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Editorial

While industrial production all over the world is steadily increasing by arithmetic progression, the population is growing geometrically and the most recent forecast evaluates slightly more than 6 billion people - more than 50% of which concentrated in the southern countries of the globe - at the beginning of the third millennium of the christian era. In parallel, cultivatable areas all over the world have decreased more than 10% while urban, uncultivated and desert areas have increased by about one third.

Besides new technologies which should make it feasible to face the impressive growth of primary needs, a more equitable re-distribution of resources is necessary, implying a consistent transfer of both resources and technologies towards developing and towards third-world countries. These are processes worthy of big concern, but, although their consequences and implications are stressed consistently by economists and politicians, they are far from being implemented in real terms, so that it is even more apparent that the present state of disequilibrium between the industrialized countries in the northern and the less developed countries in the southern hemisphere is likely to deteriorate further to the disadvantage of the poorest countries, unless countermeasures are urgently applied, capable of effectively altering the production/consumption economic system which we are accustomed to. In other words it is matter of a different cultural approach to the problem.

It is not intended here to argue about such a complex theme which deserves careful consideration by specialists in the field but rather to express some very simple considerations deriving from the above scenario.

Whatever is the distribution of the resources all over the world - even if it were the ideal case - it is clear that these have a dimension which may not yet be definitely ascertained but surely finite; in view of satisfying a continuously growing need, it will be mandatory to turn to recycling and recovery technologies for most of them. In other words, the growth of the population requires in all cases a higher rate of industrial and agricultural production, i.e. of energy production.

The two tightly connected processes - the growth of the population and the increase of production - are forcedly leading to larger amounts of wastes of different nature to be produced and to be disposed of in some way in the ecosystems. The entity of the produced wastes could be calculated on the basis of the present standards referred to both the technology and the quality of life, and, in all cases, it should be proportional to the overall population.

Although we are not able to identify the upper limit of the wastes to be disposed of at a given time, we know however that the basket which will contain the wastes has a noticeable but yet finite dimension; thus its capacity is going to be progressively exhausted.

It is clear that to first mitigate and then counterbalance these processes to reach the equilibrium by which what is disposed in the basket is taken off for an alternative utilization, a serious re-consideration of our way of life, production and consumption is necessary not only in economic but overall in cultural and ethical terms.

The research in the field of protection of the environment will represent a pillar on which civilization can stand in the future. The research does allow for basic phenomena to be clarified and understood, so that it is thereafter possible to forecast, to prevent and to mitigate the consequences of processes which threaten mankind and nature.

Of similar importance will be the development of new technologies - in particular the so-called cleaner technologies - as the decisive factor for a more efficient production at reduced energy consumption and with reduced wastes. However, the factor of paramount significance, which will warrant a generalized acceptable standard of life, will be a cultural revolution concerning the individuals' and society's approach to nature and its resources. History has shown that socio-economic, political and also religious motivations have always prevailed in determining the behaviour of mankind.

The deforestation in tropical areas, as a consequence of economic pressure, risks permanently offending an ecosystem by causing severe disequilibria and consequences at a global scale which cannot be predicted in full.

Putting aside the massive and insane waste of natural resources, the oil-field fire as a result of the Gulf war is the demonstration of the consequences - fortunately limited to a restricted area - of the present ranking of issues which has to be reviewed. The formation of a new culture and an ensuing ethical behaviour, which is more respondent to future needs, is the challenge for the year 2000 for mankind. Unfortunately, this process is very slow and the way towards its implementation is not very easy. Will mankind be given enough time to survive?

The Editor

Editor

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Programme News

EC R&D programme in the field of Environment 1991-1994 Directorate General XII, Science Research & Development

1. Programme content

The shared-cost programme R & D in the field of environment has been approved by the Council of the European Communities for the period 1991-1994.

The funds estimated as necessary for the execution of the programme amount to 261.4 Mio ECUs, including expenditure for staff and administration amounting to 15 Mio ECUs. The budget available for contracts is then estimated to 246 Mio ECUs.

The 1991-94 programme is focused on the following topics:

AREA I

Participation in Global Change Programmes:

- I.1 Natural climate change
- I.2 Anthropogenic climate change
- I.3 Climate change impacts
- I.4 Stratospheric ozone
- I.5 Tropospheric physics and chemistry
- I.6 Biochemical cycles and ecosystem dynamics.

AREA II

Technologies and Engineering for the Environment

- II.1 Assessment of environmental quality and monitoring
- II.2 Technologies for protecting and rehabilitating the environment
- II.3 Major industrial hazards
- II.4 Environmental protection and conservation of Europe's cultural heritage.

AREA III

Research on Economics and Social Aspects of Environmental Issues

- III.1 The human being, nature and society
- III.2 Environmental policy: conceptualization, implementation and monitoring
- III.3 Environment on the international scene: the transformation of internal relations.

AREA IV

Technological and Natural Risks

- IV.1 Natural Risks
 - IV.1.1 Seismic hazards
 - IV.1.2 Volcanic risk
 - IV.1.3 Wildfires
- IV.2 Technological Risk
 - IV.2.1 Risks from agricultural technologies and land use practices to soil, surface and groundwater quality
 - IV.2.2 Regional aspects of ecosystem protection
 - IV.2.3 Environment and human health
 - IV.2.4 Risks to health and the environment from chemical substances
- IV.3 Desertification in the Mediterranean area.

TARGETED PROJECTS

- TP 1 Halogens in the atmosphere and development of a scientific basis for the management of emissions of halogen containing compounds.
- TP 2 Fight against desertification in pilot sites in the Mediterranean area.

2. Implementation

The programme will be implemented by means of R&D projects, concerted actions and accompanying measures.

3. R&D Projects

Projects are either ordinary multi-partner projects or targeted projects. The projects will be the subject of shared-cost contracts.

The budget that will be available for contracts in each area of the programme is estimated as follows:

Breakdown (ECU million)

Area	Total	1991-92	1993-94
I	98	47	51
II	62	30	32
III	15	7	8
IV	71	34	37
	246	118	128

A first call for proposals will be published in July 1991 with the following deadlines for the various areas and sub-areas of the programme:

October 31, 1991	I.3; I.4; I.5; IV.1.3; IV.3; TP 1; TP 2;
November 30, 1991	III.1; III.2; III.3;
January 31, 1992	I.1; I.2; I.6; IV.1.1; IV.1.2;
March 31, 1992	II.1; II.3; II.4; IV.2;

Call for expression of interest for area II.2 with deadline October 31, 1991.

For shared-cost projects, Community financial participation will normally not be more than 50%. Universities and other research centres participating in shared-cost projects will have the option of requesting, for each project, either 50% funding of total expenditure or 100% funding of the additional marginal costs.

The maximum duration of projects to be funded under areas I, II and IV is 36 months, for area III, 18 to 24 months.

It is expected that a second call for proposal related to funds likely to be available in 1993-94 will be published in 1992.

4. Concerted Actions

Concerted actions consist of coordination by the Commission of research activities carried out in the Member States in specific areas. They may benefit from funding of up to 100% of coordinating expenditure (travel, workshops and publications).

5. Accompanying Measures

The accompanying measures will consist of:

- the organization of seminars, workshops and scientific conferences;
- internal coordination through the creation of integrating groups;
- advanced technology training programmes, with emphasis being placed on multidisciplinarity;
- promotion of the exploitation of results;
- ongoing consideration of the problems arising in the long term on the environmental sphere, by a high-level working party of experts;
- independent scientific and strategic evaluation of the operation of the projects and the programme.

Further information can be obtained from:

B. Versino, Environment Institute, CEC-JRC Ispra, I-21020 Ispra.
Tel. +39 332 789958.

EC R&D Programme MAST

Further to the information given in Environmental Research Newsletter N° 5 on this subject, recent progress is presented below.

A Specific R&D Programme in the Field of Marine Science and Technology

Rationale and Objectives

MAST-II is a direct development of MAST-I (1989-1992), a pilot programme on marine science and technology. Its general objectives are "to contribute to establishing a scientific and technological basis for the exploration, exploitation, management and protection" of European coastal waters and the seas surrounding the Community member states, and "to introduce the necessary Community dimension to various on-going research activities". The programme also aims to achieve a better balance in the marine science potential of the various areas of the EC.

The scientific and technical content of MAST-II is broadly the same as that of MAST-I. Modifications have been introduced as a result of the need to expand the programme's geographical coverage - which will now be extended to include the North Atlantic ocean and sub-polar Arctic seas - and to set up some large scale targeted projects.

The specific objectives of MAST-II are as follows:

- to contribute to a better knowledge of the marine environment and its variability, in order to improve its management and protection and to predict change;
- to encourage the development of new technologies for the exploration, protection and exploitation of marine resources;
- to improve transnational coordination and cooperation amongst marine R&D programmes in the member states and to help increase the effectiveness of these programmes through better use of research facilities, and to promote the transfer of expertise and knowledge;
- to provide the technical basis for and encourage the development of common norms, standards and design guidelines;
- to facilitate training and exchange of personnel;
- to assist (as far as possible) Community participation in international ocean programmes.

Technical Areas/Research Topics

MAST-II is divided into 5 areas, which are described briefly below. Calls for proposals will be published for four of these areas (I, II, III and V).

AREA I: Marine Science (33 MECU)*

The focus in oceanography is on the study of marine processes and fluxes. Problem oriented research can be considered, but priority will be given to projects dealing with processes and their interactions and variability in space and time. A multidisciplinary approach should be adopted, since this will contribute to a better understanding of marine systems and will provide data for numerical models.

1. Circulation and exchange of water masses

The programme will support research on ocean circulation systems and dynamics of water masses, in order to determine the water movement and physical processes in European seas and the North Atlantic ocean. Special attention will be paid to the shelf edge.

2. Biogeochemical cycles and fluxes

Biogeochemical research will be directed towards understanding and quantifying the fluxes of carbon and other elements in the sea (nitrogen, phosphorus, silica and metals). Hydrothermal activity is also included as well as the global carbon cycle in coastal and deep seas.

3. Interface and boundary processes

Exchange of matter and energy at all interfaces and boundaries of the marine system will be studied under varying environmental conditions.

4. Biological processes

Research will be directed to studies of biological processes in pelagic and benthic ecosystems (including microorganisms), population dynamics and ecosystem modelling (in relation to physical modelling).

5. Marine geosciences

Research in marine geoscience will include stratigraphy, geophysics and geotechniques and will address specific problems related to the properties and behaviour of sediments in various marine situations (e.g. shelf, slope and deep sea).

Area II: Coastal Zone Science and Engineering (13 MECU)

The main objectives are to gain a better understanding of coastal physical processes and morphodynamics, and to develop the application of modern concepts in coastal engineering and management.

1. Coastal physical processes

Research will be carried out on waves, currents (and their interactions), sediment transport and behaviour (including interactions with biological activity), with a view to developing and integrating numerical models of these coastal processes.

2. Coastal engineering

Research will focus on marine processes which affect the behaviour of coastal structure and will address the need to make progress in the harmonisation of coastal engineering design practices in Europe.

Area III: Marine Technology (27 MECU)

The focus is to encourage the development of existing and new instruments and to promote enabling technologies necessary for the advancement of marine science and related future industrial developments.

1. Instrumentation for science

The research on instrumentation will concern the development of new sensors and instrument packages for autonomous long-term in-situ monitoring, for surface, water column and seabed measurements, and for sampling (including deep sea activities).

2. Underwater acoustics

Research on underwater acoustics will be aimed at self-navigation of autonomous vehicles, determination of sea floor and ice properties, and innovative acoustic measurements.

3. Establishing technologies

The programme will support the development of new or improved enabling technologies, such as underwater signal transmission, imaging, marine applications of modern robotics and testing advanced materials/components for use in marine instrumentation.

Area IV: Supporting Initiatives (4.5 MECU)

The supporting initiatives are complementary to research and are aimed at a more effective use of research and training facilities, and a better use of data.

At the moment, the following seven supporting initiatives are planned:

1. European ocean data and information exchange
2. Preparation of norms and standards in marine science and technology
3. Modelling coordination
4. Research vessel and equipment coordination
5. Design of large scale facilities
6. Advanced training
7. New approaches for surveying and mapping.

Area V: Large Targeted Projects (14 MECU)

The Commission will coordinate at least two large "targeted" interdisciplinary projects which cover specific geographical areas. For the moment, two such projects are planned: one in the Mediterranean and one in the North Atlantic.

Further information can be obtained from:

J. Boissonnas, DG XII/E, CEC, 200 rue de la Loi, B-1049 Brussels, Tel. +32 2 235 6787, Fax +32 2 236 3024.

* The amounts in brackets are indicative of the budget available for cost-sharing contracts. They are for reference only and do not legally bind the Commission.

Environmental Protection

Air

EC Research Programme and Support Activities to the Commission

The aims of the researches managed by DG XII/E on one side and performed by the Joint Research Centre on the other side, have been already presented in preceding issues of the Environmental Research Newsletter. It is recalled here that the former encompass projects developed by national laboratories through shared-cost and concerted actions. Of relevant significance is the contribution coming from the four-years' programme (1988-1991) of the Joint Research Centre Ispra for which worth mentioning are also the activities performed in support of DG XI for the implementation of regulatory action.

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

Tropospheric chemistry is one of the major issues in air pollution, as the clarification of the very complex processes occurring in the troposphere is fundamental in addressing suitable air-pollution combatting strategies. As a consequence this item deserves the rather large effort which is being spent either through the shared-cost contracts and the COST Project 611 "Physico-chemical Behaviour of Atmospheric Pollutants", or through the Air Quality research project developed at the JRC Ispra.

The most recent progress accomplished in this area is presented in the following:

1.1. Shared-cost contracts

The following new contracts have been signed recently, managed by DG XII/E1 (see also Environmental Research Newsletter N° 5):

Measurements of biogenic NMHC emissions from vegetation representative of European ecosystems

Contract N° STEP 0060

The aim is to provide natural emissions data important for the modelling of European ozone formation.

Participating institutes (and project leaders):

- AERE Harwell, UK (G.L. Dollard, coordinator)
- University of Lancaster, UK (C.N. Hewitt)
- TNO Delft, NL (J. Duyzer)
- Univ. Aveiro, P (C.A. Pio)
- Ecole Nat. Sup. Chimie, Toulouse, F (L. Torres)
- Techn. Universität München, D (R. Steinbrecher)

The chemistry of NO_x in orographic clouds

Contract N° STEP 0051

The objective is to elucidate the fate of nitrogen oxides regarding their contribution to the oxidicity of the atmosphere.

Participating institutes:

- UMIST Manchester, UK (T.W. Choulaton, coordinator)
- ITE Penicuik, UK (D. Fowler)
- UEA Norwich, UK (G.J. Dollard)
- University of Stockholm, S (D. Johansson)
- Max Planck Institut für Chemie Mainz, D (P. Crutzen)

Polar atmospheric chemistry

Contract N° STEP 0077

The objective is to establish a relationship between airborne and deposited in snow acid compounds in order to validate the use of ice core samples for historic records of atmospheric composition.

Participating institutes:

- CNRS Grenoble, F (M. Legrand, coordinator)
- NERC Cambridge, UK (W. Wolff)
- CNRS Gif-sur-Yvette, F (H. Cachier)
- Universität Heidelberg, D (D. Wagenbach)

PAN intercalibration

Contract N° EVAV-0222

The objective is to calibrate a PAN standard and a PAN analyzer with errors not larger than +/- 10%, in order to create a European platform for comparison of PAN data.

Participating institutes:

- NILU Lillestrom, N (T. Krognes, coordinator)
- Université Paris XII, F (G. Toupance)
- Univ. Patras, GR (S. Glavas)
- TNO Delft, NL (J. Hollander)
- Meteo Consult Glashütten, D (R. Schmitt)
- Swedish Env. Prot., S (P. Oyola)
- CNR Rome, I (P. Ciccioli)
- Centro Nac. Sanidad Madrid, E (R. Fernandez)

Transformation and removal of Nitrogen compounds in the marine atmosphere

Contract N° STEP 0047

The objective is to elucidate the fate of nitrogen compounds in a marine atmosphere.

Participating institutes:

- Risø Roskilde, DK (S. Larsen, coordinator)
- TNO Den Hague, NL (G. de Leeuw)
- Universität Mainz, D (A. Flossman)
- Ecole Sup. Mécanique Nantes, F (P. Mestayer)
- University Göteborg, S (E. Ljungstrom)

EUROCORE follow-up

Contract N° STEP 0064

This project involves the expertise of laboratories able to analyze trace constituents in ice samples extracted during the EUROCORE campaign performed in Greenland in the summer 1989.

Participating institutes:

- CNRS Grenoble, F (R. Delmas, coordinator)
- KFA Jülich, D (R. Kley)
- UIA Antwerp, B (F. Adams)
- CNRS Gif-sur-Yvette, F (H. Cachier)
- Univ. Göttingen, D (G. Gravenhorst)

Further information can be obtained from:

G. Angeletti, DG XII/E1, CEC, 200 rue de la Loi, B-1049 Brussels.
Tel. +32 2 2358432.

1.2 Concerted Action "Physico Chemical Behaviour of Atmospheric Pollutants (COST Project 611)

Past issues of Environmental Research Newsletter have exhaustively presented the structure and the aims of this concerted action and the activities carried out by the different working groups operating within that frame. In particular the reader has to refer to Environmental Research Newsletter N° 5 (June 1990) to get a comprehensive view on this item.

The most significant results are presented here as far as it concerns Working Party 2.

Meeting on Atmospheric Oxidation Processes

Madrid, September 25-27, 1990

The Meeting was held at C.I.E.M.A.T. (Centro de Investigaciones Energéticas Medioambientales y Tecnológicas). The programme included sessions devoted to the EUROTRAC projects LACTOZ and HALIPP, as well as opportunity for presentation of results from the CEC supported OCEANOX project, which addressed oxidation processes in the marine boundary layer, and the new STEP projects, which address both tropospheric degradation of CFCs substitutes and polar stratospheric chemistry. 84 delegates from 13 countries attended the meeting which provided a forum for scientists from local scientific institutes to hear about the new developments in atmospheric chemistry as well as giving opportunity for the international teams to meet and discuss.

The importance of the interaction of laboratory studies, modelling and field studies was highlighted. The first two scientific presentations of the Meeting exemplified this interaction. Dr. Niki (Toronto) and Dr. Stockwell (visiting scientist at Jülich, Germany) presented work involving the application of models, based on up-to-date laboratory kinetics and mechanistic data to describe observational data on photo-oxidant formations. The two main conclusions from these studies are:

- biogenic hydrocarbons and aromatics are major precursors for oxidant formation at rural sites in the Eastern North American continent;
- Peroxy radical + radical reactions are important determining radical concentrations in the boundary layer when NO_x is low.

Further application of laboratory kinetics and models to field studies was described by Dr. Dorn (KFA, Jülich) who reported progress on the measurements of OH radical concentrations using long path laser absorption spectroscopy. The models overpredict the measured OH by at least 30% indicating some inadequacy in the current mechanisms for surface air free radical photochemistry.

The presentations from the investigators on the LACTOZ project related primarily to the kinetics and mechanism of the gas phase oxidation of more complex hydrocarbon species, including the biogenic hydrocarbons isoprene and β pinene.

HALIPP contributors presented 9 papers at Madrid. The contributions came from England, France, Germany and Switzerland. Six of these dealt with photochemical processes and reactions in aqueous solutions; one paper addressed the determination of sticking coefficients in the gas-liquid transfer of materials; and two papers were concerned with aerosol heterogeneous surface reactions and photo-catalysis.

The third session of the Meeting concentrated mainly on reactions of halogen-containing molecules.

Work on the reactions of halogen oxides with dimethyl sulphide (DMS) and related chemistry of iodine species has been carried out in the OCEANOX project in which investigation of the oxidation processes in the marine boundary layer close to coastal regions has been investigated. The most important result is that it is now established that the oxidation of DMS by the IO radical is slower by 3 orders of magnitude than originally assumed, and this can consequently be neglected as an atmospheric loss process for DMS.

Some presentations were related to the chemistry of polar ozone depletion, covering both homogeneous gas phase chemistry and heterogeneous chemistry. A very useful study of the photodissociation pathways of HOCl was reported, which provided data for accurate calculation of the photochemical loss of this important reservoir species.

Several topics were identified as in need of more intensive investigation. These include: the quantitative understanding of the fast photochemistry controlling local OH radical concentration; the extent to which nighttime oxidation chemistry driven by NO_3 influences NO_y partitioning and hydrocarbon oxidation; the understanding and model representation of the interface between homogeneous gas phase and homogeneous liquid phase processes.

Further information can be obtained from:

G. Angeletti, DG XII/E 1, CEC, 200 rue de la Loi, B-1049 Brussels.
Tel. +32 2 2358432.

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

Kinetics and mechanisms of the gas phase reactions of nitrogen containing pollutants

Following the research lines established in previous studies (see Environmental Research Newsletters N° 2 and 5) kinetics and mechanisms of tropospheric reactions in a NO_x rich atmosphere have been investigated in the laboratory.

Special attention has been put on the degradation of atmospheric trace substances of biogenic origin by gas phase reactions with the nitrate radical NO_3 (nighttime chemistry).

Reaction between NO_3 and dienes

Taking advantage of the results of the studies concluded on alkenes, the research has addressed the reaction of NO_3 with dienes with particular attention to the environmentally important species isoprene. The optical analytical facilities have been supplemented by gas chromatographic analysis for identification and measurement of intermediates and end products. Contrary to the case of the daytime reaction with OH radicals, the reaction with NO_3 apparently leads to unsaturated nitroxy-substituted carbonyl compounds as main products with only small yields of formaldehyde and of unsaturated, unsubstituted carbonyl compounds.

Much effort has been spent on the synthesis of compounds including also partly deuterated species to clarify the reaction mechanism and product distribution. In the case of 1,3 butadiene products have been identified and a reaction mechanism has been proposed.

The results on isoprene seem to indicate that this diene follows a similar reaction scheme. Further work is in progress to clarify the relative importance of the alternative reaction pathways and for a definite identification of products.

Reaction between NO_3 and reduced organosulphur compounds

The study originally performed on dimethylsulphide CH_3SCH_3 has been extended to methyl mercaptane CH_3SH and to dimethyl disulphide CH_3SSCH_3 . Intermediate and product analysis, performed by FT-IR and ion chromatography show that in purified air containing NO_x , methanesulphonic acid (MSA) is the main oxidized sulphur end product. SO_2 , HCHO and CH_3ONO_2 were identified and quantified for all the three reactions. The methylthyl radical (CH_3S) and the methylthioxy radical (CH_3SO) appear to be the key intermediates in the oxidation of the three products investigated.

Studies performed also using CD_3SCD_3 , support the hypothesis of a hydrogen abstraction as rate determining step for the reaction of NO_3 with CH_3SCH_3 and with CH_3S , while not excluding the initial formation of an adduct.

In the case of dimethylsulphide it appears that in the NO_x rich atmosphere the sulphur containing products, SO_2 and methanesulphonic acid are formed approximately in the same ratio.

This supports the reaction mechanism proposed.

The partition of the oxidized sulphur is relevant due to the different gas to particle conversion behaviour of SO_2 and MSA; an aspect which is presently investigated.

Reaction between NO_3 and halogenated alkanes

This study addresses the atmospheric compatibility of some halogenated alkanes proposed as alternative to Freons and characterized by the presence of H atoms in their molecules (hydrochlorofluorocarbons HCFC; hydrofluorocarbons HFC).

Five of these compounds were reacted in a smog chamber with NO_3 ; all of them exhibited a very low reactivity with upper limits for the rate constant evaluated $10^{-21} \text{ cm}^3 \text{ molecule}^{-1}$ at 296 K. The attention was then addressed to the nighttime chemistry of the aldehydes expected to be formed by the much faster OH radical attack of the halogenated alkanes. The aldehydes CCl_3CHO and CF_2ClCHO were synthesized, reacted with NO_3 and the reaction followed by infrared spectroscopy. Evidence was obtained that COCl_2 in the first case and COF_2 in the second case are main reaction products. The study is in progress.

Kinetics of the O₃/NO₂/NO₃/N₂O₅/air system

The kinetics of the system has been investigated by simultaneous direct spectroscopic measurement in the IR and in the UV-VIS of the species involved.

Values for the equilibrium constant K_{eq} of the reactions $NO_3 + NO_2 + M \rightleftharpoons N_2O_5 + M$ and for the unimolecular thermal decay $NO_3 \rightarrow NO + O_2$, both of importance for the modelling of the NO₃ system in air, have been determined.

Formation of HONO on aerosol particles in foggy periods in the presence of fog

A commercial differential optical absorption spectrometer measuring a set of trace gases absorbing in the UV-VIS wavelength region has been used to obtain simultaneous information, based on the observed Mie scattering, on aerosol parameters (e.g. total surface).

The technique has been applied to follow the formation of HONO in the gas phase during fog and haze episodes in a semirural area. The preliminary results give direct evidence of an important contribution of reactions on wet aerosols to the transformation of tropospheric NO_x into HONO.

The studies on the NO₃ chemistry are conducted in collaboration with the Chemistry Department of the University of Odense (DK).

The activities are scientifically coordinated in the frame of the EURO-TRAC-LACTOZ subproject and of the CEC coordinated action COST 611.

Further information can be obtained from:

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

Analytical Spectroscopic Techniques

Evaluation of spectral parameters, required for application of spectroscopic analytical techniques or for radiative transfer calculation and in relation to the studies of atmospheric chemistry has been pursued. Infrared Fourier transform and tunable diode laser spectroscopy are used.

In the period the theoretical analysis of the parallel ν_2 and of the perpendicular ν_5 infrared bands of $^{12}CH_3 \ ^{35}Cl$ (1313 - 1536 cm⁻¹) has been completed in collaboration with the Laboratoire Infrarouge, Université Paris Sud, Orsay. The measured line intensities were analyzed by a three interacting band system, including in addition the $2\nu_3$ band to account for Coriolis and Fermi interactions, to yield the values of the dipole moment derivatives.

In connection with the studies of the tropospheric chemistry of halogenated hydrocarbons (see above) a programme has been undertaken aiming at the evaluation of infrared absorbing properties of HFC, HCFC and possibly of their stable transformation products. To cover the temperature range of atmospheric interest, (220-300 K) a variable temperature gas cell has been set up, tested and inserted in the sample compartment of an IR-FT spectrometer. The first gas investigated is difluoroethane CH₃CHF₂.

Further information can be obtained from:

- G. Restelli, Tel. +39 332 789225
- F. Cappellani Tel. +39 332 789228
Environment Institute, CEC-JRC Ispra, I-21020 Ispra.

2. Stratospheric Chemistry and Ozone Depletion

European Arctic Stratospheric Ozone Experiment (EASOE)

Within the framework of the STEP Programme (OJ N° L 359, 08.12.1989) the CEC has launched a call for proposals for contributions to a measurement campaign during winter 1991/92 related to polar stratospheric ozone depletion in the Arctic region.

The primary aim of this Experiment is to study the spatial distribution and the dynamical behaviour of chemical trace constituents in the lower stratosphere in middle and high latitudes of the northern hemisphere using a combination of field research and modelling.

The rationale for the project is based on previous experiments in 1988 and 1989, indicating a perturbation of the chemistry in the northern polar

stratosphere. It is planned to make extensive use of ground based measurements, balloons and sondes as well as of aircraft and satellite data supported by modelling, in order to map the temporal and spatial development of the concentration of ozone and related trace species in the lower stratosphere during the period November 1991 to end March 1992. The measurement phase will be followed by a post-mission analysis and evaluation phase.

Research activities will be in line with the following scientific objectives:

- to detect the onset of perturbed chemistry and any associated ozone loss
- to study the spatial extent of the perturbed chemistry
- to investigate the effects at lower latitudes of transport of chemically perturbed air
- to investigate the dilution effect at lower latitudes.

The deadline for submission of proposals was 30 April 1991. Four projects have been selected in the meantime:

- aircraft measurements
- balloon measurements
- modelling and
- ground-based measurements.

About 50 institutes will participate in these projects.

The European Communities contribution will not exceed 50% of full cost or 100% of marginal cost (for universities only).

First European Workshop on Stratospheric Ozone Depletion

As already mentioned in Environmental Research Newsletter N° 5, a Workshop has been organized jointly by the CEC and the BMFT (Bundesministerium für Forschung und Technologie), Germany, and held at Schliersee, Bavaria, in October 1990.

Main conclusions of the Workshop can be summarized as follows:

During six years since the discovery of the Antarctic "ozone hole" very significant progress has been made in understanding the processes responsible for the ozone loss. The Workshop heard an impressive list of achievements in terms of new field and laboratory measurements, improved modelling techniques and, overall, an improved understanding of how the high latitude lower stratosphere behaves. It is now accepted that ozone is destroyed by reactions involving chlorine compounds and that polar stratospheric clouds play important roles in chemical conversion, dehydration and denitrification. However, it was also made clear that there are still many uncertainties:

In particular, the temporal variation of species concentrations in polar regions is still poorly understood. The workshop emphasized the requirement for long duration campaigns to study the chemical and dynamical evolution of the polar lower stratosphere in both hemispheres.

The International Ozone Trends Panel (IOTP, 1991) results indicating recent ozone losses in the Northern Hemisphere are not well understood. The Workshop indicated that further studies in high and middle latitudes of the northern hemisphere are needed, especially in winter and spring.

The need for more measurements was emphasized throughout the Workshop. In particular, it was felt that fast response in-situ devices for measuring both long-lived and radical species need to be developed.

The use of long-duration, high flying aircraft should be examined further. These aircrafts could possibly be unmanned.

The Workshop heard of some very impressive research on processes involving polar stratospheric clouds. Nevertheless, further work, both in field and in the laboratory, is very important on all aspects of the role of PSCs: chemical conversion, dehydration and denitrification.

Similarly there is a need for further laboratory studies of gas phase chemistry, and in particular of the chlorine and bromine reactions.

Numerical modelling has advanced significantly in recent years with a number of research teams now working on three-dimensional atmospheric models including detailed descriptions of chemistry. These models must, increasingly, be brought to bear on polar ozone problems; in particular dynamically and chemically constrained versions of these models must play a significant role in future polar campaigns.

Further information can be obtained from:

J.H. Büsing, DG XII/E 1, CEC, 200 rue de la Loi, B-1049 Brussels, Tel. +32 2 2355625.

3. Support Activities

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

Although the new activities regarding the harmonization of the NO₂ directive and preparatory actions for the future EC regulation on photo-oxidants received major attention, the former harmonization programme on the SO₂ directive has emerged in the preparation of Instruction Manuals for air quality monitoring networks. In parallel to the running harmonization programmes attention has further been focused on the complex problem of the network design and the mapping of air pollutants.

Harmonization programmes for current Directives

a) SO₂ directive. Instruction Manuals

As a result of the Common Measuring Programme (CMP) for the implementation of Directive 779/80/EEC (SO₂ and TSP), DG XI and CLAP proposed to put at the disposal of monitoring network managers and technicians, instruction manuals for harmonized strategies and procedures.

EC experts having participated in the CMP and having a considerable competence in the field have been asked for contribution. Meetings were organized to constitute two experts groups for the SO₂ and the BS instruction manuals and to prepare their table of contents in collaboration with the Central Laboratory. The contractants will be authors of the final document that will be published by the EC Commission, the latter having the copyright for publication. The final documents are expected by the end of 1991.

b) NO₂ directive. Common Measuring Programme (CMP)

A new CMP has been developed for the harmonization of the Directive 85/205/EEC (NO₂); it consists of the following actions:

- intercomparison of different NO₂ primary calibration standards
- quality assurance of NO₂ calibration procedures implemented in the Member States
- quality assurance of NO₂ measurements in EC networks.

This programme was presented and favourably accepted by the Member States at a meeting held in March 1990 in Brussels.

Concerning the first action, a new technique for the preparation of primary calibration gas mixtures by the static volumetric dilution method has been developed with success in collaboration with the Umweltbundesamt Pilotstation Frankfurt. A permeation bench has also been constructed to control the reliability of the NO₂ permeation sources used in national network laboratories for calibration purposes. As a first step in the intercomparison of NO₂ permeation sources the presence of impurities has been analysed by FTIR spectroscopy.

A new device (Test Atmosphere Generator, TAG) able to generate a multicomponent gas mixture at the inlet of the measuring stations has been conceived, in order to control the quality of the measurements and the efficiency of the sampling lines. The construction of this device has been realized by COSMA (France). First laboratory tests showed results in full agreement with the specifications. The TAG will be implemented in the next NO₂ quality assurance programme foreseen to start in 1992.

Preparative actions for future Directives

Photochemical Pollution Measurement Techniques

Within the framework of the preparation by DG XI on future EC regulations on tropospheric photo-oxidants and precursors, a working group (WG) on volatile organic compound (VOC) measurement techniques has been set up and coordinated by CLAP. An exact definition of the tasks of this WG was discussed in the 1989 progress report.

The WG which includes experts from 9 European countries, started its work in 1989 and continued in 1990 with meetings held in Ispra. A final draft report has been prepared by the coordinators of the WG which reflects the outcome of the discussions among the experts regarding the following items:

- Criteria for selection of VOC to be measured with highest priority. The selection was based on the known reactivity of these species and on their estimated emission rates and abundancies in urban atmospheres as well as in the free troposphere. The list agreed upon by the experts consists of 33 species.
- Criteria for selection of sampling sites in urban and non-urban areas.

- Recommendations regarding the choice of sampling periods and frequencies.
- Discussion on sample collection systems and analysis methods. Methods capable of measuring the full recommended list of VOC as well as methods, involving lower costs, permitting only the measurement of a reduced number of VOC.
- Discussion on how to prepare standard mixtures for calibration purposes.
- Discussion on the costs of VOC measurements.

A first draft of this document was favourably received at the national expert meeting on the reduction of photochemical pollution, held in March 1990 in Brussels. The final document will be available in 1991 after amendments suggested by some of the national experts.

Following a recommendation from the WG, a VOC measurement inter-comparison exercise which should involve laboratories from all of the EC member states, will be carried out starting in June 1991. This activity is organized by the CLAP in collaboration with the National Physical Laboratory in the UK which will provide cylinders with identical standard VOC mixtures in nitrogen to be distributed among the laboratories involved. There will only be one cylinder available per country but in some countries several laboratories have expressed an interest in participating in the exercise. For this reason, standard cylinders within each country will be circulated. Standard cylinders will also be provided to the TOR and EMEP networks.

Further action is foreseen once the intercomparison exercise has been completed.

Monitoring network design

a) Rouen - Le Havre

After a successful study in the Paris agglomeration, the passive diffusion tube technique was implemented to map the NO₂ distribution over the Rouen-Le Havre region in collaboration with ALPA-REMAPP (Observatoire de la Pollution Atmosphérique en Basse-Seine). Diffusion tubes were installed in 104 sampling sites during 15 day periods between 1/4/90 and 30/6/90. Iso-concentration curves have been obtained that will be used to support the extension and the re-design of the ALPA-REMAPP air pollution network.

b) Madrid

Within the framework of an agreement between DG XI, the JRC Environment Institute and the Ayuntamiento de Madrid, a pilot study has been launched, to measure the NO₂ distribution over the Madrid area in order to assess the design of the newly installed air monitoring network. A first diffusion tube campaign took place between 15/5/90 and 15/9/90, involving about 200 sites over 15 day sampling periods. A second winter campaign has been started on 15/11/90 continuing until 31/1/91.

In addition to the diffusion tube campaigns, mobile laboratory measurements were also performed over the greater Madrid area from 14 to 25 November 1990. Ground level concentrations of SO₂, NO, NO₂, NO_x, CO and particulates were recorded at 30 min interval and compared with the data of the Madrid automatic air monitoring network. Mobile measurements of individual parameters have also been performed every 50 m over distances ranging from 45 to 65 km. Measurements were carried out along four main circuits to characterize:

- pedestrian and commercial areas in the centre of the city
- the external ring motorway surrounding the city
- the main north-south axis, identified by the boulevards
- the industrial area in the SE outskirts of the city.

The results of this study have been presented in April 1991.

Further information can be obtained from:

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

3.2 The EMEP Station at the Environment Institute of JRC Ispra

The main objective of EMEP, the cooperative programme for Evaluation and Monitoring of the long-range transmission of air pollutants in Europe, is to provide governments with information on the deposition and concentration of air pollutants, as well as on the quantity and significance of the long-range transport of pollutants and fluxes across national boundaries. By the end of 1990 EMEP data were being collected at about 100 measurement sites in 24 European countries.

Following the Council Resolution N° 81/462/EEC, article 9, DG XI proposed an active participation in this programme by establishing an EMEP Station at Ispra. Since November 1985 this Station has operated on a regular basis in the extended measurement programme and data are transmitted monthly to the Norwegian Institute for Air Research (NILU) for the statistical evaluation and to DG XI for information.

The following parameters are measured:

- in air: O₂, NO, NO₂, O₃, and CO continuously; HCl, HNO₃, NH₃, non methane hydrocarbons, methane, peroxyacetyl nitrate (PAN) and organic acids occasionally;
- in atmospheric particulate: SO₄⁻², NO₃⁻, NH₄⁺, Cl⁻, TSP and acidity on daily basis; heavy metals are measured in 7 days samples;
- in precipitation samples (wet only): SO₄⁻², NO₃⁻, Cl⁻, NH₄⁺, Na⁺, K⁺, Ca⁺⁺, Mg⁺⁺, pH, electrical conductivity and strong acidity on daily basis; organic acids and heavy metals occasionally;
- meteorological parameters: direction and speed of wind, temperature and relative humidity of air, atmospheric pressure, rainfall and solar radiations continuously.

The detailed results of all collected data are reported in Annual Reports.

The pH-values of acid rain and the concentrations of the most important pollutants in air measured at the JRC-EMEP Station during the last five years calculated as yearly averages are reported in the Table below.

The reported data show that during the last five years the pH values are about constant, the SO₂ concentrations are decreasing, the NO₂ concentrations are slightly increasing, while the O₃ concentrations during the last three years are quite constant.

Determination of organic acids in air and precipitation:

Air sampled by a scrubber system has given concentrations of formic acid from 0.3 to 0.9 ppb and of acetic acid from 1.1 to 2.4. Day to day samples have shown variations from 0.1 to 0.6 ppb for formic acid and from 0.7 to 6.1 ppb for acetic acid with an average of 0.3 ppb for formic acid and of 2.1 ppb for acetic acid.

The concentration in rain samples was between < 0.1 and 0.8 ppm for formic acid and between < 0.1 and 1.1 ppm for acetic acid.

Year	pH (precipitat.) yearly avg.	SO ₂ (air) yearly avg. µg/m ³	NO ₂ (air) yearly avg. µg/m ³	O ₃ (air) yearly µg/m ³
1986	4.27	10.9	19.8	-
1987	4.42	10.8	27.9	-
1988	4.41	8.1	25.6	44
1989	4.46	9.4	30.2	42
1990	4.46	6.0	29.9	41

Further information can be obtained from:

- G. Serrini, Tel. +39 332 789977
- W. Leyendecker, Tel. +39 332 789419
Environment Institute, CEC-JRC Ispra, I-21020 Ispra (VA).

EC Regulatory Action

Most of the EC regulatory action on air, managed by DG XI, has been treated in preceding Environmental Research Newsletters (see for instance ERN N° 5). The information hereafter gives the most recent developments of a directive proposal regarding the incineration of hazardous waste.

EEC Policy on the control of Atmospheric Emissions from Waste Incineration

In 1989, the Community adopted two directives on the prevention and reduction of air pollution from new/existing municipal waste incineration plants (89/369/EEC and 89/429/EEC).

To complement the environmentally safe manner of eliminating waste, the Commission is preparing a proposal to set out the necessary provisions to prevent or minimize as far as possible the negative impact resulting from the incineration of hazardous waste. The incineration of such waste may cause harmful emissions in particular organic compounds, HCl, HF and heavy metals or dioxins and furans which are considered highly dangerous. Given this harmful pollution potential, adequate measures based on the latest developments of prevention/reduction techniques have been taken into account.

It appears not to be appropriate, for the time being, to fix a legally binding emission limit value for dioxins and furans in the directive proposal, since it is not possible to measure these emissions continuously with the measurement technique yet available. The directive proposal will provide for a specific obligation to minimize the emissions of dioxins and furans as far as possible by using progressive techniques and to make every effort not to exceed a guide value of 0.1 ng Toxic equivalent/m³.

Technique to reduce dioxins and furans below this limit exists at present time.

For other pollutants, very stringent emission limit values are set in the directive proposal.

In the last few years, the development of reduction techniques in the field of waste incineration has progressed rapidly, therefore the directive proposal intends and rewards the dynamism of technical progress not only by requiring that stringent emission limit values are respected, but also by requiring the use of recently developed techniques which are appropriate to prevent environmental pollution.

In order to control the destruction of organic compounds, operation parameters (e. g. temperatures, oxygen concentration in the exhaust gas, ...) will have to be measured continuously.

As a matter of principle, the incineration of hazardous waste should not be limited to specifically designed installations, provided that appropriate precautions are taken in such a way that the same environmental protection is guaranteed. However, a minimum quantity of dangerous waste being burnt as additional fuel will be set.

Apart from specific information and reporting to the Commission, Member States will have to ensure public information on the incineration of hazardous waste and the emissions therefrom as well as on the impact assessment to be carried out before granting the permit and the results on monitoring.

Further information can be obtained from:

- P. Stief-Tauch, DG XI/A3, CEC, 200 rue de la Loi, B-1049 Brussels, Tel. +32 2 2351050.

Industrial Risk

EC Research Programme and Support Activities to the Commission

This theme includes researches on Major Technological Hazard, which are managed by DG XII/E, as well as researches on Industrial Hazard, which are carried out at two Institutes of the Joint Research Centre. The main features of the two closely linked research lines have been presented in Environmental Research Newsletter N° 5 (June 1990). In this issue emphasis is put on the most significant progress accomplished at the Institute for Systems Engineering and Informatics and at the Institute for Safety Technology as far as it concerns both the direct research and the activity in support to DG XI regulatory action.

1. Activities at the Institute for Systems Engineering and Informatics of the JRC Ispra

1.1 Risk and Reliability Analysis of Complex Plants

The STARS Project

The STARS project (Software Tools for Analysis of Reliability and Safety) aims at assisting risk and reliability analysis of plant, in the process industries, in power generation and in other types of complex electro-mechanical installations. The project, started in 1989, is planned to end in 1992.

The objective of the STARS project is the creation, maintenance and use of a living safety-oriented plant model. The intention is to represent the knowledge, the models, the input data and the assumptions which go into a risk or reliability analysis of a plant in an explicit, declarative, and consistent format. The model, thus, created is then used by different reasoning modules and calculational tools to produce different types of analysis. As the model evolves, both with plant modifications and with the results of further reasoning, calculation, or operating experience, these are incorporated into the plant model.

While the conception of STARS starts off with an integrated set of software tools for the initial design-time activities of risk and reliability analysis, the aim of the project is much more ambitious. Once a STARS model has been constructed for a plant, it can be used dynamically as a decision support system, i.e. different design alternatives or maintenance policies can be compared, and safety analysis can be carried out under different hypotheses, investigating for example the impact on safety of taking a certain subsystem out of service, given the current plant configuration.

The architecture of STARS consists of four knowledge bases and a number of software modules which, although they can be used independently, are designed to cooperate in an integrated software package in order to ensure coherence and ease of use. The activities supported cover most of the tasks involved in plant safety and reliability analysis.

The main ones are:

- Plant description
- Hazard identification
- Model analysis
- Physical effects analysis
- Consequence (vulnerability) analysis

Participation in the STARS project can be either full or partial. The full participants, in addition to the JRC-ISEI, are three:

- The National Research Laboratory of Denmark (RISØ)
- The Technical Research Centre of Finland (VTT) and
- the company TECSA spa, based at Bergamo in Italy.

Other organisations, whether research centres or industrial companies, wishing to take part in the project may become affiliates by contributing a modest amount of resources, either in form of manpower under the overall direction of the project manager or with a direct financial contribu-

tion. In return for this contribution, affiliates are entitled to use all the tools and knowledge bases developed in the project as soon as they are released. The current list of affiliates includes:

- the TNO department of occupational safety in Holland
- Asea Brown Boverly in Sweden
- Framatome in France
- Neste Oy in Finland.

Further information on STARS can be obtained from:

André Poucet, Institute for Systems Engineering and Informatics, CEC-JRC Ispra, I-21020 Ispra (Va), Tel. +39 332 789604, Fax +39 332 789472.

The FORMENTOR Project (Eureka N° 19)

The FORMENTOR project aims to take the STARS concept of a "living" safety-oriented model one step further by using the knowledge held in such a model in real time, so as to support the plant operators in keeping the plant under control. The objective of this project is, therefore, to develop a real time expert system capable of:

1. early detection of situations where the plant is deviating from its normal behaviour and is moving in a direction that could eventually lead to an accident;
2. generation and testing of action plans to return the plant to safe operation;
3. predicting the further evolution of the plant state under different hypotheses;
4. helping the operator to choose the most appropriate action plan, by explaining the consequences of different actions and justifying its explanations in a fashion consonant with the operator's understanding of the plant.

It will be seen that the users of a FORMENTOR system are plant operators rather than safety engineers or designers. This fact, along with FORMENTOR's real-time requirements, has important consequences, in particular on the style of user interface and form of representation of the target plant to be used. The FORMENTOR project is therefore currently studying these questions from two points of view: On the one hand theoretical studies are under way on both the user interface requirements and the target system representation language, while simultaneously two pilot applications are being developed. One of these is being undertaken in France; the target system involved is a satellite cryostat, and the application covers the safety aspects of the maintenance and of the liquid helium changing phase in the cryostat during ground operations. The other application is being carried out on a chemical plant in Scotland and covers various aspects of the operation of a butadiene plant. Once these two applications have started to produce their first results in terms of user requirements and functionalities needed, these will be fed into the construction of the first version of the FORMENTOR generic toolkit, which will in turn be used to construct full-scale applications.

The members of the FORMENTOR-Eureka Consortium, in addition to the JRC-ISEI, are:

- Cap Gemini Innovation, France
- Aerospatiale, France
- Det Norske Veritas, Norway.

Further information can be obtained from:

Neil Mitchison, Institute for Systems Engineering and Informatics, CEC-JRC Ispra, I-21020 Ispra (VA), Tel. +39 332 789637 Fax +39 332 789472.

1.2 Territorial Risk Management

Decision Support Systems for Territorial Risk Management

Decision support systems and methods for multi-criteria decision aids have been studied during several years. In 1990 new relevant mathematical models of decision processes were investigated related to "preference elicitation" including both interactive methods and outranking methods.

The existence of a mathematical analogy between the problem of the aggregation of quality parameters and the application of multi-criteria decision analysis has been investigated, indicating that a new formal approach could be useful to experts in the relevant field.

Studies on territorial risk management dealing with industrial impact were initiated. The aim is to compare heterogeneous effects such as major hazards, pollution of air, water and soil, negative effects on the landscape, public opposition, etc.

Methodological work has started for the improvement of sociological studies in the area of risk management. Protocols will be developed and empirically tested cross-culturally in order to provide effective research tools. These will enable the availability of reliable and comparable sociological data from different countries and various socio-cultural settings. The results of this work are a necessary step to enhance effective risk management.

In 1990 two main application projects have been started in collaboration and with the partial financial support of the Italian Ministry for the Environment:

RITO (Rifiuti Tossici)

The RITO project concerns the development of a computerised Decision Support System (DSS) for the management of toxic industrial wastes on regional scale, providing for the disposal of all the wastes within the same region in which they are produced. The most important methodological aspect is the integration between a DSS and a Geographic Information System (GIS). In the specific case this integration is performed with two different commercial GIS (Geoscope and Intergraph-Microstation) with a very powerful and interesting outcome for informatics systems dealing with territorial management. The system is integrated in a shell, thus, allowing windowing of the different modules.

MAPO (Master Plan of the Po River)

The MAPO project concerns the development of a computer based Decision Support System (DSS) to assist management, planning and control of the activities in cleaning up a large river basin, i.e. that of the river Po in Northern Italy. The DSS will be implemented on a workstation and will be in communication with a remote Information System (IS) containing all the data. From a methodological point of view the networking of DSS and IS and the development of an input control module for checking the quality of data are the more relevant results so far. Moreover, an expert system is being built for the construction of scenarios, which uses different input and knowledge. The system will employ a user friendly graphical interface and it will permit the integration of programme modules from various sources and written in different programming languages.

Transportation Risk Management

During 1990 an important study of historical accidents in relation to transportation of hazardous materials was carried out, and the results indicate that the consequences of transportation accidents are as severe as for fixed installations.

Consequence models to be included in transportation risk modelling were studied in detail, and an analysis of the special requirements for transportation was performed.

In 1989 a Transportation Risk Management system (TRIM) was developed and in 1990 this was improved by including a new geographical database for the Italian Region Lombardy, and work was begun on a very detailed database for the road network from one of the member states (Denmark), to test the quality of input and output needed for the TRIM system. TRIM evaluates accidents in terms of accident frequencies and their respective frequencies. For evaluating the consequences TRIM uses a simple model, which at the moment can handle accident involving toxic gases. The frequencies are evaluated based on a base frequency for road and rail accidents (per kilometer), combined with specific conditional probabilities for rupture of various containers included in the model.

A first analysis of the actual road traffic of hazardous materials in one member state (Italy) was carried out, and the results documented in an internal report. The preliminary studies indicate that approximately 6% of the goods transported by road are hazardous.

Further information can be obtained from:

Palle Haastrup and Massimo Paruccini, Institute for Systems Engineering and Informatics, CEC-JRC Ispra, I-21020 Ispra (VA), Tel. +39 332 789083 and +39 332 789302, respectively.

1.3 Risk Assessment and Environmental Impact Assessment Procedures

Procedures for Risk Analysis

The project Benchmark Exercise on Major Hazards Analysis has been finalized. As already described in Environmental Research Newsletter N° 5 (June 1990), it was aimed at evaluating the state of the art in risk analysis, assessing available models and procedures, and estimating the degree of the associated uncertainties. The reference object was an ammonia storage facility including a sea terminal, a refrigerated storage, an underground pipeline and a pressurized storage. Eleven European teams representing control authorities, research organizations, engineering companies and industries were involved.

The final reports are now available.

To assess systems reliability and to evaluate the frequencies of malfunctions via the Fault Tree Technique, the ISPRA computer code (Interactive Software Package for Reliability Analysis) has been developed and released for use on IBM-compatible personal computers. This is the new version of the previous SALP-PC code. It is completely interactive and provided with a powerful user friendly interface. Allowed logical operators are: AND, OR, NOT, K/N, XOR and INH. The code also allows easy treatment of boundary conditions, sensitivity analysis and reproduction of fault trees in graphical form on printers and plotters.

Further information can be obtained from:

S. Contini, Institute for Systems Engineering and Informatics, CEC-JRC, I-21020 Ispra (VA), Tel. +39 332 789207, Fax +39 332 789007.

Environmental Impact Assessment (EIA)

In addition to risk, other uncertainty measures are of relevance when dealing with environmental impact of hazardous chemicals. Therefore the activity on risk assessment has been extended to the study and application of indicators/indices of environmental quality impact: some first results are being achieved on fuzzy sets methods to compare and combine physico-chemical and biological water quality indicators. Even the use of lichens as indicators of cumulative pollution is under investigation.

Finally a new concept of expert system for EIA studies is being developed.

A comprehensive overview of the state of the art in the field has been achieved through the Workshop on "Indicators and Indices for Environmental Impact Assessment and Risk Analysis" held at Ispra on 15 and 16 May, 1990. The proceedings contain four main sections: Case Studies; Indicators and Indices for Air, Water and Soil; Use of Environmental Data; Routine and non Routine Risk.

Finally in the framework of the EURO COURSE programme a course on Environmental Impact Assessment is scheduled at Ispra for 30 September - 4 October, 1991. The aim of this course is to present methods and approaches to make efficient and transparent the overall cognitive process feeding EIA studies. In addition to the topics already dealt with by the workshop, methods for dealing with uncertainties and formalizing the use of expert judgment, techniques for risk communications and models for environmental management and decision making will also be discussed.

Further information can be obtained from:

A.G. Colombo, Institute for Systems Engineering and Informatics, CEC-JRC Ispra, I-21020 Ispra (VA), Tel. +39 332 789406, Fax +39 332 789007.

2. Activities at the Institute for Safety Technology of the JRC Ispra

Industrial safety research at the Institute for Safety Technology is concerned with process and equipment failures within the chemical industry. A deterministic approach is adopted and interest is focused on the

analysis of transport phenomena associated with the following sequence of failures and accident events:

- Anomalies in the operation of a batch-type chemical reactor leading to thermal runaway.
- Emergency pressure relief and fluid discharge from chemical reactor vessels and storage vessels to dump tanks.
- Performance of downstream equipment following emergency relief.
- Release of hazardous fluids from the equipment.
- Dispersion of a dense vapour cloud in the environment.
- Combustion and explosion of flammable substances.

In this frame 4 research activities are underway: Runaway reactions in batch reactors, Emergency pressure relief from reactor vessels, Modelling of dense vapour cloud dispersion, Numerical simulation of reacting gas flows.

2.1 Runaway Reactions in Batch Reactors

The general objective is:

- prevention of runaway by development and testing of early-warning techniques and improved control systems;
- assessment of techniques to stop an ongoing runaway event.

The work concentrates on experimental investigations in the 100 l reactor FIRES (Facility for Investigating Runaway Events Safely) and in small calorimeter equipment. For guiding and analyzing the experiments use is made of the mathematical simulator FISIM.

The assembly and characterisation of key elements of the FIRES facility, including commissioning of control and data acquisition systems and preliminary experiments to calculate heat capacities, heat transfer coefficients, heat losses, and stirring effects in the reactor vessel have been carried out.

Neutralisation experiments involving hydrogen chloride and sodium hydroxide were carried out in semi batch mode to study the dynamic behaviour of FIRES and to adjust FISIM.

A start was made with esterification reaction experiments between 2-butanol and propionic anhydride in collaboration with the UK Health and Safety Executive, Buxton Laboratory. Experiments in the reaction calorimeter (RC1) and in the adiabatic vent sizing calorimeter (PHI-TEC) were performed to obtain kinetic data and investigate runaway reaction phenomena, and early warning detection techniques.

Similar experiments were subsequently performed in FIRES. Data from these experiments are now being used to validate scaling criteria for heat transfer and runaway reaction prediction, and to assess the reliability of data obtained using different thermo-analytical techniques such as DSC, ARC, PHI-TEC, and RC1.

Small scale toluene nitration experiments were pursued as preparative work for the experiments in FIRES. The influence of the operating conditions (concentrations, stirrer speed, starting temperature, stream feed, etc.) in normal industrial conditions has been studied.

2.2 Emergency Pressure Relief from Reactor Vessels

The objective of this work is to assess and further improve methods for the design of emergency pressure relief and fluid discharge systems. Experimental work regards investigations in the MPMC (Multi-Phase Multi-Component) test facility (a 50 litres discharge vessel connected by a ventline to a 1 m³ catch tank). Modelling work comprises assessment of the DIERS methodologies and development of the computer program RELIEF.

The MPMC test facility has provided very interesting experimental data on the venting of flashing high-viscosity fluids and chemically-reacting fluids (hydrogen peroxide decomposition). Additional flow visualisation tests have revealed the complex flow phenomena occurring during the venting of such fluids and have provided some of the necessary insight for development of analytical models. New and simple design methods have been developed for use by industry. The experimental data are being used to validate the computer program RELIEF. Current modifications to the MPMC facility will allow more detailed measurements and work in the near future will include studies of venting of long horizontal vessels, flashing flow through safety devices (pressure relief valves, rupture discs) and some larger-scale tests for validation of design methods and the RELIEF code for application to industrial-size systems.

In the framework of the emergency pressure relief system design methods, an assessment of the DIERS simplified formulations has been performed through comparisons between calculations made with this method and with the US vent sizing computer code SAFIRE. In the range of overpressures currently allowed (15%-25% of the set pressure) the results obtained were found in satisfactory agreement.

The RELIEF code models the transient behaviour of a chemical tank reactor during the emergency relief phase of a thermal runaway event. The development phase of the preliminary version of RELIEF treating the fluid dynamic behaviour one-dimensionally has been completed. Phase equilibrium is governed by ideal gas and liquid behaviour. An arbitrary number of chemically reacting components can be modelled. The chemical reaction is restricted to the liquid phase and the component concentrations and temperature are assumed to be axially uniform but time varying. Tempered, gassy and hybrid systems have been studied.

Work on an input processor to increase the ease and flexibility of use is at an advanced stage. Application of the developed techniques has led to the formulation of a new critical flow model that describes the flow of a multicomponent chemically reacting fluid in the vent line. This model could have important applications for predicting the behaviour of gassy type systems (e.g. exothermic decomposition of peroxides), where no evaporative cooling takes place.

Development and testing continues of an advanced version of RELIEF which models the chemical behaviour as well as the fluid dynamic behaviour fully one-dimensionally. This version will assess the validity of the assumption of axially uniform component concentrations for a given venting scenario. It will also enable other types of problems to be studied where thermal propagation phenomena are important.

The intention is to put the code RELIEF at a later stage at the disposal of the European Chemical Industry with the aim to facilitate implementation of the Seveso Directive. A way to achieve this is that personnel from chemical industry be seconded to Ispra to help orientate the validation exercise to areas of industrial relevance.

2.3 Modelling of dense vapour cloud dispersion

The objective is to provide enhanced numerical methods to predict the behaviour of denser than air vapour clouds in irregular terrain with obstacles. Both the quasi-instantaneous release resulting from the complete failure of a containment structure and the more frequent small-scale continuous release are considered.

Research concentrates on the application and further development of the 3-D finite volume code ADREA-HF and a simpler intermediate computation model (based on the shallow layer approach). The work is performed in the frame of a collaboration with the Centre Demokritos of Greece and in association with the ongoing and future Shared-Cost Action programmes on Major Technological Hazards.

The work on the ADREA-HF code has focused on the Thorney Island field test number 8, which consisted of an instantaneous release of ca. 2000 m² dense gas with a subsequent dispersion over a flat, unobstructed terrain. The simulations were performed using four different turbulent schemes, with increasing complexity: from a simple 0-equation model to the default k-l model of the code. The influence of several other parameters on the cloud dispersion has also been investigated: atmospheric stability conditions, turbulence length scales, turbulence source terms, etc. The conclusions drawn from the comparison between the calculated results and the experimental data indicate that the future work should be directed towards an improvement of the predicted cloud arrival time and peak concentration.

A 1-D version of the shallow layer model has been developed with the capability of describing a 3-dimensional cloud by integration over the cloud height and width. A comparison with the field test mentioned above has been initiated. The results from a recent series of 2-D wind tunnel experiments with an impermeable wall has been well predicted assuming a very simple relationship for the increase in the entrainment velocity due to the obstacle.

Planned activities include completion of the 1-D shallow layer in order to make it available for the industry, and introduction of a droplet dynamics model in the ADREA-HF code. The latter activity is connected to the planned ammonia release field experiments, to be performed within the Shared-Cost Action programme STEP.

2.4 Numerical Simulation of Reacting Gas Flows

The numerical simulation of multidimensional flows with chemical reactions is a rather new activity within the frame of the Industrial Safety

programme of the JRC Ispra. The objective is to provide computational tools addressing the following problem areas:

- accidental situations where deflagration/detonation processes are of major concern: e.g. combustion of vapour clouds propagation of flame fronts and of detonation/blast waves in an industrial environment;
- optimization of combustion processes with respect to energy saving and reduction of pollutant emissions, e.g. NOx.

The development work, started end of 1989, resulted in a computer program for the simulation of two-dimensional transonic flows of chemically reacting fluids. Particular attention has been devoted to the selection of an appropriate numerical solution strategy. The method applied belongs to the class of high resolution techniques which allow the accurate capturing of flow discontinuities. Due to the use of unstructured grids, a large flexibility exists to represent complex geometrical boundaries. Confined as well as external flows with obstacles can be described. The numerical results obtained so far indicate a clear superiority of the chosen concept over standard numerical techniques.

Future work will concentrate on improved modelling of physical processes (turbulence models for compressible reactive flows) and on introduction of new numerical algorithms (adaptive grid management, implicit flow solvers).

2.5 Eurocourse on "Safety of Chemical Batch Reactors and Storage Tanks"

This course was held at Ispra during the period April 15-19, 1991. The course lectures have been published in a volume by Kluwer Academic Publishers, Dordrecht (Editors: A. Benuzzi and J.M. Zaldivar); EUR 13437, 1991.

Further information can be obtained from:

R. Nijssing, Institute for Safety Technology, CEC-JRC Ispra, I-21020 Ispra Tel. +39 332 789306, Fax +39 332 789648.

3. Support Activities

3.1 Support to the Implementation of the Seveso Directive (82/501/EEC)

The Community Documentation Centre on Industrial Risk (CDCIR)

The CDCIR documentation centre is becoming the "core" for exchanging information and comparing national approaches for achieving a harmonised safety regulation.

The principal CDCIR activities have been:

- the acquisition and the classification of about 1000 relevant documents.
- Bulletins are being regularly issued and distributed to about 500 interested organizations.
- The centre has been provided with recorders, TV set, dias display, etc. to be able to show videos of accidents or other relevant illustrative material.
- A service for responding to the request of information by external users is being organized.
- The publication of comparison studies on national approaches and safety regulations.

Major Accident Reporting System (MARS)

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

The analysis of the accidents notified to the Commission has now resulted in a comprehensive report on "Lessons Learned". Since this includes main statistical data, and analysis of causes and measures for preventing recurrence of accidents, purged from confidential information, it could be released to a much wider community of those involved in plant safety. The study confirms the role of managerial and organizational failure as the root causes of the large majority of accidents.

Other results

Other activities have been directed to increase the knowledge base of the Community by analysing relevant national experiences.

A detailed comparison of national approaches to the safety notification has been included for diffusion into the CDCIR. A first study on the experience gained by handling chemical accidents emergencies in the U.K. has been completed. Similar studies are being finalized for other countries.

Another topic of major relevance of the Directive is informing the public about the risks of accidents. In this domain studies have been promoted, following the main indications of the Varese Conference. The results on a pilot study on risk information needs in the vicinity of hazardous installations are now available.

Further information can be obtained from:

A. Amendola, Institute for Systems Engineering and Informatics, CEC-JRC Ispra, I-21020 Ispra (VA), Tel. +39 332 789350, Fax +39 332 789007.

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

Within the framework of the project Biotechnology carried out at the JRC by the Institute for Systems Engineering and Informatics (ISEI), in support of the DG XI, action oversighting the recently adopted Directives on the contained use of Genetically Modified Micro-organisms and on the deliberate release into the environment of Genetically Modified Organisms, a Eurocourse has successfully been promoted in Ispra from 4 to 7 June, 1991.

The course, entitled "Scientific-technical Backgrounds for Biotechnology Regulation" gathered lecturers from research institutes, bio-industries and regulatory bodies to cover their specific areas of interest with an emphasis on the risk/safety aspects of biotechnology. The initiative developed with the participation of lecturers from the CEC-DG III, V, XI and XII, from the US Environmental Protection Agency, the European Patent Office, from European and US universities, and from national industries and multinational corporations.

The main goal to induce a first confrontation between the biotechnologists engaged in R&D and large scale production work and the regulators responsible for the implementation of norms and codes of practice was indeed fulfilled. The attendants to the course expressed their appreciation in having been exposed to presentations of the crucial topics in the use of genetic engineering from the specific standpoints of these different branches of biotechnology operators: those who were developing new methods and commercial applications and the civil servants in charge of ensuring the safe progress and the public consent of this activity.

Further information can be obtained from:

F. Campagnari, Institute for Systems Engineering and Informatics, CEC-JRC, I-21020 Ispra (VA), Tel. +39 332 789350, Fax +39 332 789007.

EC Regulatory Action

1. Industrial Risk

As previously described, the EEC forth Environment Action Programme (1987-1992) pays particular attention to the prevention of Industrial Accidents (OJ No C 328, 7. 12. 1987) via the implementation of the Council Directive 82/501/EEC on the major accident hazards of certain industrial activities. In addition Council Resolution of 16 October 1989 on guidelines to reduce technological and natural hazards (OJ No C 273, 26. 10. 1989) further invited the Commission to focus on certain issues in respect of the Directive.

Since the Resolution by Council the Commission has carried out a comparative study on national approaches to the safety reports required by Article 5 of the Directive and, in cooperation with Member States, held a workshop on specific aspects of safety reports relating to liquified petroleum gas (LPG).

The Commission is now fully involved, in cooperation with the competent authorities responsible for the implementation of the Directive, in a fundamental review of the whole Directive. The aims of the review are to simplify the application of the Directive, introduce a requirement for Land Use Planning controls at and around hazardous installations, and to introduce aspects relating to "Human factors" into the safety report in particular.

In embarking upon the review the Commission has recognised the changing nature of industry, the increasingly urgent needs to provide the latest techniques to protect the environment and the wish to maintain the Directive's position as one of the leading international instruments in Major Accident control.

In addition to the work on Council Directive 82/501/EEC the Commission is working on a new proposal to introduce a framework for environmental auditing of certain industrial activities. The work is at an early stage but

already it is clear that this important new field is an area of work which will create both a means for industry to demonstrate what it is doing to improve its environmental controls and to inform the public of the environmental performance of participating companies.

Further information can be obtained from:

R. Delogu, DG XI/A/2, CEC, 200 rue de la Loi, B-1049 Brussels.
Tel. +32 2 2357172.

2. Biotechnology

After more than one year after the adoption of the two Council Directives for biotechnology on 23 April 1990 (Directive 219/90/EEC on the contained use of Genetically Modified Micro-organisms (GMMs) and Directive 220/90/EEC on the deliberate release into the environment of Genetically Modified Organisms (GMOs)), preparatory meetings of DG XI officers with the delegations of national experts take place regularly. The two Directives shall be transposed into national legislation not later than 23 November 1991. These meetings serve as guidance for the interpretation of the various provisions in the articles and the annexes of both Directives, in order to be correctly integrated in the norms issued by the competent authorities of the Member States.

Further information can be obtained from:

F. Campagnari, Institute for Systems Engineering and Informatics, CEC-JRC, I-21020 Ispra (Va), Tel. +39 332 789350, Fax +39 332 789007.

Waste Management and Technologies for Environmental Protection

EC Research Programme and Support Activities to the Commission

The reader has to refer to Environmental Research Newsletter N° 5 for detailed information on both the activities managed by DG XII/E and the research programme carried out at JRC-Ispra.

In a general way it can be recalled that the aim of the above activities is the development of suitable techniques and technologies for the prevention, limitation and abatement of pollution and for the rehabilitation of contaminated environments.

In the following the most recent progress accomplished in Waste Research, in Pollution Reduction and in EEC Regulatory Action is reviewed.

1. Waste Research

1.1 Shares-cost contacts Call for proposals

Technology for Environmental Protection (STEP-Research Area 8) and Recycling Waste (REWARD)

This area is considered as part of the basis for future research activities on Technologies for protecting and rehabilitating the environment. Research concerned with the treatment and disposal of toxic waste and of liquid effluents and the recycling of urban and industrial wastes (presently REWARD) will be complemented by the

development of low-emission and low waste technologies for industrial sectors.

A total number of 195 proposals for STEP-Research Area 8 was received following the call for proposals launched on 30 December 1989 and closed on 30 March 1990 (O.J. N° C 326 of 30.12.1989).

Projects proposed on **Waste Research** concentrate on toxic and dangerous wastes and more specifically on new processes for treatment (15% of the proposals), safe disposal of waste and risk assessment (20%) and remediation (12%). Six projects were retained for cost-shared contracts on:

- industrial toxic waste treatment,
- assessment and improvement of biotechnological process for rehabilitation of contaminated soils,
- factors controlling the migration and attenuation of priority pollutants in landfills pollution plumes,
- mechanisms, quantification and impact of pollution generated by existing and abandoned disposal sites,
- rehabilitation of contaminated soils and waste materials; bio-leaching and biosorption of metal,
- genetic engineering of a halohydrolyase for the treatment of chloro-acetate toxic waste.

Emission abatement was the subject for 28% of the proposals on **Waste water treatment** with eight projects retained for cost-shared contracts on:

- xenobiotic degradation by bacteria,
- feasibility of using artificially immobilized bacteria for waste water treatment at low temperatures,
- removal of inorganic nitrogen compounds from waste and potential drinking waters using immobilized micro-algae,
- optimization of biological processes for conversion of nitrogen aqueous pollutions,
- biotechnological process control of chlorinated solvent - contaminated water and air emissions,
- detoxification of effluents by photocatalytic science and engineering (DEPSE),
- optimization of water treatment by TiO₂-photocatalyse degradation of pollutants to satisfy EEC standards,
- up-grading and innovation of trickling filters in response to new EEC environmental guidelines.

and 15% on **abatement of emission to atmosphere** with 4 projects retained for cost shared contracts on:

- optical probes for emission reduction and analysis (OPERA),
- gazification of waste preserved wood impregnated with toxic organic and/or organic chemicals,
- improved control of the chemical and physical processes in incineration and gasification,
- the abatement of large intractable organic emission sources by the use of biological process.

Only 8% of the proposals were presented for **Clean Technologies** and one project was retained on:

- the replacement of perchlorethylene by non-toxic solvents in full-width solvent scouring of fabrics.

One can notice as a result of this call for proposals that an emphasis is put on improvement of waste water treatment and safe disposal of toxic and dangerous waste and its assessment, while clean technologies seem to give place in the future to low waste technologies.

For REWARD only 5 topics of Research Area 2 "Recycling Technologies" were subject to cost-shared contracts:

Separation and Recovery Processes and Process Optimization, where 44% of the total number of 82 proposals were submitted; two projects were accepted for cost-shared contract:

- investigation into the suitability for recycling of engineering plastics for commercial durables,
- use of chemical markers to enable identification and separation of different plastics from mixed plastics wastes

Up-grading and end-use of reclaimed products: 42% of the proposals were presented in this topic; eight projects were selected for cost-shared contracts on:

- production of sulfur from gypsum as industrial by-products,
- up-grading of PET X-Ray films,
- end-use and up-grading of mixed plastic waste from public, industrial and private collection and sorting,
- development of recycling of demolition waste,
- development of a model optimizing the re-use of building and demolition waste and reducing the environmental impact of this waste,
- utilization of mycellum as by-products from fermentation to extract metals from industrial effluents.

Only 1 proposal was made for the **development of appropriate sensors for process and product quality control**, and 2 on **development of cost-effective low-emission techniques for the extraction, containment and possible re-use of valuable products** and 8% of proposals were dedicated to the **Production of chemicals from specific organic waste** with one project accepted for cost-shared contract:

- production of chromophoric support materials from Prawn and Crab-shell waste.

Further information can be obtained from:

P. L'Hermite, DG XII/E 1, CEC, 200 rue de la Loi, B-1049 Brussels. Tel. +32 2 2355163.

1.2 Concerted Action "Treatment and Use of Sewage Sludge and Liquid Agricultural Wastes" - COST Project 681

As announced in Environmental Research Newsletter N° 5, a Symposium has been organized by the Commission of the European Communities,

Brussels, Directorate General XII "Science, Research and Development", Division "Environmental and Waste Recycling", and the National Technical University of Athens (NTUA), Division of Water Resources, within the framework of the Concerned Action "Treatment and Use of Organic Sludge and Liquid Agricultural Wastes" (COST 681).

The Symposium took place from 1 to 4 October 1990 in the War Museum, Rizari and Vassilissis Sofias Avenue, Athens.

The aims of the Symposium were:

- to update the knowledge in this area of research,
- to set up precisely the gaps still existing for identifying the issues with the ungoing and future problems,
- to select the subjects to be treated on these basis in order to obtain the best return in the exploitation of the results.

The final goal was to re-dimension the fears of public concern.

Priority was given to the following topics:

- analysis, behaviour and fate of organic micropollutants,
- risk assesment of organic micropollutants; state-of-the-art and recommendations for the future,
- long term effects in connection with the use of sludge and effluents from livestock and concepts for their agricultural use taking account of the changes in agriculture,
- alternative treatment and recycling processes for sludge: and slurries including transport problems,
- economics of treatments of sludge and slurries and their control,
- identification of the real risk and the new problems.

These topics were treated along five sessions:

- Technical and Economic aspects of treatment and disposal of sewage sludge and slurries (6 papers presented),
- Long-term Environmental Wastes (5 papers),
- Analysis and risk assessment of Organic Micropollutants (5 papers),
- Risk assessment of the Occurrence of Pathogens in Sewage Sludge and effluents from Livestock (6 papers)
- Implementation of Regulations, Practical Experiences and Public Perception (6 papers).

In addition 42 posters were exposed.

In order to avoid unnecessary repetition in reviewing work done by the working parties and produce as uninspiring agenda, the favoured approach of the Scientific Committee was to have invited papers from outside and within the COST structure to highlight what had been achieved and what gaps still exist in knowledge.

A review of the research work implemented by the five working parties and their results since 1972 will be annexed to the proceedings of the Symposium which constitute the final Scientific Report of Concerned Project COST 681 "Treatment and use of organic sludge and liquid agricultural wastes".

Further information can be obtained from:

P. L'Hermite, DG XII/E1, CEC, 200 rue de la Loi, B-1049 Brussels. Tel. +32 2 2355163.

1.3 Chemical Waste Research at the Environment Institute of the JRC Ispra

Development and Evaluation of a Mobile Analytical Laboratory

The project in the framework of Eureka activities intends to develop and to evaluate a mobile analytical laboratory capable of performing "in field" sampling and analysis of waste, soil, soil-air and water contaminants including sediments and suspended particles.

The mobile analytical laboratory is expected to be relevant for the control and monitoring work carried out by private and public environmental bodies at national and international levels.

The following potential work areas are considered, in terms of management of accidents, spills and contaminated sites:

- emergency response, fast analytical screening;
- long term analytical support to reclamation of contaminated sites;
- preventive pollution control of soils, and of surface and underground waters;

- identification and characterization of contaminated areas.

The main advantages are:

- possibility to operate in remote areas;
- on site analysis without delivery of dangerous samples and preserving the representativity of samples (e.g. volatile compounds);
- rapid analytical screening in case of emergencies in order to support the implementation of mitigation procedures;
- immediate decisions.

Final goal of the project: to build up a prototype to demonstrate practical applications in field within two and a half years.

The need for analysis and the demands for answers are different for the different work areas mentioned above.

For the immediate emergency response there will be a need for rapid qualitative and/or semiquantitative data to provide a provisional characterization of the nature, the source and magnitude of the emergency accident.

One of the purposes of this will be to provide, by an initial analytical screening, data for the authorities to decide upon immediate actions and the need for further sampling and analytical capacity.

For the long-term actions, such as reclamation of contaminated sites and for preventive pollution monitoring, there will be a need for different types of screening analyses. The screening should be used as a tool for the initial localization and description of the extent of the contaminated area, for the development of sampling strategy and for decision makers at different levels.

The project will define which are the achievable detection limits for the most relevant pollutants present in different matrices and with which accuracy, precision and selectivity can be measured.

It is essential within the project to develop protocols for surface soil and water sampling and sample treatment to be performed by the mobile laboratory. This work will be based on internationally accepted standard methods and guidelines as well as the professional experience of the involved participants.

Underground soil samples will be taken by a special sampling equipment, to which some geochemical probes can be associated. The instrument, basically working as a penetrometer, consists of a rigid weight-driven rod injected into the soil; his efficiency is then depending on the nature of the soil. The possibility of completing this device with a geochemical probe to investigate interstitial pore water is being studied.

Sample treatment should be based on the recent development and should be as simple as possible, always taking into account the need for reliable analyses. Sample extraction and pretreatment schemes will be taken from standard methods and the international literature. From this sample treatment protocol will be developed for each matrix and type of compound.

It should be mentioned that details on sampling equipment and sampling procedures might be changed during the project.

Analytical equipments should be as simple and rugged as possible.

Many organizations contributed to define and agreed to participate to the project, in particular 3 Danish, 1 Dutch, 2 English, 3 Italian, 1 Russian and 1 International laboratories or industrial companies. The project coordination will be assured by the JRC-Ispira, assisted by a Steering Committee which will also consider the interest in the project expressed by other groups.

Further information can be obtained from:

S. Facchetti, Environment Institute, CEC-JRC-Ispira, I-21020 Ispira.
Tel. +39 332 789970.

2. Reduction of Pollution: Industrial Emission

The Ispira Mark 13A Process for Flue Gas Desulphurization at the Environment Institute of the JRC Ispira

The Ispira Mark 13A process

The subject matter process is an alternative flue gas desulphurization process which produces sulphuric acid and hydrogen instead of gypsum like the majority of to-day's industrially applied processes. The process was invented at the JRC Ispira in 1980 where also the laboratory and

bench-scale development work took place in the period 1980-1988. The Commission is strongly supporting the final stage of the project i.e. the design, construction and operation of pilot plant to desulphurise a flue gas throughput of 32,000 Nm³/h at the SARAS Refinery at Sarroch in Sardinia (Italy). JRC Ispira bears the responsibility for the technical supervision of this pilot plant project which is administratively under the responsibility of DG XIII Luxembourg.

The pilot plant in Sarroch was completed during the year 1988 and the start-up and operation phase started in the first months of 1989. The first year of operation was mainly dedicated to the testing of components (flowmeters, pumps, piping...) when the plant was in full operation for more than 2000 hours. Several problems with components were encountered during this phase. The most serious one was the untightness of the reactor piping circuit due to a supplier's error in the manufacture of the GRP flanges. It proved to be necessary to replace all flanges and a large part of the piping of this plant section. Also maintenance problems with the liquid circulation pumps and with liquid flowmeters occurred. Both problems were satisfactorily solved during the year 1990. It has to be noted that the main troubles occurred in classical equipment items, utilized in many similar industrial plants. These problems could not be attributed to intrinsic properties of the Ispira Mark 13A process. The solving of the aforementioned problems caused considerable delays in the performance of the experimental programme. The delays caused, on their turn, financial and organizational problems to the main contractor, Ferlini Technology, who decided during 1990 that he needed a partner with considerable chemical engineering experience for a successful termination of the contract. Consequently, work on the pilot plant project was temporarily suspended and new organization forms for the project are now under study.

A bench-scale plant of the Ispira Mark 13A process is in operation at the Environment Institute. This plant is mainly used to study specific problems for support of the pilot plant project, for example the testing of candidate electrolytic cells, the study of the effects of specific impurities in the flue gas etc..

A major problem emerged during 1990 was the fact that during the pilot plant operation an excessive HBr emission in the purified flue gas was observed (approximately 150 mg/m³). The problem may be caused by the formation of a stable aerosol of aqueous HBr during the condensation of saturated water vapour in the scrubber.

The possible formation, prevention and abatement of aqueous hydrogen bromide aerosols was studied in the bench-scale unit. During these experiments, it proved to be possible to reduce the HBr concentration in the purified flue gas to approximately less than 2 mg/m³ by prevention measures (increasing the efficiency of the reactor) without the application of special abatement equipment.

Removal of nitrogen oxides from flue gases

Besides the abatement of sulphur dioxide, the JRC conducts a research for the extension of the Ispira Mark 13A process to a combined desulphurisation-denoxing process.

Two possibilities are under study:

- catalytic reduction with hydrogen
- cathodic electrolytic reduction.

It appeared that the poisoning of the noble metal catalysts by remnants of sulphur dioxide was a decisive obstacle for the direct catalytic reduction. The mechanism of the poisoning was studied in detail. The conclusion was that adsorption and chemisorption of sulphur compounds on the active sites of the catalyst cause an irreversible deterioration of the catalytic activity. Consequently, the development of an industrial denoxing process based on the direct reduction of nitrogen oxides with hydrogen at low temperatures is not feasible.

The main step for the alternative electrolytic process is the absorption of NO in an aqueous Fe(EDTA) complex. The chemical equilibrium of this absorption was studied including the effect of remnant SO₂ on this process step. Subsequently, work was concentrated on the possible preparation of a stream of concentrated NO by desorption at higher temperatures, for instance by steam stripping. The production of gaseous NO in concentrations of more than 15 vol% could open the way to the development of attractive regenerative denoxing process alternatives.

Further information can be obtained from:

D. van Velzen, Environment Institute, CEC-JRC Ispira, I-21020 Ispira (Va), Tel. +39 332 789124.

EC Regulatory Action

The information given here updates the situation as described in Environmental Newsletter N° 5 (June 1990).

Implementing the Community Strategy for Waste Management

Council Directive 91/156/EEC amending Council Directive 75/442/EEC on Waste (OJ N° L 78, 26.03.1991).

Environment Ministers adopted on 18 March 1991 the "framework directive" on waste. This directive substantially modifies the existing directive. It introduces more precise definitions of wastes, disposal and recovery operations, extends the control and licensing requirements. Member States now have an obligation to create, in collaboration with each other, where necessary a sufficient disposal infrastructure which should allow to dispose of wastes near to their generation in installations respecting high environmental standards. The directive provides for additional rules to be adopted for specific types of waste and thereby sets a framework for further waste legislation.

Council Directive 91/157/EEC on used batteries and storage batteries containing certain heavy metals (OJ N° L 78, 26.03.1991).

Alongside with the framework directive, Council adopted on 18 March 1991 a first "daughter" directive on used batteries.

The Directive introduces a compulsory labelling scheme for certain types of batteries containing mercury, cadmium or lead. It prohibits the marketing of batteries containing more than 0.025% mercury as from 1.1.1993. It requires Member States to ensure that labelled batteries are collected and disposed of or recycled separately. To this end deposit schemes can be introduced. Since Council could not adopt the label at this time, it will be one of the first tasks of the technical committee established by the framework directive to decide on an appropriate labelling scheme.

Proposal for a Council Directive on Hazardous Waste (N° 4198/91 of 22.1.1991)

Council agreed on 21 December 1990 on the contents of this proposal which will replace Directive 78/319 EEC on toxic and dangerous wastes. The Directive is likely to be finally adopted in September 1991 after the European Parliament will have given its opinion on the modification by Council of the legal basis proposed by the Commission.

(100A - 130s). The most important modification introduced by this directive is a new definition of hazardous waste: a list or catalogue of types of hazardous wastes to be drawn up by the Commission with the Member States on the basis of three annexes defining the field of application.

New Proposals of the Commission

Proposal for a Council Regulation on the supervision and control of shipments of Waste within, into and out of the European Community (COM (90) 415 final of 26 October 1990).

This regulation is meant to replace the Council Directive 84/631/EEC on the control of transfrontier shipments of hazardous wastes. A modification has become necessary on the one hand because the implementation of the directive showed to be too divergent in Member States and on the other hand because the directive needed to be adopted to the Basel Convention signed on 22 March 1989 and because of the removal of border controls between EC Member States. The proposal for a regula-

tion implements directly the Basel Convention as far as movements involving third countries are concerned. Inside the EC it is proposed to control movements within a Member State in the same way as movements between Member States as soon as two competent authorities are concerned. As an important new feature the regulation should apply to all wastes rather than only to hazardous wastes. In addition it implements the prohibition of waste exports to ACP countries contained in the Lomé IV Convention signed on 15 December 1990.

Proposal for a Council Directive on the landfill of waste (COM(91) 102 final of 22 May 1991).

As a further step towards harmonization in the field of waste disposal the Commission has adopted a proposal for a directive aiming at harmonizing the requirements for the landfilling of waste. The proposal classifies landfills into three categories: inert waste, municipal waste and other compatible waste, and for hazardous waste and fixed conditions for the acceptability of wastes to each type of landfill. It lays down some design specifications, rules for licensing and managing landfill sites and for closure procedures and post-closure care.

Among the economic instruments applicable to the landfill of waste, the price to be charged in a landfill shall cover at least all the costs involved in this operation. Following this financial instruments shall ensure that there are sufficient funds available to cope with any possible damage to the environment. This is carried out through the financial guarantee during closure and aftercare operations and through the Landfill Aftercare Fund covering the normal aftercare costs and the expenses of the necessary prevention or clean up of damage caused by the landfill.

The operator of a landfill shall be liable under civil law for the damage and impairment of the environment caused by the waste.

Further information can be obtained from:

K. Rudischhauser, DG XI/A4, CEC, 200 rue de la Loi, B-1049 Brussels, Tel. +32 2 2355442.

Industrial Emission

Important projects currently in preparation for controlling industrial emissions:

- Incineration of hazardous wastes (directive proposal, to be presented to the Council in September 1991), setting emission and operating standards (for new and existing plants) as well as monitoring requirements; this directive needs to be completed later by appropriately defined measurement procedures and reference methods, particularly for dioxins and furans.
- Integrated industrial pollution control approach, considering emissions to air, water and land together so that the conditions set in a permit will reflect best environmental practice and the use of best available techniques. Specific details for particular industrial plants would be set out in future annexes. The monitoring of emissions will be important, which is also a feature of the
- Environmental auditing proposal, designed to encourage firms to audit their activities in an integrated way, considering waste recycling, raw materials use and other features, in addition to industrial emissions. Two types of audits are proposed: internal, by the firm, and external, by independent consultants.

Further information can be obtained from:

P. Stief-Tauch, DG XI/A 3, CEC, 200 rue de la Loi, B-1049 Brussels, Tel. +32 2 2351050.

Other Activities Relevant to EC Environmental Programmes

Protection and Conservation of European Cultural Heritage

Support of Pilot Projects for the Conservation of the Community's Architectural Heritage

The Commission of the EC (DG. X - Cultural Action) has established, since 1984, an annual scheme in favour of the conservation of architectural heritage.

Conservation does not only aim at the protection of architectural edifices or sites, but also at the achievement of socio-economic objectives. Better quality of life, the promotion of professional possibilities for the unemployed, development of regional and cultural tourism are only a few examples.

Within the framework of these objectives the Commission launched a four-year's programme in 1989, each year dealing with a specific theme as follows:

- 1989: Civil and religious buildings of exceptional importance.
- 1990: Historic buildings and groups of buildings which define and characterize an urban or rural pattern.
- 1991: Testimonies to production activities in industry, agriculture, crafts, etc.
- 1992: Upgrading of public spaces in historic centres as part of a restoration project.

The 1990 action focused attention on the architecture of our every-day environment: the centres of our towns which are very often forgotten and delapidated. Furthermore, it paid special attention not just to "monuments" in the classical sense of the term but also to groups or individual buildings and houses of traditional architecture.

The selected projects for 1990 offer a perfect illustration of the diversity and richness of architectural heritage throughout Europe: they demonstrate villages of "vernacular" architecture, built without architects, houses and public/private edifices characteristic of small towns.

Despite the restricted number of selected projects (26 out of 1138 submitted in 1990) due to the very limited budgetary resources available (2,6 MECUs for 1990), the Commission's action aims at encouraging similar pilot initiatives at regional, national and European level.

The 1991 scheme was launched last December (OJ N° C 304/4.12.1990) and has resulted in the submission of over 400 projects.

The final selection will be decided by the Commissioner Mr. Jean Dondelinger in June 1991, like in previous years on the basis of the advice of a jury of international experts in the field of architecture, archeology and restoration.

The 1992 scheme will be announced in the Official Journal of the European Communities before the end of this year (probably in September 1991).

Hereafter the list of the 1990 selected pilot projects in the different countries including date or period of construction and their typology:

- B Vormalig St. Jans Hospitaal, BRUGGE
Ancient Hospital
- B/L Vall. Belgo-Luxemb. de l'Attert, ATTERT-ELL-BECKERICH, 1800-1850
Traditional houses and chapels
- D Rysum, AURICH, 15 a. c. onwards
Rural village

- D Südlicher Brückenkopf, REGENSBURG, 1616-1620
Tower-gate at the entrance of the town and two storehouses
 - D Stadtturm, STRAUBING, 1316-1406; 1565-1581
Tower with clock
 - Dk Den Reformerte Kirke, KØBENHAVN, 1687
Baroque style church
 - E Paseo de Ronda de la Murallas, IBIZA, 1554-1585
Town defensive walls
 - E Barriada de S.ta Cruz, PALMA DE MALLORCA, 13 - 14 a.c.
Fishermen's ancient quarters
 - E Calle de Balborraz, ZAMORA, 12 and 15 a. c., 18 - 19 a.c.
Houses of an ancient street
 - F Place Ducale, CHARLEVILLE MEZIERES, ++ 1610-1625
Pavilions of Louis XIII style
 - F Jacquemart, LAMBESC, 1526-1545
Tower with mechanical and solar clocks
 - F Les Ursulines, MONTPELLIER, 14, 17, 18 and 19 a.c.
Ancient monastery and prison buildings
 - GR Varossi's Neighborhood, IDESSA, 19 a.c.
Traditional dwelling quarters
 - GR Tsikalioti's Mansion, LEONIDIO, 1808
Traditional fortified house
 - IR New Tipperary, TIPPERARY TOWN, 1890
A house in a new town
 - IT Rocca Sanvitale, FONTANELLATO, 13 - 15 a.c.
Fortified castle
 - IT Centro Storico di Salci, SALCI, 13 - 19 a.c.
Castle and fortified village
 - IT Palazzo Pubblico, SAN GIMIGNANO, 13 - 14 a.c.
Gothic style palace
 - L Faubourg du Grund, LUXEMBOURG, Moyen-âge, + 1750
The Neumunster Monastery in the historic centre
 - NL Onze Lieve Vrouwetoren, AMERSFOORT, 15 a.c.
Gothic style bell-tower
 - NL Omwallingen en Hoge Fronten, MAASTRICHT, 1229-1777
Walls and fortifications of the town
 - P Quarteirão IA - Mouraria, LISBOA, Moyen-âge - 20 a.c.
Dwelling quarters in historic centre
 - P Aldeias Serranas, LOUSA, 17 - 18 a.c.
Seven small villages
 - UK Conwy Suspension Bridge, CONWY, 1822 - 1826
Suspended bridge
 - UK College Buildings, ELY, 12 - 19 a.c.
Buildings around the Cathedral
 - UK Carlton Terraces, GLASGOW, 1802 - 1857
Two Georgian style terraces
- Further information can be obtained from:
Enrica Varese, DG X/C 1 CEC, 200 rue de la Loi, B-1049 Brussels.
Tel. +32 2 2359946, Fax +32 2 2364255.

Chernobyl five years on: A survey of studies carried out in the Environment Institute of the CEC JRC-Ispra (Italy)

Immediately following the accident at the Chernobyl nuclear power plant, the Commission of the EC set up a special Task Force to re-examine all aspects of nuclear safety, from reactor design to off site radiological consequences and emergency planning.

From the start, many of the groups into which the Task Force was divided, pointed out the need for an easily accessible way of storing the large number of environmental radioactivity measurements coming from the different countries reached by the radioactive air plume.

To meet this demand, the Joint Research Centre (Ispra) set up the REM (Radioactivity Environmental Monitoring) database. This brings together and stores in a uniform way environmental radioactivity data produced in the aftermath of the Chernobyl accident. Its aim is:

- to promote the integration of this information on a European basis and so to establish a historical record of the accident and its consequences
- to make the data widely available in a coherent form for scientific study and analysis (accessible via x-25 connection).

The database contains the results of radionuclide measurements on both environmental samples and foodstuffs (see survey in Appendix), drawn from reports, papers in scientific journals, and data transmitted to the JRC specifically for this purpose.

The database has been regularly updated and screened to create sub-sets on the contamination of important sample types, such as air and deposition. This has provided a unique insight, based on the measurements of:

- how the Chernobyl cloud passed over Europe and to what extent this radioactivity was deposited on European soil.

These sub-sets also formed the basis of radiological data observations used for the ATMES exercise. This exercise, which was jointly sponsored by the International Atomic Energy Agency (IAEA), the World Meteorological

Organization (WMO) and the Commission of the European Communities (CEC), reviewed and compared the results obtained by 21 atmospheric transport models from research centres all over the world. Starting from the source term and the meteorological conditions, these models attempt to calculate the path of the radioactive plume and the quantity of radioactive material deposited on the ground.

The air concentration and deposition estimates produced by these models were compared with the corresponding values in REM. The results of this comparison were discussed at the ATMES Workshop, held in Belgirate (Italy) on 12 to 14 March 1991. The conclusions were:

- using recorded meteorological data, only one third of the models were able to predict the cloud arrival time with reasonable accuracy (6 - 10 hours) for several days of travel time
- moreover the results obtained using forecasted meteorological data for that time showed a considerable deterioration. This means that there is a need to improve the quality of wind field and precipitation forecasting.

Due to the nature of the Chernobyl accident, however, the source term could only be roughly estimated. This creates a consistent uncertainty in all the model results. In order to provide an alternative data set with a well-defined source term, a European tracer exercise has been suggested. This proposed new joint IAEA/WMO/CEC initiative would consist of the release, from a given location, of an inert and non-toxic tracer, which can be detected at very large distances.

In addition, to provide a new data set for future use, the exercise would also involve participants being requested to make their estimate of the tracer pathway and concentration using real-time emergency procedures, thus allowing not only the accuracy of the model but also the efficiency of these procedures to be tested.

Further information can be obtained from:

F. Girardi, Environment Institute, CEC-JRC Ispra, I-21020 Ispra.
Tel. +39 332 789952.

Survey of Chernobyl Measurements in REM DB (Number of Measurements)

Sample Type	B	D	DK	E	F	GR	I	IRL	L	NL	P	UK	Non-EC	Total
Air	2041	4659	1278	1211	17995	469	7120	60	371	1500	43	3023	4332	44102
Deposition	428	1636	1092	257	2920	8782	13110	146	282	1389	57	1418	3230	34747
Surface Water	481	165	116	293	1819	82	3487	—	115	507	8	2046	121	9240
Drinking Water	80	15	24	82	200	61	3487	24	21	7	—	42	42	4085
Milk	582	234	615	219	6732	16	39634	—	1042	769	240	6894	28716	85693
Meat	172	—	36	—	—	—	10532	—	78	6	5	1320	8274	20423
Vegetables	—	94	164	320	—	—	17591	—	113	133	95	1206	1675	21391
Fruit	—	6	180	—	—	—	5827	—	44	—	7	12	3426	9502
Cereals	—	—	160	—	—	—	5131	—	30	—	5	36	2444	7806
Fish	—	9	—	—	—	—	3698	—	32	15	7	268	215	4244
Other	816	340	113	30	719	—	54573	—	22	1896	249	5568	23205	87531
Total	4600	7158	3778	2412	30385	9410	164190	230	2150	6222	716	21833	75680	328764

Contributions of the EC Biotechnology Programmes to pre-normative Research and to Environment Protection

Introduction

The relationship of biotechnology to ecology is double. First and foremost, knowledge and techniques originating from molecular and cellular biology contribute directly to the analysis, understanding, protection or decontamination of the environment. Examples of applications of this type are particularly numerous and range from the exploitation of multi-enzymatic systems for complex detoxification procedures to the high resolution automated identification of microbial strains in ecosystems, the evaluation through analyses of restriction fragment length polymorphism of subtle modifications in the genetic diversity of wild species or the release of new varieties of plants which require fewer amounts of pesticides or fertilisers.

Similarly, new sophisticated approaches for the in vitro study of the effects of pollutants may not only contribute to a reduction of experimentation with laboratory animals; the accuracy of analyses with cultured cells or sub-cellular fractions is such that entirely new types of studies can now be made by biologists and informaticians of the relationships between the structures of molecules and their functions. The potentialities of their contributions to the establishment of modern norms and standards are important.

Such positive effects of biotechnology have been and are being fully taken into account by the programmes listed in the table, which the Commission has launched or intends to launch for promoting the applications of modern biology to agriculture, industry, health and environment protection. (Outlines of research strategies and reviews of achievements have been presented elsewhere [1-7]).

CEC programme for biotechnology and portion of budget allocated to pre-normative research

	Budget (in Mio ECU)	
	Total	for pre-normative research
BAP (Biotechnology Action Programme)	75	7
BRIDGE (Biotechnology Research for Innovation, Development and Growth in Europe) 1990-1993	100	14
BIOTECHNOLOGY (in preparation*)	(164)	(30)

* Source: Com (90) 160 final - SYN 265

But biotechnology may also pose certain questions which deserve attention. It is unlikely but possible that certain risks are associated to the release of genetically modified microorganisms and plants (GMO's) or that vaccines obtained by recombinant DNA techniques are not stable. As in all cases where a new biological system is exploited, one must take into account the possibility that toxic compounds accumulate in our environment or that damages are made to natural ecosystems.

The purpose of the present review is to outline the efforts made in the past (Biotechnology Action Programme: 1985-1989) or underway (BRIDGE: 1990-1993) for assessing and preventing risks associated to GMO's, analyzing in vitro the toxic effects of new molecules or evaluating genetic erosion and the diminution of biodiversity among domesticated and wild species. It can be seen from Table 1 that a significant percentage of the budgets earmarked for these programmes supports such efforts and that this proportion increases regularly with time.

Identification of risks possibly associated to the release of genetically modified organisms

In BAP, 58 laboratories throughout the Communities have been engaged in 16 transnational projects devoted to the assessment of risks possibly associated to microorganisms under physical containment, depollution bacteria, plant-interacting bacteria, transgenic plants and genetically engineered viruses.

The results, recently reviewed at a meeting of contractors in Padova, [7] showed that it was possible, for each case of release envisaged, to establish ecological principles based upon the nature of the organisms, the genetic elements inserted in the GMO's under consideration and the environment where release is planned.

Several laboratories also worked, in the framework of BAP, on biological containment, that is to say the introduction in the genome of GMO's of elements which prohibit their multiplication or the transfer of genetic information to other species in the environment.

The discussions in Padova demonstrated the importance of BAP results as a crude basis for the preparation of regulatory principles and the need for a systematic organization and analysis of the knowledge made available through research.

Research for risk assessment now continues with BRIDGE; 62 laboratories from the EC and EFTA countries are engaged in 14 projects aiming at the evaluation of possible interactions between GMO's and related species. In addition, a large, so-called "targeted" project involving 16 laboratories is also underway for the development of methodologies rendering possible the automated identification of microorganisms in the soil.

It is anticipated that future Community programmes in biotechnology R&D will amplify the work carried out in BRIDGE and extend the analysis of risks to other groups of organisms (e.g. transgenic fish, insects).

Further information can be obtained from:

I. Economidis, DG XII-F/2, CEC, 200 rue de la Loi, B-1049 Brussels, Tel. +32 2 235 15 74)

In vitro testing of the toxicity of molecules

In BAP, 19 laboratories associated in 7 transnational projects developed novel in vitro tests methods for a range of different purposes (evaluation of nephrotoxicity, reconstruction of human skin and testing of drugs in cancer chemo-therapy, immunotoxicology). The new tests are faster, cheaper and often more accurate than experimentation on animals; many of them are now used, on a routine basis, by industry. In 1990, one of the BAP contractors working in this sector of research received the "European Pharmaceutical Industry Research Award"; another BAP contractor with his project was among the five most highly recommended entries for this award.

These efforts are considerably expanded in BRIDGE where 40 laboratories grouped in ELWWs (European Laboratories Without Walls; for a detailed description, see E. Magnien et al [3]) collaborate in 8 transnational, multidisciplinary projects.

An intensification of this research, particularly in immuno-toxicology and in developmental biology, is foreseen by the Commission services during the coming years.

Further information can be obtained from:

- A. Klepsch, Tel. +32 2 235 32 10
- H. Bazin, Tel. +32 2 764 34 34
DG XII, CEC, 200 rue de la Loi, B-1049 Brussels.

Analysis and conservation of genetic diversity

This topic, not covered by BAP and BRIDGE, should be tackled in the next Community programme for biotechnology R&D. One essential objective will probably focus upon the development of rapid molecular genetic screening methods for the analysis on a very large scale of genetic diversity in and between populations. The target is important because genetic diversity which cannot be measured satisfactorily, at low costs, and on a routine basis, through the use of existing methods, is the principal prerequisite to the survival and evolution of wild species and to the adaptability of modern agriculture to changing conditions and requirements.

The revitalization of taxonomy, the assessment of gene erosion in wild and domesticated species and the characterization of genetic relationships between different ecotypes directly depend on the analysis of genetic diversity.

Modern biology is not only instrumental to the study of bio-diversity, it should also facilitate the preservation of genetic material (cryogenic storage of semen, oocytes, embryos, stem cells, cell lines, pollen, meristems) in prevision of future exploitation needs or for release under more favourable habitat conditions.

Further information can be obtained from:

K. Beese, DG XII, CEC, 200 rue de la Loi, B-1049 Brussels,
Tel. +32 2 235 44 84.

References:

1. Biotechnology R&D in the Community, Vol. I, Catalogue of BAP achievements (1991), A. Vassarotti and E. Magnien edit., Elsevier
2. Economidis I., Proceed. Forum Européen (Grenoble, 1989)

3. Magnien E., Aguilar A., Wrapp P. and de Nettancourt D., Biofutur, 17 - 30 (Nov. 1989)
4. De Nettancourt D., International Dairy Federation special issue, 8902, 95 - 99 (1989)
5. Malmborg Ch. af, Feillet P., Kafatos F., Koeman J., Saviotti P., Schmidt-Kastner G., Walker G., Research Evaluation Report 32, EUR 1183, CEC Luxembourg (1988)
6. De Nettancourt D., Chimicaoggi 3, Vol. 9 (March 1991)
7. De Nettancourt D., Agro-Food Industry High Tech 2 (March 1991)
8. Biotechnology Action Programme of the EC, Sectoral Meeting on Risk Assessment, Univ. di Padova (1990), I. Economidis, editor.

Further information on the whole EC Biotechnology Programme can be obtained from:

D. De Nettancourt, DG XII/F, CEC, 200 rue de la Loi, B-1049 Brussels,
Tel.: +32 2 235 4044.

Information

Eurocourses at the JRC Ispra

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

Extract from the programme foreseen in the second semester 1991:

Reliability and Risk Analysis

30 Sept. - 4 October 1991: *Environmental Impact Assessment (EIA)*
Legislation - EIA Approaches and Techniques - Indicators, Indices and Decision Methods - Economical and Sociological Dimensions of EIA.

7 - 11 October 1991: *Experimental and Numerical Methods in Earthquake Engineering and Structural Dynamics*

Introduction: State of the Art in Earthquake Engineering - Experimental Techniques: In-situ Testing and Shaking-table Simulations - Reaction-Wall Testing and the Pseudo-Dynamic Test Method - Modelling of Material and Structural Behaviour - Aseismic Design.

21 - 25 October 1991: *Remote Sensing*
Ocean Colour: Theory and Applications in a Decade of CZCS Experience.
A Workshop organized in the framework of the International Space Year 1992 activities.

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

Secretariat EUROCOURSES, JRC, I-21020 Ispra (VA), Italy.
Tel. +39 332 789819/789308. Telex 380042 - 380058 EUR I.
Fax +39 332 789839.

Research Programmes and Projets

Economic and Social Research Council (ESRC), Polarise House, North Star Avenue, Swindon, SN2 1UJ. Tel. +793 41 3000. Fax +793 41 3001.

ESRC Global Environmental Change (GEC) Programme has developed its first phase. Two objectives have been defined:

- 1) to take global environmental concerns to the heart of social sciences;
- 2) to establish the central contribution of the social sciences alongside other sciences in the international debate on GEC.

ESRC corporate plan encourages projects involving international research collaboration, research on international policies and cases studies in particularly affected regions.

Newly established

Private Institute for Environmental Protection (IEP), Berlin.

Its objective: to encourage and support the environmentally sound development of enterprises in Eastern Germany and throughout Eastern Europe. - IEP's approach: to determine how the interests of the customer can be brought in line with the interests of the environment by means of reasonable, attainable and payable solutions.

Further information can be obtained from:

IFU - Privates Institut für Umweltschutz GmbH Berlin, Kurfürstendamm 180, D-1000 Berlin 15, Tel. +30 883 2818;
Fax +30 882 6644; Telex 184 114 bttext d.

Conferences

Conferences on **Thermal Building Research** in the European Community:

Building Simulation 91

20 - 22 August, 1991 Nice, France.

Detailed information can be obtained from:

IBPSA-BS'91, Coupure Links 653, B-9000 Gent,
Tel. & Fax +32 91 23 49 41.

International Symposium on Energy and Environment (ISEE) 1991

25 - 28 August, 1991, ESPOO, Finland.

Detailed information can be obtained from:

Helsinki - University of Technology, Otakaari 4, 02150 Espoo.
Tel. +358 0 451 3580. Fax +358 0 451 3419.

Air Movement and Ventilation Control within Buildings

24 - 27 September, 1991

12th AIVC Conference, Chateau Laurier, Ottawa, Canada.

Detailed information can be obtained from:

Barclays Venture Centre, University of Warwick, Science Park, Sir William Lyons Road, Coventry, CV 4 7EZ, U.K.

International Symposium - Transport and Air Pollution

10 - 13 September, 1991, Avignon, France.

For further information please contact:

R. Joumard, INRETS, case 24, F-69675 Bron Cedex;
Tel. +33 78 90 93, Fax +33 72 37 68 37.

7th International Symposium on Inhaled Particles

16 - 20 September, 1991, Edinburgh, Scotland.

The objectives of the Symposium are to present results of recent research on inhaled particles and their biological effects, both human and experimental with special emphasis on the occupational and para-occupational environment.

Detailed information can be obtained from:

Dr. A. Robertson, Institute of Occupational Medicine Ltd., 8 Roxburgh Place, Edinburgh, EH8 9SU, Scotland; Tel. 4431-667-5131, Fax -0136.

13th International Symposium on Polynuclear Aromatic Hydrocarbons

1 - 4 October, 1991, Palais des Congrès, Bordeaux Lac.

Sponsored by the CEC and other agencies, this meeting will be focussed on the presentation of state-of-the-art research results on the analysis, chemical properties and biological effects of Polynuclear Aromatic Hydrocarbons.

Further information can be obtained from:

Dr. Ph. Garrigues, URA 348 CNRS, Université de Bordeaux I,
F-33405 Talence Cedex; Tel. +33 56 84 63 05, Fax +33 56 84 66 45

6th International Symposium on Environmental Pollution and its Impact on Life in the Mediterranean Region

6 - 9 October, 1991

Organized by MESAEP (Mediterranean Scientific Association of Environmental Protection)

Topics: Chemical Aspects of Environmental Pollution - Biological, (Eco)toxicological and Health Aspects - Recent Developments and Advances in Waste Management - Aspects of Mediterranean Climatic Change.

Detailed information can be obtained from:

D. Kotzias, CEC-JRC Ispra, Environment Institute, I-21020 Ispra (Va),
Tel. +39 332 789647, Fax +39 332 789222.

Organic Pollution of Groundwater

21 - 24 October, 1991, Birmingham, UK

A four day course offered jointly by the Universities of Birmingham and Waterloo (Ontario).

For further details contact:

Vanessa Chesterton, Hydrogeology Research Group, School of Earth Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT (UK), Tel. +44 21 414 6751.

Biological Wastegas Cleaning

28 - 29 October, 1991, Maastrich, The Netherlands.

Detailed information can be obtained from:

VDI-Kommission Reinhaltung der Luft, Postfach 1139,
D-4000 Düsseldorf 1, Germany; Tel. +49 221 6214-0,
Fax +49 221 6214-575.

11th Biennial Meeting of the European Association for Cancer Research (EACR)

3 - 6 November, 1991, Genoa, Italy.

This meeting, also sponsored by the CEC, has already been announced in Environmental Research Newsletter N° 6.

Further information can be obtained from:

EACR-XI Secretariat, Ufficio Rapporti Internazionali, Segreteria Scientifica, Istituto Nazionale per la Ricerca sul Cancro, Viale Benedetto XV, 10, I-16132 Genoa, Italy. Tel. +39 10352827; Fax +39 10352888.

International Society of Exposure Analysis

18 - 21 November, 1991, Atlanta, Georgia.

First annual meeting. Abstract form can be obtained from Gerald Akland, Technical Program Chairman, Monitoring & Assessment Division, U.S. Environmental Protection Agency, MD-75, Research Triangle Park, NC 27711.

Please address all communications to:

Myron A. Mehlman, President, 7 Bouvant Drive, Princeton, JN 08540,
USA 609-683-4750.

International Conference on River Water Quality - Ecological Assessment and Control

16 - 18 December, 1991, Brussels.

This conference is sponsored by DG XI, CEC, Brussels; UK National Rivers Authority and UK WRs.

Detailed information can be obtained from:

G. Premazzi, Environment Institute, CEC-JRC Ispra, I-21020 Ispra,
Tel. +39 332 789266.

European Conference on Underwater Acoustics

14 - 12 September, 1992, Luxembourg

Under the auspices of CEC, DG XII and DG XIV, Brussels.

Planned sessions on the following topics:

Acoustical oceanography, propagation, imaging, acquisition and processing of data, sediment diagnostics, noise, reverberation, scattering, Arctic and Antarctic acoustics, large scale models, shipboard noise reduction, use of sonar in fisheries, transducers and instrumentation, etc. - Several workshops will also be held concurrently. Radar and aircraft noise specialists are welcome.

Deadline for reception of abstracts: 31 January, 1992.

Further information can be obtained from:

Dr. M. Weydert, CEC - DG XII/E (MAST Programme), SDME 3/46,
200 rue de la Loi, B-1049 Brussels. Fax +32 2 236 3024.

Publications

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

Environmental Radioactivity in the European Community 1984 - 1985 - 1986

Radiation Protection Report N° 46
Edited by DG XI, Luxembourg, and JRC, Ispra
EUR 12254

Global Change System for Analysis, Research and Training (START)

Report of a Meeting at Bellagio (Italy), 3 - 7 Dec., 1990.

The International Geosphere-Biosphere Programme: A Study of Global Change (IGBP) of the International Council of Scientific Unions
Edited by J.A. Eddy, T.F. Malon, J.J. MacCarthy, and T. Rosswall.
Copies of this **Report N° 15** are available from the IGBP Secretariat, The Royal Swedish Academy of Sciences, Box 50005, S-104 05 Stockholm, Sweden.

Global Change Newsletter N° 5

March 1991

Distribution by the IGBP Secretariat, see above.

Global Change Report N° 12

1990

The International Geosphere-Biosphere Programme: A Study of Global Change.

The Initial Core Projects

Distribution by the IGBP Secretariat, see above.

Global Change Report N° 13

Stockholm 1990

Terrestrial Biosphere Exchange with Global Atmospheric Chemistry
Distribution by the IGBP Secretariat, see above.

The International Global Atmospheric Chemistry (IGAC) Programme

A Core Project of the International Geosphere-Biosphere Programme. The goals of the IGAC Programme are: to develop a fundamental understanding of the chemical processes that determine the chemical composition of the atmosphere; to understand the interactions between atmospheric chemical composition and biological and climatic processes; to predict the impact of natural and anthropogenic forcings on the chemical composition of the atmosphere; to provide the necessary knowledge for the proper maintenance of the biosphere and climate.
Edited by Ian E. Galbally. ISBN 0 643 05062 0.

A Framework for Research on the Human Dimensions of Global Environmental Change

by Harold K. Jacobson and Martin F. Price, for the ISSC Standing Committee on the Human Dimensions of Global Change. CISS-ISSC, UNESCO.

Transport and Transformation of Pollutants in the Troposphere

Proceedings of EUROTRAC Symposium '90, Garmisch-Partenkirchen, Germany, 2 - 5 April, 1990,
Edited by P. Borrell, P.M. Borell and W. Seiler
The Hague, SPB Academic Publishing. - III. With index.
ISBN 90-5103-058-4.

EUROTRAC Newsletter N° 8

Spring 1991

Edited by P. Borrell and T. Cvitas, published by the International Scientific Secretariat (ISS), PO Box 1343, D-8100 Garmisch-Partenkirchen, Germany.

Green Paper on the Urban Environment

This Green Paper analyses the environmental problems facing Europe's towns and cities and suggests some future policy directions.

Published specifically to generate wider discussion on this issue prior to further EC urban environment improvements, the Green Paper is the result of extensive consultation with many representatives of European cities and considers all the complex aspects of urban problems.
EUR 12902, ISBN 92-826-1660-6.

Urban Environment - Expert Contributions

Designed as a complement to the above publication, this document contains the summaries of all CEC conferences held to prepare for, and contribute to the Green Paper on the Urban Environment.

EUR 13145, ISBN 92-826-1800-5; can be supplied together with the above mentioned publication in a card folder.

Integrated Approaches to Water Pollution Problems

Proceedings of the International Symposium (SISIPPA '89), Lisbon, Portugal, 19 - 23 June 1989.

Editors J. Bau, J.D. Henriques, J. de O Raposo, J.P. Lobo Ferreira, 1991, ISBN 1 85598 011 8.

Distributed by Scientific and Technical Information Ltd., Blackhorse Road, Letchworth, SG 6 1 HN, U.K.; Tel. +462 672555, Fax. +462 480947.

Advances in Water Treatment and Environmental Management

Proceedings of the 1st International Conference, Lyon, France, June 1990.

Edited by G. Thomas, R. King (BHR Groupe Ltd.), 1991, ISBN 1 85598 009 6. Distribution: see above.

Human Ecology - Coming of Age: An International Overview

Proceedings of the Symposium organized at the occasion of the 5th International Congress of Ecology (INTECOL), Yokohama, Japan, 23 - 30 August, 1990.

Edited by Shosuke Suzuki, Richard J. Borden and Luc Hens, ISBN 90-70289 81 4, available at VUB-Press, Pleinlaan 2, B-1050 Brussels.

Annual Report '90 of the Environment Institute, CEC-JRC Ispra

The report summarizes the progress accomplished in the course of 1990 in the various projects included in the multiannual (1988 - 91) Specific Research Programmes tackled by the Institute, i.e. Environment Protection and Radioactive Waste Management, the former being focussed on environmental chemicals, air pollution and pollutant transport, water pollution, chemical waste, food & drug analysis, the latter on safety assessment for waste disposal in geological formations. The scientific support given to the Commission Services for the implementation of EC directives dealing with chemicals, air pollution, water pollution, chemical waste and radioactive environmental monitoring (REM) is also described. Lastly the outcome of various activities related to work for third parties and to the participation of the Institute in EUREKA and COST projects are shortly outlined.

EUR 13806

Available from Environment Institute, CEC-JRC Ispra, I-21020 Ispra.

Biomass for Energy, Industry and the Environment - A strategy for the Future

Edited by G. Grassi, CEC Brussels, and A.V. Bridgwater, Aston University Birmingham
EUR 12897.

European Community Research on Conservation of Species

An Assessment of the Work carried out within the Framework of the 3rd Environmental R&D Programme.

Edited by P. L'Hermite, DG XII/E 1, CEC.

Air Pollution Research Report 25:

Field Measurements and Interpretation of Species Derived from NO_x, NH₃ and VOC Emissions in Europe

Proceedings of a Workshop organised within the framework of the Concerted Action "Physico-Chemical Behaviour of Atmospheric Pollutants", COST 611, held in Madrid, Spain, 12 - 14 March 1990

edited by S. Berilke, M. Millan and G. Angeletti
ISBN 2-87263-045-7.

Air Pollution Research Report 31:

The Nitrate Radical: Physics, Chemistry and the Atmosphere 1990

by R.P. Wayne, I. Barnes, P. Biggs, J.P. Burrows, C.E. Canosa-Mas, J. Horth, G. Le Bras, G.K. Moortgat, D. Perner, G. Poulet, G. Restelli and H. Sidebottom;

edited by R.P. Wayne, University of Oxford, U.K.
ISBN 2-87263-048-1.

Air Pollution Research Report 33:

Joint Workshop COST 611/Working Party 2 and EUROTRAC

25 - 27 Sept. 1990, Madrid

Atmospheric Oxidation Processes

- I. Volatile Biogenic Species (LACTOZ)
- II. Heterogeneous Processes of Major Pollutants (HALIPP) (kinetic and mechanistic studies in the laboratory)

edited by K.H. Becker, University of Wuppertal, Germany
ISBN 2-87263-054-6

These reports belong to the Air Pollution Research Report Series of the Environmental Research Programme of the CEC.

Air Pollution Research Report 34:

Polar Stratospheric Ozone

Proceedings of the First European Workshop, 3 - 5 October 1990, Schliersee, Bavaria, FRG

edited by J.A. Pyle, N.R.P. Harris, Cambridge, UK
ISBN 2-87263-060-0

These reports belong to the Air Pollution Research Report Series of the Environmental Research Programme of the CEC.

Water Pollution Research Report N° 12:

Eutrophication and Algal Blooms in North Sea Coastal Zones, the Baltic and Adjacent Areas

Prediction and Assessment of Preventive Actions

Edited by C. Lancelot and G. Billen, Université Libre de Bruxelles, and H. Barth, CEC, Brussels.
EUR 12190.

Water Pollution Research Report N° 13:

EROS 2000 (European River Ocean System)

Proceedings of the First Workshop on the North-West Mediterranean Sea, Paris, 7 - 9 March 1989

Edited by J.-M. Martin and H. Barth, ISBN 2-87263-031-7;
EUR 12189.

Water Pollution Research Report N° 21:

Organic Micropollutants in the Aquatic Environment

Proceedings of the Sixth European Symposium, held in Lisbon, Portugal, 22 - 24 May, 1990

edited by G. Angeletti and A. Bjorseth. ISBN 0-7923-1104-3.

Water Pollution Research Report N° 22:

Multivariate Statistical Techniques for Environmental Sciences

Proceedings of a workshop organized within the framework of Working Party 1 of the Concerted Action "Organic Micropollutants in the Aquatic Environment" COST 641, held in Oslo, Norway, 29 - 30 January 1990, edited by K. Seip and B. Vigerust, ISBN 2-87263-041-4

These reports belong to the Water Pollution Report Series of the Environmental Research Programme of the CEC.

Practical Applications of Quantitative Structure-Activity Relationships (QSAR) in Environmental Chemistry and Technology

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Published by Kluwer Academic Publishers, P.O. Box 322, NL-3300 AH Dordrecht, The Netherlands.

Proceedings of the Colloquium "Recherche et Environnement"

24 - 25 Sept. 1990, Palais de l'Europe, Strasbourg, organized by the Interdisciplinary Research Programme "Environment" (PIREN) of Centre National de la Recherche Scientifique.

Informations can be obtained from: PIREN, CNRS, 15 quai Anatole France, F-75007 Paris.

Biotechnology R&D in the EC

Biotechnology Action Programme (BAP) 1985 - 1989

edited by A. Vassarotti, E. Magnien

published in 2 volumes: Volume I - Catalogue of BAP Achievements; Volume II - The Detailed Final Report of BAP Contractors (comprises more extensive reports of research activities jointly presented by the project's participating contractors).

Published for the CEC by Editions Scientifiques Elsevier, 29 rue Buffon, F-75005 Paris

EUR 12938; ISBN 2-906077-13-5 (set)

(see also page 19-20)

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

