simple list of priority projects for financing.

In **HUNGARY**, the PHARE national environment programme, Phase I, was launched in September 1990 (total allocation 27 MECU, including 2 MECU for the Regional Environment Centre, Budapest).

Twenty three projects were approved for financing under this programme.

A total of six projects were financed in the field of **nature conservation** (worth 3.16 MECU), including several studies on environmental education and training, environmental protection of the FERTO national park, Hungarian wetlands and grasslands, and cave and spring ground-water sources (eg the KARST thermal water-systems of northern Hungary). A regional integrating monitoring system (RIM) has also been financed.

In the field of **air pollution**, it was necessary to help modernise the emissions and air quality monitoring networks as well as the national network of stations which register background air pollution. There is also a programme on catalysis to reduce vehicle exhaust emissions (eg. refitting engines for urban bus-fleets).

The Hungarian population relies for up to 65% of its **water** consumption on underground water sources. Many surface waters have been pol-

luted by industrial inorganic substances dumped by industry and by untreated sewage from intensive animal husbandry. Three quarters of surface waters are potable only after purification treatment. There are therefore projects to monitor water quality, to establish a hydrometric monitoring system, to dredge salt from Lakes BALATON and VALENCE, and to rehabilitate the KOROS oxbow region in the Transdanubian lowlands region. Two complementary studies, one on groundwater pollution and one on thermal water sources are also being conducted (3.86 MECU sub-total).

In the sector of **waste**, the amount of urban and other waste produced is high by international standards but the available technology is inadequate to dispose of or utilise it efficiently. PHARE is financing a pilot project to introduce low waste technologies to a disposal plant in the VAL VERTESASCA region, and also an inventory of groundwater pollution sources (3.3 MECU).

In the **energy** sector, the common central European problem lies in the excessive emissions of SO<sub>2</sub> from heavy industry. PHARE is paying for a study which investigates ways of reducing SO<sub>2</sub> emissions at three key national power stations, as well as for the cost of installing fluidised bed boilers at AJKA and DOROG power stations and a project on energy savings at the Taurus rubber plants (5.88 MECU sub-total).

In **POLAND**, the significant part (10 MECU) of the funding for the 1990 PHARE national environment programme (total worth 22 MECU) was reserved for projects to help reduce **air pollution**. Production licences were accorded to state firm RAFAKO for the serialized production of flue gas desulphurisation equipment to be used in coal-fired electricity power stations, for circulating fluidised bed boilers (5 MECU) and for the import of ambient air pollution monitoring equipment for use by the State inspectorate for environmental protection. (Although contracts have now been concluded with most suppliers, some 5 MECU has had to be re-allocated due to technical and absorption problems. This money will be spent on contingency projects requiring large investments, see below). A project for air monitoring by means of a mobile laboratory in the MORAVIAN GATES region between OSTRAVA and UPPER SILESIA has been fully implemented in March/April. The final report summarizing the analytical data is due to be ready by September 1992.

*There was a smaller level of funding for technical assistance on **water protection, waste management, nature conservation and general environmental education projects**. This assistance involved the drawing-up of detailed designs for constructing a "show-case" incineration plant for toxic chemical waste in BYDGOSZCZ, providing equipment to improve operational controls at the CZAJKA waste water treatment plant and hiring consultants to prepare feasibility and design studies for building a sewage and industrial effluents treatment plant in the Cracow area. A*

study will also be prepared outlining options for de-salination of discharges of mine water from the CZEJCOTT mines. The establishment of a National Foundation for the GREAT MAZURIAN lakes (NE Poland) and a Foundation for the WARTA river included the preparation of a master plan for this region. Provision is also made in the contingencies for an environmental impact assessment of the construction of the CZORSZ-TYN dam. The remaining funds were ear-marked for technical assistance to the Ministry of Environment and its project implementation unit and for an environmental education and training exchange programme.

In the **CZECH and SLOVAK FEDERAL REPUBLIC (CSFR)**, sixteen projects were initially funded in five sectors (general ecology, waste, water, air and nuclear energy). The 1990 PHARE national environment programme was the largest with 30 MECU in total. However, as the Financial Memorandum was only signed in January 1991, this has meant that the Federal Ministry of the Environment is at least six months behind in implementing these projects.

The general-use projects included producing a **ground-water** model for Slovakia's southern lowlands around the GABCIKOVO-NAGYMAROS water-works, and the re-fit of two toxicological centres in PARDUBICE and BRATISLAVA.

The disposal of **urban and toxic waste** in the CSFR is inefficient and the percentage disposed of is very low. PHARE is funding four actions in this sector: (i) a study is being made of the waste sector in the CSFR, (ii) an information centre on hazardous waste is to be established and (iii) basic engineering services will be provided for the incinerator at SALA (5.8 MECU sub-total). There is also a pre-investment study to consider the feasibility of modernising a municipal waste disposal plant in OSTRAVA (iv).

The high levels of ambient **air pollution** are responsible for the CSFR having one of the worst environmental records in Europe. This is mainly due to the reliance of its energy and heavy industries on high sulphur content lignite coal. The resulting emissions, mostly comprising SO<sub>2</sub>, NO<sub>2</sub> and VOC's are singularly responsible for devastating the north Bohemian and Silesian countryside and for drastically reducing adult life expectancy in this region. For these reasons the air sector projects concentrated on the reduction of emissions, with the installation of de-sulphurisation equipment and the transfer to the Czechoslovaks of a licence to produce air filters. Another project to provide basic engineering services for desulphurization at the PRUNEROV electricity plant in northern Bohemia (5.30 ECU sub-total) was finally withdrawn early this year after the state enterprise obtained a substantial loan from the World Bank and the project risked becoming duplicative.

In the **water** sector, it is fair to say that water quality was fairly well measured in the 1945 to 1989 period, although many parameters commonly used in the EC were ignored. A major project therefore involves improving the existing monitoring systems (eg. on the Elbe/Labe river which flows through the industrial heartland of Northern Bohemia). A pilot project to modernise the methods of sludge disposal at a major sewage treatment plant in Prague was also financed (5.90 MECU sub-total).

Finally, the dangerous out-datedness of the Soviet-built **nuclear reactors** used by the Czechoslovaks required urgent technical assistance from PHARE. This came in the form of an expert opinion on the operational safety of the V230 reactors and basic engineering services to update the control systems on both the V230 and V213 reactor types (3.50 MECU).

With regard to the former **GERMAN DEMOCRATIC REPUBLIC**, the Commission had originally committed 20 MECU for environmental projects in 1990. They mostly involved **air and water monitoring** and waste treatment. The programme was discontinued following the reunification of Germany. However the allocation still stands and the projects are now being implemented in the new Länder by the Federal Government pursuant to EC procedures.

In the former **YUGOSLAVIA**, the national indicative programme was originally worth 35 MECU (1990). An additional 61 MECU was provided in 1991 for general restructuring. PHARE aid was however frozen in mid-1991 and allocations are only now being made again, this time on an individual Republic basis starting with newly independent Croatia and Slovenia.

The environmental sector was also marginally covered in the indicative programmes signed with **BULGARIA** (3.5 MECU) and **ROUMANIA** (2 MECU) in 1990.

### The development of a PHARE strategy for environmental assistance (from 1991 onwards)

Whilst the 1990 environmental sector programmes had used a piecemeal approach to project selection, the 1991 programmes were pre-

pared on the basis of a G24 **Environmental Strategy Paper** which has the full support of the Central and Eastern European governments and was adopted by the G24 Environment Working Group on 15 May 1991. The essential difference is that the assistance is now concentrated on a number of **priority areas** which are considered key to the environmental reform process in Central and Eastern Europe.

The five national environment programmes concluded in 1991 (Bulgaria, CSFR, Hungary, Poland and Roumania) therefore concentrate on strengthening and expanding the institutional, policy and regulatory frameworks in order to provide a sound foundation for longer-term reforms and investments to be launched and a sustainable economic development achieved. Thus the 1991 programmes prioritise a small number of areas in support of the national environment policy (where it exists), focussing on the alleviation of the principal constraints hindering the implementation of the environmental reform process, as well as some operational activities to promote that process.

Although based on the 'strategic' or 'programme approach', the 1991 (phase II) programmes will be implemented through more than 100 individual projects and interventions. The projects are however no longer outlined individually in the national programmes.

In the case of **HUNGARY**, the environmental programme in 1991 (total value 10 MECU) had four components:

- (i) to strengthen environmental education/public awareness and the government's environmental management capabilities;
- (ii) to assist with the implementation of the national air pollution strategy;
- (iii) to develop and implement a national municipal solid waste policy and
- (iv) to strengthen nature conservation management.

At this point in time the Environment Ministry's Project Implementation Unit is just starting work on the first phase of the 1991 Work Programme, which is essentially a planning period in which the individual projects and interventions are defined.

In the case of **CZECH and SLOVAK FEDERAL REPUBLIC**, the 1991 environment programme is modest (5 MECU), partially due to the changing priorities of the Federal Government within the overall PHARE Programme as the privatisation process begins to affect Czechoslovak industry.

The overall objective is to assist the Federal Environment Ministry with the implementation of its state ecological policy and its programme for environmental protection. This involves in particular four areas:

- (i) verifying the impact of pollution on human health, based on pilot studies in the towns of TEPLICE (Czech Republic) and NOVAKY (Slovak Republic);
- (ii) establishing a national system of environmental education in order to make the widest possible public (especially the young) aware of an integrated conception of the environment;
- (iii) improving and standardising sampling methods for water quality monitoring, enhancing environment impact assessment (EIA) capability and upgrading the ministry's information base for policy-making.

The underlying projects under this programme remain to be formulated.

In **POLAND**, the 1991 programme (total 35 MECU) concentrates on four priority areas:

- (i) launch of a major regional environment programme for UPPER SILESIA on the basis of an integrated approach and de-centralised management; activities will centre around master plans for air and water pollution, waste management and a study to stop food crop production on soils affected by toxic substances. A Project Implementation Unit is operating from KATOWICE;
- (ii) strengthening institutional environmental management;
- (iii) preparation of three national environment sector programmes for waste management, accidental environmental threats and national environmental training;
- (iv) financing a small number of low-cost investments of high priority and early impact for which studies have been completed under the 1990 programme (eg. a master plan for the GREAT MAZURIAN lakes to ensure environmentally sound and sustainable development, and assistance to the WARTA river foundation (NGO).

The Project Implementation Unit in Warsaw has prepared detailed descriptions of each of these sub-components, project data sheets as well as a timetable for implementation and disbursement of funds. This information is available directly from the unit.

By contrast to the EC-associated countries, the **BULGARIAN** indicative programme was prepared in 1991 for a period of two years.

A total of 15 MECU has been set aside for the environmental sector programme. The funds are being spent in two fundamental areas:

- (i) technical assistance in institutional strengthening and establishing three monitoring networks, including support for the Project Management Unit in the Ministry in Sofia (sub-total 1.6 MECU over 2 years);
- (ii) modernising monitoring and information systems for air, water and radioactivity sectors (the last is particularly important given that a single nuclear reactor at KOZLODUI is responsible for providing 40% of generated power for the country) (Sub-total 11.9 MECU).

In **ROUMANIA**, the 1991 programme contributed 2 MECU to the environmental sector. The programme had two components: development of a national air monitoring system, beginning with a pilot project to monitor air pollution in Bucharest (1 MECU), and secondly, institutional strengthening and strategy formulation for the Environment Ministry (1 MECU).

The Phare Operational Service has also provided independent technical assistance to help resolve environmentally-related border disputes (eg. pollution from ROSSE- GIORGIU on the Bulgaro-Roumanian frontier). There is the possibility that independent Community expertise will be requested soon by the Czechoslovaks and Hungarians to resolve their dispute concerning the completion of the GABCIKOVO-NAGYMAROS hydro-electric dam complex.

### Regional Environment Programmes

It is increasingly clear that national programmes alone cannot hope to tackle the vast environmental degradation in Central and Eastern Europe. The trans-boundary nature of many of such problems makes regional cooperation essential.

The G24 Environment Sector Strategy Paper (see above) accordingly stressed the need for enhancing such cooperation, and following the DOBRIS castle meeting of European Environment ministers in June 1991, the European Community decided to launch a 1991 **Regional Environment Programme** (20 MECU). This programme, some elements of which are implemented in close collaboration with other international donor organizations, is made of five components:

- (i) EC support for an integrated environmental programme for the DANUBE RIVER BASIN. (A work programme has been adopted by all riparian and donor countries and organisations, whilst a Programme Co-ordination Unit will operate from Brussels under CEC supervision);
- (ii) EC financial support and co-ordination of a regional environmental programme for the "BLACK TRIANGLE" area (roughly the area between GORLITZ (PL), USTI NAD LABEM (CS) and DRESDEN (FRG)). (A framework plan is being elaborated for the development and environmental rehabilitation of the region. A Project Co-ordination Unit will operate from the CZECH town of USTI NAD LABEM);
- (iii) a research programme on the effects of air pollution on health in selected regions;
- (iv) the extension of CORINE environmental data collection methodologies, developed originally in the Community, to the PHARE countries. (This work is being undertaken by the EC European Environment Agency Task Force);
- (v) additional funding for the elaboration of the State of the Environment Report for Europe.

The Commission is heavily involved in the initiation and co-ordination of all these sub-programmes, although implementation will depend increasingly on the Central and Eastern European authorities themselves.

### The Perspective for national and regional Environment Programmes in 1992 and beyond

The EC PHARE Programme was established by Council Regulation in 1989 to run for an initial period of only three years, although it is increasingly apparent that the programme will continue and expand due to the sheer extent and intractability of the problems which Eastern Europe faces and for which it separately needs Community expertise.

The EC Commission has now signed indicative programmes for this year with most of the PHARE member countries. The estimated allocations for the environment within these agreements are the following:

Hungary:	10.0 MECU
Poland :	15.0 MECU
CSFR:	0.0 MECU
Bulgaria:	7.5 MECU
Roumania:	5.0 MECU

From initial indications environmental components are unlikely to be present in the indicative programmes to be signed with Slovenia, Croatia, Albania and the Baltic States, although there may be environmental aspects concerning some of the other sectors prioritised by these governments.

The Commission has sent sectoral programming missions to the other listed countries in April and May.

As far as it concerns regional programmes, there will be a substantial budget for regional cooperation projects generally in 1992; EC countries have prioritised energy, nuclear safety, transport, telecommunications and environmental projects. The estimate for the regional environmental programme is around 15-20 MECU.

Generally, the amount of funding necessary to solve the environmental problems in this region is enormous. For example, it has been estimated that the environmental rehabilitation of the Baltic Sea alone will cost approximately 7 Billion US dollars.

The EC PHARE Programme is essentially playing a "kick-start" role in the environmental reform process in Eastern Europe. The aim is firstly to alleviate the most immediately threatening environmental problems, and then to help create the right conditions for investments from the private sector which must come if long-term solutions are to be found for these environmental problems. As PHARE activities broaden the Commission will have also an increasing role in bi-laterally and multi-laterally funded projects.

For general programming information on environmental actions, please contact:

DG XI/PHARE, CEC, 200 rue de la Loi, B-1049 Bruxelles,  
Tel. + 32 2 2369518.

For a complete data base of all environmental projects funded in Central and Eastern European countries, please contact:

DG I / G24 Co-ordination Unit, CEC, 200 rue de la Loi,  
B-1049 Bruxelles, Tel. + 32 2 2390210.

For further information about individual projects please contact the local Project Implementation Unit (PIU) in the beneficiary country's environment ministry (co-ordinates available from the EC delegations).

### TEMPUS Projects concerning Environmental Sciences

From the beginning of the programme, environmental protection has been considered as a priority subject area by all the eligible countries.

From a total of 1338 Joint European Projects (JEP) proposals for the academic year 1990/91, 78 have been classified in the subject area "Environmental Protection" from which 10 were approved (total N° of approved JEPs: 153). As regards the second round of selection (academic year 1991/92), from a total of 1402 JEPs newly submitted for approval, 100 have been considered as related to Environmental Protection, from which 15 accepted for financial support (total N° of approved JEPs: 318). It is to be noted that a greater number of JEPs deal with environmental sciences although classified in other areas, such as "applied sciences, technologies and engineering" or "natural sciences and mathematics". The involvement of eligible countries in the 25 ongoing JEPs in Environmental protection is as follows: Hungary is participating in 10, Poland in 9, Czecho-Slovakia in 7, Bulgaria in 5 and Yugoslavia in 2. Roumania does not participate in any JEP concerning this discipline.

Further information on TEMPUS can be obtained from:

EC TEMPUS Office, 14 rue Montoyer, B-1040  
Bruxelles, Tel.+ 32 2 5040711, Fax +32 2 5040700.

