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Environmental Research Newsletter

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Editor Dr. G. Rossi
Assistant Editor Dr. G. Realini with the collaboration of Dr. M. Borlé-Talpaert (presently Ministry of Environment, Rome)

Environment Institute
Joint Research Centre
I-21020 ISPRA (VA), ITALY
Tel.: ++39-332-789981
Fax: ++39-332-785631
Correspondent from DG XII EEC Brussels:
Mrs. J. Acevedo

Editorial

The composition of the earth atmosphere, and the innumerable subtle changes of it, which can in the long term have a large impact on the planet temperature and on the future of the biosphere, remains one of the major issues of environmental research, and this newsletter gives examples of the ways and means by which the Commission of European Communities deals with the issue.

Supporting the on-going research by an appropriate commitment of resources is an obvious and powerful tool, and results obtained by the Commission in its own establishments and through contractual activities on the atmospheric chemistry of ozone, NO_3 and organics, which are reported here, are only a few examples of a long list of on-going research.

The problems, however, are enormous, and the way ahead of us frequently seems to us, scientists, discouragingly long, especially when compare it with the small way we have covered.

Take the atmospheric sulphur case, as an example. Atmospheric pollution by SO_2 was a major problems of the past two decades, and no doubt that the drastic diminution of atmospheric SO_2 obtained in western European countries was a major success of the European environmental policy, although still anthropogenic emission are of the same order of magnitude of natural ones..

Recent research, however, has pointed out that emissions of sulphur counteract the radiation forcing and global warming due to greenhouse gases. This because H_2SO_4 droplets, formed by oxidation of atmospheric sulphur compounds, scatter the sun radiation, and, which may be even more important, act as cloud condensation nuclei, modifying the microphysical properties of marine stratus clouds in the sense of an increased albedo. Oceans, on the other hand, are the source of dimethylsulphide (DMS), a biologically emitted species, representing the second most important flux of atmospheric sulphur, after anthropogenic SO_2. Quantifying the cooling effect of atmospheric sulphate, and the relative weight of the natural and the anthropogenic component, presently appears as a major research challenge.

The matter has been extensively discussed at the DMS symposium, recently held in Belgirate, Italy (see the summary report of the meeting in this newsletter).

Several questions are still open: what is the effect of anthropogenic sulphur emissions on climate? And what will be the effect of future reductions of SO_2 emissions? Will this reduction make the greenhouse effect even worse?

The answer to all these questions can only come through additional research, and even more important, by coordinating the present efforts in an international framework. The formation of EIPO, a European Project Office of the international activities on atmospheric chemistry (IGAC), also reported in this newsletter, goes in this direction, and it will be hopefully followed by other similar initiatives.

F. Girardi
JRC Environment Institute

Programme News

Fourth R&TD Framework Programme

On April 21st 1993 the Commission of the European Communities has adopted its guidelines for the Fourth Community R&TD Framework Programme - to cover the years 1994 to 1998 - in the light of the conclusion of the Edimbourgh European Council (see also Environmental Research Newsletter n° 10, December 1992.).

The financial resources allocated to the programme amounts to 13.100 MECU the breakdown being as it follows:

Area of Activity	Breakdown of Funding for the Fourth EC R&TD Framework Programme 1994-98	
	1 Research, Technological Development and Demonstration Programmes	10.925
	2 Cooperation with Third Countries and International Organisations	790
	3 Dissemination and Utilization of Results	600
	4 Stimulation of the Training and Mobility of Researches	785
	Total	**13.100**

A special effort will be made to be selective in the activities to be carried out and to improve the dissemination and the utilization of the research results so as to maximize the spin-offs from the Community research.

Further, the programme is aimed at helping to establish a Community policy in R&TD more than activities additional to those carried out within the framework of the Member Countries programmes.

In view of the above and of a more stringent application of the principle of subsidiarity, focus is placed on a number of sectors and generic technologies with multisectoral impact.

New features of the programme are the research in the education training needs and methodologies as well as in transport systems.

In the latter case these will be focused on the complementarity of various transport systems, scenarios and analysis at urban, rural, regional and European level being to be developed.

Further action is foreseen to stimulate the training and the mobility of young researchers through the development of networks and of a suitable Community grant scheme.

Efforts will be done to promote concerted actions and to coordinate the participation of the Members Countries in major international projects on one side and the activities carried out in European organizations (ESA, CERN, ESO) on the other side.

A stronger synergistic impact will be sought from a closer cooperation between Community and EUREKA activities respectively.

The Joint Research Centre is going to play a relevant role in particular as focal point for networks bringing together public and private laboratories of the Member Countries and as centre of gravity for European research consortia.

As far as it concerns the 1st Area of Activity the topics included in it are expected to share the funds as it follows:

- Information and Communication Technologies 36.0 %
- Industrial Technologies 16.5 %
- Environment 9.0 %
- Life Sciences and Technologies 12.0 %
- Energy 23.0 %
- Research for a European Transport policy 2.5 %
- Targeted Socio-Economic Research 1.0 %

Enviromental Protection

Air

EC Research Programme and Support Activities to the Commission

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

Stratospheric Ozone

The EC Environment R&D Programme (1991-1994) is aimed at contributing to the scientific and technical basis for the implementation of EC environmental policy. The Programme is open to a project-by-project participation of institutes and organisations from non-Member States; a full posticipation of the EFTA States (except Switzerland) is foreseen in the framework of the EEA agreement. The specific objectives for the topic "Stratospheric Ozone" witihin the Programme are as follows:

- to understand and forecast processes which lead to the depletion of the ozone layer and
- to estimate the health risk of exposed population groups and to quantify effects on the natural environment.

Furthermore, the Programme supports the development of techniques and instrumentation to study stratospheric and tropospheric chemistry.

The Environment Programme (1991-1994) constitutes an extension and expansion of the former STEP Programme (1989-1992) to which Austria, Finland, Iceland, Norway and Sweden were associated. It supports, in line with the recommendations adopted at the First Meeting of the Ozone Research Programme Managers, systematic measurements, process studies, prediction ad impact related issues by means of long-term strategic research as well as campaign-type field experiments.

In particular, emphasis has been put on the following topics:

- Stratospheric chemistry and ozone depletion
  - Detection and spatial extent of perturbed chemistry and associated ozone loss.

- Effects of transport of chemically perturbed air.
- Homogeneous and heterogeneous processes influencing the partitioning and distribution of active halogen, nitrogen and hydrogen radicals.
- Dynamics and composition of lower stratospheric air.
- Distribution and trends of solar UV flux in Europe.

- Health risks and risks to the natural environment
  - Identification of groups at risk and estimation/prediction of exposure by direct/indirect methods.
  - Understanding mechanisms of UV radiation effects, primarily on human skin, and on the immune system.
  - Accurate field exposure levels of UV-B radiation.
  - Biological action spectra of UV-B for sensitive components of the foodwed.
  - Direct effects of UV-B radiation on sensitive organisms in aquatic and terrestrial ecosystems.

Co-ordinated research projects are funded through EC R&D Programme "Environment" and National R&D Programmes.

European-wide co-ordination in the field of stratospheric chemistry and ozone depletion is promoted by a Task Group, consisting of:

- The Co-ordinating Unit hosted by the British Antarctic Survey, Cambridge, jointly funded by the UK and the CEC; (head: J. Pyle).
- The "Science Panel" composed of 15 senior scientists from EC and EFTA countries; (chairman: G. Mégie).

Research into properties of CFCs and potential substitutes, into the clean tecnologies and recycling technologies is dealt with in other research areas of the Environment R&D Programme.

Understanding the dynamics and chemistry of ozone in middle latitudes in the lower stratosphere remains the highest scientific priority. In this connection, ground-based monitoring of stratospheric ozone-related species continues to be a key component for future stratospheric research on a global and macro-regional scale.

As regards modelling activities, the strategy aims at increasing the detailed understanding of the relevant atmospheric processes in order to carry out long-term predictions of possible ozone change.

Field experiments and modelling will be supported by laboratory studies with emphasis on a better understanding of the role of the chemistry of atmospheric bromine compounds, new chain carriers and catalytic cycles, liquid stratospheric particles, key chemical components of the stratosphere (HOCl, $ClONO_2$, N_2O_5, etc.), and low temperature homogeneous and heterogeneous chemistry. Research aimed at the improvement of data on uptake coefficients on PSC materials, on the degradation of HFCs, HCFCs, and similar compounds is required as well as laboratory spectroscopic studies in support of remote sensing measurements.

In relation to estimating and predicting the impact of changes in UV-B radiation on health and the natural environment, it is intended to further develop research on the themes described above. A comprehensive assessment will be made of European efforts in this area and a long-term European strategic research plan will be formulated at a workshop in Munich on 27-29 October 1993. The workshop, organized by the Commission of the European Communities and hosted by the Forschungszentrum fur Umwelt und Gesundheit (GSF), will be open to European scientists working in this field. (see the section: Conference announcements).

A call for proposals covering the second phase (1993/94) of the EC R&D Programme "Environment" has been launched in April 1993 with a deadline of 11 June 1993 (tentative).

Besides the above described research topics, the call has also solicited the submission of proposals in the framework of the Second European Stratospheric Arctic and Middle Latitude Experiment (SESAME). A planning document is available on request to all scientists interested to participate in SESAME.

For further information, please contact:

H. Ott, CEC DGXII D 1, 200, rue de la Loi B-1049 Brussells
Tel. ++32.2.2951182, Fax ++32.2.2963024

J. Büsing, CEC DGXII D 1, 200, rue de la Loi B-1049 Brussels
Tel. ++32.2.2951182, Fax ++32.2.2963024

Concerted Action in Air Pollution Epidemiology

Since the well-known episodes of air pollution in the late 1940's and early 1950's, the extent, quality and quantity of air pollution in Europe has changed considerably. Decline of the old "smokestack" and development of new industries, coupled with changing trends in power generation, increases in traffic and in the mobility of populations, as well as changes in lifestyles present special challenges for the assessment of exposure and health effects of air pollution.

Despite major difficulties, epidemiologic studies are crucial for effective air pollution control decisions. They acknowledge the fact that people are variably and simultaneously exposed to a multitude of pollutants and other stressors; they allow the study of long-term effects; with adequate exposure monitoring, they allow for quantitative risk assessments; and they provide data for cost-benefit considerations. International cooperation in the design, implementation and interpretation of these studies maximises the potential benefits that may be obtained from them.

Air pollution epidemiology research is supported throughout Europe by the Commission by shared-cost actions in the ENVIRONMENT R&D Programme, in the Programme of Cooperation with Central and Eastern European Countries, and in the PHARE Programme. Of equal, if not greater, significance, is the fostering of international cooperation in this area through a Concerted Action on Air Pollution Epidemiology.

In 1990 COST countries agreed to establish a concerted action in air pollution epidemiology, known as COST Project 613/2 (COST Project 613/1 is a concerted action on indoor air pollution coordinated by the JRC Ispra). The Commission undertook to provide the Secretariat for 613/2, funding activities such as workshops, meetings, publications etc. (but not research). The concerted action was subsequently transferred from COST to the ENVIRONMENT R&D Programme of the Commission, assuring a more effective linkage of the research and the coordination activies to the Commission in this area.

The main objective of the concerted action si *to improve the quality and the effectiveness of epidemiological research on atmospheric pollution and health through European coperation*. Under this main objective, the technical objectives have evolved considerably during the last three years. They are presently:

- raising and unifying the standards of study designs, measurement techniques, and data analysis methodologies
- creating a pan-European network of experts in air pollution epidemiology
- facilitating cross-border multicenter studies
- identifying and addressing air pollution situations specific to certain regions utilizing the unique opportunities of East-West-European study comparisons.

The concerted action is directed by a steering committee which consists of leading scientists from EC and EFTA Member States as well as reprentatives from the WHO and the Commission. Partecipation of scientists from Central and Eastern Europe is also assured. The work is performed in working groups and workshops. There are seven working groups.

The first three working groups were established to review our knowledge of and to produce reports on **Exposure Assessment, Health Effects Assessment** and **Study Designs** in air pollution epidemiology. These reports are aimed at researchers, reviewers and managers. Their purpose is to fill the gap between textbooks in air pollution, medicine or epidemiology, and the original research literature by providing general, relevant and up-to-date information. The methodological essentials are presented in a condensed form but information is provided on the sources of the details given.

A fourth working group on **Training Programs** is charged with evaluating existing European training programs which may be useful in the multifaceted field of air pollution epidemiology. The group is attempting to combine them into larger collaborative programs and to disseminate information on the possibilities for partecipation. Three new working groups are now being formed to work on **Socioeconomic and Ethnic Confounders**, on **Risk Assessment**, and on **Time-Activity Patterns**.

To date, two workshops have been organised and planning is now underway for a third. The first workshop "**EC (COST) - East European Workshop on Air Pollution Epidemiology**" was held on 23-35 May 1991 in Budapest. In this meeting, 47 epidemiologists as well as representatives of the CEC, the WHO, and the REC (Budapest Regional Environmental Center for Central and Eastern Europe) met to exchange information, experience, ideas and plans for future research. The meeting demonstrated both the needs and the opportunities for environmental research cooperation in Europe. The second regional workshop "**Air Pollution and Health in the Mediterranean Region of Europe**" was held in Athens on 8-10 October 1992. Epidemiologists, mainly from that region, discussed the air pollution problems specific to that region, in whose warm sunny climate the air pollution is caused mainly by exhausts from dense traffic and secondary photochemical oxidants. Planning is now in progress for a third regional workshop to develop and build upon the ideas discussed at and since the Budapest meeting.

A final aspect of the concerted action is the establishment of an independent **International Review Board** for research proposals and reports in air pollution epidemiology. The services of this board can be made available to all istitutions supporting research in air pollution epidemiology.

The following reports have been prepared to date within the concerted action:

- Exposure Assessment;
- Health Effects Assessment;
- Proceedings EC(COST)-East European Workshop on Air Pollution Epidemiology (23-25 May, 1991, Budapest);
- Study Designs;
- Proceedings Workshop on Air Pollution and Health in the Mediterranean Area (8-10 October 1992, Athens)

For further information contact: M. Jantunen (coordinator), Division of Environmental Health, National Public Health Institute, P.O. Box 95, SF- 70701 Kuopio, FINLAND

C. Nolan, CEC, DGXII-D1 Environment Research Programme, 200 rue de la Loi, B-1049 Brussels
Tel. ++3222961633, Fax ++3222963024

EC Concerted Action on Atmospheric Chemistry

The concerted Action "Physico Chemical Behaviour of Atmospheric Pollutants" was launched as COST Project 611 since 1978 and formally ended in December 1990. The achievements of this concerted action, like for other COST Projects, were reviewed in Vienna, at the Conference celebrating 20 years of COST in November 1991

During this period about 20 workshops and 3 symposia were organised within the framework of 3 Working Parties (WP1: Development of analytical techniques to measure trace components of the atmosphere, WP2: Atmospheric chemical and photochemical processes; WP3: Field measurements and their interpretation).

In addition specific Task Forces were established on acid deposition and photochemical oxidants, contributing to fill gaps of knowledge and to develop joint research projects.

In the past emphasis has been put on continental European atmospheric processes which are important in view of the understanding of global processes.

These processes, considered within the framework of the Core project IGAC of IGBP are mainly concerned with:

- the role of boreal and polar regions in changing atmospheric composition
- natural variability and anthropogenic pertubation of the marine atmosphere
- global distribution, transformation, trends and modelling.

These themes are part of the EC 1991-1994 R&D Programme.

In view of the acute environmental problems over Europe caused by atmospheric pollution, the Concerted Action Atmospheric Chemistry, follow-up of COST 611, is focussing now these problems in order to quantify the European contribution to processes governing environmental change on hemispheric and global scale, as considered within IGAC.

Cooperation with the coordinated Programme EUROTRAC of EUREKA is continuing, in particular concerning the subprojects LACTOZ, HALIPP, BIATEX and GCE.

Research projects funded within the 1991-1994 EC Programme "Environment".

Tropospheric Physics and Chemistry

Atmospheric Oxidation processes for possible CFC replacement compounds

The objective is to provide detailed reaction rate and mechanistic data for oxidation of halogenated compounds in the troposphere. These data will give estimates of chlorine and bromine fluxes into the stratosphere and contribute to better understand their tropospheric sinks.

The project is coordinated by H. Sidebottom, University College Dublin.

LABVOC and FIELDVOC: laboratory and field studies on the degradation mechanism of biogenic VOCs: Isoprene and DMS

These two projects aim to examine the behaviour of two important naturally emitted volatile organic compounds: isoprene in continental regions and dimethylsulphide in marine areas.

Degradation products of DMS and isoprene in their reactions with OH and NO_3 radicals will be investigated. Field experiments will be done in Britain concerning DMS, and in Portugal for isoprene.

The two projects are coordinated by:
G.K. Moortgat, MPI Mainz and B. Bonsag, CNRS Gif-Sur-Yvette.

OCTA: Oxidising capacity of the tropospheric atmosphere.

This project, linked to the North Atlantic Regional Experiment (NARE) of IGAC, aims to improve knowledge of the oxidising capacity through:

- measurement of key radical species in fully characterized air masses; tracking the evolution of primary and secondary chemical species in air parcels and combining measurement and the meteorogical state of the atmosphere using photochemical transport models in summer and winter. Use will be made of a sophisticated research aircraft, operated by the UK Meteorological Office Research Flight and capable of a wide range of measurements, instrumented top measurement site and lighiting ballooonborne instrumented packages.

The coordinator is D. McKenna of the same office.

AERONOX: impact of No_x emissions from aircraft upon the atmosphere at flight altitude 8-15 KM.

The objective of this project is to determine the emissions of NO_x from aircraft engines and global air traffic at cruising altitudes, the resultant increase in NO_x concentrations, and the effects on the composition of the atmosphere, in particular with respect to ozone formation in the upper troposphere.

The project intends to set up a data base for the air traffic emissions. To achieve this, it is foreseen to combine engine emissions, measured and determinated within this project, with an air traffic register, which will be established under the coordination of ECAC/ANCAT with DG XI. The influence of these emissions on the atmosphere will be determined by studying the physical and chemical processes within te aircraft wake and by calculating the 3D NO_x concentration change with general circulation and chemstry models.

The project is divided into three major subprojects:

- Engine exhaust emission;
- Physics and Chemistry in the aircraft wake;
- Global atmospheric simulations.

No field or in-situ measurements are included.

The coordinator is U. Schumann, DLR, Oberpfaffenhofen.

Experimental determination of the formation rate of O (1D) and OH in the troposphere from the ozone photolysis by solar radiation

Improvement of the understanding of the primary OH production rate in the troposphere is the major objective of this project.

Laboratory work will be carried out to investigate the O (1D) quantum yield as a function of wavelength with high spectral resolution and for various temperatures over the pertinent range of tropospheric conditions. The branching ratio of the reaction of O (1D) with N_2O will be investigated in laser experiments. Field measurements will also be carried out in order to intercompare three different techniques to measure the rate coefficient for O_3 photolysis: the chemical actionometry, actinic filter radiometer and actinic spectroradiometer.

A. Hofzumahaus, KFA Jülich, is the coordinator of the project.

Assessment of the relative importance of terrestrial biogenic oxygenated VOCs emissions for tropospheric ozone formation over Europe.

The project investigates the impact of biogenic oxygenated volatile organic compounds (BOVOC) on the chemistry of the lower troposphere over Europe.

The emissions of BOVOC from most abundant types of European vegetation will be quantified and the effect on the chemistry of the atmosphere, especially oxidant formation calculated. The measurements will focus on the most important BOVOC compounds, e.g. hexenol and hexenylacetate, but the analytical techniques, which will be developed, will also allow the determination of a broad range of other BOVOC compounds at levels relevant for the chemistry of the atmosphere as alcohols, aldehydes, etc. The emission studies will include enclosure measurements, experiments in controlled environment chambers, and ambient atmospheric investigations combined with the Rn tracer technique and micrometeorological measurements.

The project is coordinated by J. Rudolph, KFA Julich.

SECAP: South European cycles of air pollution

This project deals with the investigation of the continuity, extent and annual evolution of the trasformation, deposition and trasport processes in the Mediterranean basin, which presents some new and specific problems associated with the topography and climate in these latitudes. On the basis of recent experiments, it appears that:

- there are places where the chemical transformation and deposition processes may be very closely linked to the local atmospheric dispersion scenarios, i.e. the chemistry may become site, or region specific.
- there are important mechanisms which can lead to the ageing and mid-tropospheric injection of polluted airmasses, which can then become free to participate in regional and long-range transport processes within the whole of Europe.
  This investigation would help defining the contribution of southern Europe, i.e. Mediterranean area and Portugal, to the global circulation of atmospheric pollutants.

M. Millan, CEAM Valencia is the coordinator.

Soil as a sink for atmospheric methane and the effects on the sink due to inputs of nitrogen

The project aims to elucidate the role of methane as a sink in Northern European terrestrial ecosystems, as an attempt to contribute to one of the IGAC activities (TRAGEX, Trace Gas Exchange). Methane oxidation rates will be measured in forests, natural grassland, peatland and agricultural ecosystems receiving different input of nitrogen. The information obtained will provide an important input for modelling the methane sink over the whole mid-latitudes, which is required for further modelling of climate change.

K. Smith, Scottish Agricultural College, Edinburgh is the coordinator.

Deposition of ozone and NO_2 to European forest

It is expected that this project will provide reliable values for the deposition velocity of O_3 and NO_2 to European forests.

There is need for a generalized framework to interpret experimental data in order to generalize and derive deposition loads to regions.

Specific tasks of this project are:

- to derive parameters such as flux-profile functions describing turbulent exchange of trace gases over different forests,
- asses the influence of stand architecture and ecosystem type,
- study the effect of atmospheric chemical reactions,
- obtain a continuous record of O_3 deposition fluxes to forests,
- study gas exchange processes taking place in the canopy.

J. Duyzer, TNO Delft is the coordinator.

Backgroung maritime contribution to atmospheric pollution in Europe.

A new multi-disciplinary, collaborative network of coastal research stations located mainly on the Western periphery of Europe is the aim of this project. It is expected that the network will provide a unique facility for research to various scientists in Europe and will be relevant also for the IGAC activities on North Atlantic experiment. The coastal field stations used are: Mace Head in Western Ireland, Aveiro in Portugal, Porspoder (near Brest) in France. The two Scandinavian sites proposed at Saeby (near Gothenburg), Sweden and at Lista on the southern tip of Norway are well positioned to sample the northerly Atlantic and Arctic air masses flowing into northern Europe.

Intensive field measurement campaigns will permit budget/flux estimates to be made for nitrogen, sulphur and chlorine. Chemical composition of size differentiated aerosol will be also determined for background marine air.

S.G. Jennings, University College Galway, is the coordinator of this project.

Measurement techniques for atmospheric components in the troposphere.

Vertical profile measurements of tropospheric constituents from the ground using a novel ranging UV-visible spectrometer.

The project aims to develop a new ranging UV-visible spectrometer for making remote vertical profile measurements of a range of atmospheric trace constituents throughout the troposphere from the ground. Particular advantages of this instrument are that range resolved measurements of weakly as well as strongly absorbing species are possible, and that simultaneous measurements of different constituents can be obtained with a single instrument.

A secondary advantage of the instruments is its compactness which makes it portable. The technique has also significant potential for the measurement of stratospheric composition from both the ground and from aircraft.

The coordinator of the project is R. Jones, University Cambridge.

Development of a mobile field instrument for the fast simultaneous measurement of OH and HO_2 radicals in the troposphere by high repetition rate laser-induced fluorescence.

The understanding of the tropospheric chemistry requires the direct measurement of OH radicals in the atmosphere. Therefore, the objective of this project is to develop an operative mobile field instrument for highly sensitive, fast in-situ measurements of OH and HO_2 in the troposphere. The OH-radicals are sampled by fast gas expansion of ambient air into a low pressure fluorescence chamber and are detected by laser-induced fluorescence (LIF) using the excitation wavelength 308 nm. A high-repetition rate laser system will be used to give adequate sensitivity (10^5 OH/cm^3 in a few minutes). Applications for the operation of the instrument in aircraft are investigated.

The coordinator of the project is A. Hofzumahaus, KFA Jülich.

EUPHORE: European Photoreactor

A outdoor smog chamber (using natural sunlight) is built in Valencia for studying mechanisms of photochemical processes which lead to oxidant formation, in particular ozone, in the polluted air of most European regions and which also influence the oxidising capacity of the atmosphere on a global scale. The development of measures to effectively control the photo-oxidant formation necessarily depends on the provision of reliable mechanistic data which can be obtained from this smog chamber studies.

A dual chamber facility will be constructed; it will be used in a

differential mode ensuring the kinetic analysis od specific chemical systems at ambient concentration levels of the reactants. Systems proposed to be studied in the presence of different Noxa concentrations are: biogenic VOCs aromatic VOCs alternative fuel components, air polluted by a real emission source (automobile engine) and radical reactions important for tropospheric oxidation processes.

K.H. Becker, Universität Wuppertal is the coordinator of this project.

Further information can be obtained from:
G. Angeletti, CEC DG XII/D-1, 200, rue de la Loi B, 1049 Brussels
Tel. ++32.2.295.84.32, Fax ++32.2.2963024

Air Quality Research at the Environment Institute of the JRC

Mechanisms and kinetics of gas phase reactions in the polluted troposphere

Oxidation at night by the nitrate radical, NO_3, is more and more felt as an important sink for biogenic and anthropogenic compounds in the troposphere, affected by increasing levels of NO_x.

The nitrate radical, which is rapidly photolized in daylight, builds-up at night, formed by the reaction between NO_x and O_3

Its reaction with atmospheric trace gases, in addition to providing relevant scavenging pathways, alternative to those photochemically driven at daytime, may have other consequences. On one side it may lead to the formation of noxious compounds, on the other side it may change the budget and the equilibrium distribution of NO_x, with an impact at the regional/global scale on the tropospheric ozone budget and on the atmospheric oxidation capacity. The research in progress in the previous years on the chemistry of this radical has been extended to get further insights into the mechanisms of the nighttime oxidation of alkenes, dialkenes and of aromatics.

The results of the studies on the mechanism of oxidation of organo-sulphur compounds, with special attention to dimethylsulphide, are part of the joint effort in the "Atmospheric Sulphur and Climate" Project.

Reaction of NO_3 with alkenes and isoprene

A study was carried out in collaboration with the University of Kiel on the formation of oxiranes in the reaction of the nitrate radical with alkenes and with isoprene.

Oxirane derivatives were found as most abundant products in the reaction in argon at 20 Torr; but were below their detection limit when the reaction was performed in air at 740 Torr. An interesting observation was that both cis- and trans-2-butene gave a mixture of cis- and trans-1,2-dimethyloxirane which demonstrates the formation of a reaction intermediate that allows rotation around the C2-C3 bond.

The yield of oxirane observed to be as high as 20% in the reaction of isoprene with NO_3 in argon at 20 Torr, was reduced to a negligible value in the reaction in air at ambient pressure. This information adds to and supports the results of the previous studies on the nighttime oxidation of isoprene.

Reaction of NO_3 with Aromatics

A result of the previous studies performed on the nighttime oxidation of methylsubstituted benzenes, was the observation of nitroderivative compounds in the reaction products. The possible occurrence of artifacts, caused by reaction of the products on the sampling columns, was evaluated in a series of experiments performed in collaboration with the University of Milano, Italy. The conclusion of these investigations is that nitro-derivatives appear to be formed as minor product in the gas-phase reaction between $N0_3$ radicals and methyl-substituted benzenes.

The formation of these toxic compounds is especially worth of attention in polluted urban air, where the presence of aromatics shows a tendency towards an increase.

NO_y interconversion processes: the reaction between NO_3 and HO_2.

In the chemical reactions system which controls the formation and the fate of the nitrate radical considerable importance has been recently attributed to the reaction between the nitrate radical and the hydroperoxyl radical: in particular to the branching reaction forming OH radicals,

$NO_3 + HO_2 \rightarrow OH + NO_2 + O_2$

which may be, under some conditions, an important source of OH radicals at night (see Newsletter Nr. 9). The study conducted in 1991 at atmospheric pressure resulted in a rate constant for this branching reaction slower by one order of magnitute than the values measured under low pressure conditions. The study has been repeated, using the same experimental approach, with the radicals reacting at 50 Torr total pressure.

Again only an upper limit could be measured since oxidation of $C_{13}O_{18}$ in the chamber was observed in some cases even when the tracer was mixed with purified air only. The average of the best fit values for kb (in parentheses one standard deviation) was 0.17 ($\pm$0.26) $\cdot$ I0 $^{-12}$ cm + 3 molecule $^{-1}s^{-1}$ at 296K. The upper bound of the 95% confidence interval for the mean of the upper limits calculated for the different runs was 0.80 $\cdot$ 10^{-12} cm + 3 molecule $^{-1}s^{-1}$ at 296K. This conservative estimate of the upper limit of kb at 50 Torr is significantly below the values measured at low pressures (0.5 – 2 Torr) : (3.6 $\pm$ 0.9) $\cdot$ 10^{-12} cm + 3 molecule $^{-1}s^{-1}$ at 0.5 Torr and (2.5 $\pm$ 0.7) $\cdot$ 10^{-12} cm + 3 moleculels $^{-1}s^{-1}$at 2 Torr.

This fact emphasizes the problem of the application of kinetic data for tropospheric reactions, measured by techniques requiring a low pressure of the reacting mixture. The case of reactions with occurrence of competitive pathways seems to be most sensitive to this problem and underlines the importance of testing reaction schemes in smog chamber studies at tropospheric pressures.

Reaction between NO_3 and reduced organo-sulphur compounds

During the previous studies of the DMS-NO_3 reaction, the formation of a peroxynitrate intermediate has been put in evidence. The structure of this compound, has not yet been clarified ($CH_3S(O)O_2NO_2$ or $CH_3S(O)_2O_2NO_2$?). Analogously to the well known homologues, peroxyacetylnitrate (PAN), the stability of the intermediate has been found to exibit a strong temperature dependence and its lifetime with respect to thermal decomposition is comparable, and significantly long at low temperatures (in parentheses the values for PAN): 0.05 hour (1.2 hour) at 293K, 1.5 hour (27 hour) at 273K, 15 years (90 years) at 223K. This means that the formation of this intermediate in the oxidation of DMS in air, may play a role in the transport of sulphur and nitrogen over long distances in cold marine air masses.

Spectroscopic evidence that peroxynitrate intermediates are formed in the oxidation by NO_3 of other reduced organic sulphur species, mercaptanes, sulphides and disulphides, has been obtained.

Further information can be obtained from:
J. Hjorth, E.I., CEC-JRC Ispra, I-21020 Ispra (VA) Italy
Tel. ++39-332-789076, Fax ++39-332-785837
G. Restelli, E.I., CEC-JRC Ispra, I-21020 Ispra (VA) Italy
Tel. ++39-332-789225, Fax ++39-332-785837

Monitoring of Atmospheric Pollutants

Tropospheric ozone in the pre-alpine and alpine regions

The 5-year database of surface ozone measurements recorded in the pre-Alpine and Alpine regions since 1987 has been analysed in terms of relations between measured ozone concentration, synoptic meteorological evolution and air masses circulation on regional scale. A study on the characterization of the meteorological conditions leading to photochemical pollution episodes on regional scale is in progress.

Historical ozone data

The large concern on the positive trend of tropospheric ozone at mid-latitudes of the northerns hemisphere (NH) has focused attention on historical ozone observations made by the Schonbein technique one century ago. An ad-hoc procedure to convert the original readings into present-day concentrations (in ppbv) has been set up and validated. The same procedure has been applied to observations made around 1880-1890 in South America and at tropical latitudes. Meteorological observations (including ozone readings) were made by the same instrumentation and following

the same procedures from scientists trained in Europe. The re-evaluated historical data recorded in South America and at Tropical Latitudes show that one century ago the surface ozone levels at mid-latitudes of the Southern Hemisphere (SH) were comparable to those observed in the NH. Moving to tropical latitudes, the converted historical data are lower than those observed at mid-latitudes of both NH and SH.

At present-time, the ozone levels at mid-latitudes of the SH are lower than those of the NH, indicating a change with respect to the past century, while in both hemispheres, the levels at tropical latitudes are lower than those observed at mid latitudes, showing a situation qualitatively similar to that of the preindustrial period.

Further information can be obtained from:
S. Sandroni, E.I., CEC-JRC Ispra, I-21020 ISPRA (VA) Italy
Tel. ++39-332-789203, Fax ++39-332-785236

Measurement of total column atmospheric pollutants by UV-VIS spectroscopy

The Brewer ozone spectrophotometer, on loan of the Italian Ministry of the Environment,has been operated continuously along the year. The instrument has participated to the 1991-1992 European Arctic Stratospheric Ozone Experiment (EASOE) as a network station of the ground based ozone observing system, thus providing on a daily basis measurements of the ozone field at the Ispra site (45.803° latitude, -8.627 longitude). The instrument is now participating to the 1992-1993 exercise in preparation of the next EASOE campaign.

The 1991-92 campaign that completed its main measurement phase at the end of March 1992 has confirmed at this site the anomalously low ozone column values as measured from other ground stations and from satellite determinations by the NASA Total Ozone Mapping Spectrometer.

The Brewer spectrophotometer allows to perform measurements, in addition to O_3,of NO_2 (separating tropospheric and stratospheric components) and SO_2 total column, even if with an accuracy by far lower than that obtainable for O_3. Due to the emission at surface level, these pollutants are mainly concentrated below the inversion layer so that a correlation between SO_2 and NO_2 measured at ground and by the Brewer should be observed. The data measured at the Ispra EMEP station were used for the comparison: the agreement between the two families of data can be considered satisfactory, taking into account that measurements at ground may be influenced by local effects, while integrated values in the mixed layer and above are determined by influences over a much larger horizontal scale. Variations in the mixing layer depth and, to a lesser extent, variations in the pollutant concentration profile within the mixing height, inducing errors in the calculation of the column budget from ground level measurements, may also worsen the correlation with the Brewer data.

Further information can be obtained from:
F. Cappellani, E.I., CEC-JRC Ispra, I-21020 Ispra (VA) Italy
Tel. ++39-332-789228, Fax ++39-332-785837

The BEMA project

The Unit "Atmosphere/Biosphere Interactions" at the Environment Institute of the JRC continued the previous year's activities which aimed to contribute to the understanding of the impact of natural and anthropogenic emissions on the processes that determine the chemical composition of the atmosphere. Within the global change issue, the work has been further reoriented from the acidic deposition problem to the study of biogenic emissions from Mediterranean ecosystems and their potential role in tropospheric chemistry. To this aim, a project has been developed in collaboration with some European laboratories on Biogenic Emissions in the Mediterranean Area, the BEMA project.

The core of the BEMA study is a series of intensive field campaigns conducted at representative sites in Italy, France and Spain. The first measuring campaign in May/June 93 at Castel Porziano near Rome is joined by 14 scientific labs from different European countries. Both emission rates and the ambient concentrations of the primary compounds and their reaction products are determined. Fluxes will be assessed for selected ecosystems: a Pinus pinea / Quercus ilex forest with underbrush formed by typical Mediterranean shrubs, and a semi-natural grassland. Methodically, the BEMA campaign is based on a balanced combination of enclosure methods with micrometeorological-tracer-and modelling-techniques. Longer term, less intensive measurements are already carried out at Castel Porziano by the home institutes (Rome and Ispra) to characterize seasonal and spatial variabilities in concentrations of biogenic and anthropogenic compounds, emission rates and some environmental / physiological parameters controlling them.

After all, the emission fluxes obtained from Castel Porziano and from other sites will be extrapolated to allow an estimation of the type and amount of compounds emitted from vegetation in the entire Mediterranean basin. Comparison will be made with anthropogenic concentrations. These data will be of value for the parameterization of tropospheric chemistry models and in particular will allow assessment of the role of these compounds to ozone formation. Without such data the effects of proposed EC emission control strategies on ozone formation cannot be predicted for the photochemically active Mediterranean region.

The field measuring campaigns are complemented by a series of other activities, including the identification of the major vegetation types in the Mediterranean basin, intercomparison exercises to ensure the compatibility of the sampling, analytical and enclosure methods used, chemical reaction chamber experiments to identify hydrocarbon reaction products, and laboratory experiments with vegetation in controlled environments to identify emitted species and the emission controlling parameters.

The last named activity has been performed in Continuous Stirred Tank Reactors (CSTR) in temperature controlled greenhouses. Six 1200 l Teflon-covered chambers are used to study simultaneously the mass balance of trace gas exchange at long term exposed canopies of small trees. In addition, a system with six 100-400 l mobile, size-adjustable cuvettes is used for trace gas exchange measurements at shrubs and small trees/tree branches in the greenhouse and in the field. The greenhouse and field measurements are closely related to each other by studying the same plant species and by having both the twofold scope (i) to screen the type and amount of compounds emitted and (ii) to search for the environmental and physiological key factors controlling the emissions. This research required improvement of the methods of VOC sampling and analysis: A device has been developed for simultaneous sampling at up to 8 measuring points which consists of cooling traps for water, bypass fitting and remote solenoid switching of the Tenax tubes in combination with mass flow controllers. Internal standards and an artificial tracer terpene are supplied in the cuvettes by a dynamic, gas phase calibration device based on terpene diffusion tubes.

It has been shown that monoterpene emission from the conifers considered (Pinus pinea, Picea abies) is under strict control of leaf temperature, whereas stomatal conductance, photosynthetic activity, drought stress and air pollutant stress play a minor role; but temperature control can be superimposed by factors like wetting of needles or mechanical stress. For example, biogenic emissions increased more than 100 fold after application of a strong wind of 10m/sec or more than 100fold after mechanical provocation of the canopies. Even with the utmost careful mounting of spruce/pine in the cuvette, biogenic emissions are significantly enhanced for two days. In case of Quercus ilex it has been shown that this evergreen Mediterranean oak is emitting large amounts of monoterpenes, besides isoprene, though having no detectable content of monoterpenes in leaf or bark. Monoterpene emissions are controlled rather by physiological activity than by temperature, a pattern that has not yet been reported in literature.

Another experimental work with plants was the screening of aromatic Mediterranean shrubs cultivated in the greenhouse for their pools and emissions of volatile organics. Each species has a specific pool and emission pattern; the relative composition of the pool is not enough to predict emission rates. Compared to conifers, volatile oxygenated terpenoids and phenolics are more frequent in the shrubs examined; during flowering phases, additional compounds are emitted in great quantities.

In a third activity using Teflon bag reaction chambers, various aspects of the impact of biogenic compounds i.e. monoterpenes and isoprene, on atmospheric chemistry have been investigated. Special emphasis was given on the ability of these substances to form ozone in the NO_x-photochemical system. In continuation of the previous work, sunlight irradiations of selected monoterpene

hydrocarbons (α-,β-pinene)-NO_x-air, and isoprene-NO_x-air mixtures at part per billion concentrations were carried out. These mixtures were irradiated in a dual reaction chamber (Teflon) outdoor facility with temperature, humidity, sunlight intensity, NO_x concentration and ozone formation measured as a function of time.

The reactivity of the mixtures in terms of ozone production rate (ppb min^{-1}) ranged from 0.1 to 0.24 and from 0.45 to 0.57 ppb min^{-1} for α-,β-pinene and isoprene respectively. The major photooxidation products observed during the irradiation of isoprene-NO_x-air mixture were, apart from ozone, aldehydes (formaldeyhde, acetaldehyde) and ketones (acetone). Yields for formaldehyde and acetaldehyde vary between 50-80% of the reacted isoprene, depending on the initial reactant conditions. For α-, β-pinene the corresponding yields were found to be less than 5%. From the experiments performed in these studies there is an indication that the terpene/ozone reaction products formed during the sunlight irradiation do not have any impact on the ozone build-up.

Further information can be obtained from:
G. Seufert, E.I., CEC-JRC Ispra, 21020 Ispra (VA) Italy
Tel. ++39.332.785784, Fax ++39.332.785022

JRC-Ispra Support Activities

Central Laboratory of Air Pollution at the Environment Institute of the JRC-Ispra

Harmonisation Programmes for Current Directives

SO_2 Directive: updating of the SPM reference method

While the harmonisation programme has been concluded with the publication of SO_2 and black smoke instruction manuals at the use of network stations, a new action has been launched on the development of a SPM (Suspended Particulate Matter) reference method (Directive 80/779/EEC, amended by Directive 89/427/EEC). A methodology to demonstrate the equivalency of measurement methods for monitoring fine suspended particulate matter has been discussed within the CEN/TC 264 working group. This procedure, concerning in particular the measurement of fine suspended particulate matter up to 10 μm size according to the ISO thoracic convention curve ("PM10"), is in agreement with the following requirements of the Commission:

(i) an appropriate EC reference method for PM10 should be established;
(ii) EC Member States can use either the reference method under routine conditions, or methods which are equivalent to the reference method (PM 10 equivalent methods);
(iii) Member States should make the necessary steps to ensure that alternative methods are tested by an appropriate EC PM10 reference equivalence procedure.

The EC reference equivalence procedure mentioned in (iii) will preferably be based on ambient field testing instead of using the US-EPA wind tunnel methodology because of the considerable differences in sampling performances. To this end, field campaigns will be organized at four different locations characterized by typical aerosol patterns. Ispra is one of the sites selected.

NO_2 Directive: quality assurance programme of NO_2 calibration procedures

A first intercomparison of the calibration procedure implemented in laboratories of Northern Europe Member States, has taken place in May 1992 at the Landesanstalt für Immissionsschutz (Essen, FRG). Ten laboratories from seven Member States (B, DK, F, FRG, L, NL, UK) participated to the exercise. The results of the intercomparison will be released after the second exercise, executed in April 1993 at the JRC-Ispra for laboratories of South-Europe Member States.

The first exercise has shown that the overall precision of the measurements was good, with 90% of the measurements within a confidence limit of about ±10%. The wet chemical method (Saltzman) exhibited, in comparison to the static dilution method, a systematic lower response to increasing NO_2 concentrations (typically 8% at NO_2 concentrations of 350 um/m3). The effect of the relative humidity (R.H.) on the response of the chemiluminescence analyzer was examined: a typical 5% decrease in the instrument response was observed at R.H. levels increased from 10% to 50%.

Ozone Directive : VOC measurement techniques

The EC directive 92/72/EEC of 21 September 1992, on air pollution by ozone, recommends the measurement of volatile organic compounds in selected stations of the networks. The EC intercomparison exercise on VOC measurement, organised by the JRC in 1991 (see Env. Newsletters Nr. 9), was a first step towards guidelines for harmonised VOC measurements in the EC. The main results of this exercise were discussed in May and December 1992.

Analysis of the intercomparison results, showed that the performance of the laboratories was not adequate to achieve the acceptable target value of 15% accuracy, for the harmonisation of VOC measurements. The results for the 15 most volatile compounds were compared to the gravimetric standard: the accuracy averaged 36% over all the participants. This figure contrasted with the good precision observed (5%) within each individual laboratory.

From this first intercomparison, it appears that low concentration VOC mixtures in gas cylinders may not be appropriate as calibration standards for these compounds. Additional information on this important problem are expected from the next exercise scheduled for 1993.

Application and development of passive samplers: an intercomparison study

Within the framework of a collaboration between the Bavarian Lander and the CEC, the GSF Institute (Forchungszentrum für Umwelt und Gesundheit Gmbh) carried out an intercomparison campaign for NO_X, SO_2 and O_3 passive samplers.

The Central Laboratory participated to the intercomparison using NO_2 passive samplers; the EMEP station of the JRC in Ispra was selected as one of the measuring sites. The passive sampling NO_2 monitoring method set-up at the JRC, was shown to give satifactory results for NO_2 concentrations as low as 5-10 μg/m3, typical of rural areas (and very satisfactory results For the high values found in urban areas).

Monitoring network design

Under request and in collaboration with the Observatoire Regional de l'Air en Midi-Pyrénées (ORAMIP) a survey of NO_2 pollution in Toulouse (France) using passive samplers, has been designed.

Using the results of a campaign with 120 tubes spread over the 140 km^2 of the agglomeration, the maps prepared by the JRC are expected to identify three types of sites:
- sites sensitive to emissions due to traffic;
- sites sensitive to industrial emissions;
- sites sensitive to a mixed pollution, likely to be observed, in Toulouse, in particular residential areas.

Further information can be obtained from:
M. Payrissat, E.I., CEC-JRC Ispra, I-21020 Ispra (VA) Italy
Tel. ++39.332.789118, Fax ++39.332.785236
E. De Saeger, E.I., CEC-JRC Ispra, I-21020 Ispra (VA) Italy
Tel. ++39.332.785841, Fax ++39.332.785236

EC Research Programme and Support Activities to the Commission

MAJOR INDUSTRIAL HAZARD (MIH)

In the second EC R&D Framework Programme of the MIH research was part of the STEP area and was considerably expanded both in terms of finances and scope. 15 MECU of Community Funds were allocated to 20 projects. In addition to the work in:

- improving understanding at chemical and physical accident phenomena, two new areas were added, i.e.;
- technologies to prevent or ameliorate accidents;
- risk assessment and management.

The separation of activities was maintained in the new EC Environment Programme (which is part of the 3rd Framework Programme) under which new projects were started in 1992. The objectives of the work remain concentrated on the needs of companies and regulators in Europe in ensuring that the risks from industrial activities are minimised.

It was the CEC's intention to emphasise last two areas to balance the earlier concentration on experiment and modelling of chemical and physical phenomena. However the numbers of very good proposals in the above areas were so high that it has been impossible to follow this intention initially.

Area 1 - *Risk assessment and management*

The CEC has supported a considerable quantity of work on the quantification of risks. In particular the "Benchmark" (MTH-HH) compared the results of teams working in parallel on one plant. Further work in quantification including public perception of risks and human factors was started in the project MTH-LD and continues in STEP 93, 94 and 95. Safety audit techniques offer a semiquantitative approach and are being investigated in STEP 90.

The investigation of numerous industrial accidents has lead to realize that, although a single critical event might be identified as the cause (failed valve, wrong button pushed etc.), real causes are less superficial; they relate to the management of risk. The introduction and improvement of risk management into organisation is the most important issue to improve safety in Europe. For this reason work in this area is now being emphasised. A start to studying organisational safety issues in leading industrial companies was made in STEP 104. Tools to manage and process information relating to risk management at the company and at the local area level are being researched. One exciting project looks at the feasibility of establishing an integrated safety information system for two European regions, one being around Venice in Italy. A key issue highlighted by some recent tragic events is escape routs. Tools to allow for better design of sports stadia, industrial plants and built-up areas are being studied using as a basis earlier work on crowd behaviour.

Area 2 - *Improving understanding of chemical and physical accident phenomena*

In area 2, new experimental work was launched, from the most recent call, in understanding and preventing dust cloud fires and explosions. This complements the ongoing work on the release and dispersion of gases and volatile liquids (STEP 91, 99, 116 and 125), liquid fires (STEP 92), jet fires (STEP 98), warehouse fires (STEP 92, 96 and 109) and gas explosions (STEP 111). Further new work in other areas of chemical and physical phenomena was delayed until a better idea of the results of che considerable ongoing efforts is obtained through the model validation activity described below.

Area 3 - *Technologies to prevent or ameliorate accidents*

In Area 3, new work was launched, from the most recent call, on establishing a rigorous scientific understanding of water curtains, which are used as a technique for dispersing toxic clouds, and of water sprayers, which are used to cool plant containing hazardous materials in fires. Also the possibility of using inerting (reducing oxygen levels) in the handling of flammable dusts will be investigated.

Dissemination

The dissemination of the research results is an important topic in its own and worth of specific attention. To assist in this task the CEC ha set up SHARE (Safety Management and Hazard Assessment Coordination in Europe) to help bringing researchers together, to focus European research on real problems and to provide means for disseminating the outcome of this research to industry and regulators. Additionally, the CEC has set up the VALUE programme and through CORDIS can provide an information service based on electronically accessed data bases, aimed to support all the shared-cost research actions.

Model quality

The investment made by the EC, other public authoritories and companies in the 1980's in experimentation on release phenomena has lead to the production of large banks of data of varying quality. It has also resulted in the development of many mathematical models of these phenomena. These models have very often been translated into computer software. The quality of these models is very variable. Their wide availability especially through PC-versions has caused concern both in Europe and the US that decisions of great commercial and social importance are being made on the basis of poor quality models, or models used outside their limits of applicability. To investigate this question the CEC supported a study by Dr. R. Britter of the University at Cambridge. On the basis of his report "The Evaluation of Technical Models Used for Major Accident Hazard Installations" CEC (EUR-14774-EN) and the recommendation of the SHARE steering group, the CEC has established the Model Evaluation Group, with the objectives of raising the quality and awareness of the models used in hazard evaluation. It aims to involve all the leading experts in Europe to draw up advice on the use of available models and to promote the dissemination of knowledge on the applicability of these models.

European Process Safety Centre

In addition the CEC supports the aims (though no financial support has been asked or given) of the newly established European Process Safety Centre (EPSC). It has presently a paid-up membership of 40 companies and is modelled on the lines of the highly successful Centre for Chemical Process Safety in the US. The desire to promote safety technology and its dissemination, is common to both the CEC and the EPSC.

The individual projects carried out within the MIH programme are listed below.

The list of completed projects (pilot phase) and of on going ones is as it follows:

Completed Project

Project Ref.	Project title
MTH-AA	**Two Phase Cloud Growth Following a Sudden Release of Liquefied Gas.** Project Leader: John Barton, Health & Safety Executive Buxton, U.K. - Tel. ++44 29826211.
MTH-BA	**Continuous and Instantaneous Heavy Gas Clouds.** Project Leader: Prof. Peter Builtjes,TNO Apeldoorn NL Tel. ++3155493493
MTH-DB	**Investigation of Flame Propagation.** Project Leader: Dr. Hees Van Wingerden TNO Prins Maurits Lab, NL - Tel. ++3115842842
MTH-FG	**Physical Modelling of Torch Fires.** Project Leader: Dr. Nijs Duijm TNO Apeldoorn, NL Tel. ++315493493

MTH-LD **Unconscious Disinformation Process in Major Technologica Hazards.**
Project Leader: Mrs Bernadette De Vaussay, CREDA Paris, F - Tel. ++33142862097

MTH-HH **Benchmark Exercise on Major Hazard Analysis.**
Project Leader: Dr. Aniello Amendola, JRC Ispra Tel. ++39332789208

On going Projects

Risk Assessment and Management

The research in this area is based on the quantification of risk and the identification of ways of reducing it. Understanding of risk management is the most important item in reduction of risk of the general public and employers. Most large industrial accidents are, at least partially, attributable to human error. Some organisations have developed a culture that makes them generally better performers in safety issues. There is evidence that organisations strong in this respect are also strong, in other performance indices. The identification of the characteristics that go to make this "Safety Culture" and its transfer to other organisations could therefore lead not only to an increase in public safety, but more economical efficiency.

Project Ref. Project title

STEP 81 **Development and application of a multi criteria evaluation methodology for regional planning and siting of major hazard plants with a focus on the southern regions of the EC.**
Project Leader: Mr. H. Briassoulis, Society for Ecology and Development Athens GR - Tel. ++3013619837

STEP 83 **System response generator.**
Project Leader: Mr. Erik Hollnagel, CRI, Birkerøde, DK Tel. ++3376466081 - Tel. ++44925254522

STEP 85 **An overall knowledge-based methodology for hazard identification (TOMHID).**
Project Leader: Mr. N. Edmonson, UKAEA Warrington,UK Tel. ++4492523200

STEP 89 **Human error analytical taxonomy.**
Project Leader. Mr. Gioacchini, Technimont S.p.A., Milan I Tel. ++39262709025

STEP 90 **Environmental assurance index database.**
Project Leader: Mr. A Dyer, Lloyds Register, Croydon, UK Tel. ++44816814040

Assessment of the safety of hazardous industrial processes in the presence of design faults.
Project Leader: Mr. Robin Bloomfield, Adelard, London UK - Tel. ++44819831708

Auditing and safety management for safe operation operation and land-use planning: a cross-national comparison and validation exercise.
Project Leader: Mr. N. Hurst, Safety Engineering Laboratory, Sheffield, UK - Tel. ++44742892000

Integrated modelling of the management of evacuation from hazardous situations.
Project Leader: Mr. I. Brearley, UKAEA Warrington, UK Tel. ++44925232000

Multi-user system for training and evaluation of environmental emergency response (MUSTER).
Project Leader: Mr. Verner Andersen, Risø National Laboratory, Roskilde, DK - Tel. ++4542371212

"LAESS": Local area emergency support system.
Project Leader: Mr. R. Dumolo, Electrowatt, Horsham UK Tel. ++4440350131

Integrated information systems for risk management at the regional level.
Project Leader: Mr. G. Giannandrea, CVD, Venezia, I Tel. ++39415209558

Development of methods for obtaining trade-off judgements from the public suitable for input to decisions on the siting of hazardous chemical industry installations.
Project Leader: M.P. Allen, Robens Institute of Health, Guildford, UK - Tel. ++44483509203

STEP 93 **Safety optimisation criteria and risk assessment tools for emergencies and siting.**
Project Leader: Mr. I. Papazoglou,Demokritos, Aghia,GR - Tel. ++3016535683

STEP 94 **Can the mental processes of representation and decision making in a major risk situation be modified?**
Project Leader: Mr. L. Consolini, Socatec Enviroment, Vanves, F - Tel. ++33146444411

STEP 95 **European comparison of the credibility of various sources of information to the public on major industrial hazards.**
Project Leader: Mrs. Anne Lalo, University of Grenoble, F Tel. ++3376406081STEP 104

STEP 104 **Management at risk (SMART).**
Project Leader: Mr. S.A. Brearley, SRD, Warrington, UK

Chemical and Physical Phenomena

The research relates to the accidental release from store, manufacture or transportation of chemicals which are toxic or flammable. In addition to the research projects described below the models developed within the programme and elsewhere are being examined through the Model Evaluation Groups. These aim to disseminate and validate the wide range of models on chemical and physical phenomena.

Project Ref. Project title

STEP 91 **Flashing flow through and out of a breach of a pressurized vessel containing a liquified gas.**
Project Leader: Mr. J. Delhaye, Grenoble, F Tel. ++3376883054

STEP 92 **Fire and associated toxic gas releases modelling, involving in particular chlorinated solvents (Mistral).**
Project Leader: Mr. J.L. Malet, CEA, Fontenay-aux-Roses, F - Tel. ++4429876211

STEP 96 **Major Hazards arising from fires in warehouses and chemical stores.**
Project Leader: Mr. K. Moodie Health and Safety Executive, Buxton UK - Tel. ++4429876211

STEP 98 **Research on the dispersion of two-phase flashing releases (JIVE).**
Project Leader: Mr. N.J. Duijm, TNO Apeldoorn, NL Tel. ++3155493493

STEP 99 **Measurement and prediction of mean and fluctuating concentrations of flammable and toxic gas releases.**
Project Leader: Mr. R. Brown, British Gas, Midlands Research Station, Solihull, UK - Tel. ++44217057581

STEP 109 **Combustion of chemical substances and the impact in the environment of fire products.**
Project Leader: Mr. L. Smith - Hansen, Risø Laboratory, Roskilde, DK - Tel. ++4542371212

STEP 111 **Modelling and experimental research into gas explosions (MERGE).**
Project Leader: Mr. P. Mercx, TNO, Rijswijk, NL Tel. ++3115843462

STEP 116 **Modelling of two-phase release dispersion for hazard assessment.**
Project Leader: Mr. R. Martini, CISE, Segrate, I Tel. ++39221671

STEP 125 **Hazard consequences of jet fire interactions with vessels containing pressurized liquids (FLADIS).**
Project Leader: Mr. N.J. Duijm, TNO, Apeldoorn, NL Tel. ++3155493493

The effect of dust explosion pressures on industrial plant, buildings, work places, public areas and environment.
Project Leader: Mr. P. Middleton, British Material Handling Board, Ascot, UK - Tel. ++4434423404

Dispersion of two-phase flashing release - FLADIS field experiments.
Project Leader: Mr. N. Nielsen, Risø, Roskilde, DK Tel. ++4542371212

Review and dissemination of physical effect models developed within the industrial hazards "Major Industrial Hazards" programmes.
Project Leader: Mr. N.J. Duijm, TNO, Apeldoorn, NL Tel. ++3155493493

A database for validation of models used in chemical risk assessment.
Project Leader: Mr. R. Kakko, VTT, Tampere, SF
Tel. ++35831163274

Accident Prevention and Amelioration

Research aims at producing technological measures both to mitigate the consequences of an accident and to improve the intrinsic safety of plants and transport devices for dangerous bulk substances

Project Ref. Project title

Prevention of ignition in partially inerted dust/Air atmospheres.
Project Leader: Mr. N. Maddison, Chilworth Technology Ltd Southampton, UK
Tel. ++44703760722

Integrated qualitative and quantitative portable tankfoor scanner.
Project Leader: Mr. W. Van Leuven, Roentgen Technische Dienst, Rotterdam, NL
Tel. ++31104150200

Mitigation of hazardous releases by fluid curtains. Engineering predictive model validation by wind tunnel experiments.
Project Leader: Mr. J. Lieto, ITC, Lyon, F
Tel. ++3378700040

Optimisation of water sprayers (Wasp).
Project Leader: Mr. Goffe, Bertin, Tarnos, F
Tel. ++3359648648

General information on the program and on on going projects be sought from:
S.T. Cole, CEC - XII-D-1
200 Rue de la Loi B-1049 Brussels
Tel. ++32.2.295.0347, Fax. ++32.2.296.3024

More detailed questions should be addressed to the appropriate project leader indicated.

Model Evaluation Group

MEG is a European initiative on evaluation of technical models used within the major industrial hazards area and is supported by the CEC DGXII, Directorate-General for Science Research and Development.

Technical models are used in a number of areas of industrial hazards assessment. It is becoming more and more apparent that most of these models have never been through a procedure of evaluation, but nonetheless are used to assist in marking decision which may directly affect the safety of the public and the environment. As a major funder of European research on Major Industrial Hazards, DGXII is conscious of the importance in ensuring that model development is of a standard which is commensurate with the importance of model use.

A meeting which attracted 35 persons from industry, authorities and research, and with a good European coverage, agreed to establish a Model Evaluation Group and recommended that an initiative be supported by the CEC.

The objectives of a Model Evaluation Group are twofold. The primary aim is to improve the culture in which models are developed and used and so ensure that technical models used in all aspects of major hazard evaluation, are up-to-date with technical developments and utilised by personnel well-versed in their applicability and functioning.

Secondly, in the course of the work the result are applicable in assisting the CEC in establishing a balanced set of research priorities for its research programmes within Major Industrial Hazards.

The CEC's advisory body Safety Management and Hazard Assessment Research Cooperation in Europe (SHARE) acts as the steering committee for the initiative.

MEG is entrusted with the following tasks:

- Classification of available models in major industrial hazards;
- Development of a general evaluation protocol for evaluation of technical models in major industrial hazards;
- Development of a guideline for model developers;
- Definition of working groups and working groups tasks for selected classes of models;
- Status on model evaluation within the subject area of working groups;
- Identify research needs;
- Open European seminar where results are presented.

The activity in the working group is open to European researchers and users of technical models applied in the major industrial hazards area. The CEC/DGXII is supporting the work covering travel and subsistance for those nominated to perform the tasks.

Further information can be obtained from:
Steve Cole, CEC, DGXII/D/1 rue de la Loi, 200,
B-1049 Brussels, Belgium
Tel. ++32.2.295.0347, Fax: ++32.2.296.3024

Industrial Hazard Research at the Institute for Systems Engineering & Informatics of the JRC Ispra

Decision Support Systems for Environmental Management

This activity is oriented to the development of Decision Support Systems (DSS) which can be used to address problems of Environmental Management. The methods developed are based on the use of clearly specified (formal) models, or sets of models, implemented using suitable information technology, and the resulting information systems are designed to be integrated within, and to improve upon, existing decision making processes. A major feature of the systems developed is that they incorporate techniques from the field of Multi-Criteria Decision Aid (MCDA).

The choice of approach is accomplished by studying the decision-maker's behaviour in previous or, more frequently, fictitious contexts, or by otherwise interrogating him or guiding his self-examination. This method has been used in the development of several DSSs: the most recent one being RITO (Rifiuti Industriali Tossici, i.e. Toxic Industrial Wastes), a system to support the management of industrial wastes on regional scale. A number of different scenario generation techniques were implemented all based on the choice of a set of points, (in fact sites for waste disposal plants), selected from a finite set of candidate points, in order to minimise a parameter which characterised the spatial distribution of the "plant" points by quantifying their distances from another set of "customer" points.

Other possibilities for generation of alternatives studied is the integration of DSS with GIS (Geographic Information Systems). Taking for example a decision problem for the siting of a plant, the area screening techniques available in GIS could be used to identify all the potentially feasible areas in which to look for sites. This can be achieved by overlaying relevant siting factors, such as population, geology, and height, to select the areas which simultaneously satisfy required values. In DSS terminology they define the relevant subset of efficient alternatives. GIS routines also allow quick comparative evaluations, based on selected criteria, and their easy modification to meet particular requirements.

GENET - A method to generate alternatives for facilities siting using Genetic Algorithms

The process of generating alternatives has been given little attention by decision makers as part of the whole process of decision.

The purpose of this project is to present a methodology aimed at generating alternatives for siting of facilities taking into account a number of environmental factors. This is carried out by applying genetic algorithms (GAs) which are natural phenomena based algorithms for optimisation and random search procedures. GAs provide probabilistic convergence.

The mechanisms that link a GA to the problem being solved are two: a way of encoding solutions to the problem (chromosomes - to mimic natural phenomena) and an evaluation (fitness - also to mimic natural phenomena) function that returns the worth of any

chromosome in the problem context. In this study, GAs carry out simulated evolution on populations of strings of binary digits.

The methodology being developed can be described as a random search process through a discrete space whose points have a certain value according to their environmental quality (fitness). The search space is a representation of a territory whose characteristics are stored by means of a Geographic Information System (GIS). Several layers of information are stored in the GIS and each layer represents an attribute.

The attributes analysed within the study are of two types:

- mappable attributes which are of environmental nature (e.g. geology, land use, etc.) and
- continuous attributes which are not mapped and are manipulated directly by the algorithm (e.g. distance to a certain point in space).

GENET is an automatic method to generate alternatives for facilities siting linked with the GIS GRASS (Geographic Resources Analysis Support System). It is possible to run the algorithm within GRASS. In this way the necessary information is provided by this system in the most convenient format and the same system's tools are used for displaying and storing the results, i. e. the generated alternatives and their characteristics are available for further analysis, viz. environmental impact assessment, cost/ benefit analysis, risk analysis, etc.

A prototype GIS for the 'Ecocentre Ispra'

A proposal has been made to use the site of the Joint Research Centre Ispra to demonstrate more environmentally oriented approaches to site management. The project will be called "Ecocentre Ispra" and will address issues such as energy conservation, recycling of materials, waste management, and protection of people and species of animals and plants. This provides an ideal opportunity to demonstrate the application of Geographical Information Systems as a means for supporting and structuring spatially referenced information on the various themes considered, and to provide new insights into environmental problems by the use of spatial analysis. In order to illustrate some of the possibilities, and to develop further competences for use in the development of decision support systems for environmental management, a prototype demonstration system for the JRC site was implemented, currently being extended to the creation of a three dimensional model of the Ispra site.

Euroscope

Following the successful application of the Geographical Information System "GeoScope" to a project on waste management in Lombardy, it was decided that it would be very useful to have a version of this program specifically configured for use with European Statistical Data, and ready prepared with maps of the appropriate European Statistical Regions (NUTS - Nomenclature of Territorial Units for Statistics - regions). This would permit the rapid creation of the GIS support required to build decision support systems to address problems on European scale, with easy manipulation of Eurostat statistical data referenced to the NUTS regions.

The first "Beta" version of EuroScope is now available for internal use.

Road and Rail Transport of Dangerous Goods

A prototype version of the risk management programme XTRIM (an X-windows programming version of the Transport Risk Management programme) is now available. The background for developing this programme was that a collection of accidents from open literature sources showed that transport accidents form a significant fraction of accidents involving dangerous substances; namely 729 transport accidents (40%) out of 1801 accidents for both fixed installations and transport. Further study of this accident data showed that transport accidents and accidents at fixed installations have equal probabilities of escalating once they have happened.

The work of collecting transport accidents, executed in connection with the XTRIM project, was finalised in the form of an EUR report (14549 EN, 1992) containing a list of the transport accidents. The accidents are divided into groups according to the mode of transport: pipeline, road, rail, inland waterways, marine and some accidents during loading/unloading.

With XTRIM it is possible to answer the question: "What is the risk of transporting a given substance in a specific tank, using a specific route between two towns?" More complex risk assessments are possible by finding the solutions one by one and subsequent addition of these. The approach adopted for answering the question involves the assessment of three parameters:

- the traffic accident frequencies, including a description of the types of accidents with their frequency,
- the probability of having a release, given the traffic accident,
- the consequences of a release of the transported substance.

Third Party Work

The MAPO project

The initials MAPO indicate a decision support system for the Management of planning and control of the cleaning up of the river PO. The project is financed by the Italian Ministry of the Environment and by the JRC. The basin which is the subject of the study is the largest in the country.

Most of the work related to the MAPO project was carried out in 1991, and in 1992 the final report was written and delivery of the software was undertaken. (for further details about the project, see the JRC annual report of 1991). In 1992 the resulting prototype was also demonstrated to the client and to other relevant authorities. These presentations of the work went very well, and there are high hopes that the work may continue under a new agreement with the Ministry.

Work was initiated in 1992, to document and publish the scientific results obtained during the project, especially related to the integration of multi criteria decision support systems and expert systems.

RITO

RITO is a decision support system for the rational management of toxic and noxious industrial waste on regional scale, which has been developed as a third party contract for the Italian Ministry of the Environment. The system is a decision aid which should help to reduce, as much as possible, the overall impacts (on man, the environment and the economy), associated with the installation of the necessary waste disposal and treatment facilities in the reference region. During 1992 the development of the system was completed.

The RITO system consists of a high performance Personal Computer equipped with data bases, a geographical information system, various specialist programs and a user interface connecting all system components and facilitating user interaction. The most important activities accomplished this year were the system analysis and design for the integration of the complete system, the development of the user interface, and the use of the system for a case study.

The user interface program performs the integration between all specialist modules in the system, and links the system with the Geographical Information System (GIS). It supplies user-friendly and consistent communication between the user and the different modules, and produces numerical results and tables, coloured graphs and thematic maps.

For further information please contact:
P.S. Haastrup, I.S.E.I., CEC JRC Ispra, I-21020 Ispra (VA)
Tel. ++39.332.789083, Fax ++39.332.789394

New technologies and safety at work.

System Response Generator (SRG) (STEP Project 83)

The purpose of the System Response Generator project is to develop and implement a software tool which can be used to analyse the interactions between an operator and a process, in

particular the influence of human decision making and action in the way in which incidents in complex systems evolve. Specific uses of the SRG are:

- to explore the ways in which a scenario can evolve, by systematically examining all the possible combinations of conditions and events;
- to identify potential problem areas, i.e., the parts of the task and the Man-Machine Interaction where problems are likely to occur;
- to evaluate the effects of specific modifications to the system (of e.g. procedures, information presentation, level of automation, or control options), and
- to provide quantitative data as input to more formal types of analysis.

The System Response Generator architecture consists of a number of software modules.

The system mediates, supervises, and controls a simulation of human decision making and action, and a simulator of the process. A first version of the System Response Generator has been implemented and successfully tested in the avionics domain. The specification of the Operator Simulator has resulted in the design of a Contextual Control Model. The Operator Simulator is a continuation of the already existing activity on the cognitive simulation model, called COSIMO. Experiments have been conducted and analysed on the application of cognitive models in a system of co-operating agents.

Two demonstrations of the SRG have been implemented: the control of a simple tank and the control of an aircraft. For the latter application a simulation of a generic Airbus 300 has been used, with a representation of a pilot following the procedures for auto pilot based manoeuvres. The aircraft application has been used to analyse the consistence and robustness of procedures for nominal flight and emergency procedures.

Human Factors studies

The activity relating to the analysis of procedures and of human errors with dynamic methods has been developed in connection to the research conducted in the same domain in the reactor safety area. In particular, a study of the pilot-aeroplane interaction of a Boeing 747 type like aircraft, during the approach to landing phase, has been developed. A classical human reliability technique, THERP (Technique for Human Error Probability), has been employed as reference in order to present the advantages derived from the use of a dynamic human reliability analysis. It has been shown that, given certain initial conditions of the system, the study of the sequence with a dynamic technique for human reliability, based on the simulation of the man-machine system, may turn in failures success sequences obtained with the simpler THERP analysis. It could be shown that the human error dynamic event tree resulting from a man-machine simulation, with the enhanced failed sequences, which are evaluated as successes in a THERP analysis.

In this area of research, another project is being carried out in collaboration with other European research institutions and industries: HEAT (Human Error Analytical Taxonomy Project STEP-CT 90-0089). This project is dedicated to the development of a method for the data collection and organisation of accidents related to human factors and it contains a new type of protocol essentially oriented to the socio-technical aspects of the working environment in which the accident has been generated. A first set of field data have been analysed and a number of more methodological factors, relative to the data collection software have been studied (STEP-PROJECT HEAT - Interim Report, 1992). The software has been further developed at JRC and it is presently being revised and tested for the final release and description.

For further information please contact:
P.C. Cacciabue ISEI CEC-JRC Ispra, I-21020 ISPRA (VA)
Tel. ++39.332.789869, Fax ++33.332.789156

Environmental Impact Assessment

The growing need of knowledge and transparency in the management of environmental problems calls for an increasing research activity in the environmental field, particularly in the analysis of environmental systems. The Council Directive on the assessment of the effects of certain public and private projects on the environment (Directive 85/337/EEC) and the Council Regulation on ECO-audit, which is expected to be adopted very soon, ask detailed studies that require accurate methods and sophisticated tools to be performed at the convenient quality level. In fact, the quality level of the EIA performed to fulfil the requirements of the directive 85/337/EEC is generally lower than expected by the authority, in all the EC countries. The activity here discussed is intended to help to reduce the gap between the quality of the available methods to be used for environmental systems analysis and the real needs. It mainly concerns environmental indicators and indices, environmental models, methods and tools.

Environmental indicators and indices

The proceedings of the Workshop on "Environmental Indicators" held at JRC Ispra on 2 December 1991, in collaboration with the Italian Association of the Environmental Analysts, were published. The contributions deal with the following topics: fundamentals of environmental indicators and environmental standards, limits of the "objectivity" of the environmental standards, role of the environmental standards in the environmental policy, choice of the statistical parameters to be used as reference in defining environmental standards. The proceedings also contain the synthesis of the concluding Round Table devoted to a critical analysis of the available environmental standards. The need of a common language to improve the understanding among the experts in the various fields and the lack of clear reference criteria are underlined.

A synthetic index to evaluate the quality of the water of a river has been developed. The aim was to define a simple index, based on a limited number of parameters, to be used for routine monitoring. The index includes six parameters: dissolved oxygen, BOD5, COD, ammonium, total phosphorus and faecal coliforms. The quality of the water is defined according to the range of values of each parameter. The index was applied to the river Po. Two collaborations started. The first one, with the University of Pisa (I), concerns time and space variability of environmental indicators. The second one, with the University of Marburg (D), concerns distributional aspects of environmental indices.

Models describing the aversion-dispersion of pollutants in rivers and groundwaters were reviewed. The review addresses the following problems: aversion-dispersion of pollutants in rivers under normal and abnormal (i.e. accidental) conditions, thermal pollution of water courses due to discharge of hot water during normal operation and aversion-dispersion of pollutants in groundwater from diffuse and point sources.

Further information can be obtained from:
A.G. Colombo, ISEI CEC-JRC Ispra, I-21020 Ispra (VA)
Tel. ++39.332.789406, Fax ++39.332.789007

Risk Analysis

The objective of this activity is the development of procedures and models for risk analysis of chemical installations as well as the study of accidents consequences and of preventive measures.

The computer code ISPRA-FTA has been successfully distributed to about 40 organisations, and is one of the first example at JRC of a tool developed for a scientific purpose and then commercialised. A new version in C language is under development.

A model for the evaluation of the behaviour of tanks subject to nearby fires and for the assessment of the corresponding mitigating measures has been developed. It will be the subject of a PhD thesis at the university of Thessaloniki

For further information, contact:
S. Contini, ISEI - CEC - TRC CEC-JRC Ispra, I-21020 Ispra (VA)
Tel. ++39.332.789217, Fax ++39.332.789007

Support to the Community Environmental Policy

Scientific/technical support for the implementation of Directive 82/501/EEC on MajorAccident Hazards

The Community Documentation Centre on Industrial Risk (CDCIR) is now well established:

- on the one hand, by its extensive collection of documents it

allows diffusion of information on safety regulations, codes of good practice, accidents investigations and other relevant material, to authorities, industry and research organisations (the regular publication of bulletins has been insured);
- on the other hand, it is publishing the results of studies performed by JRC or sponsored by JRC to exchange information on national experiences.

Such reports have interested a wide number of customers. They can be classified into different categories:

a - Accidents Investigation:

1. Major Accident Reporting System. Lessons Learned from Accidents Notified.
2. Major Accident Reporting System. Lessons Learned from Accidents Notified. Volume 2.
3. Review of Environmental Accidents and Incidents.
4. Review of Accidents Involving Chlorine (EUR 14444 EN).
5. Review of Accidents Involving Ammonia.
6. Review of Accidents Involving Unexpected Run-away Reactions.

b - Analysis of Chemical Emergencies

7. Lessons Learnt from Emergencies after Accidents in the UK. Involving Dangerous Substances.
8. Lessons Learned from Emergencies after Accidents in the FRG involving Dangerous Substances.
9. Lessons Learnt from Emergencies after Accidents in France Involving Dangerous Substances.

At the request of the Competent Authorities the studies on emergencies have been extended to the other member countries: for Italy, Greece, Ireland, Denmark and the Netherlands the studies are already in progress; whereas for Belgium and Luxembourg, Spain and Portugal the corresponding study contracts are being established).

c - Comparison of Safety Regulations and Standards

10. National Approaches to the Safety Report.
11. Comparison of LPG Related Regulations.
12. Comparison of selected LPG Related Codes and Standards.

d - Information of the Public

13. Empirical Evaluation of Public Information around Major Hazards Sites.

Because of the success and hence increasing number of customers of the CDCIR service, it was found to be an advantage to design and implement a data base, which is able to supply the information in the bulletins on a Informatics support. Firstly floppy disks may distributed on request and when the number of data increases distribution on CD is foreseen. The database system is now in a test phase.

The Major Accidents Reporting System (MARS), 10 years after the issue of the Directive, has required a new design since the notification procedures has been modified according to the experience gathered so far from the accidents notified and the corresponding analyses. Such change is also inked to the fundamental revision of the Directive (foreseen to be proposed during 1993) where a clearer definition of notifiable accidents is given.

Furthermore cooperation has been given to the works of the revision of the Directive, for drafting guidelines for information of the public about hazardous installations and advise has been given to the relevant technical working groups for the implementation of the Directive.

Further information can be obtained from:
A. Amendola, ISEI CEC-JRC Ispra, I-21020 Ispra (VA)
Tel. ++39.332.789208, Fax ++39.332.789007

Scientific technical support for the implementation of Directive 90/219/EEC and of Directive 90/220/EEC

This activity concerns the scientific technical support for the implementation of the Directive 90/219/EEC on the contained use of genetically modified microorganisms (GMMs) and of the Directive 90/220/EEC on the deliberate release into the environment of genetically modified organisms(GMOs).

The S/T support has been organised in a way very similar to the actions on the Major Accident Project. Indeed the customer is the same DGXI service and the activities can be assisted by very similar informatics tools.

As a service to the Competent Authorities, ISEI acts as an information centre where they can obtain assistance for specific safety related questions. In addition, a mandate was given to collect relevant information on safety and regulatory issues in a biotechnology documentation centre. The content of it was reviewed in a bulletin, the 'European Community Documentation Centre on Biotechnology Safety and Information" which has been widely distributed and which will be produced on a regular basis. The structure of the bulletin and the data base is very similar to that of the previously described CDCIR.

Since a mandate was received to hold a register of biotechnology accidents, notified under Directive 90/219/EEC, a database was developed to accommodate these notifications according to a form agreed upon in the Committee of Competent Authorities. Again a structure very similar to MARS has been adopted. ISEI has further assisted DG XI in international fora and has participated in the ECUS bilateral environmental consultations (the permanent technical working group on biotechnology and the environment) and in the OECD meetings with the Group of National Experts in Biotechnology.

Further information can be obtained from:
G.L. Van den Eede, ISEI, CEC-JRC Ispra I-21020 Ispra (VA)
Tel. ++39.332.785239, Fax ++39.332.785483

Support to Civil Protection Policy

In 1992 DGXI has asked ISEI to explore the desirability and the feasibility of the creation of a European 'Observatory' on natural disasters. For the purpose ISEI is planning a conference to be held on October 1993, in cooperation with both DGXI and DGXII.

As a preparation to the conference a workshop on Emergency Management has been organised at Ispra, on 23 -24 June 1992 which opened a trans-disciplinary and cross-cultural debate among experts of different disciplines.

Among the main items emerging from the discussions as worthy of deep attention, the following are encouraging towards the prosecution of the activity:

- Unified framework for natural and technological disasters (benefits of the "Seveso Directive" for risk management of chemical installations);
- Subsidiarity: added value from the comparison of national experiences;
- Risk management whole cycle: prevention (land use planning, technology state of art), event monitoring and forecasting, preparedness & response, risk communication at each step;
- Organisational learning as an open environment (organisation has no memory...);
- Interest for the proposed observatory and usefulness of the planned conference if organised in a way that would allow a constructive debate among all involved parties among priorities for a possible common action.

For further information, contact:
A. Amendola, ISEI CEC-JRC Ispra, I-21020 Ispra (VA)
Tel. ++39.332.789208, Fax ++39.332.789007 or
Mrs. B. De Marchi, ISEI CEC-JRC Ispra, I-21020 Ispra (VA)
Tel. ++39.332.789601, Fax ++39.332.789007

Other Activities Relevant to EC Environmental Programmes

Environmental Protection and Conservation of European Cultural Heritage

Information on activities managed by DG XII-D-1 in this area was given in ERN n. 2 (Air Quality, topic "Effects of air pollution on historic buildings and monuments"), n. 4 (in the frame of the cooperation with the EUREKA project EUROCARE), n. 5 (Programme STEP) while information on DGX-Cultural Action have been given in ERN n. 5, 7 and 9.

The EC research programme in this field has grown slowly but steadily; in the third EC Environmental R & D Programme (1984-1985) some 9 istitutions participated with a total EC contribution of about 0.75 MECU; within STEP (1989-1992) there are 8 coordinated projects with some 40 participating institutions and a total EC contribution of about 5.5 MECU revealing the evolution of the programme from an initial emphasis on the effects of air pollution on historical stone monuments to the current inclusion of materials such as paper, leather, metal and brick.The projects pended within this EC research area are listed in the following table.

Effects of Air Pollution on Historic Buildings (1986-1990)

1.1 The Interrelationship of Air Pollution Levels and Stone Decay Rates at Historic Monuments
1.2 Kinetic Studies of SO_2 Reactions with Marble
1.3 Reactions of Nitric Acid and Nitrates with Pentelic Marble
1.4 Case Studies in the Deterioration of Stone Monuments in Italy
1.5 Application of Advanced Methods of Chemical Analysis to Stone Conservation
1.6 Chamber Studies on Air Pollution Damage to Stone
1.7 Ultrasound Applied the Non Destructive Examination of Stone Structures
1.8 Biodeterioration Studies on Stone Monuments
1.9 Environmental Deterioration and the Monastery of Jeronimos: A Case Study
1.10 Non-Destructive Evaluation of Stone Monuments in Pavia:A Case Study.

STEP Programme: Protection and Conservation of the European Cultural Heritage (1989-1992)

2.1 Effects of Air Pollutants on Cellulose Containing Materials
2.2 Conservation of Metal Objects from Archaelogical Sites
2.3 Environmental Deterioration of Ancient Leather
2.4 Conservation of Megalithic Monuments
2.5 Deterioration of Granitic Monuments in Various Part of Europe
2.6 Deposition of Atmospheric Pollutants on Ancient Monuments
2.7 Effects of Atmospheric Particles on Historic Buildings
2.8 Environmental Deterioration and Protection of Historic Buildings

Environmental Protection and Conservation of Europe's Cultural Heritage (1991-1994)

3.1 Marine Spray and Polluted Atmosphere as Factors of Damage to monuments in the Mediterranean Coastal Environment
3.2. Non-destructive Testing and System Identification to Evaluate Diagnostic Methods and Reinforcement Techniques Applied to Historical Building
3.3 Assessment and Monitoring the Environment of Cultural Property
3.4 New Conservation Methods for Outdoor Bronze Sculptures
3.5 Expert System for Evaluation of Deterioration of Ancient Brick Masonry Structures
3.6 Interactive Physical Weathering and Bioreceptivity Study on Building Stones, Monitored by Computerized X-Ray Tomography (CT) as a Potential Non-Destructive Research Tool
3.7 The Role of Atmospheric Pollutants and of Surface Characteristics in the Degradation of Monuments.

Projects Funded Under the EC "Protection of the European Cultural Heritage" Research Area.

This work will be continued within the framework of the EC "ENVIRONMENT" R&D Programme (1991-1994). The overall objective is to provide substantial support to the development of a scientific basis for environmental protection, restoration and conservation of European Cultural Heritage. At present (1st Phase), 7 new research contracts have been awarded with a total EC contributions of about 5 MECU, namely:

Marine Spray and Polluted Atmosphere as Factors of Damage to Monuments in the Mediterranean Coastal Environment

(Scientific Coordinator: Prof. Zezza, Politecnico di Bari)

The project is aimed at studying the role of climatic and environmental factors on the weathering process and at investigating the problems of stone decay of monuments in the Mediterranean coastal areas of southern Europe, focusing on the effects of marine salts acting together with atmospheric pollutants. In addition an analytical methodology has to be developed to identify the caracteristics of stones, that can help to understand the weathering processes in view of providing a basis for the most suitable conservation techniques and practices.

For the purpose, the following pilot monuments located along the east-west axis of the Mediterranean will be studied:

The Cathedral of Cadiz (Spain), the Cathedral of Bari (Italy), and the Temple of Eleusis (Greece). The comparison of these three locations will be supplemented by data gathered in Malta (the Church of Sta. Marija Ta'Cuerra, Siggiewi).
The research programme consists of the following main parts:

- Monitoring of environmental and micro-climate parameters, (microclimate variation, rising damp, air suspended particulates, run-off water, aerosols, trace organic compounds);
- Systematic mineralogical, petrographical and chemical analysis of weathered stones and crusts on the surfaces of the stones as a result of atmospheric pollution;
- Comparison of non-destructive dating techniques for chronological information on the organic components contaminating stones (eg. lichens colonies);
- Analysis of the physical and mechanical characteristics of the weathered surfaces and walls;
- Mapping of weathered monuments using non-destructive techniques in the in situ evaluation of damage.

Non destructive Testing and System Identification to Evaluate Diagnostic Methods and Reinforcement Techniques Applied to Historical Buildings

(Scientific Coordinator: Prof. Nappi, Università di Trieste)

The objective is the development of a methodology for diagnostics, recovery and final evaluation of restoration techniques related to the rehabilitation of historical buildings.

The research programme is to be developed through the application of non-destructive testing methods, numerical models of structural systems, parameter estimation techniques and reinforcement procedures. The survey will be carried out by electromagnetic methods, microseismics, flat actuators and dynamic excitation.

Ultrasonic measurements will also be performed in areas where high definition of mechanical parameters is required.

The above tests are expected to take place in sites of historical interest in France and Italy. Appropriate boundary walls of Middle Age towns are being selected, together with a Venetian building, due to the outstanding interest of the location and to the difficulties involved in that particular environment.

Non-destructive testing will be performed before and after convenient reinforcement techniques being applied. the experimental programme will also include pseudodynamic tests in order to check the effect of seismic actions on different kinds of injections.

Assessment and Monitoring the Environment of Cultural Property

(Scientific Coordinator: Dr. Leissner, Fraunhofer - Gesellschaft)

This project is a study of the atmospheres in which cultural properties are displayed and stored. The project has twofold objective, i.e.:

- To examine, characterize and quantify various typical environments of cultural property
- To develop a glass-based sensor to facilitate assessment of these environments.

Damage to cultural property is caused by environmental pollution in museums, libraries, and historic buildings.

Humidity, light, and air pollution (mainly sulphur dioxide, nitrogen oxides, ozone, ad organic acids) are of primary concern. Materials such as leather, paper, rubber, textiles, glass, and plastics are vulnerable to the attack of indoor pollutants, which, so far, are being monitored only in some museums due to the high costs and highly sophisticated techniques involved.

The project aims at a comparative assessments and examinations of the environment of cultural property sites in northern, central and southern Europe in view of providing the basis for the development of an innovative glass technology which has the potential for:

- assessing the damage potential of the investigated environment;
- developing effective transport and protection methods for art objects.

This first comprehensive study will help to provide information about the relationship of indoor/outdoor pollution and a greater understanding of the environments in which art objects are stored, displayed and transported thus enabling optimization of interactive conservation work to be carried out.

New Conservation Methods for Outdoor Bronze Sculptures

(Scientific Coordinator: Dr. Romich, Fraunhofer - Gesellschaft)

The aim of the project is the development of a new type of coating designed to protect outdoor bronze sculptures from corrosion and deterioration.

Currently available coating systems have proven to have only a limited period of protection (about 5 to 10 years) which is not ideal from a conservation point of view and does not conform to what might be expected from the state-of-the-art of coating systems.

Novel approach is offered by a new class of materials, i.e. organic-inorganic polymers (ORganically MOdified CERamics), presenting the combinations of properties of organic and inorganic components.

The efficacy of various types of ORMOCERs as protective coating is tested on a large number of substrates simulating corroded bronze surfaces.

The first trial applications on originals are carried out only after very broad material/scientific testing is completed. It is anticipated that one or more coatings are developed within the duration of the project.

Expert System for Evaluation of Deterioration of Ancient Brick Masonry

(Scientific Coordinator: Prof. Van Baalen, Katholieke Universiteit Leuven)

An expert systems will be made available to professionals involved in the analysis of ancient buildings in view of improving the knowledge of the effects of enviromental factors and damage to Europe's cultural heritage.

A systematized questionnaire is implemented that allows the collection of expertise from different sources in relation to damage on historic brick masonry structures. The main initial sources are literature data from in situ investigation and laboratory simulation tests. This information is collected in an "Atlas of damage to historic brick structures", containing a uniform terminology and a uniform description of damage types and damage origins deterioration processes. Focus is put on the interaction between the different brick materials and the effect of environmental factors. The deterioration causes can only be understood with the knowledge of the different historic brick masonry construction types and the historic, climatical and geographic context in which those masonries have been built, used and eventually restored.

Testing techniques and analytical methods used in field and laboratory investigations are aimed at determining:

chemical composition; mineralogical and petrographical characteristics; physical parameters (porosity and pore size distribution; higric properties; ageing; changing of pore structure with degradation; durability as function of physical properties); mechanical properties; homogeneity of mortars, bricks and masonry structure; inside structure of the masonry discolouring.

Interactive Physical Weathering and Bioreceptivity Study on Buildings Stones, Monitored by Computerized X-Ray Tomography (CT) as a Potential non-Destructive Research Tool

(Scientific Coordinator: Prof. De Cleene, Universiteit Gent)

This project will focus on physical and biological deterioration of building stones and will assess the usefulness of computerized X-ray tomography (CT) as a non-destructive research tool in monument conservation. Aggressive biological and physical conditions will be evaluated on stones originating from different cultural heritage monuments, exposed to different climatological conditions. The biological part of this project will focus on the contribution to weathering of algae, lichens, mosses, autotrophic and heterotrophic isolated from weathered building stones coming from different climatological conditions and from different substrates bacteria and fungi. Bioreceptivity as an interactive parameter for different types of weathering of building stones will be studied in situ and in controlled chambers under varying conditions.

Scanning electron microscopy (equipped with Energy Dispersive Analysis System) and fluorescence analysis will provide more petrophysical information and will help to determine the limitations and the advantages of the CT-tecnique.

Non-weathered stones will be pretreated under different conditions of pressure, humidity and temperature to create favourable physical microhabitats for a number of colonizing organisms, incubated in controlled chambers. The pretreated stones will afterwards be inoculated by algae, bacteria, fungi and lichens and their degradation will be observed and quantified by CT, scanning electron microscopy and fluorescence techniques.

The Role of Atmospheric Pollutants and Surface Characteristics in the Degradation of Monuments

(Scientific Coordinator: Prof. Lefevre, Université de Paris XII)

The objective is to characterize growth of gypsum on well characterized substrates and to model the mineralogical weathering on the surface of stones using thermodynamic computer codes.

Data (deph profiles of sulphur concentrations) will be obtained by accurate mineralogical and chemical analysis of six varieties of stones previously exposed during one year in various locations.

The experimental growth of gypsum on the substrates, will be induced in conditions close to real as far as atmospheric temperature, relative humidity, SO_2 and NO_2, levels are concerned. The eventual catalytic role of fly-ash and micro-soots will be evaluated by comparison of results in presence and in absence of these materials.

Thermodynamic modelling will be carried out of the observed or induced modifications, taking into account the chemical, mineralogical and physical characteristics of the substrates and of the dry contributions.

These experiments will permit a better estimation of the respective roles of the different atmospheric parameters in the superficial weathering of cultural items.

The research topics corresponding to the 2nd phase of the EC "ENVIRONMENT Programme" R&D (1991-1994), the deadline for submiting proposal being the 19th of July 1993, are the following:

- Assessment of the critical relationships between environmental factors and damage to cultural property:
  - environmental risk factors for various materials;
  - microclimate studies;
  - development of non-destructive methods.

- Improvement of the scientific and technical basis of conservation materials in response to environmental deterioration, including episodic events affecting mechanical stability of monuments; development of methods to screen and assess conservation materials.
- Environmental archeometry, i.e. the estimation of environmental conditions experienced by cultural items in history, by direct and indirect reconstruction of past environmental parameters and associated damage.
- Incorporation of scientific and technical knowledge into formulation of environmental policy concerning cultural heritage, including risk and damage maps, evaluation of alternative conservation strategies, effects of tourism on cultural property and societal valuation of cultural heritage.

Further information can be obtained from:
Mme J. Acevedo CEC DG XII-D-1, 200, rue de la Loi
B-1049 Brussels - Tel. 32.2.295.20.43, Fax 32.2.296.30.24

JRC - Ispra Research and Support Activities

Protection and Conservation of the European Cultural Heritage

Europe possesses and cares for more than 60% of the whole world's artistic and architectural heritage. The importance which this heritage has both as knowledge (not only artistic) and as a witness of the story of humanity is only too obvious. Only in recent times however have some problems connected with the conservation of works of art acquired a more "modern" meaning to become the subject of scientific studies.

Essentially two aspects best link works of art with modern science: analysis of authenticity and the study of conservation, i.e., of preservation over time against numerous polluting agents. The study of the authenticity of paintings in general has developed over the years mainly through the evaluations supplied by the art historian together with specific analyses made available by traditional microchemistry. In recent years has better chemical and physical knowledge applied to analytical measurement techniques allowed the birth of Archaeometry. The complexity and specificity of the techniques needed for Archaeometry are themselves the reason for the interdisciplinary character needed for the research which deals with the authenticity of works of art.

The J.R.C. Ispra has played a fundamental role in two of the most important operations involving the "scientific" study of artistic work, i.e. the frescoes of Piero della Francesca (on the occasion of the Vth centennial of his death) and the study of the equally famous bronze of the Lion of S. Marco (Venezia). From the scientific point of view the study of the measurement of the isotopic ratios of lead is particularly interesting because of the detection and recognition of some pigments used particularly in the past to make the artist's colours. The radiogenic origin of lead, producing variable isotopic compositions, allows the reconstruction of the geological path and together to discover its distribution on the earth's crust. Starting from historically dated samples, whose isotopic ratios are known as a function of their age, one can make a judgement on the sample under examination after having taken account of a series of parameters relative to the nature of the pigment itself.

Because of complex historical routes, the sensitivity of the indicators in question may not be decisive in placing the measurement result in a unique context of age. Another parameter is thus used, called the "isotopic ratio index", calculated by means of an equation which conveniently takes account of three measured isotopic ratios. Both methods were applied to the group of microsamples from both the wall paintings of Piero della Francesca and the restoration of the bronze of the Lion of S. Marco.

Referring to the study on Piero della Francesca the JRC data, as compared with those found up to now and distributed over 6 centuries, showed characteristics of:

- *similarity*, (unlike the wide disprersion of data obtained in the XIX and XX centuries),
- *grouping* on low values which can be completely inserted in the XVI centuries and before.

The results emphasize the need to build up a historical archive build up as rich as possible which can allow a systematic study to minimize the possibility of error in the interpretation of dating.

Recently, in collaboration with the Institutes of Archeology and of Earth Sciences of the University of Milan, research started aimed at improving knowledge about the lake-dwelling civilisation of the first bronze age in the Po valley. It is felt that accurate measurements of the isotopic composition of the lead in archeometallic finds and the concentration of a series of elements found at trace level in various materials can be correlated to the mineral deposits of supply. In this way the route followed by primary materials and any interchange could explain the origin of the more ancient population sites. This picture may include an investigation of finds from the famous "Similhaun man" or "Iceman" with the obvious aim of establishing his origin and possibly his tribe with scientific probability.

Further information can be obtained from:
P.R. Trincherini, E.I., CEC-JRC Ispra, I-21020 Ispra (VA)
Tel. ++39.332.789033, Fax ++39.332.785601

Conservation of Work of Art: a Portable Digital Speckle Pattern Interferometer for Micro Deformation Measurement

The measurement of micro deformations on works of art (e.g. canvases, wooden panels, frescoes, statues, etc.) may be performed by laser holographic interferometry, enabling detection and sizing of micro cracks, voids, detachments and, generally, of any micro structural alterations of the artefact. The field application of classical holographic interferometry is somehow hampered by the stability requirement (difficult to achieve out of the laboratory, unless expensive pulsed wave lasers are used) and by holographic recording and reconstruction processes which have to be made off-line and introduce delays. Actually, a measuring device for field applications should perform real-time measurements of in-plane and out-of plane displacements, operate under outdoor conditions, be constituted by only a few optical components and require no or simple adjustment work.

ESPI (Electronic Speckle Pattern Interferometry) is a technique able to match the above requirements. It enables micrometric static and dynamic surface displacements to be measured with an accuracy of ±0.1 m, and constitutes an interesting alternative to conventional holographic interferometry. It has the added advantage that, since it uses a video-electronic system for detection and processing, measurements can be made in real time and detection of micrometric deformation evolution can be easily performed. DSPI (Digital Speckle Pattern Interferometry) is a modification of ESPI, using digital frame stores and processors.

Much activity has been performed at JRC (in collaboration with the University of l'Aquila) for improving the performances of ESPI and for the development of a portable instrument. A particular mobile instrument has been realised combining the properties of DSPI with the flexibility of fiber optic illumination and allowing a rapid diagnosis of artworks. This mobile DSPI equipment is essentially constituted by optical fibres, He-Ne laser, CCD camera, video boards and an image processing system based on a portable PC microcomputer.

This system visualises deformations in the range 0.1 to 10 m and enables real-time measurements, day-light operation, portability. Since speckle data is created and recorded at video rate, it is much faster than traditional holographic techniques. Optical fibres provide only a limited area of illumination, but an optical fibre array could widen the coverage. The main limitation of the system is image quality degradation with respect to traditional interferometry: the problem could be partially overcome by suitable image processing techniques.

Further information can be obtained from:
A.C. Lucia, ISEI, CEC-JRC Ispra, I-21020 Ispra (VA)
Tel. +039 332 789155, Fax +039 332 789156

Eureka Project EU 674

Development and evaluation of a Mobile Analytical Laboratory

The Environment Istitute of the JRC (Soil, Water and Waste Unit) is partecipating to the EUREKA Project EU674: "Development and Evaluation of a Mobile Analytical Laboratory" and is acting as Project Coordinator.

The following organizations co-operate in this activity: AEA Technology (UK), Analytec (Russia), CISE (Italy), Danish Technologycal Institute (DK), Fisons PCI (UK), Force Institute (DK), ISMES (Italy), Technical Research Centre (Finland).

The objective of this cooperation is the development and evaluation of a mobile analytical laboratory capable of "in-field" sampling and analysis of waste, soil, air and water contaminants.

The Environment Institute designed and ordered two Mobile Units to be delivered to Ispra by the end of May 93. Two further Units, being developed by ISMES and Danish Technological Institute, will consitute the Mobile Analytical Laboratory. For the time being, required analytical instrumentation and standard operating procedures have been decided. A round robin exercise to determine the suitability of various preparation techniques against analytical methods, for inorganic analysis, has been carried out.

Further information can be obtained from:
S. Facchetti, Environment Institute, CEC-JRC Ispra
I-21020 Ispra (VA) - Tel. ++39.332.789969, Fax ++39.332.789328

Information

Assistance to Central and Eastern Europe in the Field of Environmental PHARE Programme

Information on environmental projects financed by the EC in Central and Eastern Europe from the beginning of the PHARE programme has been given in issue n° 9.

The 1992 Environmental Sector Programmes have been completed, these were based on the experience gained in developing the previous programmes. Financial and technical support was provided for institution strengthening and enhancement of environmental policy and management capabilities.

As a guiding principle, the 1992 programmes were focused on the development of tools for mobilizing and enhancing the management of domestic as well as external resources for supporting investments in environmental protection. Funds were made available to finance pilot projects, especially those having an important demonstration effect and with high potential and rapid pollution control impact. More collaboration with domestic and external financing institutions was sought in the programming process.

The allocations for the different countries were:

Romania	: 5.0 MECU	CSFR	: 5.0 MECU
Bulgaria	: 7.6 MECU	Poland	: 18.0 MECU
Hungary	: 10.0 MECU		

In 1992, the PHARE programme was extended to the Baltic countries (Estonia, Latvia, Lithuania) as well as to Slovenia, Croatia and Albania.

As far as the regional programmes are concerned, the countries interested had decided that transport, telecommunications, energy, nuclear safety and environment were priority issues.In considering projects in these different sectors, priority was given to the introduction and use of integrated environmental strategies to ensure that the solving of a problem in one sector does not create more problems elsewhere.

The allocation for the regional environmental sector programmes was 16 MECU devoted to the continuation of the programmes under way.

The important issue of nuclear safety in Eastern and Central Europe, a field where significant developments have recently taken place, has also received special attention in 1992. The Commission of the European Communities, considering the regional nature of nuclear safety, has allocated funds from the PHARE budget to the Regional Nuclear Safety Programme, supplementing the national sectoral programmes. The allocation is 20 MECU.

A G-24 coordination task force for nuclear safety has been set up within DG XI in order to coordinate the multilateral financial assistance in this area.

For further information, contact:
T. Dicorrado, DG XI/C.PHARE, CEC, 200 rue de la Loi,
B-1049 Brussels, Tel. +32.2.2969147

European IGAC Project Office (EIPO)

The involvment of the Commission in Global Change research, other than by its environmental research programmes, is also taking shape with the new establishment at the Joint Research Centre of Ispra of a coordinating secretariat for global atmospheric chemistry.

With a view to better coordinating the European contribution to the IGBP's Core Project International Global Atmospheric Chemistry (IGAC), it was decided to establish a Project Office for Europe, called EIPO (European IGAC Project Office), which is now operational at the Ispra Environment Institute, since December 1992.

The terms of reference of the EIPO are:

- To co-ordinate European participation in the IGAC Core Project of the IGBP, that is implemented under the responsibility of the IGAC Scientific Steering Committee. The co-ordination will focus on selected activities to be mutually agreed upon, particularly in relation to European Community Research Programmes. The co-ordination should mainly consist in supporting the IGAC convenors in promoting workshops and meetings and in preparing informative reports, in order to favour the collaboration and the exchange of information within Europe and with the wider international community;
- To help in initiating new European contributions to IGAC activities or new activities within the existing IGAC frame;
- To establish the necessary links with the Commission of the European Communities (CEC) advisory bodies (i.e. the DG XII/D Science Panel on Atmospheric Chemistry and the JRC Institute Advisory Boards) to promote the development of joint IGAC/CEC activities. Possibly, these could be submitted to CEC (DG XII/D) for funding, respecting the CEC rules and procedures (i.e. CEC "call for proposals");
- To promote links with other CEC DGs regarding IGAC/IGBP related matters.

The EIPO is managed jointly by the JRC and DG XII/D. In implementing its tasks, the EIPO will consult closely with the European members of the IGAC Council and will effectively communicate and co-operate with the IGAC Core Project Office at M.I.T., Cambridge, MA, USA. The EIPO will last until the end of the present JRC and DG XII/D multiannual research programmes on Environment, i.e. end of 1994. The continuation of EIPO will be matter of a follow-up agreement between the CEC and the IGBP.

Further information can be obtained from:
B. Versino, Environment Institute
CEC JRC Ispra - I - 21020 Ispra (VA)
Tel. ++39-332-789958, Fax ++39-332-785704

EARTH COUNCIL

THE EARTH COUNCIL is a non-governmental body, independent but recognized by governments by the United Nations and by the

international community as an important counterpart of the society in ensuring the follow-up and the implementation of the Earth Summit.

The initiative is sponsored by IUCN - World Conservation Union (Switzerland), ICSU - the International Council of Scientific Unions (France) and SID - Society for International Development (Italy).

For further information on the objectives, activities and organization of the Earth Council, please contact:
The Earth Council Organizing Committee, P.O. Box 323-1001
San Jose, COSTA RICA - Tel. ++506.233418, Fax ++506.552197

The International Saint Francis Prize for the Environment "Canticle of all Creatures" - Assisi

The 1993 Award Ceremony shall take place on October 23,1993, in the Papal Hall of the Sacred Convent of Saint Francis in Assisi, Italy. The Prize, in its threee sections, will be awarded in the following categories: Education and Communications; Scientific Research; Realized Projects and Effective Action.

The International Saint Francis Prize for the Environment "Canticle of All Creatures" is organized by the Franciscan Centre of Environmental Studies and the General Custody of the Sacred Convent in Assisi with the participation of ENEL S.p.A.

Further information can be obtained from:
Franciscan Centre of Envir. Studies, CFSA, Via del Serafico, 1
00142 ROMA - Tel. ++39.6.5191595, Fax ++39.6.50433535

ICDB-Immunoclone Database

(DIDMI-Deutsches Institut für Medizinische Dokumentation und Information)

The "ICDB - Immunoclone Database" of the Centre Européen de Recherche et de Développement en Information et Communication scientifique (CERDIC) in France, has been included into DIMDI's convenient user guidance GRIPS-Menu.

Clear and easy-to-use menus provide access to:
- monoclonal antibodies with defined reactivities,
- antibodies described by a specific author or a group of authors.

ICDB-Immunoclone Database is a factual database about immunoclones and their products (monoclonal antibodies, interleukins etc...). The documents contain information on the production and availability of the used cell cultures and on the properties and availability of the achieved products. Because of its importance for health and research policy, ICDB has been sponsored by the Commission of the European Communities from the Biotechnology Program within the framework of a multinational project.

Since 1991 DIDMI's GRIPS-Menu includes, among the others, the database "Environmental Chemical Data and Information Network (ECDIN), which has been produced within the framework of the Environment research programme of the Joint Research Centre.

For further information, please contact:
DIMDI, Mrs. Sylvia Herrmann, Weisshausstr. 27
D-5000 Koln 41 - Tel. ++49.221.47241

EUROCOURSES at the Joint Research Centre Ispra

The CEC JRC-Ispra is organizing Courses for the training of scientific and technical staff in advanced sectors of science.

The training courses are linked with the Commission R&D 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 1993:

Chemical and Environmental Sciences

Technologies for environmental cleanup: toxic and hazardous waste management

Environment Institute Ispra in collaboration with the LLNL, CA, USA

Ispra, September 13-17, 1993

Chemistry of acquatic environment: local and global perspectives

Environment Institute Ispra in collaboration with the Swiss Federal Institute of Technology, ETH, Zurich

Ispra, September 27 October 1,1993

Business and the environment

Institute for Prospective Technological Studies Ispra

Sevilla, November 8-12, 1993

Further Information and documentation can be obtained from:
Secretariat EUROCOURSES, JRC, I-21020 Ispra (VA),
Tel. ++39.332.789819, Fax ++39.332.789839

British Council Courses and Seminars

Coastal and estuarine pollution: biology and management

30 August - 10 September 1993 - University of St. Andrew

Major topics include:
- Global marine pollution problems and their regulation; Control of discharges; Toxicology testing; Oil pollution; Heavy metals and PCBs; Influence of estuarine hydrodinamics on industrial discharges; Sea lochs and coastal aquaculture; Marine conservation.

For further information, please contact:
Courses Department, The British Council,10 Spring Gardens, London SW 1A 2BN (Fax +44-71-839647/3894154)

SPARC Stratospheric Processes and their Role in Climate

A WCRP (World Climate Research Programme) Project

In March of 1992, the Joint Scientific Committee (JSC) of the World Climate Research Progrannme (WCRP) decided to implement the SPARC project. SPARC has four major research themes:
- The influence of the stratosphere on climate;
- Process studies associated with stratospheric ozone change;
- Global change of the stratosphere; and
- Monitoring and modelling of UV irradiance changes in the troposphere.

Up until the present time, the WCRP has emphasised the ocean-troposphere system in its studies of climate, but in implementing SPARC the JSC has recognised that one must understand stratospheric behaviour in many studies of climate change. For instance, one should consider what effects anthropogenic changes in stratospheric ozone might have on climate. Also, the recent eruption of Pinatubo has once again illustrated how volcanically induced changes in the stratospheric aerosol veil can influence climate, and finally it is becoming clearer that the stratospheric changes resulting from the increasing concentration of greenhouse gases must be considered in both identifying and evaluating greenhouse influences on the troposphere.

SPARC had its origins in IAMAP (International Association of Meteorology and Atmospheric Physics), IAGA (International Association of Geomagnetism and Aeronomy), and SCOSTEP (Scientific Committee on Solar-Terrestrial Physics) considerations on developing a plan for how the middle atmospheric science might contribute to the IGBP (International Geosphere Biosphere Program). It is envisaged that the IGBP will interact with SPARC to fully implement the original STIB (Stratosphere-Troposphere Influences on the Biosphere) objectives, including the original STIB (research theme on UV effects on the biosphere.

The first meeting of the SPARC Scientific Steering Group was held on September 19-20 in conjunction with a NATO Advanced Study Institute on the Role of the Stratosphere in Global Change (14-25 Sept. 1992, Carqueiranne, France). During this meeting, the SPARC Implementation Plan has been finalised and it will be published in the next few months as a WCRP document.

A SPARC Project Office is being set up in France and will take responsibility in the organisation of SPARC activities. It will begin

publishing a SPARC Newsletter as soon as possible. Plans for future SPARC-related meetings are as follows:

May 1993: SPARC session at the EGS meeting, Wiesbaden, Germany.

July 1993 - SPARC Symposium at the IAMAP meeting, Yokohama, Japan

June 1994 - STEP Symposium in Sendai (Japan)

Plans are also being under way for the following SPARC-related Workshops:

1993 - NATO ARW on Stratosphere-Troposphere Exchange, Directors J. Holton, P. Haynes, Cambridge, UK

1994 - NATO ARW: Pinatubo and Global Change, Director G. Flocco, Italy

For more information on SPARC, contact:
the SPARC Project Office or the SPARC CoChairmen
M.L. Chanin BP 3, 91371 Verrieres-Les-Buisson (F) and
M. Geller, SUNY/ITPA, Stony Brook NY 11794-3800 (USA)

Conferences

CONFERENCE REPORTS

Dimethylsulphide: Oceans; Atmosphere; Climate

Belgirate (Italy), 13-15 October, 1992

An international symposium, on marine dimethylsulphide (DMS) / climate interaction has been organized by the JRC-Environment Institute, Ispra in collaboration with the DGXII/D-Environment Programme, Brussels and the Danish Centre for Atmospheric Research-Roskilde.

DMS is now indicated as the second most important source of sulphur in the atmosphere, after anthropogenic SO_2 emission from fossil fuel combustion and industry. Speculations on a climatic role of DMS, related to gas-to-particle conversion of DMS atmospheric oxidation products and their effect on clouds microphysics, has triggered in the last years much interest, linked to the discussion on the relative effects of greenhouse gases and of atmospheric sulphate on the Earth's radiative budget.

Over 70 participants, biologists, chemists and physicists, from Europe and overseas, contributed 45 presentations and a round table discussion to update the state of knowledge of the most important component of the biologically emitted atmospheric sulphur flux. The matter was discussed in five sessions: Production by Marine Phytoplankton; Field Measurements; Atmospheric Chemistry; Gas-to-Particle Conversion and CCN Production; Global Modelling and Climatic Implications. Six papers by the JRC (EI, IRSA, IST) dealt with experimental and modelling studies of aspects of the marine DMS cycle relevant to a possible climatic effect.

The round table discussion at the end of the Symposium, while recording the significant progress made in various areas, emphasized that our understanding of the DMS cycle is still fragmentary, from the strength of the global DMS source, to the atmospheric chemical degradation, to the fundamental processes controlling gas-to-particle conversion of the DMS oxidised sulphur products and their influence on clouds. The Symposium reinforced the consciousness that a significative improvement of our knowledge of this component of the biogeochemical sulphur cycle and of its climatic implications requires a congruence of multidisciplinary efforts on the subject.

The proceedings will be published by the Commission of the European Communities.

Further information can be obtained from:
G. Restelli, Environment Institute, CEC-JRC Ispra,
I-21020 Ispra (VA) Tel. ++39.332.789225, Fax ++39.332.785837
G. Angeletti, Commission of the European Communities,
DGXII/D1, Rue de la Loi 200, B-1049 Brussels
Tel. ++32.2.2958432, Fax ++32.2.2963024

Pan-European Conference of Environment Ministers: Environment for Europe

Lucerne, 28-30 april 1993

The Lucerne Conference, held as a follow-up to Dobris (1991), brought together the ministers of environment and delegates from other ministries concerned (finance, economy, industry, planning,etc.) from all Europe, United States, Canada, Israel and Japan, as well as the Environment Commissioner of the EC and representatives from numerous international organisations, environmentalist associations, financial institutions, convention secretariats and informal sectors.

It has been the occasion for ministers and members of international organisations to discuss and endorse a series of documents on the environment in Europe:

- Ministerial Declaration;
- Environmental Action Programme (EAP) for Central and Eastern Europe (CEE);
- Report on Nature Conservation in Europe;
- Elements for a Long-Term Environmental Programme for Europe.

By far the most important document was the Environmental Action Programme for Central and Eastern Europe. It constitutes the framework of the future actions to restore the Environment in CEE countries and must be considered as a "living" document.

The EAP has been prepared by an intergovernmental Task Force chaired by the EC Commission, with the participation of the OECD and the World Bank.

It aims at providing immediate assistance to solve the most serious and urgent environmental problems in the CEE countries. In particular, it aims at mapping out the most important environmental problems, identifying priority areas for immediate remedial action and making concrete recommendations. It should serve as a guide to action for governments at national organisations, financial institutions and private investors.

The EAP is based on three main points:

- integration of environmental factors into the economic restructuring to ensure sustainable development;
- creation of institutional capacities, including training and education;
- immediate assistance programmes, for example, in regions in which a direct threat to human health or to the natural environment exists.

On all these point, the EAP provides a number of clear-cut investment projects.

The available financial resouces are limited. For this reason, the EAP shows how the most urgent problems can be tackled in a cost-effective manner. In particular, it suggest to pay attention to inexpensive solutions, souch as new filters, storage tanks and switching from coal to gas, which could be more appropriate than massive programmes. On the other hand, innovative machinery for the financing of the EAP has been considered, i.e. the introduction of market-based instruments (CO_2/energy taxes).

The EAP also underlines the need for international cooperation, for instance, with regard to investments and joint ventures and to the simplified tranfer of environmentally sound technologies.

Great emphasis was laid in Lucerne on the implementation of the EAP on a partnership basis. Under this partenership, the Central and Eastern European governments will put through the necessary reforms and make investment resources available according to their

abilities. The Western governments and the international organisations and financial istitutions will support and reinforce these efforts. In this partenership the partecipation of the informal sector in also essential.

The implementation mechanisms for the EAP is based on a project preparation framework and an informal project portfolio.

It was decided to set up a "Project Preparation Committee" which would coordinate project preparation and implementation on the guidelines of the EAP. This committee will be made up of representatives of the main financial backers and of the international financial istitutions; CEE countries will likewise be represented.

Nature conservation - Protection of biological diversity

The Council of Europe, in cooperation with the IUCN, UNEP, the EC Commission and interested governments and organisations stressed three main issues:

- the protection of biological diversity both within and outside special protected zone;
- the positive role that ecotourism can play;
- the importance of information, education and training.

Proposals were presented in a separate report by the Council of Europe, as well as in the EAP.

Immediate measures are necessary to safeguard intact areas with a rich biological and natural diversity in the interest of Europe as a whole and to promote the durable utilization of the natural resources.

The Ministers and the EC Commissioner agreed to preserve ecological and cultural diversity, protect endangered species and restore damaged areas and ecosystems. They supported the activities of the Council of Europe, particularly in connection with the promotion of the information and education of the public at large and with the efforts aimed at an ecologically development of tourism.

Report on the State of the Environment for Europe

At the end of 1993, the EC Commission will produce a comprehensive report on the state of the environment for Europe to serve as a basis for the further development for an environmental programme for Europe as a whole. The Conference received a report from the EC Commission on the progress made with the preparation work.

Elements for a long-Term Environmental Programme for Europe

The Conference examined ways and means to strengthen a number of crucial instruments of cooperation in the field of environment. The instruments under examination were technology cooperation, integrated pollution prevention and control, economic instruments, especially concerning the environmental effects of energy use and air pollution, environmental performance reviews, environmental infomation, public participation and international legal intruments.

The Conference called for a fresh impetus to be given to the development and application of innovative environmental policy instruments. For example the burden-sharing principle is to be further developed in order to promote the implementation of projects under the EAP, in particular the Geneva convention on Long Range Transboundary Air Pollution and its Protocols.

The Ministers and the EC Commissioner expressed emphatic support for the multilateral G-7 Action Programme for improvements of unsafe nuclear installations. This Programme foresees their gradual closure as well as the promotion of efficient energy use and of new and renewable energy sources.

Follow-up Process

The job of the next Conference will be to monitor the implementation of the Environmental Action Programme, to continue to promote cooperation on the preservation of biodiversity, to develop further the Environmental Programme for Europe as a whole.

The Ministers and the EC Commissioner took the necessary institutional steps for the follow-up of the results of the Lucerne Conference and the achivement of its objectives:

- The overall coordination will be the responsability of an intergovernmental working group within the framework of the UN/ECE, with participation of the EC Commission, international organisations and financial institutions as well as international bodies in non-governmental sectors active in the UN/ECE area.
- A further working group jointly chaired by the EC Commission and, on a rotating basis, by a Central and East European country, will be responsible for supervising the implementation of the Environmental Action Programme.

The Ministers and the EC Commissioner welcomed the Bulgarian proposal to host the next Ministerial Conference "Environment for Europe" in 1995.

Conference Announcement

Sixth European Symposium "Physico-Chemical behaviour of atmospheric pollutants

Varese (Italy), 18-22 October, 1993

The Commission of the European Communities (DGXII/D1, Environment Programme and Joint Research Centre, Environment Institute) organizes the Sixth European Symposium "Phsyco-Chemical Behaviour of Atmospheric Pollutants" to review the current status of research which is a part of the Concerted Action in Atmosferic Chemistry. Four main topics are foreseen:

- Oxidation Efficiency of the Atmosphere;
- Transport Processes;
- Instrumental and Analytical Techniques;
- The Role,of Clouds in Tropospheric Chemistry (joint CEC-EUROTRAC workshop).

Participants have been invited by the Countries collaborating in the Concerted Action or by the Commission of the European Communities.

Further information can be obtained from:

- G. Angeletti, CEC, DGXII/D1, Rue de la Loi 200 B-1049 Brussels - Tel. +39.332.2958432, Fax +39.332.785837
- G.Restelli, Environment Institute, CEC-JRC Ispra I-21020 Ispra (VA) Tel. +39.332.789225, Fax +39.332.785837

ADEME - Energies 93

Professional exhibition on Energy, Management and Renewable Energies 12-15 October 1993 Paris (F)

Energies 93 will be combined with Pollutec 93 - the International Environment Exibition. The combined events are organized, by the initiative of ADEME France's environmental and energy management agency, by:

SEPFI TECHNO EXPO/ADEME - ENERGIES 93
8 rue de la Michodiere, F-75002 Paris
Tel. ++33.1.47429256, Fax ++33.1.42661428

Twentieth International Technical Meeting On Air Pollution Modelling and its Application

November 29 - 9 December 3,1993 Valencia (ES)

Key topics of the meeting:

- Integrated Regional Modelling;
- Global and Long-Range Transport;
- New Developments;
- Accidental Releases; Model
- Assessment and Verification;

For further information, please contact:
Sven-Erik Gryning
Department of Meteorology and Wind Energy, Risø
National Laboratory DK - 4000 Roskilde

7th International Symposium on Environmental Pollution and its Impact on Life in the Mediterranean Region

12-15 October 1993 Juan Les Pins-Antibes (F)

Organized by the Mediterranean Scientific Association of Environmental Protection (MESAEP)

Topics:

- Chemical Aspects of Environmental Pollution;
- Biological, Eco-Toxicological and Health Aspects;
- Trends in Pollution Control Technology;
- Climatic Change and Mediterranean Studies.

For further information, please contact:
D. Kotzias, E.I., CEC-JRC Ispra, I-21020 Ispra (VA)
Tel. ++39.332.789647, Fax ++39.332.789222
D. Papameletiou, IPTS CEC-JRC Ispra, I-21020 Ispra (VA)
Tel. ++39.332.785701, Fax ++39.332.789576

The European Symposium on Environmental Protection. International Symposium on: Non CO_2 greenhouses gases; why and how to control?.

13-15 December 1993, MEEC Maastricht (NL)

Organized by the Society for Clean Air in the Nederlands.

The Symposium will focus on the following main themes:

- Scientific understanding:
  Natural and anthropogenic sources of NH_4, N_2O, CO, HCFCs and FCs; VOC and NO_x;
  Scenarios for future emissions and global warming potential of the above-mentioned components;
  Atmospheric chemistry, sinks, lifetimes, atmospheric budgets, including (3D) - modeling of the above mentioned components;
- Technological options:
  Control options and relevant technology for emission reduction of the above-mentioned components;
  Implementation in industry;
  Sinergy and antagonism between different approaches.

Further information can be obtained from:
Vereniging Lucht, P.O. Box 6013 NL-2600 JA Delft

Symposium: Challenges in Atmospheric Chemistry: Yesterday, Today and Tomorrow.

1-3 December 1993 Boulder, Colorado (USA)

Organized by the National Centre for Atmospheric Research - Atmospheric Chemistry Division - Boulder, Colorado (USA)

The Symposium which is organized in honor of the 60th birthday of Dr. Paul Crutzen, will include invited lectures on the evolution of topics upon which Dr. Crutzen has had a major impact, contributed papers by young scientists (not more than 5 years past receiving their Ph. D.), and a Panel Discussion on "Science and Society".

For further information, please contact:
Geoff Tyndall or Detlev Helmig, Atmospheric Chemistry Division, National Centre for Atmospheric Research, Boulder, Colorado 80307 (USA).

2nd International Conference on Air Pollution: Air Pollution 94

27-29 September 1994

Organized by Wessex Institute of Technology, Southampton, UK and Polytechnique University of Catalunya, Barcelona, Spain.

The Conference themes are:

- Turbulence and Diffusion Modelling; Chemical Transformation Modelling; Meteorogical Modelling; Global Studies; Monitoring and Laboratory Studies; Data Analysis and Observation; Pollution Management; Pollution Engineering.

For further information, please contact:
Sue Owen, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, S04 2AA, UK.
Tel. ++44.703.293223, Fax ++44.703.292853.

The 6th International Congress on Noise as a Public Health Problem.

5-9 July 1993, Nice (F)

Jointly organized by "Institut National de Recherche sur les Transport et leur Sécurité", "The International Commission in the Biological Effects of Noise" and "The French Ministry of the Environment".

The programme includes the following topics:

- Noise induced hearing loss; Noise and communication; Non-auditory physiological effects induced by noise; Influence of noise on performance and behaviour; Noise disturbed sleep; Noise and animal life; Noise and combinated agents; Regulation and standards.

For further information, please contact:
Conference Secretariat "Noise & Man"93", INRETS LEN
109, avenue Salvador Allende - 69500 Bron
Tel. ++33.72.362300, Fax ++33.72.376837

23rd Annual Meeting of the European Environmental Mutagen Society (EEMS)

Barcelona, 27 September - 2 October 1993

This annual meeting is being co-sponsored by the Environment R&D Programme this year to provide an opportunity for environmental health scientists working in the STEP and Environment R&D Programmes to meet each other, share their results, and coordinate their research activities more effectively. It also provides a good forum for a wider discussion of the issues involved in environmental mutagenesis and how the Commission may act through support and coordination of research in the Community to mitigate the problem.

The main topics of the Conference are:

Molecular Analysis of Mutagenesis; Mutagenesis and DNA Repair; Insertional Mutagenesis; Somatic Mutation and Recombination; Mutagenesis and Carcinogenensis; New Trends in Genetic Toxicology; Human Biomonitoring; Genetic Risk Assessment; In Vitro/In Vivo Genotoxicity Testing; Metabolism of Mutagens and Carcinogens; Clastogenicity and Aneuploidy.

For more information, contact
R. Marcos Dauder, Departament de Genetica i de Microbiologia
Facultat de Ciències, Universitat Autonoma de Barcelona
SP - 08193 Bellaterra (Barcelona)
C. Nolan, CEC DG XII-D-1, Environment Programme
200, rue de la Loi B - 1049 Brussels
Tel. ++32.2.296.16.33, Fax ++32.2.296.30.24

First CEC/US Workshop on Risk Assessment "Human genetic risks from exposure to chemicals, focussing on the feasibility of a parallelogram approach"

Durhan, North Carolina, 12-15 October 1993

This meeting is being organised by the Environment R&D Programme in conjunction with the U.S. Environmental Protection Agency.

The main objective of this first CEC/US Workshop on Risk Assessment is to identify the methodology, data requirements and mechanistic research needed to understand the human health impact of germ cell mutagens.

The rational for choosing this topic is that a coordinated effort to quantify the genetic risks resulting from exposure to mutagenic chemicals is urgently needed. Chemicals qualifying for such an approach are those with considerable population exposure and which have produced genetic effects in human somatic cells. Extrapolation from these data to what can be expected in germ cells of the exposed individuals should be possible by using good dosimetry and a parallelogram approach. The underlying idea is that an estimate of the genetic damage in human germ cells which can not be measured directly can be obtained by measuring a common end point in humans and mice e.g. genetic damage in lymphocytes, and a comparable genetic end point in germ cells of mice, the desired target tissue (inaccessible in comparable genetic

end point in germ cells of mice, the desired target tissue (inaccessible in man). The chemicals selected for review at this meeting are: Ethylene oxide, 1,3-Butadiene, Acrylamide, and Cyclophosphamide. It is anticipated that an important outcome from this workshop will be an evaluation of current knowledge and future research directions for the more precise assessment of human genetic risks from environmental and occupational mutagens.

For more information, contact:
C. Nolan, CEC DG XII-D-1, Environment Programme
200, rue de la Loi B-1049 Brussels
Tel. ++32.2.296.16.33, Fax ++32.2.296.30.24

International Symposium on Nutrient Dynamics in Coastal and Estuarine Environments

Helsingør, Denmark, 13-16 October 1993

This meeting is organised and sponsored by the Danish Environmental Protection Agency in collaboration with the Environment Research Programme of DG XII of the Commission. The symposium aims to bring together researchers from around the world to focus on specific issues concerned with coastal and estuarine systems. Special attention will be given to current perspectives on comparisons of nutrient dynamics in different geographical regions and contribution with reference to research in the Baltic Sea, the North Sea including the Wadden Sea, the Adriatic Sea and the Mediterranean are particularly welcome.

The symposium is expected to review progress in the following areas of marine ecology:

Nutrient Fluxes and Retention in Estuaries; Plankton and Nutrient Dynamics; Structure and Dynamics of Pelagic Environments; Biological Oceanography of Estuaries; Sediment and Mineralisation Processes; Sediment-Water Exchange Processes; Atmosphere-Water Exchange Processes; Macrophyte Dominated Communities; Fish and Benthic Fauna; Eutrophication and System Analysis: Case Studies

For more information, contact:
J. Anderson and Dr. J. Kirkegard, Danish Environmental Protection Agency, Marine and Waste Water Division,
Strandgade 29 DK -1401 Copenhagen
Tel. ++45.32.66.01.00, Fax ++45.32.66.04.79,
C. Nolan, CEC DGXII-D1, Environment Programme,
200, rue de la Loi B - 1049 Brussels BELGIUM
Tel. ++32.2.296.16.33, Fax ++32.2.296.30.24

EC-GSF Worshop on the Effects of Environmental UV Radiation on Health and the Environment

Munich 27-29 October 1993

The above meeting is being organised by the Commission within the framework of the Environment Research Programme in conjunction with the GSF Forschungszentrum für Umwelt und Gesundheit GmbH (Neuherberg).

The objectives are to identify priority areas for future research efforts on the environmental effects of UV-B radiation, taking into account an assessment of past and current activities and scenarios.

There will be six sessions on various aspects of environmental UV-B research, each session comprising a brief review of the state-of-our knowledge, a series of short presentations on current activities and results, and a discussion period. A seventh, final session will be devoted to identifying needs for future research. Poster presentations will be encouraged. The main areas of interest are:

Fluxes, Trends and Dosimetry; Photochemistry, Action Electroscopy; Targets: Troposphere, Materials; Health Effects; Terrestrial Ecosystems; Aquatic Ecosystems; Future Research

For more information, contact:
C. Nolan, CEC DG XII-D-1, Environment Programme
200, rue de la Loi B - 1049 Brussels
Tel. ++32.2.296.16.33, Fax ++32.2.296.30.24

Publications

Air Quality Analysis, Sources Transport, Transformation and Deposition of Pollutants Overview of Research and Result Within the 4th Environmental R&D Programme (1986-1990)

by: G. Le Bras CNRS, Orleans, France
G. Angeletti CEC, DG XII/D 1, Brussels, Belgium
ISBN 2-87063-090-2; EUR 15016
Edited by the CEC, DG XII/D-1, Brussels, Belgium

The 4th Environmental Research and Development Programme covered the period 1986-1990. but research projects in the area of Air Quality started in early 1988. Therefore some of them were extended up to 1992.

Within this research area, the thirteen projects implemented were related to the analysis, sources, transport, transformation and deposition of pollutants, which were topics covered within the concerted Action COST 611 "Physico-Chemical Behaviour of Atmospheric Pollutants". Four of these projects were also included in the LACTOZ and HALIPP sub-projects of EUROTRAC, dealing with laboratory research on gas phase, and heterogeneous and liquid phase processes, respectively.

The aim of this research was to improve the knowledge of tropospheric chemistry by addressing the major problems related essentially but not exclusively to acid deposition and ozone and photooxidant pollution. More than thirty teams from nine of the EC countries were involved in the programme.

The present report summarizes the main achievements of each project, preceded by a summary. The report also contains a significant list of papers relevant to the projects and published in the scientific literature, including the proceedings of the 1989 Symposium of the COST 611 Action.

The major atmospheric issues to be addressed were essentially related to acid deposition and photooxidant pollution, and gaps were initially identified in the following fields, as mentioned in the call of proposals:

- atmospheric nitrogen chemistry, including the wet and dry deposition and investigation on acidic substances deposited on vegetation;
- quantitative determination of the relative contributions to the production of sulphate and nitrate by gas and liquid phase processes;
- aqueous phase acidity generation and physico-chemical processes in clouds, including measurement of the chemical composition of cloud and fog water;
- study of ozone/precusors relationship in the troposphere and the interaction of the ozone production with acidic gases, including the role of CO and methane in regional ozone generation;
- simultaneous measurements of photooxidants and precursors during pollution episodes and over large areas and long time periods.

The thirteen projects selected on the basis of the above content were dealing almost equally with the acid deposition and photooxidant issues. Concerning acid deposition, the following major topics were tackled: the role of oceanic sulfur (mainly DMS) as acid precursor in the atmospheric acidity over Western Europe, the nitric acid forming potential of labile nitrogen compounds, the physico-chemical processes of acid generation in fogs, clouds and precipitation, the methodology of dry deposition measurements, the acidity of the atmosphere in areas with forest decline, and the changes of atmospheric acidity in the Northern Hemisphere since the pre-industrial era.

In relation with tropospheric ozone and photooxidant pollution, the following topics have been essentially addressed: the chemical processes of VOC oxidation in forming ozone and photooxidant (role of peroxy radicals), the nighttime oxidation of VOC_s, the fate of organic nitrates in relation with their role as NO_x reservoir species, the emissions and oxidation of natural VOC_s, the ozone and photooxidant pollution in areas with forest decline, the Mediterranean ozone and photooxidant pollution, and the changes in photooxidant levels in the Northern Hemisphere since the pre-industrial era.

European Environmental Data and Scenarios: Perspectives Towards Sustainability

by J.P. Hetteling, K. van Egmond, R. Maas; National Institute for Public Health and Environmental Protection (RIVM), P.O. Box 1, 3720 BA, Biltohoven, NL;

The report has been prepared at the request of the Commission of the European Communities as background to the contribution made by RIVM during the drafting of the 5th EC Environmental Action Programme recently adopted by the European Parliament and the Council of Ministers.

The Environment in Europe: A global Perspective

Edited by the National Institute for Public Health and Environmental Protection (RIVM), P.O. Box 1, 3720 BA, Biltohoven, NL;

The report has been prepared at the request of the GLOBE Europe organization.

GLOBE is an international organization set up on a voluntary basis by Members of the European Parliament, the USA Congress, the Japanese Diet and the Russian Parliament to promote the international cooperation for the improvement of the global environment.

The Environment in Europe and North-America Annotated Statistics 1992

by United Nations' Economic Commission for Europe.

The publication consists of two parts. Part one, intitled **"Time series and indicators"**, includes four chapters, namely:

- Environmental resources: conditions and use; Generation and treatment of waste residuals; Quality of environmental media; Environmental protection expenditures and facilities.

Under **"Agriculture and the Environment"** part two deals with:

- General context; Agriculture, climate and natural resources; Features of agricultural output; Impact of agriculture on the environment; Measures to reduce the environment impact of farming.

The publication is available from:
U.N. Publications, Palais des Nations C 109, 1
211 Geneva 10, CH - Fax ++41.22.7400931

Chemical Mechanisms Describing Tropospheric Processes

Joint CEC/EUROTRAC Workshop
LACTOZ-HALIPP Working group
Edited by J. Peeters
EUR 14884 ISBN 2-87263-088-0
COMMISSION OF THE EUROPEAN COMMUNITIES
Directorate-General XXII for Science, Research and Development
Environment Reseach Programme

COST 613/2 REPORT SERIES ON AIR POLLUTION EPIDEMIOLOGY - REPORT NUMBER 1

Exposure Assessment

COST Concerted Action in the field of Air Pollution Epidemiology was started in 1990.

Whithin the framework of this Concerted Action, two working parties were covering exposure assessment methodology for studies in air pollution epidemiology, and one covering health effect assessment methodology.

This reports deals with the methods for the exposure assessment for those ambient air pollutants that do not predominantly have indoor or occupational sources of exposure. Moreover, the reports deals with those types of air pollutants that have a predominantly inhalatory route of exposure, as opposed to exposure through ingestion. It should be kept in mind, however, that both exposures through the indoor or occupational environment, and multimedia exposures can play an important role. Many of the subjects covered in this report would also apply (mutatis mutandis) to the essessment of indoor, occupational and multi-media exposures. Futhermore, many of the techniques used in the evaluation of indoor or occupational situations can also be applied in the field of ambient air pollution.

- REPORT NUMBER 2

Health Effect Assessment

EUR 14346 EN ISBN 2-87263-074-0

"Air Pollution Epidemiology" is the science that studies human health effects of community air pollution by epidemiologic methods. Epidemiology in general studies the distribution of disease in relationship to determinants of disease in the population. Diseases in which air pollution plays a significant role are, for example, chronic obstructive pulmonary disease and lung cancer.

Standard textbooks in epidemiology generally offer incomplete guidance for the design and conduct of such studies.

For this reason, the European COST Concerted Action Committee "Air Pollution Epidemiolgy" has decided to put together concise documents on study design, exposure essessment and health effect assessment in air pollution epidemiology. To prepare these documents, Working Parties of experts from various European countries were formed. The COST 613/2 reports attempt to bridge the gap between textsbooks in air pollution and epidemiology on the one hand, and original research reports on the other hand.

COMMISSION OF THE EUROPEAN COMMUNITIES

Directorate-General for Science, Research and Development
Environment Research Programme

Mesometeorological Cycles of Air Pollution in the Iberian Peninsula (MECAPIP) Contract EV4V-0097-E

Report prepared by:

Millán M. Millán and Begoña Artiñano with the cooperation of L. Alonso, M. Castro, R. Fernandez-Patier, and J. Goberna

ISBN 2-87263-87-2 Depôt légal: D 1992/0157/10 - EUR N° 14834

The MECAPIP project was proposed as a comprehensive experimental program intended to complement ongoing atmospheric Physico-Chemistry research in other regions of Europe, by documenting conditions and cycles in the South-Western area. To this effect, it was designed to accomplish the following objectives:

- To characterize the meteorological conditions and transport mechanisms which can result in a sub-continental circulation covering most of Spain during the summer.
- To determine natural pathways, for the inflow of pollutants emitted in the coastal areas, during the convergence period of this circulation, and study the evolution of the precursors (NO_x, HC), ozone and oxidation processes along these paths.
- To increase the knowledge of meso-scale processes in the interphase zone between the Atlantic and Mediterranean air masses.

The characterization of the atmospheric was to take place by means of specifically designed field campaigns and data interpretation procedures.

At the conclusion of this project, the main accomplishments are:

- the description of the physico-chemical processes which relate the atmospheric circulations at various scales, i.e., from local, to regional, to subcontinental, with the behaviour of polluted airmasses over the Iberian penisula and Western Mediterranean areas and
- identifying the continuity of those processes within the whole of Europe.

The MECAPIP proposal was prepared for the 4th CEC Research Programme in Climatology and Environment.

The Environment Institute of the JRC ISPRA decided to support the MACAPIP 1989 field campaign with aircraft measurements and a tracer experiment.

The 1990 intensive summer field campaign took place with synoptic measurement along the Mijares river from Castelló to Mora, in the Bilbao Valle de Losa and at the Madrid sites. Standard measurements were complemented with vertical profiling of ozone in Castellón, as well as in Mora, where PAN and particulates were also measured. Free wind soundings were added to the Valle the Losa programme and ozone and wind soundings in the Madrid area.

The Scientific Programme in Forest Ecosystem 1986-1991

The final report on "The scientific programme in Forest Ecosystem 1986-1991" developed under the Forest Ecosystem Research Network (FERN) of the European Science Foundation (ESF) has been made available.

The objectives of the FERN scientific programme were to strengthen the scientific understanding of forest ecosystems in Europe to assess the true meaning of charges and to predict the future of these ecosystems on a mid and long term basis.

The programme was launched in 1986 and in 1988 was extended up to 1991 to deal with:

- retrospective study of man-induced charges and the influence of fire and grazing;
- nitrogen status and dynamics in soil-litter compartment;
- architectural patterns in forest ecosystems.

Close cooperation took place between the European Commission and FERN mainly in the form of joint undertakings for workshops, a Joint Research project on "Mechanism of nutrient turnover in the soil compartment in forests", and the organization of the 1st European Symposium on Forest and Woodlands, Terrestrial Ecosystems in 1991 (see Environmental Research Newsletter n° 8 December 1991 for the Conference Report).

Although the FERN programme ended in 1991, its themes have been included at large extent in the CEC 1991-94 R&D Environmental Protection Programme under the heading:

Biogeochemical Cycles and Ecosystem Dynamics.

For more information, please, contact:
Anne Teller, CEC DG XI, Task Force European Environment Agency, 200, rue de la Loi, B-1049 Brussels, Belgium
Tel. ++32.2.2969155, Fax ++32.2.2969562

Hidrogeological Processes in Karst Terranes

Edited By Gültekin Günay, A. Ivan Johnson & William Back

This book is the proceedings of the International Symposium and Field Seminar on Hydrogeological Processes in Karst Terranes held at Antalya, Turkey, in October 1990. This pubblication contains 37 papers that were presented at this event, and a Preface by Derek Ford. The papers originate from 14 nations and they are divided into the following topics: Environment; Geochemistry, Geomorphology, Geotechnics and Remote Sensing; Hydrogeology; Hydrology; Modelling; Regional Systems; Tracing.

It is estimated that 25% of the world's population depend largely or entirely upon karst aquifers for their water supplies. The papers in this publication should contribute to understanding the processes in these aquifers.

For more information, please, contact:
IAHS Press, Institue of Hydrology
Wallingford, Oxfordshire OX10 8 BB
Tel. ++44 491 838800, Fax ++44 491 32256

Application of Geographic Information Systems in Hydrology and Water Resources Management

Edited by K. Kovar & H.P. Nachtnebel IAHS Publication No. 211

This book is the proceedings of the Conference on the Application of Geographic Information Systems in Hydrology and Water Resources Management (HydroGIS 93) held in Vienna, April 1993. The objectives of the conference were to exchange experiences in the application of GIS and to identify research needs with respect to the specific requirements of hydrology and water resources related management. The 69 papers included in this volume are grouped under the following tipics:

Decision support and expert systems; Methodological aspects and application of GIS; Application of GIS in three-and four-dimensional problems; Coupling GIS with hydrological models; Application of GIS in water and environmental management; Application of GIS in surface water systems; Application of GIS in groundwater systems.

The conference was a contribution to the International Hydrological Programme (1990-1995), in particular to subprogramme M-2-3: The Use of Geographic Information Systems in Hydrological and Water Resources Studies.

For more information, please, contact:
IAHS Press, Institue of Hydrology
Wallingford, Oxfordshire OX10 8 BB,
Tel. ++44.491.838800, Fax ++44.491.32256

New publication

ICALPE Newsletter - First issue 1 May 1993

Edited by the International Centre for Alpine Environments (ICALPE) is planned to appear three or four times a year.

ICALPE has been established in 1989 and it is aimed at promoting the coordination of research and the dissemination of scientific knowledge for decision - making in the mountains of Europe. The newsletter is intended to constitute a forum for interaction among those interested in the environment of the mountains of Europe.

The newsletter as well as further information on ICALPE are available from:
ICALPE, Headquarters in Savoy: Savoie Tecnolac BP 230
F-73374 Le Bourget du Lac
Tel ++33.79.252004, Fax ++33.79.252848

EC Legislation

Monitoring application of community environmental law: a brief review of the trends in 1992

In recent years there has been a growing interest in monitoring the application of Community environmental law.

While the Members States are responsible for implementing the provisions concerning the environment pursuant to Article 130r(4) of the EEC Treaty, the Commission is required by Article 155 to ensure that the provisions of this Treaty and measures taken by the institutions pursuant thereto are applied. The Commission's task does not end with the adoption of a legal instrument by the Council; the Commission must make sure that the Members States comply with their obligations under Community legislation. They are required to adopt the legislation needed to incorporate Community environment law into national law, notify it to the Commission, and ensure that their internal measures are properly and fully applied.

Several instruments are available to the Commission to ensure observance of Community environment law. The procedure pursuant to Article 169 of the EEC Treaty is used when all other means have failed.

In the period preceding the adoption of a Directive and its entry into force, the Commission writes to the Member States reminding them of the Directive, the limits laid down in it and the obligations to transpose Community law into national law. The Commission requires the Member States to specify in detail the provisions of national law in which each article and clause of the directive is incorporated.

About three months before expiry of the time limit laid down for incorporation into national law of the Directive, the Commission sends a second official letter to the Member State if no communication has been received concerning the actual incorporation into national law of Community measures. In this letter the Commission reviews the situation and reminds the Member States of the obligation to observe the provisions in the directive.

The Commission is available for bilateral discussions with the Member States on all technical or legal questions concerning the incorporation of the directive into national law. It organizes multilateral meetings with the Member States' representatives to clarify the impact of the various provisions in a Directive, informs them of progress with regard to incorporation and reminds them of the time for the various Directives.

Since 1990 the Commission staff has initiated "package" meetings with the central, regional or local authorities of the Member States to discuss the factual or legal aspects of alleged infringements, complaints or implementation of environmental Directives.

The formal procedure of Article 169 of the EEC Treaty is the only means available to the Commission to control and ensure observance of Community environment law.

There are three stages in this procedure:
- letter of formal notice;
- reasoned opinion,
- application to the Court of Justice.

Each stage requires a specific and formal decision by the Commission. Given that in principle the Commission holds six meetings a year on infringements, that the Member States usually have two months to reply to a formal decision by the Commission; and that cases can take a long time to reach the Court, two years, and generally over three years, may elapse between the decision to open proceedings pursuant to Article 169 and delivery of a judgment by the Court.

In monitoring the application of the Community law three aspects are checked:
- that the Member States have adopted and notified the national measures to implement the Directives;
- that the national measures incorporate the obligations deriving from Community law fully and correctly;
- that the national implementing measures are correctly applied in practice.

Failure to notify national implementing measures

There is a specific provision in each Directive requiring the Member States to notify the Commission of national measures adopted to incorporate a Directive in national law. If, on entry into force of a Directive, the Commission has received no information regarding the national implementing measures, it opens proceeding pursuant to Article 169. Since 1990 the delegation procedure has been used.

Eight directives entered into force in 1992. Eight Member States have not to date transposed half. Three Member States have not transposed any. The majority of Member States have not transposed Directive 90/313/EEC on the freedom of access to information on the environment, which was adopted in 1992 (compliance deadline: 31.12.92).

Partial conformity of national measures

At the second stage, the Commission seeks to determine whether the national measures fully and correctly incorportate Community measures. It does not simply check whether each article of a Directive is reflected in the national legislation notified; the entire national structure of primary and subordinate legislation and administrative practice is studied bearing in mind its specific features and mode of operation, to ensure that all the objectives of Community law are achieved.

The majority of legislative and regulatory texts sent to the Commission fully and correctly transpose the provisions of Community texts. Nonetheless, there remain certain instances of divergence, which the Commission has taken up with the Member States concerned.

There is a continuation of the trend noted last years towards transposal by binding measures rather than circular letter. A number of Court judgments given in 1991 and 1992 undoubtedly contributed towards this development.

One of the directives whose transposal is creating most significant problems is Directive 85/337/EEC on the assessment of certain public and private projects on the environment.

The decision to subject projects to such assessment is left entirely to the discretion of the Member States. The Commission believes that the recitals and various provisions of the Directive, in particular Article 2, make it clear that projects listed in Annex II of Directive 85/337/EEC should also be subject of an environmental impact assessment, particularly when the nature, dimension or location of the project are such as to require it. Therefore the Member States must provide in their legislation for the possibility of the assessment of such projects. National legislation providing solely for an environmental impacts assessment for projects in Annex I to directive 85/337/EEC cannot therefore be considered complete.

Inadequate application of national provisions incorporating and environment Directive

National legislation incorporating a Community environment Directive does not automatically protect the environment; it must be actually applied. In other words, plants or programmes must be drawn up and executed, the established limit values monitored and the administrative authorizations issued. National legislation could reproduce a Directive word-for-word yet remain a dead letter for want of enforcement.

Many environmental directives require the Member States to report at regular intervals on the implementation of these directives. Only a minority of the Member States has fully met these obligations. The situation could change with the adoption by the Council of Directive 91/692/EEC on standardizing and rationalizing reports on the implementation of certain directives relating to the environment. However, the first Community report under this Directive, which concerns the water sector, will only be published by the Commission in 1997. Meanwhile, the Commission still needs national reports relating to Community environmental directives.

In the absence of such plans programmes and reports, complaints from individuals remain the most common source of information for the Commission in regard to the problems of practical implementation of environmental directives. In the handling of complaints, the Commission has taken particular note of the fact that Community provisions requiring the preparation of clean-up or management plans and programmes are frequently not implemented. It seems that national, regional and local administrations find difficulty in preparing and carrying out such programmes; the lack of precise definitions in the Community texts contributes to this problem.

The pratical implementation of Community environmental provisions remains the most pressing problem. This problem extends to all sectors (water, air, chemicals, nature, waste, general policy) and affects the credibility of Community action.

The control of pratical implementation in the waste sector particulary suffers from the fact that the definitions of waste, laid down in various directives since 1975, have been the subject of discussion with a view to amendment for several years, and this has prompted some Member States to choose national definitions which are not always consistent with the Community provisions or with those of other Member States.

In the field of nature protection, the number of complaints citing threats to bird habitats (Directive 79/409/EEC) has not significantly diminished, this amongst other reasons, stemming from the fact that the Community network of protected habitats, which was to have been established from 1981, has not been completely put in place. Directive 92/43/EEC now creates a further period of twelve years, within which a network of protected habitats is to be created, this time extending beyond birds to embrance all forms of wildlife.

As regards the application of Directive 85/337/EEC, the most remarkable problems relate to the consultation of the public, the quality of environmental impact studies, and the fact that political decisions to proceed with infrastructure projects are often taken before an impact assessment is carried out.

For more information, please contact:
J. Martinez-Aragon, CEC DGXI-1 , 200 rue de la Loi 1040 Brussels
Tel. ++32-2-2990393, Fax ++32-2-2991070
L. Kraemer, CEC DGXI-1 same address
Tel. ++32-2-2992265, Fax ++32-2-2991070

EC Legislation concerning CHEMICALS, INDUSTRIAL RISKS and BIOTECHNOLOGY

	EC Official Journal	Env. Res. Newsletter
Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and admininistrative provisions relating to the **classification, packaging and labelling of dangerous substances**	L196, 16.8.1967, p. 1	3 (Feb. 1989), p.14
– Council Directive 69/81/EEC of 13 March 1969	L68, 19.3.1969, p.1	
– Council Directive 70/189/EEC of 6 March 1970	L59, 14.3.1970, p.33	
– Council Directive 71/144/EEC of 22 March 1971 extending the time limit laid down in Article 10 of the Council Directive of 27 June 1967	L74, 29.3.1971, p.15	
– Council Directive 73/146/EEC of 21 May 1973	L167, 25.6.1973, p.1	
– Council Directive 75/409/EEC of 24 June 1975	L183, 14.7.1975, p.22	
– Commission Directive 76/907/EEC of 14 July 1976	L360, 30.12.1976, p.1 L28, 2.2.1979, p.32	
– Commission Directive 79/370/EEC of 30 January 1979	L88, 7.4.1979, p.1	
– Council Directive 79/831/EEC of 18 September 1979	L259, 15.10.1979, p.10	3 (Feb. 1989), p.14
– Act of Accession of Greece of 28 May 1979, Article 21, Annex I, Chapter X, 1.a	L291, 19.11.1979, p.17	
– Council Directive 80/1189/EEC of 4 December 1980	L366, 31.126.1980, p.1	
– Commission Directive 81/957/EEC of 23 October 1981	L351, 7.12.1981, p.5	
– Commission Directive 82/232/EEC of 25 March 1982	L106, 21.4.1982, p.18	
– Commission Directive 83/467/EEC of 29 July 1983	L257, 16.9.1983, p.1	
– Commission Directive 84/449/EEC of 25 April 1984	L251, 19.9.1984, p.1	
– Act of Accesion of Spain and Portugal of 12 June 1985, Article 26, Annex I, Chapter I.1.a	L302, 15.11.1985, p.9	
– Commission Directive 86/431/EEC of 24 June 1986	L247, 1.9.1986, p.1 L271, 23.9.1986, p.31 L50, 19.2.1987, p.38	
– Council Directive 87/432/EEC of 3 August 1987	L239, 21.8.1987, p.1	
– Commission Directive 88/302/EEC of 18 November 1987	L133, 30.5.1988, p.1	
– Commission Directive 88/490/EEC of 22 July 1988	L259, 19.9.1988, p.1	
– Commission Decision 90/420/EEC of 25 July 1990 on the classification and labelling of di(2-ethylhexyl)phtalate in accordance with Article 23 of Coucil Directive 67/548/EEC	L222, 17.8.1990, p.49	
– Council Directive 90/517/EEC of 9 October 1990	L287, 19.10.1990, p.37	
– Commission Directive 91/325 EEC of 1 March 1991	L180, 8.7.1991, p.1	
– Commission Directive 91/326/EEC of 5 March 1991	L180, 8.7.1991, p.79	
– Commission Directive 91/410/EEC of 22 July 1991	L228, 17.8.1991, p.67	
Council Directive 76/769/EEC of 27 July 1976 on the approximation of the laws regulations and administrative provision of the Member States relating to **restrictions on the marketing and use of certain dangerous substances and preparations**	L262, 27.9.1976, p.201	3 (Feb. 1989), p.15
– Council Directive 79/663/EEC of 24 July 1979	L197, 3.8.1979, p.37	
– Council Directive 82/806/EEC of 22 November 1982	L339, 1.12.1982, p.55	
– Council Directive 82/828/EEC of 3 December 1982 (PCTs)	L350, 10.12.1982, p.34	
– Council Directive 83/264/EEC of 16 May 1983	L147, 6.6.1983, p.9	
– Council Directive 83/478/EEC of 19 September 1983	L263, 24.9.1983, p.33	
– Council Directive 85/467/EEC of 1 October 1985 (PCBs/PCTs)	L269, 11.10.1985, p.56	
– Council Directive 85/610/EEC of 20 December 1985 (asbestos)	L375, 31.12.1985, p.1	
– Council Directive 89/677/EEC of 21 December 1989	L398, 30.12.1989, p.19	
– Council Directive 89/678/EEC of 21 December 1989	L398, 30.12.1989, p.24	
– Council Directive 91/173/EEC of 21 March 1991	L85, 5.4.1991, p.34	
– Council Directive 91/338/EEC of 18 June 1991	L186, 12.7.1991, p.59	
– Councill Directive 91/339/EEC of 18 June 1991	L186, 12.7.1991, p.64	
Council Directive 82/501/EEC of 24 June 1982 on the **major accident hazards of certain industrial activities**	L230, 5.8.1982, p.1	3 (Feb. 1989), p.16 7 (June 1991), p.13
– Council Directive 87/216/EEC of 19 March 1987	L85, 28.3.1987, p.36	
– Council Directive 88/610/EEC of 24 November 1988	L336, 7.12.1988, p.14	
Commission Decision 85/71/EEC of 21 December 1984 concerning the **list of chemical substances notified persuant to Council Directive 67/548/EEC** on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances	L30, 2.2.1985, p.33	
Council Directive 87/18/EEC of 18 December 1986 on the harmonization of laws regulations and administrative provisions relating to the application of the principles of **good laboratory practice and the verification of their applications for tests on chemical substances**	L15, 17.1.1987, p.29	3 (Feb. 1989), p.15
Council Directive 87/217/EEC of 19 March 1987 on the **prevention and reduction of environmental pollution by asbestos**	L85, 28.3.1987, p.40	3 (Feb. 1989), p.15
Council Directive 88/320/EEC of 9 June 1988 on the **inspection and verification of good laboratory practice**	L145, 11.6.1988, p.35	3 (Feb. 1989), p.15
Council Directive 88/379/EEC of 7 June 1988 on the approximation of the laws, regulations and administrative provisions of the Member States relating to the **classification, packaging and labelling of dangerous preparations**	L187, 16.7.1988, p.14	3 (Feb. 1989), p.15
– Commission Directive 89/178/EEC of 22 February 1989	L69, 8.3.1989, p.18	
– Commission Directive 90/492/EEC of 5 September 1990	L275, 5.10.1990, p.35	
Council Regulation EEC/1734/88 of 16 June 1988 concerning **export from and import into the Community of certain dangerous chemicals**	L155, 22.6.1988, p.2	3 (Feb. 1989), p.15
Council Regulation EEC/428/89 of 20 February 1989 concerning the **export of certain chemical products**	L50, 22.2.1989, p.1	
Council Decision 89/569/EEC of 28 July 1989 on the **acceptance by the European Economic Community of an OECD decision/recommendation on compliance with principles of good laboratory practice**	L315, 28.10.1989, p.1	

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Council Directive 90/219/EEC of 23 April 1990 on the **contained use of genetically modified microorganisms**	L117, 8.5.1990, p.1	5 (June 1990), p.20
Council Directive 90/220/EEC of 23 April 1990 on the **deliberate release into the environment of genetically modified organisms**	L117, 8.5.1990, p.15	5 (June 1990), p.20
Commission Decision of 25 July 1990 on the **classification and labelling of di(2 ethylhexyl)phtalate** in accordance with Article 23 of Council Directive 67/548/EEC	L222, 17.8.1990, p.49	
Commission Directive 91/155/EEC of 5 March 1991 laying down the detailed arrangements for the system of **specific information relating to dangerous preparations** in implementation of Article 10 of Directive 88/379/EEC	L76, 22.3.1991, p.35	
Council Directive 91/157/EEC of 18 March 1991 on **batteries and accumulators containing certain dangerous substances**	L78, 26.3.1991, p.38	5 (June 1990), p.23 7 (June 1991), p.16
Commission Decision 91/274/EEC of 21 May 1991 concerning a **list of Community legislation referred to in Article 10 of Council Directive 90/220/EEC**	L135, 30.5.1991, p.56	
Commission Decision 91/448/EEC of 29 July 1991 concerning the **guidelines for classification** referred to in Article 4 of Directive 90/219/EEC	L239, 28.8.1991, p.23	

EC Legislation concerning GENERAL POLICY

	EC Official Journal	Env. Res. Newsletter
Articles 100a, 130r,130s & 130t of the **Treaty establishing the European Economic Community (Single European Act)**	L169, 29.6.1987, p.1	
Council Recommendation 75/436/Euratom, ECSC, EEC of 3 March 1975 regarding **cost allocation and action by public authorities on environmental matters**	L194, 25.7.1975, p.1	
Council Recommendation 79/3/EEC of 19 December 1978 to the Member States regarding **methods of evaluating the cost of pollution control to industry**	L5, 9.1.1979, p.29	
Council Directive 83/189/EEC of 28 March 1983 laying down a procedure for the **provision of information in the field of technical standards and regulations** – Council Directive 88/182/EEC of 22 March 1988 amending Directive 83/189/EEC laying down a procedure for the provision of information in the field of technical standards and regulations – Commission Decision 90/230/EEC of 3 May 1990 amending the lists of standardization institutions set out in the Annex to Council Directive 83/189/EEC	L109, 26.4.1983, p.8 L81, 26.3.1988, p.75 L128, 18.5.1990, p.15	
Council 85/337/EEC of 27 June 1985 on the **assessment of the effects of certain public and private projects on the environment**	L175, 5.7.1985, p.40	4 (Dec. 1989), p.26
Council Directive 86/609/EEC of 24 November 1986 on the approximation of laws, regulations and administrative provisions of the Member States regarding the **protection of animals used for experimental and other scientific purposes**	L358, 18.12.1986, p.1	3 (Feb. 1989), p.15
Council Resolution 87/C328/01 of 19 October 1987 on the **continuation and implementation of a European Community policy and action programme on the environment (1987-1992)**	C328, 7.12.1987, p.1	
Council Regulation EEC/1210/90 of 7 May 1990 on the **establishment of the European Environment Agency and the European Environment Information and Observation Network**	L120, 11.5.1990, p.1	5 (June 1990), p.26
Council Directive 90/313/EEC of 7 June 1990 on the **freedom of access to information on the environment**	L158, 23.6.1990, p.56	
Council Directive 90/656/EEC of 4 December 1990 on the transitional measures applicable in **Germany** with regard to **certain Community provisions relating to the protection of the environment**	L353, 17.12.1990, p.59	
Council Directive 90/660.EEC of 4 December 1990 on the transitional measures applicable in **Germany** with regard to **certain Community provisions relating to the protection of the environment, in connection with the internal market**	L353, 17.12.1990, p.79	
Decision 91/400/ECSC, EEC of the Council and the Commission of 25 February 1991 on the **conclusion of the Fourth ACP-EEC Convention** – Fourth ACP-EEC Convention signed at Lomé on 15 December 1989	L229, 17.8.1991, p.1 L229, 17.8.1991, p.3	
Council Regulation 563/91/EEC of 4 March 1991 on action by the Community for the **protection of the environment in the Mediterranean region (Medspa)**	L63, 9.3.1991, p.1	

EC Legislation concerning AIR

	EC Official Journal	Env. Res. Newsletter
Council Directive 70/220/EC of March 1970 on the approximation of the laws of the Member States on measures to be taken against **air Pollution by emissions from motor vehicles**	L76, 6.4.1970, p.1	2 (Sept. 1988), p.14
– Council Directive 75/290/EEC of 28 May adapting to technical progress Council Directive 70/220/EEC	L159, 15.6.1974, p.61	
– Commission Directive 77/102/EEC of 30 November 1976 adapting to technical progress Council Directive 70/220/EEC	L32, 3.2.1977, p.32	2 (Sept. 1988), p.14
– Council Directive 78/665/EEC of 14 July 1978 adapting to technical progress Council Directive 70/220/EEC	L223, 14.8.1978, p.48	2 (Sept. 1988), p.14
– Council Directive 83/351/EEC of 16 June 1983	L197, 20.7.1983, p.1	2 (Sept. 1988), p.14
– Council Directive 88/77/EEC of 3 December 1987	L36, 9.2.1988, p.1	5 (June 1990), p.14
– Council Directive 88/436/EEC of 16 June 1988	L214, 6.8.1988, p.1	5 (June 1990), p.14
– Council Directive 89/458/EEC of 18 July 1988 amending with regard to European emission standards for car below 1.4 litres, Directive 70/220/EEC	L226, 3.8.1989, p.1	5 (June 1990), p.14
– Commission Directive 89/491/EEC of 17 July 1989 adapting to technical progress Council Directives 70/157/EEC, 70/220/EEC, 72/245/EEC, 72/306/EEC, 80/1268/EEC and 80/1269/EEC relating to motor vehicles	L238, 15.8.1989, p.43	
– Council Directive 91/441/EEC of 26 June 1991	L242, 30.8.1991, p.1	
Council Directive 72/306/EEC of 2 August 1972 on the approximation of the laws of the Member States relating to the measures to be taken against the **emission of pollutants from diesel engines**	L190, 20.8.1972, p.1	2 (Sept. 1988), p.14
– Commission Directive 89/491/EEC of 17 July 1989 adapting to technical progress Council Directives 70/157/EEC, 70/220/EEC, 72/245/EEC, 72/306/EEC, 80/1268/EEC and 80/1269/EEC relating to motor vehicles	L238, 15.8.1989, p.43	
Council Directive 75/716/EEC of 24 November 1975 on the approximation of the laws of the Member States relating to the **sulphur content of certain liquid fuels**	L307, 27.11.1975, p.22	2 (Sept. 1988), p.14
– Council Directive 87/219/EEC of 30 March 1987	L91, 3.4.1987, p.19	2 (Sept. 1988), p.14
Council Decision 80/372/EEC of 26 March 1980 concerning **chlorofluorocarbons in the environment**	L90, 3.4.1980, p.45	2 (Sept. 1988), p.16 3 (Feb. 1989), p.16
– Act of Accession of Spain and Portugal of 12 June 1985, Annex XXXII, Chapter VII.9	L302, 15.11.1985, p.9	
Council Directive 80/779/EEC of 15 July 1980 on **air quality limit values and guide values for sulphur dioxide and suspended particulates**	L229, 30.8.1980, p.30	2 (Sept. 1988), p.15
– Council Directive 81/857/EEC of 19 October 1981	L319, 7.11.1981, p.18	
– Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X.I.k.	L302, 15.11.1985, p.9	
– Council Directive 89/427/EEC of 21 June 1989	L201, 14.7.1989, p.53	5 (June 1990), p.13
– Council Directive 90/656/EEC of 4 December 1990 on the transitional measures applicable in Germany with regard to certain Community provisions relating to the protection of the environment	L353, 17.12.1990, p.59	
Council Decision 81/462/EEC of 11 June 1981 on the **conclusion of the Convention on long-range transboundary air pollution**	L171, 27.6.1981, p.11	2 (Sept. 1988), p.16
– Convention on long-range transboundary air pollution	L171, 27.6.1981, p.13	
Council Decision 82/459/EEC of 24 June 1982 establishing a **reciprocal exchange of information and data from networks and individual stations measuring air pollution within the Member States**	L210, 19.7.1982, p.1	2 (Sept. 1988), p.16
Council Decision 82/795/EEC of 15 November 1982 on the **consolidation of precautionary measures concerning chlorofluorocarbons in the environment**	L329, 25.11.1982, p.29	2 (Sept. 1988), p.17 3 (Feb. 1989), p.16
Council Directive 82/884/EEC of 3 December 1982 on a **limit value for lead in the air**	L378, 31.12.1982, p.15	2 (Sept. 1988), p.15
– Act of Accession of Spain and Portugal of 12 June 1985 Annex I, Chapter X.1.p	L302, 15.11.1985, p.9	
Council Directive 84/360/EEC of 28 June 1984 on the **combating of air pollution from industrial plants**	L188, 16.7.1984, p.20	2 (Sept. 1988), p.16
Council Directive 85/203/EEC of 7 March 1985 on **air quality standards for nitrogen dioxide**	L87, 27.3.1985, p.1	2 (Sept. 1988), p.15
– Council Directive 85/580/EEC of 20 December 1985 adapting, on account of the accession of Spain and Portugal, Directive 85/203/EEC	L372, 31.12.1985, p.36	
Council Directive 85/210/EEC of 20 March 1985 on the approximation of the laws of the Member States concerning **the lead content of petrol**	L96, 3.4.1985, p.25	2 (Sept. 1988), p.14
– Council Directive 85/581/EEC of 20 December 1985 adapting, on account of the accession of Spain and Portugal, Directive 85/210/EEC	L372, 31.12.1985, p.37	
– Concil Directive 87/416/EEC of 21 July 1987	L225, 13.8.1987, p.33	
Council Decision 86/277/EEC of 12 June 1986 on the conclusion of the Protocol to the 1979 Convention on long-range transboundary air pollution on **long-term financing of the cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP)**	L181, 4.7.1986, p.1	2 (Sept. 1988), p.16
– Protocol to the 1979 Convention on long-range transboundary air pollution on long-term financing of the cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP)	L181, 4.7.1986, p.2	
Council Directive 88/77/EEC of 3 December 1987 on the approximation of the laws of the Member States relating to the measures to be taken against the **emission of gaseous pollutants from diesel engines for use in vehicles**	L36, 9.2.1988, p.33	5 (June 1990), p.14

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Council Decision 88/540/EEC of 14 October 1988 concerning the conclusion of the **Vienna Convention for the protection of the ozone layer and the Montreal Protocol on substances that deplete the ozone layer**	L297, 31.10.1988, p.8	3 (Feb. 1989), p.16 6 (Dec. 1990), p.4
– Convention for the protection of the ozone layer	L297, 31.10.1988, p.10	3 (Feb. 1989), p.16 6 (Dec. 1990), p.4
– Montreal Protocol on substances that deplete the one layer	L297, 31.10.1988, p.21	
Council Directive 88/609/EEC of 8 June 1988 on the **limitation of emissions of certain pollutants into the air from large combustion plants**	L336, 7.12.1988, p.1	5 (June 1990), p.14
Council Directive 89/369/EEC of 8 June 1989 on the **prevention of air pollution from new municipal waste incineration plants**	L163, 14.6.1989, p.32	7 (June 1991), p.8
Council Directive 89/429/EEC of 21 June 1989 on the **reduction of air pollution from existing municipal waste incineration plants**	L203, 15.7.1989, p.50	7 (June 1991), p.8
Council Regulation EEC/594/91 of 4 March 1991 on **substances that deplete the ozone layer**	L67, 14.3.1991, p.67	
Commission Decision 91/359/EEC of 15 July allocating **import quotas for chlorofluorocarbons for the period 1 July 1991 to 31 December 1992**	L193, 17.7.1991, p.42	

EC Legislation concerning WASTE

	EC Official Journal	Env. Res. Newsletter
Council Directive 75/439/EEC of 16 June 1975 on the **disposal of waste oils**	L194, 25.7.1975, p.23	3 (Feb. 1989), p.18
– Act of Accession of Spain and Portugal of 12 June 1985, Annex XXXVI, Chapter III.1	L302, 15.11.1985, p.9	
– Council Directive 87/101/EEC of 22 December 1986 amending Directive 75/439/EEC on the disposal of waste oils	L42, 12.2.1987, p.43	
Council Directive 75/442/EEC of 15 July 1975 **on waste**	L194, 25.7.1975, p.39	3 (Feb. 1989), p.18 5 (June 1990), p.23
– Council Directive 91/156/EEC of 18 March 1991 amending Directive 75/442/EEC on waste	L78, 26.3.1991, p.32	7 (June 1991), p.16
Council Directive 76/403/EEC of 6 April 1976 on the **disposal of polychlorinated biphenyls and polychlorinated terphenyls**	L108, 26.4.1976, p.41	3 (Feb. 1989), p.18 5 (June 1990), p.24
Council Directive 78/176/EEC of 20 February 1978 on **waste from the titanium dioxide industry**	L54, 25.2.1978, p.19	4 (Dec. 1989), p.21
– Council Directive 82/883/EEC on procedures for the surveillance and monitoring of environments concerned by waste from the titanium dioxide industry	L378, 31.12.1982, p.1	4 (Dec. 1989), p.21
– Council Directive 83/29/EEC of 24 January 1983 amending Directive 78/176/EEC on waste from the titanium dioxide industry	L32, 3.2.1983, p.28	4 (Dec. 1989), p.21
Council Directive 78/319/EEC of 20 March 1978 on **toxic and dangerous waste**	L84, 31.3.1978, p.43	3 (Feb. 1989), p.19
– Act of Accession of Greece of 28 May 1979, Annex I, Chapter XIII 1.e	L291, 19.11.1979, p.17	
– Act of accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X.I.c	L302, 15.11.1985, p.9	
Council Directive 82/883/EEC of 3 December 1982 on procedures for the **surveillance and monitoring of environments concerned by waste from the titanium dioxide industry**	L378, 31.12.1982, p.1	4 (Dec. 1989), p.21
– Act of accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X.1.d	L302, 15.11.1985, p.9	
Council Directive 84/631/EEC of 6 December 1984 on the **supervision and control within the European Community of the transfrontier shipment of hazardous waste**	L326, 13.12.1984, p.31	3 (Feb. 1989), p.19
– Commission Directive 85/469/EEC of 22 July 1985 adapting to technical progress Council Directive 84/631/EEC on the supervision and control within the European Community of the transfrontier shipment of hazardous waste	L272, 12.10.1985, p.1	
– Council Directive 86/121/EEC of 8 April 1986 adapting, consequent upon the accession of Spain and Portugal, Directive 84/631/EEC on the supervision and control within the European Community of the transfrontier shipment of hazardous waste	L100, 16.4.1986, p.20	
– Council Directive 86/279/EEC of 12 June 1986 amending Directive 84/631/EEC on the supervision and control within the European Community of the transfrontier shipment of hazardous waste	L181, 4.7.1986, p.13	
– Council Directive 87/112/EEC of 23 December 1986 adapting to technical progress for the second time Council Directive 84/631/EEC on the supervision and control within the European Community of the transfrontier shipment of hazardous waste	L48, 17.2.1987, p.31	
Council Directive 85/339/EEC of 27 June 1985 on **containers of liquids for human consumption**	L176, 6.7.1985, p.18	3 (Feb. 1989), p.19
Commission Directive 85/469/EEC of 22 July 1985 adapting to technical progress Council Directive 84/631/EEC of 6 December 1984 on the **supervision and control within the European Community of the transfrontier shipment of hazardous waste**	L272, 12.10.1985, p.1	
Council Directive 86/278/EEC of 12 June 1986 on the protection of the environment, and in particular of the **soil, when sewage sludge is used in agriculture**	L181, 4.7.1986, p.6	3 (Feb. 1989), p.19 4 (Dec. 1989), p.25 5 (June 1990), p.24

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Council Directive 89/369/EEC of 8 June 1989 on the **prevention of air pollution from new municipal waste incineration plants**	L163, 14.6.1989, p.32	7 (June 1991), p.8
Council Directive 89/429/EEC of 21 June 1989 on the **reduction of air pollution from existing municipal waste incineration plants**	L203, 15.7.1989, p.50	7 (June 1991), p.8
Waste Management Strategy (1989)		
Council Decision 90/170/EEC of 2 April 1990 on the **acceptance by the European Economic Community of an OECD Decision/Recommendation on the control of transfrontier movements of hazardous wastes**	L92, 7.4.1990, p.52	
Council Directive 91/271/EEC of 21 May 1991 concerning **urban waste water treatment**	L135, 30.5.1991, p.40	8 (Dec. 1991), p.8

EC Legislation concerning NATURE

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Council Directive 79/409/EEC of 2 April 1979 on the **conservation of wild birds**	L103, 25.4.1979, p.1	
– Act of Accession of Greece of 28 May 1979, Annex I, Chapter XIII, point1.f	L292, 29.10.1979, p.17	
– Council Directive 81/854/EEC of 19 October 1981 adapting, consequent upon the accession of Greece, Directive 79/409/EEC on the conservation of wild birds	L319, 7.11.1981, p.3	
– Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X, 1.h and 6	L302, 15.11.1985, p.9	
– Commission Directive 85/411/EEC of 25 July 1985	L233, 30.8.1985, p.33	
– Council Directive 86/122/EEC of 8 April 1986 adapting, consequent upon the accession of Spain and Portugal, Directive 79/409/EEC on the conservation of wild birds	L100, 16.4.1986, p.22	
– Commission Directive 91/244/EEC of 6 March 1991	L115, 8.5.1991, p.41	
Council Regulation 348/81/EEC of 20 January 1981 on **common rules for imports of whales or other cetacean products**	L39, 12.2.1981, p.1	
– Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X,1.l.	L302, 15.11.1985, p.9	
Council Decision 81/691/EEC of 4 September 1981 on the conclusion of the **Convention on the conservation of Antarctic marine living resources**	L252, 5.9.1981, p.26	
– Convention on the conservation of Antarctic marine living resources	L252, 5.9.1981, p.27	
Council Decision 82/72/EEC of 3 December 1981 concerning the conclusion of the **Convention on the conservation of European wildlife and natural habitats**	L38, 10.2.1982, p.1	
– Convention on the conservation of European wildlife and natural habitats	L38, 10.2.1982, p.1	
Council Decision 82/461/EEC of 24 June 1982 on the conclusion of the **Convention on the conservation of migratory species of wild animals**	L210, 19.7.1982, p.10	
– Convention on the conservation of migratory species of wild animals	L210, 19.7.1982, p.11	
Council Regulation EEC/3626/82 of 3 December 1982 on the **implementation in the Community of the Convention on International Trade in Endangered Species of wild fauna and flora**	L384, 31.12.1982, p.1	
– Commission Regulation EEC/3418/83 of 28 November 1983 laying down provisions for the uniform issue and use of the documents required for the implementation in the Community of the Convention on international trade in endangered species of wild fauna and flora	L344, 7.12.1983, p.1	
– Council Regulation EEC/3645/83 of 1 November 1983	L367, 28.12.1983, p.1	
– Commission Regulation EEC/3646/83 of 12 December 1983	L367, 28.12.1983, p.2	
– Commission Regulation EEC/577/84 of 5 March 1984	L64, 6.3.1984, p.5	
– Commission Regulation EEC/1451/84 of 25 May 1984	L140, 26.5.1984, p.21	
– Commission Regulation EEC/1452/84 of 25 May 1984	L140, 26.5.1984, p.23	
– Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X,1.n and 7	L302, 15.11.1985, p.9	
– Council Regulation EEC/1831/85 of 27 June 1985	L173, 3.7.1985, p.1	
– Commission regulation EEC/2384/85 of 30 July 1985	L231, 29.8.1985, p.1	
– Council Regulation EEC/2295/86 of 21 July 1986	L201, 24.7.1986, p.1	
– Council Regulation EEC/1422/87 of 21 May 1982	L136, 26.5.1987, p.6	
– Commission Regulation EEC/1540/87 of 22 May 1987	L147, 6.6.1987, p.1	
– Commission Regulation EEC/3143/87 of 19 October 1987	L299, 22.10.1987, p.1	
– Commission Regulation EEC/869/88 of 30 March 1988	L87, 31.3.1988, p.67	
– Commission Regulation EEC/3188/88 of 17 October 1988	L285, 19.10.1988, p.1	
– Commission Regulation EEC/610/89 of 9 March 1989	L66, 10.3.1989, p.5	
– Commission Regulation EEC/2496/89 of 2 August 1989 on a prohibition on importung raw and worked ivory derived from the African elephant into the Community	L240, 17.8.1989, p.5	
– Commission Information 89/C 327/01 Names and addresses of the management and scientific authorities designated by the Member States in accordance with Article IX (1) of the Convention on International Trade in Endangered Species of wild Fauna and Flora referred to in Article 7 of Council Regulation 3626/82/EEC of 3 December 1989 on the implementation in the Community of Cites	C327, 30.12.1989, p.1	
– Commission Information 89/C 327/02 Ports of entry and exit designated by the Member States for trade with third countries in accordance with Article	C327, 30.12.1989, p.20	

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VIII (3) of the Convention on International Trade in Endangered Species of wild Fauna and Flora and referred to in Article 16 of Council Regulation 3627/82/EEC of 3 December 1982 on the implementation in the Community of Cites – Commission Regulation EEC/197/90 of 17 January 1990	L29, 31.1.1990, p.1	
Commission Regulation EEC/3418/83 of 28 November 1983 laying down provisions for the **uniform issue and use of the documents required for the implementation in the Community of the Convention on International Trade in endangered Species of wild fauna and flora**	L344, 7.12.1983, p.1	
Council Directive 83/129/EEC of 28 March 1983 concerning the **importation into Member States of skins of certain seal pups and products derived therefrom** – Council Directive 85/444/EEC of 27 September 1985 – Council Directive 89/370/EEC of 8 June 1989	L91, 9.4.1983, p.30 L259, 1.10.1985, p.70 L163, 14.6.1989, p.37	
Commission Regulation EEC/2496/89 of 2 August 1989 on a **prohibition on importing raw and worked ivory derived from the African elephant into the Community**	L240, 17.8.1989, p.5	

EC Legislation concerning NOISE

	EC Official Journal	Env. Res. Newsletter
Council Directive 70/157/EEC of 6 February 1970 on the approximation of laws in the Member States relating to the **permissible sound level and the exhaust system of motor vehicles** – The 1972 Act of accession – Commission Directive 73/350/EEC of 7 November 1973 – Council Directive 77/212/EEC of 8 March 1977 – Commission Directive 81/334/EEC of 13 April 1981 adapting to technical progress Council Directive 70/157/EEC – Commission Directive 84/372/EEC of 3 July 1984 adapting to technical progress Council Directive 70/157/EEC – Council Directive 84/424/EEC of 3 September 1984 – Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter IX.4 – Council Directive 87/354/EEC of 25 June 1987 amending certain directives on the approximation of the laws of the Member States relating to industrial products with respect to the distinctive numbers and letters indicating the Member States	L42, 23.2.1970, p.16 L73, 27.3.1972, p.14 L321, 22.11.1973, p.33 L66, 12.3.1977, p.33 L131, 18.5.1981, p.6 L196, 26.7.1984, p.47 L238, 6.9.1984, p.31 L302, 15.11.1985, p.9 L192, 11.7.1987, p.43	
– Commission Directive 89/491/EEC of 17 July 1989 adapting to technical progress Council Directives 70/157/EEC, 70/220/EEC, 72/245/EEC, 72/306/EEC, 80/1268/EEC and 88/1269/EEC relating to motor vehicles	L238, 15.8.1989, p.43	
Council Directive 78/1015/EEC of 23 November 1978 on the approximation of the laws of the Member States on the **permissible sound level and exhaust system of motorcycles** – Council Directive 87/56/EEC of 18 December 1986 – Council Directive 89/235/EEC of 13 March 1989 amending Directive 78/1015/EEC on the approximation of the laws of the Member States on the permissible sound level and exhaust system of motorcycles	L349, 13.12.1978, p.21 L24, 27.1.1987, p.42 L98, 11.4.1989, p.1	
Council Directive 79/113/EEC of 19 December 1978 on the approximation of the laws of the Member States relating to the **determination of the noise emission of construction plant and equipment** – Act of Accession of Greece of 28 May 1979, Annex I, Chapter X.1	L33, 8.2.1979, p.17 L291, 29.10.1979, p.17	
– Council Directive 81/1051/EEC of 7 December 1981 – Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter IX.1 j – Commission Directive 85/405/EEC of 11 July 1985 adapting to technical progress Council Directive 79/113/EEC	L376, 30.12.1981, p.49 L302, 15.11.1985, p.9 L233, 30.8.1985, p.9	
Council Directive 80/52/EEC of 20 December 1979 on the **limitation of noise emissions from subsonic aircraft** – Council Directive 83/206/EEC of 21 April 1983	L18, 24.1.1980, p.26 L117, 4.5.1983, p.15	
Council Directive 84/533/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the **permissible sound power level of compressors** – Commission Directive 85/406/EEC of 11 July 1985 adapting to technical progress Council Directive 84/533/EEC	L300, 19.11.1984, p.11 L233, 30.8.1985, p.11	
Council Directive 84/534/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the **permissible sound power level of tower cranes** – Council Directive 87/405/EEC of 25 June 1987	L300, 19.11.1984, p.130 L220, 8.8.1987, p.60	
Council Directive 84/535/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the **permissible sound power level of welding generators** – Commission Directive 85/407/EEC of 11 July 1985 adapting to technical progress Council Directive 84/535/EEC	L300, 19.11.1984, p.142 L233, 30.8.1985, p.16	

	EC Official Journal	Env. Res. Newsletter
Council Directive 84/536/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the **permissible sound power level of power generators**	L300, 19.11.1984, p.149	
– Commission Directive 85/408/EEC of 11 July 1985 adapting to technical progress Council Directive 84/536/EEC	L233, 30.8.1985, p.18	
Council Directive 84/537/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the **permissible sound power level of powered hand-held concrete-breakers and picks**	L300, 19.11.1984, p.156	
– Commission Directive 85/409/EEC of 11 July 1985 adapting to technical progress Council Directive 84/537/EEC	L233, 30.8.1985, p.20	
Council Directive 84/538/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the **permissible sound power level of lawnmowers**	L300, 19.11.1984, p.171	
– Commission Directive 87/2??/EEC of 7 April 1987 adapting to technical progress Council Directive 84/538/EEC	L117, 5.5.1987, p.22	
– Council Directive 88/180/EEC of 22 March 1988 amending Directive 84/538/EEC on the approximation of the laws of the Member States relating to the permissible sound level of lawnmowers	L81, 26.3.1988, p.69	
– Council Directive 88/181/EEC of 22 March 1988	L81, 26.3.1988, p.71	
Council Directive 86/594/EEC of 1 December 1986 on **airborne noise emitted by household appliances**	L344, 1.12.1986, p.24	
Council Directive 86/662/EEC of 22 December 1986 on the **limitation of noise emitted by hydraulic excavators. rope-operated excavators, dozers, loaders and excavator-loaders**	L384, 31.12.1986, p.1	
– Commission Directive 89/514/EEC of 2 August 1989 adapting to technical progress Council Directive 86/662/EEC	L253, 30.8.1989, p.35	
Council Directive 89/269/EEC of 4 December 1989 on the **limitation of noise emission from civil subsonic jet aeroplanes**	L363, 13.12.1989, p.27	

EC Legislation concerning WATER

	EC Official Journal	Env. Res. Newsletter
Council Directive 73/404/EEC of 22 November 1973 on the approximation of the laws of the Member States relating to **detergents**	L347, 17.12.1973, p.1	4 (Dec. 1989), p. 21
– Council Directive 82/242/EEC of 31 March 1982	L109, 22.4.1982, p.1	4 (Dec. 1989), p. 21
– Council Directive 86/94/EEC of 10 March 1986	L80, 25.3.1986, p.51	4 (Dec. 1989), p. 21
Council Decision 75/437/EEC of 3 March 1975 concluding the **Convention for the prevention of marine pollution from land-based sources**	L194, 25.7.1975, p.5	4 (Dec. 1989), p.22
– Convention on the prevention of marine pollution from landbased sources	L194, 25.7.1975, p.5	4 (Dec. 1989), p.22
– Council Decision 87/57/EEC of 22 December 1986 concluding the Protocol amending the Convention for the prevention of marine pollution from land-based sources	L24, 27.1.1987, p.46	4 (Dec. 1989), p.23
Council Directive 75/440/EEC of 16 June 1975 concerning the **quality required of surface water intended for the abstraction of drinking water in the Member States**	L194, 25.7.1975, p.26	4 (Dec. 1989), p.18
– Council Directive 79/869/EEC of 9 October 1979	L271, 29.10.1979, p.26	4 (Dec. 1989), p.19
– Act of Accession of Spain and Portugal of 12 June 1985, Annex XXXVI, Chapter 111.2	L302, 15.11.1985, p.9	
Council Directive 76/160/EEC of 8 December 1975 concerning the **quality of bathing water**	L31, 5.2.1976, p.1	4 (Dec. 1989), p.19
– Act of Accession of Greece of 28 May 1979, Annex I, Chapter XIII.1.a	L291, 19.11.1979, p.17	
– Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X.1.b and Annex XXXVI, Chapter III.3	L302, 15.11.1985, p.9	
Council Directive 76/464/EEC of 4 May 1976 on **pollution caused by certain dangerous substances discharged into the aquatic environment of the Community**	L129, 18.5.1976, p.23	4 (Dec. 1989), p.20
Council Decision 77/585/EEC of 25 July 1977 concluding the **Convention for the Protection of the Mediterranean Sea against pollution and the Protocol for the prevention of the pollution of the Mediterranean Sea by dumping from ships and aircrafts**	L240, 19.9.1977, p.1	4 (Dec. 1989), p.23
– Convention for the protection of the Mediterranean Sea against pollution	L240, 19.9.1977, p.3	
– Protocol for the prevention of pollution of the Mediterranean Sea by dumping from ships and aircraft	L240, 19.9.1977, p.13	
Council Decision 77/586/EEC of 25 July 1977 concluding the **Convention for the protection of the Rhine against chemical pollution** and an Additional Agreement, signed in Berne on 29 April 1963, concerning the **International Commission for the protection of the Rhine against pollution**	L240, 19.9.1977, p.35	4 (Dec. 1989), p.23
– Convention for the protection of the Rhine against chemical pollution	L240, 19.9.1977, p.37	
– Additional Agreement, signed in Berne on 29 April 1963, concerning the International Commission for the protection of the Rhine	L240, 19.9.1977, p.51	
– Council Decision 82/460/EEC of 24 June 1982	L210, 19.7.1982, p.8	4 (Dec. 1989), p.24

	EC Official Journal	Env. Res. Newsletter
– Council Decision 85/336/EEC of 27 June 1985	L175, 5.7.1985, p.36	4 (Dec. 1989), p.24
– Council Decision 88/381/EEC of 24 June 1985	L183, 14.7.1988, p.27	4 (Dec. 1989), p.24
Council Decision 77/795/EEC of 12 December 1977 establishing a **common procedure for the exchange of information on the quality of surface fresh water in the Community**	L334, 24.12.1977, p.29	4 (Dec. 1989), p.19
– Act of Accession of Greece of 28 May 1979, Annex 1, Chapter XIII.1.b	L291, 19.11.1979, p.17	
– Council Decision 81/856/EEC of 19 October 1981	L319, 7.11.1981, p.17	
– Commission Decision 84/422/EEC of 24 July 1984	L237, 5.9.1984, p.15	
– Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X.1.d and 4	L302, 15.11.1985, p.9	
– Council Decision 86/574/EEC of 24 November 1986	L335, 28.11.1986, p.44	4 (Dec. 1989), p.19
– Commission Decision 90/2/EEC of 14 December 1989	L1, 4.1.1990, p.20	
Council Directive 78/659/EEC of 18 July 1978 on the **quality of fresh waters needing protection or improvement in order to support fish life**	L222, 14.8.1978, p.1	4 (Dec. 1989), p.19
– Act of Accession of Greece of 28 May 1979, Annex 1, Chapter XIII.1.d	L291, 19.11.1979, p.17	
– Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X.1.f	L302, 15.11.1985, p.9	
Council Directive 79/869/EEC of 9 October 1979 concerning the **methods of measurement and frequencies of sampling and analysis of surface water intended for the abstraction of drinking water in the Member States**	L271, 29.10.1979, p.44	4 (Dec. 1989), p.19
– Council Directive 81/855/EEC of 19 October 1981	L319, 7.11.1981, p.16	
– Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X.1.i and Annex XXXV, Chapter III.5	L302, 15.11.1985, p.9	
Council Directive 79/923/EEC of 30 October 1979 on the **quality required of shellfish waters**	L281, 10.11.1979, p.47	4 (Dec. 1989), p.19
Council Directive 80/68/EEC of 17 December 1979 on the **protection of groundwater against pollution caused by certain dangerous substances**	L20, 26.1.1980, p.43	4 (Dec. 1989), p.20
Council Directive 80/778/EEC of 15 July 1980 relating to the **quality of water intended for human consumption**	L229, 30.8.1980, p.11	4 (Dec. 1989), p.19
– Council Directive 81/858/EEC of 19 October 1981	L319, 7.11.1981, p.19	
– Act of Accession of Spain and Portugal of 12 June 1985, Annex I, Chapter X.I j and Annex XXXVI, Chapter III.6	L302, 15.11.1985, p.19	
Council Decision 81/420/EEC of 19 May 1981 on the conclusion of the **Protocol concerning cooperation in combating pollution of the Mediterranean Sea by oil and other harmful substances in cases of emergency**	L162, 19.6.1981, p.4	4 (Dec. 1989), p.23
– Protocol concerning cooperation in combating pollution of the Mediterranean Sea by oil and other harmful substances in cases of emergency	L162, 19.6.1981, p.6	

	EC Official Journal	Env. Res. Newsletter
Council Directive 82/176/EEC of 22 March 1982 on **limit values and quality objectives for mercury discharges by the chlor-alkali electrolysis industry**	L81, 27.3.1982, p.29	4 (Dec. 1989), p.20
Council Directive 82/242/EEC of 31 March 1982 on the approximation of the laws of the Member States relating to **methods of testing the biodegradability of non-ionic surfactants** and amending Directive 73/404/EEC	L109, 22.4.1982, p.1	4 (Dec. 1989), p.21
Council Decision 83/101/EEC of 28 February 1983 concluding the **Protocol for the protection of the Mediterranean Sea against pollution from land-based sources**	L67, 12.3.1981, p.1	4 (Dec. 1989), p.23
– Protocol for the protection of the Mediterranean Sea against pollution from land-based sources	L67, 12.3.1981, p.1	
Council Directive 83/513/EEC of 26 September 1983 on **limit values and quality objectives for cadmium discharges**	L291, 24.10.1983, p.1	4 (Dec. 1989), p.20
Council Decision 84/132/EEC of 1 March 1984 on the conclusion of the **Protocol concerning Mediterranean specially protected areas**	L68, 10.3.1984, p.36	4 (Dec. 1989), p.23
– Protocol concerning Mediterranean specially protected areas	L68, 10.3.1984, p.38	
Council Directive 84/156/EEC of 8 March 1984 on **limit values and quality objectives for mercury discharges by sectors other than the chloralkali electrolysis industry**	L74, 17.3.1984, p.49	4 (Dec. 1989), p.20
Council Decision 84/358/EEC of 28 June 1984 on the **Agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances (Bonn Agreement)**	L188, 16.7.1984, p.7	4 (Dec. 1989), p.24
– Agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances (Bonn Agreement)	L188, 16.7.1984, p.9	
Council Directive 84/491/EEC of 9 October 1984 on **limit values and quality objectives for discharges of hexachlorocyclohexane**	L274, 17.10.1984, p.11	4 (Dec. 1989), p.20
Council Directive 85/613/EEC of 20 December 1985 concerning the adoption, on behalf of the Community, of programmes and measures relating to **mercury and cadmium discharges under the Convention of the prevention of marine pollution from land-based sources**	L375, 31.12.1985, p.20	4 (Dec. 1989), p.22
– PARCOM Decision 85/1		
– PARCOM Decision 85/2		
Council Decision 86/85/EEC of 6 March 1986 establishing a **Community information system for the control and reduction of pollution caused by the spillage of hydrocarbons and other harmful substances at sea**	L77, 22.3.1986, p.33	4 (Dec. 1989), p.22
– Council Decision 88/346/EEC of 16 June 1988	L158, 25.6.1988, p.32	
Council Directive 86/280/EEC of 12 June 1986 on **limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive 76/464/EEC**	L181, 4.7.1986, p.16	4 (Dec. 1989), p.20
– Council Directive 88/347/EEC of 16 June 1988	L158, 25.6.1988, p.35	4 (Dec. 1989), p.20
– Council Directive 90/415/EEC of 27 July 1990	L219, 14.8.1990, p.49	
Council Directive 91/271/EEC of 21 May 1991 concerning **urban waste water treatment**	L135, 30.5.1991, p.40	8 (Dec. 1991), p.8