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Contents

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Editorial

The present issue of Environmental Research Newsletter is devoted mainly to the impact and effects of chemicals. This includes aspects of human health effects, environmental risks, waste, industrial safety, occupational exposures and biotechnological hazards.

In contrast to air pollution which may cause problems on a global scale, for example its possible role in climatic change and acid deposition in remote areas, the control of chemicals appears at first sight to be of a more regional or geographically-limited concern, e.g. the Seveso and Sandoz accidents. However, in many instances, the control of industrial chemicals in the environment requires also attention and cooperation at international levels. A case in point was the much publicized recent attempt to dispose of chemical waste from some EC-Countries through shipment to other lands.

Considerable benefits may be obtained by tackling the problem of chemicals control through a close international coordination and a subsequent sharing of tasks. A relevant example concerns the magnitude of work involved in the establishment of the European Inventory of Existing Commercial Chemicals (EINECS). Such coordinated and cooperative approaches are a feature of joint activities between the EC and the OECD. The OECD, on the basis of national and Commission's ECDIN data bank information, has compiled a list of high production chemicals ($\geq$1000 t/yr); similarly the EC is preparing a regulation based on the EINECS data which also includes ecological risk assessment derived from ECDIN and OECD information.

In the past, improvements in pollution abatement in a particular environmental compartment have sometimes been gained at the expense of another one (air, water, soil). More recently the Commission's approach to environmental protection developed into that of an integrated control. In this context, the Commission's DG XI recently sponsored a Conference in Brussels, Belgium, on "Integrated Pollution Control in Europe and North America" concerned mainly with aspects of regulations, implementation and inspection problems.

The recent reorganization of the EC Joint research Centres with the creation of the Environment Institute which will harmonize the scientific approach to the various apects of environmental research is another example of this integrated approach.

F. Geiss
Director of the Environment Institute
Joint Research Centre Ispra

EC Research Programmes and Support Activities to the Commission

Programme News

EC Research Programmes STEP and EPOCH - DG XII / E (1989 - 1992)

STEP (Science and Technology for Environmental Protection) and EPOCH (European Programme On Climatology and Natural Hazards) are two specific research and technological development programmes in the field of environment. They are designed to contribute to the implementation of "Quality of life: Environment" activity of the 1987-1991 EC Research and Technological Development Framework Programme (see below). These two programmes have been proposed for adoption to the Council (OJ No C 327, 20.12.88). They continue and expand the current programmes in these areas initiated in 1986.

STEP covers the research topics specified under "environmental protection", "cultural heritage", "major technological hazards" and "fire safety".

EPOCH treats the topics under the headings "climatology" and "natural hazards".

The programmes will be implemented by means of (i) shared-cost research contracts, (ii) concerted actions, (iii) coordination activities, (iv) education and training activities and (v) studies and assessments. Publication in the Official Journal of the European Communities of June 1989 of a first call for research proposals is expected by June 1989.

Projects must be transnational and are open to universities, research organisations and industrial companies, including small and medium-sized enterprises, individuals, or any combination there of established in the Community.

The main objectives of the programmes can be summarised as follows:

- provision for scientific and technical support to the environmental policy of the Community aimed at the solution of short-term policy matters and medium and long-term formulation of preventive and anticipatory policies;
- further improvement of overall research efforts in the Community, reduction of overlaps and identification of gaps through coordination of national R & D programmes; and
- promotion of overall scientific and technical quality in the field of environmental research as a contribution to the strengthening of the economic and social cohesion of the Community.

The programme **STEP** is sub-divided into nine research areas:

1. ***Environment and human health:***
   aiming at the protection of human health from environmental pollution (including the indoor environment) through early identification of groups at risk, quantification of exposure, identification of early effects and through epidemiological surveillance.
2. ***Assessment of risks associated with chemicals:***
   potential risks from chemicals to human health and the environment. This part of the programme is directed to support Community regulations.
3. ***Atmospheric processes and air quality:***
   elucidate the turn-over of pollutants in the atmosphere and assess the impact of air pollution on terrestrial and aquatic ecosystems.
4. ***Water quality:***
   development and validation of analytical methods for the determination of water quality and investigation of the transformation of pollutants in the aquatic environment including their effects on living targets.
5. ***Soil and groundwater protection:***
   generate a scientific basis for the protection of soil and the prevention of groundwater pollution.
6. ***Ecosystem research:***
   acquisition of knowledge on structure, functioning and vulnerability of ecosystems to define a long-term strategy for their protection, restoration and/or management.
7. ***Protection and conservation of the European cultural heritage:***
   provide a scientific basis for relevant aspects of Community cultural and environmental policies.
8. ***Technologies for environmental protection:***
   develop and assess processes for the treatment and disposal of waste and reduction of emission including the use of "clean technologies".
9. ***Major technological hazards and fire safety:***
   provide a scientific basis for the assessment of risks to the general population from potentially hazardous industrial activities and fire in buildings. Given due consideration to human factors, prevent and reduce accidents also by the proper design of equipment/machinery.

EPOCH is concerned with the study of climate, induced in particular by greenhouse gases, and with hazards and risks associated with climatic changes and variability as well as other natural phenomena. The programme is sub-divided into four research areas:

1. ***Past climates and climate change:***
   provide a better understanding of the functioning of the climate system apart from changes induced by man's activities.
2. ***Climate processes and models:***
   understand the mechanisms ruling the various components of the climate system and their interactions to improve the physical formulation and the "parametrization" of climate models, thus our ability to predict climate change.
3. ***Climatic impacts and climate-related hazards:***
   understand the effects of climatic and hydrogeological factors, especially climate change, upon various sectors of the European environment.
4. ***Seismic hazards:***
   develop and improve the means for predicting, preventing and mitigating the seismic risks in Europe, not only in earthquake-prone areas but also in low-seismicity areas where nevertheless high-risk objects (industrial and power plants, dams, etc.) exist.

Further information can be obtained from:
Ph. Bourdeau, Director, DG XII/E, CEC, 200 rue de la Loi, B-1049 Brussels. Tel. + 32 2 2356140.

Environment Research Programme of the EC Joint Research Centre (1988-1991)

Adopted by the Council of Ministers on 14 October 1988 (OJ No L 286, 20.10.88), this specific research programme under the heading "Quality of Life" includes three branches: environmental protection, application of remote-sensing techniques and industrial hazards.

The aim is to contribute to the generation of scientific knowledge in the fields of environmental protection and industrial safety necessary for the implementation and further development of the Community environment policy and the Community consumer protection policy.

The scientific and technical content of theJoint Research Centre (JRC) Environment Programme can be summarised as follows:

- Environmental protection
  - environmental chemicals (ECDIN)

- genetically engineered substances
- air pollution
- quality of water
- chemical wastes
- environmental studies for the Mediterranean basin
- European monitoring network
- food and drug analysis

• Application of remote sensing techniques
- monitoring of land resources and their use
- monitoring of the marine environment
- advanced techniques

• Industrial hazards
- safety and reliability assessments
- risk management
- human factors in high-risk prevention and its management
- uncontrolled reactions
- risks due to the transport of dangerous products on a European scale.

A project on the evaluation and monitoring of radioactivity including waste aspects is an integrated part of the overall "Quality of Life" programme.

Following a recent restructuration, as from 4.11.1989, the JRC is organized in nine institutes. Research in the Environment Programme is the concern of the:

- ***Environment Institute***, acting Director F. Geiss;
- ***Institute for Remote Sensing Applications***, Director R.L. Klersy;
- ***Institute for Systems Ingineering***, acting Director G. Volta; and
- ***Safety Technology Institute***, Director H.F. Holtbecker.

The last three institutes being only partly involved in environmental research. The radiation protection programme is integrated in the Environment Institute activities.

Further information on the programme can be obtained from the above-cited institutes located at the CEC-JRC, Ispra Site, I-21020 Ispra.

Framework Programme of Community Activities in the Field of Research and Technological Development (1987-1991)

(Official Journal of the European Communities No L 302, 24.10.87)

The framework programme provides for the following activities:

1. Quality of life
   - 1.1. Health
   - 1.2. Radiation protection
   - 1.3. Environment
2. Towards a large market and an information and communications society
   - 2.1. Information technologies
   - 2.2. Telecommunications
   - 2.3. New services of common interest (including transport)
3. Modernization of industrial sectors
   - 3.1. Science and technology for manufacturing industry
   - 3.2. Science and technology of advanced materials
   - 3.3. Raw materials and recycling
   - 3.4. Technical standards, measurement methods and reference materials
4. Exploitation and optimum use of biological resources
   - 4.1. Biotechnology
   - 4.2. Agro-industrial technologies
   - 4.3. Competitiveness of agriculture and management of agricultural resources
5. Energy
   - 5.1. Fission: nuclear safety
   - 5.2. Controlled thermonuclear fusion
   - 5.3. Non-nuclear energies and rational use of energy
6. Science and technology for development
7. Exploitation of the sea bed and use of marine resources
   - 7.1. Marine science and technology
   - 7.2. Fisheries
8. Improvement of European S/T cooperation
   - 8.1. Stimulation, enhancement and use of human resources
   - 8.2. Use of major installations
   - 8.3. Forecasting and assessment and other back-up measures (including statistics)
   - 8.4. Dissemination and utilisation of S/T research results.

ERRATUM

p. 3, col. 2, l. 3 should read 4.11.1988 (and not 1989)
p. 18, col. 2: delete lines 4, 5 and 7.

1. Environment and Human Health

Research to identify biological markers of exposure and preclinical effects is managed by DG XII/E and implemented by shared-cost contracts (1.1. below). The JRC Ispra is involved in the coordination of the Concerted Action COST 613 on "indoor air quality and its impact on man" (1.2. below) and in specific research activities in indoor air pollution (1.3. below). Trace metal exposure and health effects is another group of research activities in this programme (1.4. below).

1.1. Biological markers of exposure and preclinical effects

The activity managed by DG XII/E focuses on the early identification of groups at risk, the quantification of exposure by means of target or organ loads and the identification of early, reversible effects. Two coordinated "European Projects" grouping several shared-cost contracts were started in February 1989.

Biomonitoring of human populations exposed to genotoxic environmental pollutants

The objective is to develop population monitoring systems to quantify exposure to, and early effects of, genotoxic pollutants.

Participating institutes are:

- Danish Cancer Society, Copenhagen, Denmark (H. Autrup);
- University of Patras, Greece (N. Demopoulos);
- MRC Toxicological Unit, Carshalton, UK (P. Farmer);
- University of York, UK (R. Garner);
- MRC Cell Mutation Unit, Sussex University, UK (A. Lehmann);
- Universidad Autonoma de Barcelona, Spain (R. Marcos);
- Vrije Universiteit Brussel, Belgium (M. Kirsch-Volders);
- Rijksuniversiteit Leiden, The Netherlands (A. Natarajan);
- University of Wurzburg, FRG (H. Neumann);
- University of Essen, FRG (K. Norpoth);
- University College of Swansea, UK (J. Parry);
- Institute of Occupational Health, Helsinki, Finland (M. Sorsa), EC-Finland bilateral cooperation.

Early indicators of nephrotoxic effects resulting from exposure to environmental pollutants.

The objective is to develop, validate and apply sensitive tests for the detection of early effects of environmental pollutants on the kidney.

Participating institutes are:

- University of Louvain, Belgium (R. Lauwerys);
- University of Parma, Italy (I. Franchini);
- CSIC, Barcelona, Spain (E. Gelpi);
- University College of London, UK (M. Hutton); and Cambridge University, UK (R. Price and M. Lockwood);
- University of Antwerp, Belgium (M. de Broe);
- Medizinische Hochschule Hannover, FRG (H. Stolte);
- Robens Institute, University of Surrey, UK (P. Bach);
- INSERM, Hôpital Broussais Paris, France (Ph. Druet).

Further information can be obtained from:
H. Ott, A. Sors, DG XII/E, CEC, 200 rue de la Loi, B-1049 Brussels.
Tel. + 32 2 2351111.

1.2. "Indoor Air Quality and its Impact on Man" COST Project 613

This Concerted Action, started in March 1987, is managed by the Joint Research Centre at Ispra. It aims at determining the impact on human health of air pollution in non industrial - indoor environments (homes, schools, offices, etc.).
Non-EC Member States, Switzerland and Norway, participate in this action.

The objectives for European cooperation in the field of Indoor Air Quality are:

- identification, characterization and sources of pollutants;
- assessment of population exposure;
- assessment of health effects;
- development and validation of reference methods; and
- collation, synthesis and dissemination of data.

To achieve these aims, the following activities are in progress:

- establishing of an inventory of ongoing Indoor Air Quality research activities in the Member Countries;
- coordination and development of common projects on priority issues aiming at filling research gaps and/or supporting the regulatory activities of the Commission; and
- collaboration with other international organisations.

1.2.1. Activity of Working Groups

The Concerted Action has been organised in 4 Working Groups of experts from Member States.

Working Group 1: "sick building syndrome" investigations

A "*guide to approach the problem of building sickness syndrome*" is being discussed. It aims at helping persons not necessarily experts in "sick building" investigations to advise on types of research and competences needed to solve specific complaints including symptomatology, diagnosis and responsible factors (physical, chemical, biological or psychological). A draft scheme of stepwise investigations for buildings with problems is also included.

Working Group 2: Strategies for indoor measurements

A "*sampling strategy in indoor air analysis*" which aims at improving the quality of the measurements performed by various laboratories is under discussion. This draft report contains a detailed discussion on the dynamics of the indoor environment and on the objectives of indoor pollution measurements as well as general rules for an optimal sampling strategy concerning time, duration, frequency and location. These rules concern pollutants or pollutant classes of interest such as formaldehyde, nitrogen dioxide, suspended particulate matter, asbestos, radon and volatile organic compounds. Although the document deals with the assessment of chemical substances, much of the content may also apply to microbiological indoor pollutants.

Working Group 3: Guideline for formaldehyde emission measurements

A draft report on "*Formaldehyde emission from materials: guidelines for the determination of steady state concentrations in test chambers*" is under discussion. It aims at describing a method allowing the reproducible measurement of steady state concentrations of formaldehyde emitted from wood-based materials using a large scale, walk-in type test chamber. Detailed information concern: (i) the general characteristics of the test chamber (size, design, tightness, construction materials, quality of air, control of physical parameters); (ii) the environmental parameters influencing steady state concentrations of formaldehyde and (iii) the procedures for handling source materials as well as sampling and analysis of formaldehyde.

Working Group 4: Health Effects of indoor pollutants and suitable research methods

Experts from Member States are preparing on request a draft document synthesizing available information on "*observed and potential health effects of indoor pollution*".

Future activities

Three new working groups are foreseen with the following mandates:

- evaluation of interest in developing European ventilation standards;

- identification of needs for common work on methodological or other issues in the field of microbiological indoor pollution; and
- preparation of a guideline for the determination of volatile organic compounds (VOC) emission from materials used indoor.

1.2.2. Support activity to Commission services

Reports from the Concerted Action COST 613 supplied to the Commission services allow the evaluation and opportunity for regulatory action in the field of indoor air quality. Three such reports have so far been drafted and contain information on existing knowledge in the field of exposure and health effects of indoor pollution by radon, formaldehyde and nitrogen dioxide in Community countries.

"Radon in Indoor Air", J.P. Mc Laughlin, Report EUR 11917 EN, 1988, CEC Luxembourg.
Radon was selected since it is a well studied indoor pollutant in terms of actual concentrations and expected adverse health effects. The report refers to doses and risk factors of radon exposure, as well as recommendations for its control. A summary of indoor radon surveys up to 1986 in EC and some non-EC Member States is included.
The report is available upon request, see address below.

"Indoor NO_2 Pollution in European countries", J.S.M. Boleij, publication as a Report EUR scheduled for March 1989.
The scope of this review is to identify differences and common denominators between various aspects of indoor pollution by NO_2 and help to identify a European approach to this issue. Emphasis is put on the specific situations in the various participating countries. Preventive measures to reduce NO_2 levels are also discussed.

"Review of formaldehyde as an indoor air pollutant", L. Molhave, publication as a Report EUR scheduled for mid 1989.
This report summarizes the present knowledge about formaldehyde as an indoor air pollutant in the non-industrial environment and related national and international regulations. Information on exposure and health effects concern only occupants in "normal" buildings.

1.2.3. Research Project Inventory

An inventory of ongoing research in the field of indoor air quality in the Member States was prepared. The first edition includes 112 projects. The publication of an updated version supplemented with about 200 more projects is scheduled for February/March 1989. Copies of the inventory are available free of charge from the JRC Ispra (see below).

1.2.4. Conferences

4th International Conference on Indoor Air Quality and Climate "Indoor Air 87"

The conference was held in Berlin, FRG, on 17-21 August 1987 under the auspices of the CEC. Proceedings may be obtained from:
Institut für Wasser-, Boden-und Lufthygiene des Bundesgesundheitsamtes, Corrensplatz 1, D-1000 Berlin 33.

5th International Conference on Indoor Air Quality and Climate "Indoor Air 90"

to be held in Toronto, Canada, on 29 July-3 August 1990.

Further details can be obtained from:
Indoor Air 90, Centre for Indoor Air Quality Research, University of Toronto, 223 College Street, Toronto, Ontario, Canada M5T 1R4.
Telefax (416) 978-8605.

1.2.5. Contacts with international organizations

WHO

WHO Regional Office for Europe participates to the meetings of this Concerted action with observer status. Reciprocally, members of the COST Committee participate to WHO technical meetings.

NATO

Contacts are also established with NATO which has started a pilot study on indoor air quality. Major goal of the study is to collate information on research activities and resources, national policies and regulations in this field, as well as to promote public information.

Further information can be obtained from:
M. Maroni, Istituto di Medicina del Lavoro,
Clinica del Lavoro "Luigi Devoto", via S. Barnaba 8,
I-20122 Milano.

Further information on the Concerted Action as well as reports can be obtained from:
H. Knoeppel, M. De Bortoli, Environment Institute, JRC Ispra, I-21020 Ispra. Tel. + 39 332 789111.

1.3. Indoor Air Pollution

The JRC Ispra is directly involved since 1981 in an indoor air pollution research programme.The aim is to establish a scientific basis for indoor air quality criteria and for the control of indoor pollution sources affecting human health. The environments considered are those with high "population residence times" (e.g. residential dwellings, schools, office buildings) or with presumed high air pollution levels (e.g. new buildings).

Pollution by volatile organic compounds (VOC) is given a high priority because of its

- high concentration levels found indoors, compared to outdoors;
- high complexity of this type of pollution requiring a widespread effort of assessment;
- potentially important health relevance; and the
- experience in the field of environmental organic analysis existing at the JRC.

A survey on 15 homes was carried out with the aim of assessing the indoor-outdoor difference in the concentration of VOC. To this scope continuous sampling was carried out for 4 to 6 days and the samples were analysed by gas chromatography. Results indicated for 33 compounds that the indoor/outdoor ratio was always greater than one (reaching 10 and even more for certain compounds). The gas chromatography-mass spectrometry analysis carried out showed the presence of 47 to 118 compounds in a single home.

A survey on indoor air quality was carried out in ten administrative buildings in Brussels on request of the European Parliament. The scope was to determine possible causes of complaints by the staff working in these premises. A questionnaire was also completed by all employees to relate their complaints with possible VOC concentrations.

An investigation on the exposure to pentachlorophenol (PCP) in tannery workers and in homes was carried out in cooperation with the Istituto di Medicina del Lavoro (University of Milano) by measuring the concentration of the compound in air, home dust, blood and wine. The concentration in wine was highly correlated with that in home-dust where a wood treatement with PCP based preservative had been made.

A diffusion sampler for VOC has been developed, which collects vapours at a very low flow rate (5-8 cm^3/hour) over one week. The vapours are then desorbed thermally by means of an appropriate device coupled with the gas chromatograph.

A start has been made for the determination of VOC emitted by different materials (building, furnishing, household) through the test chamber method.

Research to evaluate the genotoxic potential of acetaldehyde and methylglyoxal, two VOCs in sidestream of cigarette smoke, a major indoor polluant, indicated that both exerted genotoxic effects when injected in mice. In particular, acetaldehyde interferes with hepatic DNA repair as evidenced by the enhanced poly(ADP-ribose) polymerase activity in the cells of treated animals, while methylglyoxal appears to induce germ cell damage. Moreover, methylglyoxal interferes with mouse embryo development in vitro.

Further information can be obtained from:
H. Knoeppel, M. De Bortoli, Environment Institute, JRC Ispra, I-21020 Ispra. Tel. + 39 332 789111.

1.4. Trace Metal Exposure and Health Effects

The JRC activity at Ispra on Trace Metal Exposure and Health Effects aims to provide the Commission with the technical support for implemen-

ting regulatory actions to prevent potential health risks of exposure to certain trace metals. These actions involve the preparation of criteria documents which are relied upon to determine sound dose-effect/response relationships.

The main goal is to evaluate the toxicological significance of present and future emission of trace metals in the environment released from different anthropogenic sources (e.g. fossil-fuelled power plants, fertilizers) and of trace metal occupational exposure hazards to workers.

This activity relies on higly sensitive nuclear and radioanalytical techniques such as neutron activation analysis (NAA) and radiotracers. These techniques are used in combination with cellular fractionation, cell culture, and standard biochemical methods.

The activity is subdivided in the following areas:

- Trace metal exposure.
- Monitoring of trace metals in humans.
- Metabolism of trace metals.

The most important results achieved sor far are:

Comparative metabolic studies on inorganic and environmental organic forms of arsenic in different animal species.

The interaction of inorganic As (As_i) with cellular components of rats, mice, rabbits and marmoset monkeys varies according to the animal species, depending on the biotransformation of As_i. The detoxification of As_i is closely related to the rate of its methylation in tissues. The retention and distribution of the organic forms of As differ widely from that of As_i. As a matter of fact, arsenobetaine and dimethylarsinic acid, the main metabolite after exposure to inorganic arsenic, were found neither to interact with biochemical components of blood and tissues nor to be biotransformed, but were excreted unchanged. This is in agreement with the low degree of toxicity of these As species.

Trivalent and pentavalent inorganic arsenic were found to cause cytotoxicity and transforming activity in BALB/3T3 cells. No significant difference was observed for the two forms when the effect was correlated to the internal cellular arsenic burden instead of the external exposure. This suggests that the effect is independent of the valence state of the As in the culture medium.

Metabolic and toxicity studies on thallium.

Results on the daily treatment of rats with Tl (I) via drinking water for 9 months, suggest the cumulative nature of selected toxic effects and individual variations in susceptibility of rats to induced neuropathy. This indicates that continuous exposure to relatively low doses of thallous ions may be responsible for disorders of the peripheral nervous system. In addition, the male reproductive system is a target site susceptible to toxic effects under chronic exposure, testicular cells being mainly involved.

Determination of vanadium in blood and urine of boiler cleaners of large oil-fired power plants.

Urinary vanadium levels proved to be good indicators of vanadium absorption in exposed subjects. Blood vanadium indicator does not seem to be as sensitive as urinary one, since differences in concentrations are hardly appreciable at a low level of exposure with presently available analytical methods. A long-term vanadium accumulation may occur during low levels chronic exposure.

Development of newer indicators of trace metal-body-burden such as transbronchial biopsy and washing lung fluid.

A method based on neutron activation analysis of bronchoalveolar lavage was developed to measure on a long term basis the lung content in trace metals of differently exposed subjects. Results suggest that this procedure could provide useful qualitative information on metals which could be actually retained in the lung. The approach contributes to a correct diagnosis of trace metals exposure.

Evaluation of normal levels of trace metals in human lung tissues.

Indicative trace element reference values in human lung were suggested to address experimental work for establishing trace metal levels in the lung tissue of inhabitants in the EC Member Countries.

A narrow range of concentration of forthy-eigth elements determined in thirteen sampling points of the lung tissues to study their regional distribution was found when compared to values in the literature.

Distribution of trace metals in various tissues from workers of hard metal industry.

The aim of this study is to establish correlations between metal concentrations (Co, W, Ta) and biological samples (blood, urine, toenails, pubic hair) as well as to identify indicators of exposure. A correlation was found between urine and blood concentration for Co, and between Co and W in urine and whole blood. Particularly high concentrations of these metals were found in pubic hair and toenails suggesting that they could be used as possible indicators of exposure to hard metal dust. Comparative analysis of samples taken from hard metal workers with those from a worker who had died from pneumoconiosis suggests that no correlation probably exists between internal dose, length of exposure and development of lung disease.

Further information can be obtained from:
E. Sabbioni, Environment Institute, JRC Ispra, I- 21020 Ispra.
Tel. + 39 332 789070.

2. Environmental Chemicals

Since the first European Community R&D Programme in the field of Environment started in 1973, research was undertaken to evaluate the potential risks due to the many thousands of chemical substances in the environment. Activity in this area contributes to the defining of Community regulations. This research is managed partly by DG XII/E and implemented by shared-cost projects to assess risks associated with chemicals (2.1. below) and partly by the JRC Ispra for a data and information network as well as an inventory of existing commercial substances (2.2.below).

2.1. Assessment of risks associated with chemicals

The previous EC Environmental Research Programmes managed by DG XII/E laid emphasis on contract research to develop methodologies for the assessment of chemicals which may be released in the environment and to improve the interpretation of test results. The activity focused mainly on mutagenic and carcinogenic risks of environmental chemicals. Emphasis was given to methods and procedures of relevance to present and possible future Community actions on environmental chemicals, in particular to Directive 79/831/EEC on the classification, packaging and labelling of dangerous substances.

In the 4th EC Environmental R&D Programme (1986-1990), research considers also methods to replace or reduce the use of laboratory animals in testing chemicals, as recommended in Council Directive 86/609/EEC on the protection of animals used for experimental and other scientific purposes.

2.1.1. Genetic Effects of Environmental Chemicals

Research in this area is a continuation of the work carried out within previous programmes.Results obtained in the framework of the 3th Environmental R&D Programme (1981-1985) involving the participation of 21 laboratories concerned with Genetic Effects of Environmental Chemicals were collated by J. Parry. Twelve laboratories cooperated on various aspects of quantitative comparative mutagenesis to form the molecular dosimetry project. A report and summary of this work was prepared by A. van Zeeland. Both reports were reviewed and published by the same authors in Mutagenesis, 1988, 3. Copies of the report and reviews are available through H. Ott, CEC, DG XII/E, Brussels.

The development of methods for assessing the mutagenic and carcinogenic risks of environmental chemicals continued during the 4th En-

vironmental R&D Programme (1986-1991) through a limited number of coordinated "European Projects" on well defined research themes. These are listed below, with an indication of the institution concerned as well as the responsible scientist.

Mechanisms of mutagenesis and molecular dosimetry (quantitative mutagenesis)

The objective is to study the molecular interactions of environmental mutagens and carcinogens with DNA and to correlate DNA damage and biological endpoint, including supporting methodological development (e.g. preparation of suitable monoclonal antibodies).

Participating institutes are:

- Gesellschaft für Strahlen und Umweltforschung, FRG (U. Ehling);
- Universität Essen, FRG (M. Rajewsky);
- National Hellenic Research Foundation, Greece (S. Kyrtopoulos);
- Universidad de Cordoba, Spain (C. Pueyo de la Cuesta);
- International Agency for Research on Cancer, France (R. Montesano);
- Istituto Superiore di Sanita, Italy (A. Carere);
- National Institute for Research on Cancer, Italy (A. Abbondandolo);
- Università di Pisa, Italy (N. Loprieno);
- Università "La Sapienza" Roma, Italy (F. Palitti);
- TNO National Biological Laboratory, The Netherlands (R. Baan);
- Medical Research Council, UK (C. Arlett);
- University College of Swansea, UK (J. Parry);
- State University of Leiden, The Netherlands (P. Lohman).

Validation of tests for genomic mutations (nondisjunction)

The objective is to develop and validate assays to evaluate chemicals capable of inducing genomic mutations.

Participating institutes are:

- Gesellschaft für Strahlen und Umweltforschung, FRG (U. Ehling);
- Greek Atomic Energy Commission, Greece (A. Kappas);
- Istituto Superiore di Sanità, Italy (A. Carere);
- National Institute for Research on Cancer, Italy (A. Abbondandolo);
- Università di Pisa, Italy (N. Loprieno);
- Università "La Sapienza" Roma, Italy (F. Palitti);
- State University of Leiden, The Netherlands (P. Lohman);
- University College of Swansea, UK (J. Parry).

Tests for non-genotoxic (epigenetic) carcinogens

The objective is to develop and validate methods to identify non-genotoxic carcinogens, including cell-transformation tests.

Participating institutes are:

- CNRS-Cancérogénèse Exptal. Tox. Génétique, France (I. Chouroulinkov);
- International Agency for Research on Cancer, France (R. Montesano);
- Istituto Superiore di Sanita, Italy (A. Carere);
- National Institute for Research on Cancer, Italy (A. Abbondandolo);
- Università di Pisa, Italy (N. Loprieno);
- Università "La Sapienza" Roma, Italy (F. Palitti);
- State University of Leiden, The Netherlands (P. Lohman);
- University College of Swansea, UK (J. Parry).

Assessment of scientific quality of research carried out in laboratories supported by the EC Environmental R&D Programme in the field of "Genetic Effects of Environmental Chemicals"

An assessment made on the basis of publications in relevant international journals for the period 1981-1987 covered contributions to 10 major scientific journals in the research sector. Nine hundred and eighty nine scientific papers in 274 volumes of these journals were examined. Details of the EC contributions are given in the Table below.

Research Areas	*EEC lab. litt.: World litt.* %	*EC Env. Prog. funded litt.: EEC lab. litt* %	*EC Env. Prog. funded litt.: World litt.* %
Molecular dosimetry	*63.6*	*47.6*	*30.0*
Methods for indentifying chemicals inducing aneuploidy	*71.4*	*52.0*	*37.1*
Transplacental assays	*55.0*	*45.5*	*25.0*
Micronucleus assays	*47.6*	*14.7*	*7.0*
Unscheduled DNA synthesis	*43.2*	*19.5*	*8.4*
Study of non-mutagenic carcinogens	*30.4*	*25.0*	*7.6*
Development of methods for population monitoring	*40.8*	*7.0*	*3.2*
Total	*44.7*	*22.4*	*10.0*

Laboratories within the EEC contributed 44.7% of the total world litterature in this research area. Of these, 22.4% of the total EEC output came from laboratories supported by the Environmental R&D Programme. Thus contributing 10% of the total world litterature in these areas.

Bibliography analysis indicates that scientific papers with authors from more tan one European country is still a relatively rare event. It is to be expected that the number of such collaborative papers will substantially increase with the development of the coordinated "Europrojects" initiated in the 4th Environmental R&D Programme.

2.1.2. Replacement of Animals used in Toxicity Testing

A coordinated European project aims at improving and/or developing new approaches and techniques to replace or reduce the use of vertebrate animals for toxicological testing procedures.

Evaluation of metabolic activation systems using plant and human blood cells

The following institutes carry out research to develop alternative test methods for the assessment of chemicals using less or, avoiding vertebrate whole animals.

- Université Catholique de Louvain, Belgium (A. Leonard);
- Autonomous University of Barcelona, Spain (M. Llagostera);
- Universidade Nova de Lisboa, Portugal (J. Rueff);
- Università "La Sapienza" Roma, Italy (A. Carere);
- State University of Leiden, The Netherlands (P. Lohman).

2.1.3. Ecotoxicology

The research area concerning the "assessment of risks associated with chemicals" considers also the aquatic ecotoxicology of chemical substances in freshwater and marine environment. A final report of results obtained in the framework of the 3rd EC Environmental R&D Programme (1981-1985) is pending and will soon be available.

The development of appropriate tests to assess the ecotoxicological effects of chemical compounds continued during the 4th EC Environmental R&D Programme (1986-1991) through shared-cost contracts, as listed below.

Development and validation of methods for evaluating chronic ecotoxicity to freshwater ecosystems

This project aims at:

- develop methods for evaluating chronic toxicity to freshwater

organisms. These methods should be suitable for incorporation of chemicals produced in high quantities (level 2) into the risk evaluation scheme for notification required by the 6th Amendment to Directive 79/831/EEC;

- validate ecotoxicological methods by comparing No Observed Effect Concentrations (NOECs) determined in single species laboratory tests, with NOEC's determined in multi-species field tests. This validation will facilitate the extrapolation of laboratory tests to field conditions.

Participating institutes are:

- Shell Research Ltd., Sittingbourne Research Centre, UK (N.O. Crossland);
- University of Wales, Institute of Science and Technology (UWIST), Cardiff, UK (R. Edwards, D. Pascoe);
- Gesellschaft fur Strahlen und Umweltforschung (GSF), Neuherberg, FRG (F. Korte, J.P. Lay);
- Fraunhofer Gesellschaft fur Ekotoxikologie (FKG), Schmallenberg, FRG (W. Klein, F. Otto);
- University of Ghent, Belgium (G. Persoone).

Microcalorimetry of bacterial metabolism

The objective is to apply microcalorimetry as a new approach to assess the biodegradability of chemicals as a complement to existing tests based mainly on oxygen consumption.

In its introductory phase this project is developed by several institutes of the Universidad de Barcelona, Spain (J. Wagensberg).

Further information on shared-cost contracts managed by DG XII/E in the field of "Assessment of risks associated with chemicals" can be obtained from:
H. Ott (2.1.), A. Sors (2.1.1. and 2.1.2.), H. Barth (2.1.3.),
DG XII/E, CEC, 200 rue de la Loi, B-1049 Brussels.
Tel. + 32 2 2351111.

2.2. Environmental Chemicals Data and Information Network - European Inventory of Existing Commercial Chemical Substances

Activities in this programme are carried out at the JRC Ispra and aim also at supplying other Directions General with information necessary for their tasks.

2.2.1. Environmental Chemicals Data and Information Network (ECDIN)

ECDIN is a factual data bank on "Environmental Chemicals", i.e. substances which actually or potentially are interacting with the environment, or with human health.

It is designed to be an instrument which will enable those persons involved in management and research to obtain reliable information on chemical products manufactured by human activity in such an amount to be of environmental significance. As a criterion, substances produced and/or consumed in more than 1000 kg/year (or even less for extremely toxic compounds) are considered.

ECDIN allows a mutlidisciplinary simultaneous examination of several approaches to the problem of chemical hazards as well as a display of hard data besides bibliographic references. Data stored is preselected, possibly evaluated before entering in ECDIN by experts in the field.

The information collected in ECDIN cover the whole spectrum of parameters and properties which may help users to evaluate real or potential risks linked to the use of a particular chemical as well as its economical and ecological impact. It is subdivided into Data Categories, Files and Subfiles. The files list includes:

A. Identification (Chemical Synonyms; Chemical Structure Diagrams; Identifiers and Definitions);
B. Physico-chemical Properties;
C. Production and Use (Chemical Producers; Chemical Processes; Production and Consumption Statistics; Export Statistics; Import Statistics; Uses);
D. Legislation and Rules (IRPTC-Legal; Directive 67/457/EEC; IRPTC-Waste);
E. Occupational Health and Safety (Human Health Effects; Occupational Exposure limits; Occupational Poisoning Reports; Occupational Diseases Prevention; Symptoms and Therapeutic Treatment);
F. Toxicity (Classical Toxicity, Carcinogenicity, Aquatic Toxicity, Effects on Soil Microorganisms, Mutagenicity);
G. Concentration and Fate in the Environment (Concentration in Environmental Matrices; Concentrations in Human Media; Concentrations in Animal Media; Metabolims in Soil; Aquatic Bioaccumulation);
H. Detection Methods (Analytical Methods; Odour and Taste Threshold Concentrations);
I. Hazard Information.

ECDIN has been conceived both as a scientific tool for the Commission Services concerned with chemicals, and as a public service in general. Data can be retrieved by the ECDIN Display System. The Data Base Management System is ADABAS, from Data Systems AG. The system is available on-line, through the European computer network DATAPAC, and other international networks. Commission services may connect to the Ispra Host, while the general public is served by a commercial host, at present the Danish DATACENTRALEN IS, Copenhagen. A total or partial dissemination of ECDIN on Compact Disks is under study.

The 1st International Workshop on Data Banks in Occupational Health was held in Varese (Italy) 30-31 October 1986.
Proceedings entitled 1st International Workshop on Data Banks in Occupational Health, ed. L. Parmeggiani, R. Roi, G. Aresini and G. Del Bino were published by the CEC, EUR 11022 EN, 1987, CEC Luxembourg.

Further information can be obtained from:
M. Boni, Environment Institute, JRC Ispra,
I-21020 Ispra. Tel. + 39 332 789720.

2.2.2. European Inventory of Existing Commercial Chemical Substances (EINECS)

This activity is carried out at the JRC as a support to DG XI which is responsible for Environment, Consumer Protection and Nuclear Safety, including the impact of industry on the environment and the management of waste products.

The 6th Amendment (Directive 79/831/EEC) of the EC Council Directive on classification, packaging and labelling of dangerous substances (Directive 67/548/EEC) requests the Commission to establish a list of commercial chemical substances present on the market in the Member States on 18 September 1981 (article 13 of Directive 79/831/EEC). This date was set as the final term to distinguish on a legal basis "existing" and "new" chemicals; the latter needing a notification procedure before marketing. The above measures aimed at the limitation or prevention of the release of hazardous or detrimental substances into the environment.

In view of the large number of compounds and extensive relevant information which had to be processed, the preparation and compilation of the inventory was carried out in various stages between 1981 and 1987.

As a first step, 33000 compounds of significant industrial and commercial importance were compiled from the US-inventory (Toxic Substances Control Act), the Stanford Research Institute Directory and the EEC Customs List.

In a following step, 150000 substances reported by chemical producers and suppliers had to be processed for their eventuel inclusion in EINECS.

The Advance version of the EINECS inventory (Master Inventory), published in 1987 in English in print and on magnetic tape, included 100115 entries, approximately subdivided into:

- 75000 organic compounds;
- 5000 inorganic compounds; and
- 20000 substances of unknown or variable composition (UVCB without well defined molecular formula).

The EINECS Master Inventory is presently being translated into the various Community languages as a prerequisite to its publication, foreseen for 1989, in the Official Journal of the European Communities. The inven-

tory may be of value also for the comprehensive and systematic risk evaluation of existing chemicals.

Preparatory work in progress will structure the EINECS inventory according to chemical composition and properties. At the same time, assessment methods being tested and validated may help to complement existing experimental data.

Further information can be obtained from:
W. Karcher, Environment Institute, JRC Ispra, I-21020 Ispra.
Tel. + 39 332 789983.

3. Waste Research

Research on waste managed by DG XII/E is implemented by shared-cost contracts in the field of toxic and dangerous wastes, abandoned disposal sites (3.1.) and by a Concerted Action on "treatment and use of organic sludge and liquid agricultural waste" (3.2.). The JRC Ispra contribution to research on chemical waste includes studies on the migration and transformation of pollutants from waste deposits and their possible impact on human health and the environment as well as the development of a support system for the management of higly toxic wastes (3.3.).

3.1. Toxic and dangerous wastes - Abandoned disposal sites

The shared-cost contracts managed by DG XII/E presently in progress are listed below with an indication of the institution concerned as well as the responsible scientist.

Characterization, behaviour and detoxification of wastes and leachates

The objectives are to characterize waste, to understand leachate migration, the behaviour of wastes in landfills and to develop appropriate methodologies.

Participating institutes are:

- Technische Universitat Berlin, FRG (P. Gössele);
- A.N.R.E.D. Angers, France (H. Billard).

Integrated study on the migration of trace metals in ground water

The objective is to develop a methodology for implementing real case studies of trace metal pollutant mobility in ground water.

Participating institutes are:

- Laboratoire des Sciences du Genie Chimique, ENSIC, Nancy, France (D. Schweich);
- B.R.G.M., dept. Water Resources, Orleans, France (A. Bourg);
- CEA, Centre d'Etudes Nucleaires, Grenoble, France (R. Margrita);
- Universite Catholique de Louvain, Colloids Lab., Louvain, Belgium (A. Cremers);
- Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, FRG (S.H. Eberle);
- Institute of Hydrology and of Sanitary Engineering, Univ. of Stuttgart, FRG (H. Kobus);
- Castalia Spa, Roma, Italy (V. Bonaventura);
- Joint Research Centre Ispra, CEC, Italy (B. Versino).

Reclamation of abandoned and contaminated lanfill sites

The objective is to better understand landfills and their effects on groundwater quality with respect to abandoned or currently used landfills. Possible future landfills are also considered.

Participating institutes are:

- Department of Environmental Engineering, Technical University of Denmark, Lyngby, Denmark (T.H. Christensen);
- Dames & Moore International, Booth House, Twickenham, UK (R. Holmes).

Further information can be obtained from:
H. Ott, P. L'Hermite, DG XII/E, CEC, 200 rue de la Loi, B-1049 Brussels. Tel. + 32 2 2351111.

3.2. "Treatment and Use of Organic Sludge and Liquid Agricultural Waste" COST Project 681

This Concerted Action managed by DG XII/E is a follow-up of activities started in 1972. Non-Member Countries Austria, Finland, Norway, Sweden and Switzerland paricipate in this COST Project. Informal relations exist with Canada, FAO and WHO.

It is organized in five Working Parties (WP) which held scientific meetings and international symposia (Cadarache, France, 1979; Wien, Austria, 1980; Brighton, UK, 1983; Rome, Italy, 1985; Amsterdam, The Netherlands, 1988), some of these were jointly organised with FAO.

CEC/EWPCA Conference on "Treatment and Use of Sewage Sludge: New Developments, Technological Aspects and Environmental Effects", Amsterdam (The Netherlands), 19-23 September 1988.

Organised by the CEC, the Netherlands Association on Waste Water Treatment and Water Pollution Control (NVA) and Aquatech, the programme included: (i) sludge characterization; (ii) sludge management options for treatment and disposal; (iii) agricultural use of sewage sludge: quality aspects; (iv) sludge dewatering and biological conditioning; (v) sludge incineration; (vi) other thermal processes; and (vii) landfilling.

Proceedings edited by A.H. Dirkzwager and P. L'Hermite, EUR 11918, in press.

3.2.1. Activity of Working Parties

Working Party 1: Organic Sludge and Liquid Agricultural Wastes Processing

Research on organic sludge processing aims at obtaining a better quality end-product at low cost as well as developing new processes for the disposal of sludge and slurries.

Workshop on "Treatment of Sewage Sludge: Thermophilic Aerobic Digestion and Processing Requirements for Landfilling", Nancy (France), 25 November 1987.

The need to review the status of thermophilic aerobic digestion was evidenced; further research needs on the process were discussed. It appears from a survey that in the countries participating to the action landfilling was the predominant method of sludge disposal and deserves much more attention and research effort.

Proceedings edited by A.M. Bruce, F. Colin and P.J. Newman were published by Elsevier Applied Science Publishers LTD, Crown House, Linton Road, Barking, Essex IG11 8JU, UK, EUR 11764 1987. Distributor in the USA and Canada Elsevier Science Publishing CO., Inc., 52 Vanderbilt Avenue, New York, NY 10017, USA.

Workshop on "Thermal Treatment of Sludge", Bitonto (Italy), 27 June 1988.

The workshop reviewed the latest developments in the various methods of incineration and of thermal treatment. Considerable technological progress has been achieved in sludge incineration over the last few years.

Nevertheless problems concerning dewatering, odour control and disposal of final ash need further investigation.

Proceedings edited by F.Colin, P.J. Newman and L. Spinosa, in press.

Working Party on "Odour Problems".

An "ad hoc" expert group is involved in problems of odour control and standardisation of organoleptic measurements for assessing the odour emission and immission.

Workshop on "Volatile Emissions from Livestock Farming and Sewage operations", Uppsala (Sweden), 10-12 June 1987.

The workshop organised jointly by the CEC and the FAO aimed at bringing together experts on methods of collection and measurement of volatile emissions developed at various research centres to discuss control and treatment systems which are being evaluated at trials under farm conditions.

Proceedings edited by V.C. Nielsen, J.H. Voorburg and P. L'Hermite were published by Elsevier Applied Science Publishers LTD, Crown House, Linton Road, Barking, Essex IG11 8JU, UK, EUR 11294, 1988, ISBN 1-85166-227-8. Distributor in the USA and Canada Elsevier Science Publishing CO., Inc., 52 Vanderbilt Avenue, New York, NY 10017, USA.

Workshop on "Improved Recommendations for Olfactometric Odour Measurements and for Recommendations for Odour Intensity Measurement", Zürich (Switzerland), 20-21 April, 1988.

Draft proposals of recommendations were discussed at the workshop. Agreement was reached only on improved recommendations on olfactometric odour measurements.

Proceedings edited by M. Hangartner, J. Hartung, M. Paduch, B.F. Pain and J.H. Voorburg, in press.

Working Party 2: Chemical Contamination of Sludge and Soils

Attention is focused here on sampling problems involved in the analysis of sludge, slurries, soils and plants in order to obtain representative samples allowing to set up reference methods for interlaboratory comparisons. These latter are requisites for long-term observation of soil quality, reaction to pollutants, fertilisers and/or air pollution. An inquiry into organic substances in sewage sludge is planned to help defining further priority pollutants by comparing sludges from industrialised and rural areas.

Workshop on "Organic Contaminants in Waste Water, Sludge and Sediments: Occurence, Fate and Disposal", Brussels (Belgium), 26-27 October 1988.

The workshop was organised jointly by COST 681 and COST 641 "Organic Micropollutants in the Aquatic Environment".

The importance of increasing research in the field of occurence, behaviour and fate of organics in the environment to assess effective measures of prevention and proper treatment of all types of wastes was underlined. Chloro-organic compounds and surface active agents were recognised as the most important groups of pollutants, followed by polycyclic aromatic hydrocarbons (PAH) resulting mostly from combustion processes and phtalates. Simple aromatic substance, heterocyclic compounds, volatile and easily degradable organic chemicals like alcohols, ketones, etc. being of minor importance.

Proceedings edited by D. Quaghebeur, I. Temmerman and G. Angeletti, EUR 11957, in press.

Working Party 3: Hygienic Aspects Related to the Treatment and Use of Organic Sludge

The different areas of activities of this working party concern the study on populations exposed to slurry, research on indicators for treatment and differences in sludge and slurry types.

Workshop on "Hygienic Aspects of the Treatment and Use of organic Sludge and Liquid Agricultural Wastes", Dublin (Ireland), 21-23 September 1987.

Delegates from the FAO-European Cooperative Network on Animal Waste Utilisation (Subnetwork 1) participated to the workshop.

The purpose was to identify means for the hygienic management and disposal of organic sludge and liquid agricultural manures and considered the application of suitable models for the evaluation of the microbiological safety of treated organic wastes.

Progress reports on recent developments were presented by national delegates. Overviews on recent developments in (i) organic sludge management, (ii) hygiene management of animal wastes and (iii) survival of **Mycobacterium paratuberculosis** and **Mycoplasma** spp. in animal slurries were presented by invited experts.

Proceedings were published as an internal report.

Second Workshop on "Hygienic Aspects of the Treatment and Use of organic Sludge and Liquid Agricultural Wastes", Lelystad (The Netherlands), 26-28 September 1988.

Delegates from the FAO-European Cooperative Network on Animal Waste Utilisation (Subnetwork 1) participated to the workshop.

The objective was to establish an actual overview of the national legislation concerning the agricultural utilization of sewage sludge and animal manures with respect to environmental protection. The increasing importance of the problem of disposal of surpluses of liquid and/or solid animal manures in the countries with a dense animal population and a very intesified animal production was underlined. Problems arising from the leaching of nitrate into the ground water, the overfertilization of soils and crops and dangers of disease spreading were discussed.

Proceedings are being published as an internal report.

Working Party 4: Agricultural Value of Sewage Sludge and Liquid Agricultural Wastes

This working party aims at establishing how the different types of sludges and slurries can be utilised in different farming systems to give maximum efficiency with minimal risks of pollution. Priorities identified concerned leaching problems and the consequences on ground water quality; the nitrogen cycle as a whole and alternative uses, other than agricultural ones. These subjects are closely linked to WP 5. Furthermore problems concerning quick ammonia analysis systems and hygienic aspects in relation to application of sludge/slurries are also considered in collaboration with WP2 and WP3.

Joint Meeting of WP4 and WP5 on "Agricultural Use of Organic Sludge and Liquid Agricultural Wastes", Valencia (Spain), 16-17 November 1987.

A representative of Subnetwork 4 "Economic Use of Animal Manure as a fertilizer without causing Environmental Hazards" of the FAO European Cooperative Network on Animal Waste Utilization participated to the meeting.

Progress research reports dealt mainly with beneficial effects (nutrients, organic matter) and environmental impacts (leaching of nutrients, influence of heavy metals and micropollutants on plants and soil microbiology). Conclusions emphasized the complexity of micropollutant analysis and the need for more detailed investigation on leaching problems.

Proceedings were published as an internal report.

FAO / CEC-COST 681 (WP4 and WP5) Joint Workshop on "Safe and Efficient Slurry Utilisation", Liebefeld/Bern (Switzerland), 20-22 June 1988.

The main objective was the discussion of "Guidelines for an Economical Use of Slurry on Agricultural Land" prepared by H. Vetter and G. Steffens from FAO, Subnetwork 4 "Economic Use of Animal Manure as a fertilizer without causing Environmental Hazards".

These guidelines aimed at pointing out which adverse effects can occur by an incorrect slurry application and how slurry can be used in an economical, efficient and safe way. Considering differences in soils, climate and growing conditions, it is obvious that these guidelines can only be used as a framework pointing out the most important connections concerning slurry applications. Regional guidelines should be established for each specific situations.

Legal regulations to avoid undue pollution may be necessary for regions with too high livestock units density. These should consider restricted slurry application rates, restricted application dates, contracts for transfer

of surpluses, size of manure storage facilities and possibly limiting number of animals on a particular farm on the basis of area available for manure application. Legal regulations should consider also climatic and soil conditions as well as land use and the sensitivity of environment to excessive rates of manure application.

Proceedings are being published as an internal report.

Working Party 5: Environmental Effects of Organic Sludge and Liquid Agricultural Wastes

The different areas of activities concern (i) chemical characterisation of metal availability and changes in speciation in relation to soil properties and time; (ii) long-term effects of contaminants introduced to the soil; (iii) assessment of the environmental effects of organic micropollutants; (iv) determination of the background levels of metals in the European soils; (v) sampling procedures for sludge-treated soil (in collaboration with WP2 and WP3); and (vi) evaluation of guidelines for the control of contamination problems.

Meetings and Workshops organised in collaboration with WP4 (see above).

3.2.2. Inventory of National Research Projects

An inventory of national research projects was established.The second editions issued in 1983 was updated in 1985 and 1988. Copies can be obtained free of charge from P. L'Hermite.

Further information as well as reports can be obtained from:
H. Ott, P. L'Hermite, DG XII/E, CEC, 200 rue de la Loi,
B-1049 Brussels. Tel. + 32 2 2351111.

3.3. Chemical Waste

The major problem facing industrialised countries from hazardous and toxic waste materials in the environment is investigated at the JRC Ispra through studies on:

- the fate, transformations and pathways of toxic chemicals released during waste management activities;
- the estimation of human exposure to toxic residues originating from chemical waste; and
- the design and preparation of a decision support system, called Chemical Emergencies Management (ChEM), to supply information on the management of toxic chemicals and suggest strategies in the case of chemical accidents.

3.3.1. Migration and transformation of pollutants

The release and migration of solutes, colloidal or volatile species in the environment from waste material calls for a multidisciplinary approach to ensure that the toxic waste disposed of is isolated from the biosphere. Risk analysis models for possible release to the biosphere should be developed to allow important safety parameters to be identified. Close link between laboratory and field research is essential and models derived from these studies should be further verified by field experiments.

A study of trace metals leaching from pulverised fuel ash of coal-fired power plants has been undertaken at Ispra on laboratory scale using radiochemical techniques. Radioactive tracers of As, Sb, Bi, Se, Te, Cr, Mo, W, Ni, and Cd in coal fly ash-water systems have indicated the distribution coefficients when in single ionic forms. Results obtained on the adsorption and desorption behaviour of trace metals on coal fly ash columns were explained on the basis of surface predominance, the oxidation state and the aqueous chemistry of the relative element. Ion exchange, coprecipitation phenomena and competion reactions are also important processes considered. Results indicate that anionic species formed by B, As, Sb, Se, Cr, Mo, W and V are more mobile in alkaline leachates than are cationic species formed by Cd, Ni and Pb. The influence of the redox potential on the release of chromate and on the retention of chromium (III) ions was demonstrated. High performance ion chromatography allowed to identify and determine quantitatively various trace metal ionic species.

Trace metal migration in soil and interaction with soil strata have also been studied in the laboratories of the JRC. Results confirmed that an increase in organic matter content of soils also increased the sorption of both chromate and chromium (III) species. The chromium (III)/soil distribution coefficient was reduced when soluble organic matter was leached out at pH 6-8.

The experimental data have been used as input to mathematical dynamic models (compartmental and finite element type) to study solute release and migration of trace metals from a hypothetical coal fly ash repository to groundwater. Thus proving that soil water distribution coefficient was a crucial parameter in determining trace metal migration form a repository to groundwater.

The more detailed finite element model predicted that the As (Chromium) concentration in groundwater 20 meters beneath the repository will persist above the maximum permissible concentration level, as defined in EC/778 Directive in drinking water quality, for 60-130 years. Because of its high mobility in the soil sink, As reaches saturated groundwater media after 2 years of continuous release with an average horizontal diffusion velocity of 1/3 the calculated Darcy velocity. Diffusion of chromium proves to be similar but slower.

Laboratory and field measurements of the most important chemical and physical parameters involved in soil water distribution cofficients must be further improved to produce high quality input data for validation of the model.

3.3.2. Estimation of human exposure to toxic residues

Because of difficulties arising from the complexity of chemical mixtures and the difficulty of estimating individual exposure, procedures based on the usefulness of biological markers as dosimeters for individual exposure have been proposed. Genotoxic chemical are electrophilic reagents for nucleophilic groups in DNA and proteins. Indications exist that heterogeneous exposure to carcinogenic agents can be estimated by the determination of adducts formed with blood proteins or with DNA in circulating lymphocytes. Adducts are measured in tests carried out at the JRC by radioimmuno assay, P 32 post labeling, high performance liquid chromatography coupled with specific detectors, gas chromatograhy-mass spectrometry and fast atom bombardment mass spectrometry (FAB-MS). The FAB-MS method is used for the characterisation and measurement of alkylated DNA bases; the sensitivity is in the order of picomoles. Development of other mass spectrometric methods is in progress to increase specificity and sensitivity of detection.

In a separate study the assessment of exposure to polyhalogenated aromatic compounds (PCDD, PCDF, PCB) was determined using the procedure based on toxicity equivalent factors applied to a specific situation of an area surrounding a civil incinerator. From data collected, it appears that at a distance of 1 kilometer from the plant, the concentration of PCDD equivalents was less than 10% of that found near the plant. The assignment of toxicity equivalent factors to different congeners depend on biological tests being performed in different laboratories and values presently used may change.

The development of reference analytical methods depends to a large extent on the availability of specific standards. Well defined reference compounds of mutagenic importance,O6-ehtylguanine and O6-ethylguanosine were synthesised. Standards for PCB analysis as well as the tetra and pentachlorobiphenyl congeneres were prepared. A synthesis of uniformely C14 labelled 3,3', 4,4', 5,5' hexachlorobiphenyl is now in progress.

3.3.3. Chemical Emergencies Management (ChEM)

This Joint Research Centre project deals with management of equipment and emergency situations where higly toxic compounds are involved. Advanced computer science techniques are used for the development of decision support systems. The project has so far been concentrated to develop two experimental prototypes:

- a knowledge based system for the threat level estimation of emergency situations involving halogenated aromatic compounds such as PCB, PCDD and PCDF; and
- a hypermedia information system based on multimedia (praphics, photos, text, data) for the management of electrical equipment containing PCB.

The knowledge based system developed gathers information related to the context of a specific accident. The output is an estimation of the level of chemical hazard related to general information about the incident, toxic

levels, estimated damage to the environment, dynamics of the current accident state, suggestions for urgent actions, etc. The validation of the developed system has been made using past accident histories in different dynamic phases.

In the second phase of the project, special attention has been given to man-machine interactions with the knowledge based system. A graphical interface has been developed and integrated with the expert system based on a multi-level computerized map structure (Hypermap). This new approach to the design of chemical emergency systems interfaces exploits the spatial distribution of information and processes characteristic of the situation permitting an easy, fast and consistent use of all information available, their interaction and the decision making tools. A prototype model has been built which is implemented at present for a number of plants in the Lombardy region of Italy.

Future developments foresee the use of distributed artificial intelligence techniques for the development of a modular distributed computer system based on a "multi-agent" architecture.

The multimedia system is a complex association network containing the technical knowledge necessary for accident and pre-accident problem solving activity. This refers to electrical phenomena occuring in the equipment, to physical and chemical properties of the material involved, to chemical and toxicological properties of compounds in the container as well as the various factors of the environment concerned. A hypothetical population of electrical transformers containing PCB has been located in the vicinity of the Joint Research Centre Ispra. The need for census and survey of PCB-containing electrical equipment is recognised in most EC countries and legislation has been accordingly adapted. The ChEM project supports this operation. First results are expected in 1989.

Further information can obtained from:
S. Facchetti, F. Argentesi, Environment Institute, JRC Ispra, I-21020 Ispra. Tel. + 39 332 789111.

4. Reduction of Pollution

DG XII/E supports shared-cost contracts aiming at developing advanced technologies for waste water treatment and reduction of water pollution (4.1.below). The JRC Ispra is involved in the development of processes reducing the emission into the atmosphere of sulphur and nitrogen oxides from flue gases (4.2. below).

4.1. Clean technologies: waste water treatment and reduction of water pollution

Shared-cost contracts managed by DG XII/E presently in progress are listed below with an indication of the institution concerned as well as the responsible scientist. Work on pilot scale or demonstration projects are implemented by the "ACE" Programme, DG XI/A3 (see p. 20).

Development of high rate algal ponds for the photosynthetic reclamation of waste waters

The objective is to increase the efficiency of algal ponds used for waste water treatment.

Participating institutes are:

- Faculté de Pharmacie, Université de Montpellier, France (J. Bontoux);
- Centro de Investigaçao do Ambiente, Lisboa, Portugal (A.M. Magro);
- Istituto di Microbiologia Agraria, Firenze, Italy (R. Materassi);
- Informes y Proyectos, Madrid, Spain (S. Jimenez).

Advanced design and operation of municipal waste water treatment

The objective is to control the microorganisms growth, to decrease the active reactor volume and to reduce the energy consumption for waste waters treatment plants.

Participating institutes are:

- Department of Environmental Engineering, Technical University of Denmark, Lyngby, Denmark (M. Henze);
- Consorcio de Aguas, Bilbao, Spain (M. Lueje Concha).

Purification of waste waters by ion exchange pumping

The objective is to develop technology for recovering chemical compounds from waste waters by temperature control in the absorbing resin beds.

Participating institutes are:

- Department of technical Chemistry, University of Oviedo, Spain (J.M. Diaz);
- Faculty of Engineering, University of Porto, Portugal (A. Rodrigues).

Use of heterogenous photocatalysis for the reduction of water pollution

The objective is to remove pollutants in waste waters using photoactivated semiconductor particulates.

Participating institutes are:

- CNRS Ecole Centrale Ecully, Villeurbanne, France (P. Pichat);
- Institut fur Ökologische Chemie, Freising-Attaching, FRG (K. Hustert);
- Chemistry Department, University College, Cork, Ireland (J. Cunningham);
- Ente Nazionale Idrocarburi ENI Ricerche, San Donato Milanese, Italy (E. Borgarello);
- Dipartimzento di Chimical Analitica, Universita di Torino, Italy (E. Pelizzetti);
- Laboratoire de photochimie, Université Claude Bernard, Lyon, France (B. Pouyet).

Further information can be obtained from:
H. Ott, P. L'Hermite, DG XII/E, CEC, 200 rue de la Loi, B-1049 Brussels. Tel. + 32 2 2351111.

4.2. Ispra MARK 13A Process for Flue Gas Desulphurisation

The Ispra MARK 13A process for flue gas desulphurisation is a patented method for removing sulphur dioxide from flue gases, particularly in fossil-fuel-fired power stations. The process was invented and developed at the J.R.C. Ispra Establishment. It is a direct spin-off from the former hydrogen energy research programme.

The process is a cycle based on the oxidation of sulphur dioxide to sulphuric acid by bromine and the subsequent recovery of bromine by electrolysis of hydrobromic acid with formation of hydrogen. Potential advantages of this process are:

- sulphuric acid and hydrogen produced are valuable chemicals which can be marketed or reutilised;
- all reactants are generated inside the process so that the disposal of solid products and waste water is not required;
- the reaction takes place in the liquid phase which allows high reaction rates and small equipment volumes, probably leading to lower investment and operation costs.

Development work started in 1981 with preliminary laboratory tests, followed by a feasibility study, bench-scale operation with flue gases from heavy

oil combustion at the Ispra Establishment and with flue gases from coal combustion at the laboratories of ENEL at Livorno, Italy. After successful completion of the bench-scale work, the construction of a large-scale pilot plant was decided. For this purpose, a call of tenders was published in 1984.

On 15 December 1985 a contract was signed with the firm Ferlini Technology of Genova for the construction and operation of a pilot plant. The plant is designed for a throughput of 32 000 m^3/h of flue gas (max. 40 000 m3/h) with SO_2 contents of up to 4 500 mg/m^3. The degree of desulphurisation has to be higher than 90%. The plant is being erected at the site of the SARAS Refinery in Saroch, Sardinia, where there is a need for sulphuric acid. The design, engineering and construction of the plant is sub-contracted to the firm Kraftanlangen Heidelberg. Technical supervision of the project is entrusted to J.R.C.-Ispra. The Commission participates financially in the project for 50% of the total cost to a maximum of 5 Mio ECU.

The construction of the pilot plant is in progress. The first previsions for the completion of the construction were for the end of May 1988. However, unforeseen events caused additional delays. Cold tests (e.g. running of reactants, leak tests, etc...) started at the end of July and the commissioning and start-up procedure proceeded during August and September. Hot start-up and start of the operation with hot flue gases will be successively performed.

Further research aiming at extending the Ispra MARK 13A process to a combined desulphurisation/denoxing process is under way. Two methods are investigated.

One method consists in the absorption of the nitrogen oxides in an aqueous solution containing Fe(II)EDTA as a complex agent followed by an electrochemical decomposition of the formed NO-complex. Preliminary experiments on the formation of the Fe(II)EDTA.NO complex, the electrochemistry of the Fe EDTA complex, the electrochemistry of the Fe(II)EDTA.NO complex were carried out. Particular attention was paid to the study of basic electrochemistry of the Fe(II)EDTA/Fe(III)EDTA redox couple.

Another method is based on the catalytic reduction of nitrogen oxides with hydrogen formed by the electrolytic decomposition of hydrobromic acid. Screening tests for candidate catalysts are in course since 1987.

Further information can be obtained from:
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EC Regulatory Actions

Information on the European Community legislation was already given in Environmental Research Newsletter N°2.

A summary of the main aspects is again reproduced below for information.

EUROPEAN COMMUNITY LEGISLATION

EC institutions:

- *European Commission:* proposes and administers laws and regulations.
- *Council of Ministers:* makes the major policy decisions of the Community.
- *European Parliament:* has an advisory role in the legislative process.
- *Economic and Social Committee:* id.
- *Court of Justice:* interprets the law and controls the legality of the decisions.

Legal instruments:

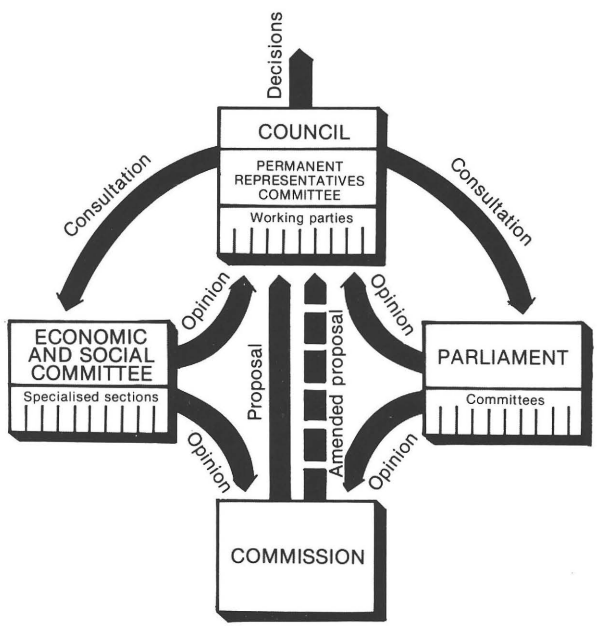
- Acts with no binding force: *recommendations and resolutions*
- Acts with binding force proposed by the Commission to the Council and adopted by the Council:

regulations:
- are binding and directly applicable in all Member States;
- are usually used for very specific purposes such as trade in products and financial matters;
- have not often been used for environmental legislation, except for controls on trade in endangered species.

decisions:
- are directly binding on the persons to whom they are addressed, including Member States, individuals and legal persons;
- have been primarily used in environmental legislation to authorise the Community to become a party to international conventions, but also for other purposes, e.g. to set up a system of information exchange on water quality.

directives:
- are binding, as to the result to be achieved, upon each Member State to which they are addressed, but leave to the national authorities the choice of form and methods;
- are the main tools of Community environmental policy.

Legislative process in the Community:



1. Chemicals, Industrial Risks and Biotechnology

The Community regulatory actions in these fields take into account

- the creation of a large internal Community market;
- the enhancement of safety, the prevention and reduction of accidents; and
- the survey and protection of the environment.

The regulatory actions related to the first point are mainly prepared by DG III, Internal Market and Industrial Affairs, while DG XI, Environment, Consumer Protection and Safety, is concerned with environment protection and safety problems.

The priority topics of the Fourth Environmental Action Programme (DG XI) in the specific sectors of chemicals and biotechnology are summarised as follows:

- Chemicals:
  - implementation of new chemicals notification system and classification, packaging and labelling of "new" and "existing chemicals";
  - comprehensive structure for integrated risk assessment of "existing chemicals" listed in EINECS;
  - development of the substance-oriented approach (priority substances: PCBs, cadmium, lead, phosphates, arsenic, copper, mercury, asbestos, dioxins, etc.)
  - integrated regulation for dangerous chemicals;
  - legislation and Community action at international level regarding the export and import of dangerous chemicals banned or severely restricted in the Community;
  - further development and implementation of the Directive on Major-Accident Hazards;
  - protection of the ozone layer.
- Biotechnology:
  - harmonization of standards and procedures for the classification, containment, accident control, emergency planning and response, as well as the disposal, as waste, of potentially hazardous organisms used in industrial production processes;
  - notification and consultation on the planned use of novel organisms in the environment.

1.1. Chemicals

Control of hazardous chemicals in the environment led to the development of EC policies with a preventive approach aimed at making the population aware of the dangers from substances, assessing the risks before they could be a threat to society, and legislating to minimise the risks of accidents.

In the Fourth Action programme the Commission wishes to enhance measures for the implementation and enforcement of legislation approved by the Council of Ministers.

Council Directive 67/548/EEC - Classification, packaging and labelling of Dangerous Substances

(OJ No L 196, 16.08.1967)

Five years before the Community initiated a fully-fledged environmental policy, the EC Council of Ministers adopted the 1967 Directive on classification, packaging and labelling of dangerous substances.

The purpose of the framework Directive was to harmonize the laws of the Member States on these. This Directive has been amended 6 times since its adoption. The 6th Amendment to the Directive, Council Directive 79/831/EEC, is the version in force today (see below). A 7th Amendment will be proposed to the Council at the end of this year.

The Directive distinguishes between new and existing chemicals. Existing chemicals are those which were placed on the Community market before 18 September 1981 and are listed in the European Inventory of Existing Commercial Chemical Substances (EINECS), see also p. 8.

Classification of a dangerous substance

The Directive lists fourteen categories for the classification of dangerous substances according to their physico-chemical or toxicological properties. They are: explosive, oxidizing, extremely flammable, highly flammable, flammable, and very toxic, toxic, harmful, corrosive, irritant, dangerous for the environment, carcinogenic, teratogenic and mutagenic.

The definitions of these categories and the classification criteria are given in the Directive.

Annex VI of the Directive contains the criteria for the interpretation of test results and rules for classification and labelling of dangerous substances.

The list of dangerous substances, classified in the order of the atomic number of the element most characteristic of their properties is given in Annex I of the Directive.

Labelling

Once the substance has been classified in one or more categories the label follows automatically from that classification.

The label must take account of all potential hazards which are likely to occur during normal handling and use, and must clearly show:

- the name of the substance;
- the symbol indicating the danger involved (list of symbols in Annex II of the Directive);
- standard phrases indicating the nature of special risks (Annex III of the Directive);
- standard phrases indicating safety advice (Annex IV of the Directive);
- the name and address of the manufacturer, the distributor or importer.

A manufacturer or an importer of a dangerous chemical substance into the European Community has to label that substance before he puts it on the market.

If the substance is listed in Annex I of the Directive the label contained in that Annex must be applied. If it is not listed, a provisional label remains valid until the substance is listed in Annex I.
Industry estimates that about 20000 of the 100000 "existing chemical substances" listed in the EINECS inventory and present on the Community market before 18 September 1981 are dangerous in the sense of the 6th Amendment Directive. To date, the EC has agreed labels only for about 1000 substances.

Classification and labelling of carcinogenic substances

During the last 3 years priority has been given to substances having carcinogenic properties. These substances are classified into 3 categories according to the effect or hazard involved. The labelling takes into account the category the substance is placed in as well as other dangerous properties.

The Commission intends to list all substances having carcinogenic properties in Annex I of the Directive, together with their appropriate labels. For this purpose, the Commission asked the Member States to submit data on proven or suspected carcinogens, together with labelling proposals. A total of about 170 suspected carcinogenic substances were submitted. A decision was taken by the Commission for 80 carcinogens or groups of carcinogens. The other 90 suspected carcinogens are under discussion in the Working Group. A total of 200 carcinogenic substances are expected to be classified by 1990.

6th Amendment to the Directive: Council Directive 79/831/EEC - Notification and Risk assessment of new chemicals

(OJ No L 259, 15.10.79)

The 6th Amendment to the Directive 67/548/EEC introduced a pre-market testing and notification system for new chemicals placed on the Community market. Existing chemicals are exempt from notification.

Every producer or importer who places a new chemical substance on the market for the first time in the European Community after 18 September 1981 must submit a notification dossier about the chemical to a national competent authority at least 45 days in advance.

Substances which are already subject to Community controls, such as pharmaceuticals, narcotics, and radioactive substances, are excluded from the scope of the Directive.

The notification must contain 4 items:

- a technical dossier supplying the information necessary for evaluating foreseeable risks, whether immediate or delayed, that the substance may entail for people and the environment-the "base set" of information including physico-chemical data, toxicological and ecotoxicological tests, production quantities, uses, safety measures, and ways of rendering the substance harmless is given in Annex VII of the Directive;
- a declaration concerning the unfavourable effects of the substance in terms of the various uses envisaged (i.e. a risk assessment);
- the proposed classification and labelling if the chemical is hazardous;
- proposals for precautions for safe use and disposal.

The notification also has to give information on where the chemical is produced, quantities, and ways of making it harmless.

Low-volume (under 1tonne/year), research chemicals, and polymers containing less than 2% of a new monomer need not to be notified. A limited "announcement" must still be submitted to the national competent authority of each Member State where the substance is marketed.

More thorough toxicological and ecotoxicological testing is required at certain threshold levels of marketing - 100 tonnes/year or 500 tonnes total, 1000 tonnes/year or 5000 tonnes total. These tests are set out in Annexe VIII of the Directive.

A summary of the notification is sent by the national competent authority to the Commission, which circulates it to the other competent authorities during the 45-days waiting period. Unless there is an objection, the substance may be placed on the market at the expiration of the waiting period. A properly notified substance may be marketed throughout the entire Community; it may not be subjected to further national controls.

A total of about 500 substances have been notified during the first four years of the procedure.

Council Directive 88/379/EEC - Classification, packaging and labelling of dangerous preparations

(OJ No L 187, 16.08.88)

Since most of the chemical products on the market are mixtures of more than one substance, i.e. preparations, the Council of the European Communities has recently adopted a Directive on the labelling of preparations.

The principles and definitions of this Directive are the same as in the Directive for dangerous substances.

The manufacturer has two possibilities to establish the dangerous properties of a preparation:

- he may test it as a whole by using the methods of Annex V and the criteria of Annex VI of the Substances Directive, or
- he can apply a method laid down in the Preparations Directive using the toxicological properties taking into consideration the concentrations of the constituents of the preparation.

The symbols, risk and safety phrases are the same as those used for dangerous substances.

Council Directive 86/609/EEC - Protection of animal used for experimental and other scientific purposes

(OJ No L 358, 18.12.86)

The aim of this Directive is to ensure that where animals are used for experimental scientific and other purposes the provisions laid down by law, regulation or administrative provisions in the Member States for their protection are approximated so as to avoid affecting the establishment and functioning of the common market, in particular by distorsions of competition or barriers to trade.

Each Member State shall ensure that experiments using animals considered as endangered following Regulation (EEC) No 3626/82 are prohibited unless they are in conformity with the Regulation and the objects of the experiment are research aiming at preserversion of the species in question or essential biomedical purposes where the species in question exceptionally proves to be the only one suitable for those purposes.

Council Directive 87/18/EEC - Harmonization of laws, regulations and administrative provisions concerning good laboratory practices and the control of their applications for tests on chemical substances

(OJ No L 15, 17.1.87)

This Directive states that Member States shall take all measures necessary to ensure that laboratories carrying out tests on chemical products, in accordance with Directive 67/548/EEC, comply with the principles of good laboratory practice specified in Annex 2 to the Decision of 12 May 1981 of the Council of the OECD on the mutual acceptance of data for the evaluation of chemical products.

Council Directive 88/320/EEC - Inspection and verification of Good Laboratory Practice (GLP)

(OJ No L 145, 11.6.88)

This Directive applies to the inspection and verification of the organizational processes and the conditions under which laboratory studies are planned, performed, recorded and reported for the non-clinical testing, carried out in accordance with the rules and regulations, of all chemicals (e.g. cosmetics, industrial chemicals, medicinal products, food additives, animal feed additives, pesticides) in order to assess the effect of such products on man, animals and the environment.
For the purposes of this Directive, the GLP is described in Council Directive 87/18/EEC.

The Directive specifies that the provisions concerning the inspection of laboratories and audit of studies are those contained in Annexes 4 (Guide for Compliance of Monitoring Procedures for Good Laboratory Practice) and 6 (Guidance for the Conduct of Laboratory Inspections and Study Audits) of the final report of the Working Party of the OECD Environment Committee on the mutual recognition of compliance with GLP (OECD ENV/CHEM/CM/87.7).

Council Directive 76/769/EEC - Restrictions on the marketing and use of dangerous substances and preparations

(OJ No L 262, 27.09.76)

The Directive created a framework for bans or restrictions on specific dangerous chemicals or preparations by means of an Annex. Member States must take all necessary measures to ensure that these dangerous substances and preparations are only placed on the market or used subject to the conditions specified. These restrictions do not apply to marketing or use for the purposes of research and development.

Since the adoption of the Directive, the Annex has been amended seven times to regulate 12 dangerous substances and preparations. Proposals aiming at including new substances and preparations have been submitted to the Council.

Council Regulation (EEC) No 1734/88 - Export from and import into the Community of certain dangerous chemicals

(OJ No L 155, 22.6.88)

The problem of the export of dangerous substances to developing countries is one of the most important political topics in the field of environmental protection and international trade. Various international organizations, such as the Organization for Economic Cooperation and Development (OECD), the Food and Agricultural Organization (FAO) and the United Nations Environment Programme (UNEP) have become active in this area.

The purpose of this Regulation is to establish a common system of notification and information for imports from and exports to third countries of certain chemicals which are banned or severely restricted on account of their effects on human health and the environment. The dangerous substances covered are listed in the Regulation and are those which are banned or severely restricted in the Community. The Council did, however, adopt a Resolution at the same time as the Regulation inviting the Commission to examine the question of "Prior Inform Consent" in greater detail and to submit, where necessary, in the light of the information supplied by the Member States and developments in relevant international bodies, an appropriate proposal with the view to possible amendment of the Community regulation.

Council Directive 87/217/EEC - Prevention and reduction of environmental pollution by asbestos

(OJ No L 85, 28.3.87)

This is the first "substance-oriented" directive announced under the Fourth Environmental Action Programme which links controls on emissions to

air, water and land. It is intended to supplement restrictions on asbestos laid down by Directive 76/769/EEC on marketing and use of dangerous substances, and by other Directives dealing with worker protection, discharges to air, and waste.

Member States shall take the measures necessary to ensure that asbestos emissions into air, into water, and solid asbestos wastes are, as far as reasonably practicable, reduced at source and prevented.

It covers crocidolite, actinolite, antophyllite, chrysolite, amosite, and tremolite. A limit value for air emissions of 0.1 milligrams per cubic metre (mg/m^3) is set, with an exemption for plants emitting less than 5000 m^3/hour of gaseous discharges if they do not emit more than 0.5 grams per hour.

Liquid effluents from asbestos cement and paper and board manufacture must be recycled. If recycling from the manufacture of asbestos cement is not economically feasible, the asbestos content of the wastes must not exceed 30 g/m^3. The Directive applies to new plants, those which are built after 1 January 1989, and to existing plants (those built before this date) from 1 July 1991.

Work with asbestos products and the demolition of buildings may not cause significant environmental pollution by asbestos fibres or dust.

In the course of transport and landfill, no asbestos fibres or dust are to be released and no liquids containing asbestos fibres are to be spilled. Waste is to be treated, packaged or covered so that no release from landfill will occur.

Monitoring methods for discharges to air and water are laid down. The Commission is to review the methods used and make recommendations for a harmonized system in March 1992.

1.2. Ozone Layer

The Community, by successive Council Decisions, limited the production and the use, within the Community, of chlorofluorocarbons (CFCs) responsible for the depletion of the ozone layer. Furthermore, the Community is a contracting party to the international conventions dealing with the protection of the ozone layer.

Council Decision 80/372/EEC - Chlorofluorocarbons in the environment

(OJ No L 90, 03.04.80)

The Decision requires the Member States to prevent any increase in the production capacity of two chlorofluorocarbons (CFCs) F-11 and F-12. It further requires the Member States to take all appropriate measures to reduce, by 31 December 1981, the use of these CFCs in the filling of aerosol cans by at least 30%, compared with 1976 levels.

It commits the Commission and Member States to re-examine these measures in the light of scientific and economic data. Upon a proposal by the Commission the Council was to adopt any further measures necessary before 30 June 1981.

Council Decision 82/795/EEC - Consolidation of precautionary measures concerning chlorofluorocarbons in the environment

(OJ No L 329, 25.11.82)

In follow-up to the previous Decision, the Council agreed to maintain the production cap on CFCs and adopted a definition of production capacity and a reference figure of 480000 tonnes per year of F-11 and F-12, based on the capacity of the producers operating in the Community in March 1980.

Member States are required to cooperate with the Commission in gathering and evaluating statistical information. A further re-examination of the problem was set for 1983 and the Council was to take further measures no later than 31 December 1983.

Council Decision 88/540/EEC - Conclusion of the Vienna Convention for the protection of the ozone layer and the Montreal Protocol on substances that deplete the ozone layer

(OJ No L 297, 31.10.88)

On 14 October 1988 the Council adopted the Vienna Convention for the protection of the ozone layer and the Montreal Protocol on substances that deplete the ozone layer.

The Vienna Convention for the protection of the ozone layer was signed by the Community together with several of its Member States on 22 March 1985. It came into force on 22 September 1988 and was ratified by the Community on 17 October 1988.

The Convention aims at protecting human health and the environment against adverse effects resulting from modification of the ozone layer. To this end the Parties agreed to cooperate, in accordance with their means and capabilities, (i) to promote research and information exchange in order to better understand and assess the effects of human activities on the ozone layer and the effects on human health and the environment from modification of the ozone layer; (ii) to adopt appropriate legislative or administrative measures and to harmonize appropriate policies to control, limit, reduce or prevent human activities with adverse effects in this field; (iii) to formulate agreed measures, procedures and standards for the implementation of this Convention; and (iv) to implement effectively this Convention and protocols.

The Montreal Protocol on Substances that deplete the ozone layer was signed by the Community together with several of its Member States on 16 September 1987. It was ratified by the Community on 16 December 1988.

The Protocol aims at taking precautionary measures to control total emissions of substances that deplete the ozone layer, with the ultimate objective of their elimination on the basis of developments in scientific knowledge, taking into account technical and economic considerations. To this end, the Protocol institutes a system for the control of the production and consumption of CFCs 11, 12, 113, 114, and 115 and halons 1211, 1301 and 2402 on the world level. World production and consumption of these substances is to freeze in 1989 to the levels of 1986 and be reduced by 20% in 1993 and by 50% in 1998 with respect to 1986. An exemption for 10 years is given to developing countries. Also, industrialized countries can increase their production by a maximum of 10% to provide for the basic needs of developing countries and for the purposes of industrial rationalization, i.e. for consolidating production among themselves as it becomes uneconomical to run factories at low capacities.

Council Regulation (EEC) No 3322/88 on certain chlorofluorocarbons and halons which deplete the ozone layer

(OJ No L 297, 31.10.88)

This Regulation implementing the Protocol applies to the importation, exportation, production and consumption of the chlorofluorocarbons and halons in the Community. It aims at reducing their production and sales by the same percentages as those foreseen by the Protocol.

Council Resolution for the limitation of use of chlorofluorocarbons and halons

(OJ No C 285, 9.11.88)

The Council resolution invites the Commission, in cooperation with the Member States, to initiate discussions on voluntary agreements at the Community level with all industries concerned. Wherever feasible the substitution of chlorofluorocarbons and halons in products, such as aerosols, in equipment or processes using them should be performed. If such substitution is not feasible, the use of these substances should be drastically reduced. Commission is invited to report on progress made.

In June 1988, the Council of Ministers adopted a decision for the ratification by the Community and its Member States of the Vienna Convention. They also agreed on a regulation implementing the Protocol in the Community and on a Resolution for actions going beyond the Protocol. On 14 October 1988 the Council adopted formally the above acts. On 17 October the Community ratified the Convention with the ratification of the Protocol to take place in November. The Regulation implementing the Protocol is addressed directly to the producers and importers of CFCs and halons in the Community. They are to reduce their production and sales in the Community by the same percentages as foreseen by the Protocol.

1.3. Industrial Risks

Council Directive 82/501/EEC - Major-accident hazards of certain industrial activities

(OJ No L 230, 05.08.1982)

This Directive, also known as the "Seveso Directive" after the accident in the Italian town in 1976 which released clouds of dioxin. establishes a procedure wereby industrial plant operators, local and national

authorities and the European Commission cooperate in identifying and controlling the risks of major accidents from industrial installations.

The Directive defines a major accident as: "an occurrence such as a major emission, fire or explosion resulting from uncontrolled developments in the course of an industrial activity, leading to a serious danger to man, immediate or delayed, inside or outside the establishment, and/or to the environment, involving one or more dangerous substances".

The Directive's first aim is to reduce the likelihood of a major accident by requiring industry to incorporate preventive measures into the design of a plant or a manufacturing process from the beginning. Industrial managers must now consider possible causes of a major accident, monitor processes at critical points, anticipate events which might lead to a disaster, and introduce stringent safety measures.

The second objective of the Directive is to ensure that if an accident occurs, it does not escalate into a disaster. It requires chemical plant managers to install control and safety measures, and prepare emergency plans.

The Directive is divided into 2 parts.

The first part is a framework of general requirements covering any industrial activity carried out in an industrial plant which involves, or may involve, one or more toxic, flammable, or explosive substances capable of presenting major hazards.

Under this part of the Directive, the manufacturers are required to prove to the Competent Authorities at any time that they have identified major-accident hazards, adopted the appropriate safety measures, and provided the people working on the site with information, training and equipment in order to ensure their safety.

The second part of the Directive constitutes a rather specific set of provisions. On the basis of the lists of chemicals in Annexes II and III of the Directive, certain industrial activities are subject to systematic controls when these chemicals are or may be present in excess of a fixed quantity. The systematic controls are based on a notification procedure whereby the manufacturer will submit to the national Competent Authorities a detailed study, containing information about:

- substances and manufacturing processes, hazards and risks, safety precautions and emergency procedures;
- industrial plant, including siting, exposed groups and environment, sources of danger from the location of the plant, preventive measures and technical controls
- possible major-accident situations, including emergency plans, safety equipment, alarms and resources.

The Directive sets out the various party's obligations in the case of a major-accident in the Community.

Manufacturers must:

- inform the Competent Authorities;
- provide the Competent Authorities with information on the nature, characteristics and potential consequences of the accident for man and the environment, as well as inform them of the emergency measures taken to combat the accident; and
- inform Competent Authorities of the measures envisaged to alleviate the effects of the accident including long-term effects and to prevent any recurrence of such an accident.

Competent Authorities must:

- collect information on the accident;
- ensure the application of emergency plans;
- check measures taken to alleviate the effects of the accident; and
- inform the Commission of the accident which occured on their territory, collect information required for the analysis, and submit a major-accident report.

The EC Commission is required to:

- collect information on the accident and manage a data bank;
- call a meeting of the Committee of Competent Authorities; and
- provide the Member States with information in its possession likely to help control the accident.

The Directive came into force on 8 January 1984. It covers both new and existing industrial activities.

A first limited revision of the Directive was adopted in March 1987 by the Council of the European Communities on the basis of the scant experience and knowledge acquired in the short period the Directive has been in force. The revision concerning Annex II completed the list of substances and modified some thresholds. The first amendment came into force on 24 September 1988.

A second Amendment of the Directive was prepared by the Commission in response to the accident which occured in Basel on 1 November 1986 and adopted by the Council on 24 November 1988. This amendment aims at extending the scope of the Directive to the storage of dangerous chemicals and also to strengthen its provisions regarding information to the public liable to be affected by a major accident.

The Commission will later present a fundamental revision of the Directive when sufficient experience has been gained from its implementation.

1.4. Biotechnology

Over the past ten years, the European Community has been progressively developing and implementing a Community strategy for biotechnology in Europe.

Since current provisions under product legislation or legislation on risks from industrial chemicals are either inadequate or inappropriate, the Commission proposed a special legislation to cover the "contained industrial use of microorganisms" and the "release of genetically modified organisms to the environment".

In March 1988, the European Commission approved three proposals for Council Directives. The first is more specifically related to protection of workers, whilst the others concern the protection of the general population and the environment from any potential risk arising from the use of genetically modified organisms when released to the environment and when used under containment. Only the proposals related to the protection of the environment are dealt with in this paragraph.

Proposal for a Council Directive on the contained use of genetically modified micro-organisms

(OJ No C 198,28.07.88)

This proposal deals with the contained use of microorganisms in laboratories and industrial installations.

Its purpose is:

- to establish safety assessments;
- to classify microorganisms into two groups: one without risks to man and environment, the other requiring containment; and
- to establish working practices and containment measures corresponding to the hazard the microorganism represents.

The criteria in the annexes are taken from the OECD document on the Recombinant DNA Safety Considerations.

Proposal for a Council Directive on the deliberate release to the environment of genetically modified organisms

(OJ No C 198,28.07.88)

This proposal covers all operations, from research to marketing, involving the intentional introduction into the environment of genetically modified organisms (GMOs). The relevant provisions of this proposal do not apply to medicinal or veterinary products, foodstuffs, feeding stuffs and their additives, plants and animals produced or used in agriculture, or any product covered by Community legislation which includes a specific risk assessment.

This proposal is based on the consensus reached within the OECD, that all deliberate release should be reviewed on a "step-by-step" and "case-by-case" basis before being performed. In fact, the possible risks are difficult to foresee and any general guideline in a regulatory scheme would not, in the Community's view, ensure adequate protection for the environment and population.

The proposal is divided into four parts:

- General articles on scope, purpose and definitions relevant to the Directive;
- Articles relevant to the deliberate release of GMOs for research and development purposes;

- Articles relevant to the marketing of products containing GMOs;
- Final provisions on confidentiality, information to the public and procedure to amend the annexes of the Directive.

The proposal establishes a scheme of notification and endorsement for every case either for research and development purposes or for marketing. The notification gives details on the **organism** proposed for the release, the **conditions**, and the **environment** into which such a release is to take place. Furthermore, an assessment of the possible hazards to human health and the environment which may arise must be submitted. In the case of marketing, the notification must include proposals for labelling, packaging and conditions of use.

Further information can be obtained from:
G. Del Bino, DG XI/A2, for Directives concerning environment protection and safety problems,
P. Gray, DG III/B2 for the Directive on the contained use of genetically modified organisms,
G. Von O'Svath, DG III/C5, for Directives 76/769/EEC and 88/379/EEC,
CEC, 200 rue de la Loi, B-1040 Brussels.
Tel. + 32 2 2351111.

2. Waste Management

Although most of the Member States have been implementing waste management policies for more than ten years, it is extremely difficult to obtain reliable data for comparing the quantities of waste produced or disposed of.

An estimated amount of 2500 million tonnes of waste is produced each year, including 1100 million tonnes of agricultural waste, 400 million tonnes of mining waste, 100 million tonnes of housewold waste and 80 million tonnes of industrial waste. These were the figures in 1984.

The main problem is caused by hazardous waste, of which an estimated 25 to 35 million tonnes is produced every year in the Community.

Due to environmental constraints, disposal of waste has to be controlled and monitored. Waste must be recycled, reused or processed. Although over 60% of all industrial and 95% of agricultural waste are estimated to be reused, a considerable volume of waste is still being dumped.

A Community legislation on waste management was developed within the context of the four Environmental Action Programmes. The priority topics of the Fourth Environmental Action Programme on Waste management are summarised as follows:

- Prevention of waste:
  - further development and extension of the "clean technologies" programme provided for under ACE Regulation (demonstration projects for recycling wastes; safe disposal of wastes; revision of the Directive on toxic and dangerous wastes; international agreements on transport of dangerous materials); and
  - definition of criteria for "environmentally sound products".
- Recycling and re-use of waste:
  - more rational management of wastes including re-use, recycling, treatment, transformation, detoxification, etc.
- Safe disposal of waste:
  - proposal of further Directives in specific areas, e.g. batteries, PCBs, solvents, etc. to complement the existing set of Directives;
  - further revision of the description of waste in the "toxic and dangerous" waste Directive;
  - proposals on the question of civil liability and insurance in relation to the transfrontier movement of such wastes; and
  - clean-up of sites from uncontroled discharged wastes.

Acting on proposals from the Commission, the Council of Ministers adopted a series of Directives which are binding on all Member States in terms of the results to be achieved but which leave the national Authorities free to choose how to achieve them.

2.1. Framework Directive on Waste

Council Directive 75/442/EEC on waste

(OJ No L 194, 25.7.75)

The Directive seeks to provide a framework whereby the Member States could control the disposal of wastes nationally, instead of locally as in the past.

The Directive defines

- "waste" as any substance or object which the holder disposes of or is is required to dispose of pursuant to the provisions of national law in force; and
- "disposal" as the collection, sorting, transport and treatment of waste as well as its storage and tipping above or under ground, the transformation operations necessary for its re-use, recovery or recycling.

The fundamental obligation of the Directive is that Member States are required to take the necessary measures to ensure that waste is disposed of without endangering health and without harming the environment.

The Directive does not apply to radioactive wastes, mining waste, some agricultural wastes, waste waters and gaseous effluents.

Four general obligations are laid down. Member States must:

- designate national competent authorities to be responsible for waste management under the Directive;
- see that the competent authorities draw up waste disposal plans;
- subject installations which treat, store or dispose of wastes for third parties to a prior permit requirement; and
- apply the "polluter pays" principle.

In addition, they must encourage recycling, and submit situation reports to the Commission every three years.

The plans to be drawn up by the competent authorities must cover: (i) the type and quantity of wastes to be disposed of; (ii) technical requirements; (iii) suitable disposal sites; and (iv) special arrangements for particular wastes.

The permits must cover: (i) the type and quantity of waste involved; (ii) technical requirements and precautions; and (iii) information to be made available on request of the competent authority concerning the origin, destination and treatment, and type and quantity of the waste.

The competent authorities must carry out periodic inspections to ensure that the conditions of the permits are being complied with.

Under the "polluter pays" principle, the cost of disposing of the waste must be borne by the originator of the waste or by the holder who has the waste disposed of by another party.

A proposal for a Council Directive amending this Directive has been submitted to the Council on August 1988 (OJ No C295, 19.11.88).

2.2. Waste Oils

Council Directive 75/439/EEC on the disposal of waste oils

(OJ No L 194, 25.7.75)

The Directive is designed to prevent damage to the environment from the uncontrolled disposal of waste oils and also seeks to ensure that different financial arrangements adopted to promote safe disposal and recycling do not create barriers to the common market.

The Directive defines "waste oils" as any semi-liquid or liquid used products totally or partially consisting of mineral or synthetic oil, including the oily residues from tanks, oil-water mixtures and emulsions.

Member States are required to take the necessary measures to ensure the safe collection and disposal of waste oils, and to ensure that they are, as far as possible, recycled.

The Directive prohibits: (i) the discharge of waste oils to water and drainage systems; (ii) any deposit and/or discharge harmful to the soil; (iii) any uncontrolled discharge of residues from processing; and (iv) any processing of waste oils causing air pollution exceeding the level prescribed by existing provisions.

This Directive was recently amended by the Council in 1986 to solve the problems caused by the uncontrolled burning of used oils in smaller installations and the contamination of used oils by PCBs. The modified Directive gives a preference for the re-refining of used oils, and sets a limit value for the concentration of PCB/PCT in regenerated oils (50 ppm).

Additional rules apply to the burning of oils to avoid atmospheric pollution. Limit values for emission in the air are fixed for the incineration plants which have a power capacity higher than 3 Mwatts. Used oils which have a concentration of PCB/PCT higher than 50ppm cannot be burnt and are considered as hazardous waste.

Every 3 years the Member States must submit a report to the Commission. The Commission must report to the Council by January 1992 on the measures taken by the Member States concerning the operation of regeneration and combustion plants.

2.3. Polychlorinated Bi-and Tri-Phenyls (PCBs and PCTs)

Council Directive 76/403/EEC on the disposal of PCB and PCT
(OJ No L 108,26.04.1976)

The aim of the Directive was to cover the conditions of collection, regeneration and destruction of PCB and thus to supplement the control of these substances in order to avoid any dispersal into the environment.

Member States are required to take the necessary measures to prohibit the uncontrolled discharge, dumping and tipping of PCB and of objects and equipement containing such substances, and also to make compulsory the disposal of waste PCB and PCT contained in objects and equipment no longer capable of being used. The preferred method of disposal is regeneration.
Member States are required to set up or designate the installations, establishments or undertakings which are authorized for the purposes of disposing of PCB on their own account and/or on behalf of third parties.

The Commission has sent to the Council a proposal to amend this Directive due to the fact that an almost complete ban on the use of PCB has been effective since July 1986. PCB should be completely disposed of and a technical annex will give rules for the disposal and transport of the material.

2.4. Hazardous Wate

Council Directive 78/319/EEC on toxic and dangerous waste
(OJ No L 84, 31.3.78)

This Directive falls within the framework of Directive 75/442/EEC and focuses on laying down a broad framework for the control of household and toxic wastes.

Member States must ensure that toxic and dangerous waste may only be stored, treated and/or deposited by authorized undertakings and that producers and holders of such wastes may only have it stored treated or deposited by an authorized undertaking.

"Toxic and dangerous waste" is defined as any waste containing or contaminated by the substances or materials listed in an Annexe to the Directive of such a nature, in such quantities or in such concentrations as to constitute a risk to health or to the environment.

The Directive does not cover radioactive wastes, specific agricultural wastes, explosives or hospital wastes.

The Directive lays down that, with certain exceptions, wastes containing toxic and dangerous substances or materials can be disposed of only by the installation, establishments or undertakings authorized by the competent national authorities to do so on their own account or on behalf of third parties.

The Directive does not lay down the specific methods of disposal for the various categories of toxic and dangerous waste. However, the Commission's role in implementing the Directive may include, subsequently, the elaboration of codes of practice for the disposal of various toxic and dangerous wastes.

In order to ensure maximum coordination at national and Community level, it is foreseen that special plans for the disposal of toxic and dangerous waste shall be drawn up and kept up-to-date by the competent national authorities. Member States shall forward them to the Commission and draw up every three years a situation report on the disposal of toxic and dangerous waste in their respective countries. The Commission will itself report every three years to the Council and to the European parliament on the implementation of the Directive.

Proposal for a Council Directive on hazardous waste
(OJ No C 295, 19.11.88)

The object of this Directive is to approximate the laws of the Member States on the controlled disposal of hazardous waste. The adoption of a uniform definition of waste and hazardous waste should make implementation of this Directive more effective. Moreover the proposal contains also new provisions for the collection and transport of hazardous waste, and a scheme for periodic information of the Commission on the plants authorized for the disposal of hazardous waste. This should help all interested parties to be accurately informed as to where hazardous waste can be treated in the Community.

2.5. Transfrontier Shipment of Hazardous Waste

Council Directive 84/631/EEC on the supervision and control within the EC of the transfrontier shipment of hazardous waste
(OJ No L 326, 13.12.84)

This Directive supplements Directive 78/319/EEC on toxic and dangerous wastes by regulating their shipment across national frontiers within the Community from collection to disposal. It was modified in June 1986 to cover exports of waste outside the European Community *(Council Directive 86/279/EEC).*

It requires the Member States to take the necessary measures to ensure the use of a detailed consignment note when the holder of a dangerous or toxic waste (as defined in Directive 78/319/EEC, except for chlorinated solvents, organic solvents, and PCBs) intends to move it across a national frontier.

The consignment note gives details about the source and composition of the waste, routes, insurance against damage to third parties, measures for safe transport and compliance with conditions imposed by Member States, and the existence of a contractual agreement with the consignee of the waste.

The Directive also states that, in the case of a shipment of hazardous wate from a Member State to a Third State, the holder of the waste must obtain the agreement of the Third State of destination before embarking upon any procedure for shipping the waste. These arrangements comply with the OECD and UNEP recommendations in this field.

The Directive also sets out conditions governing packaging, labelling and instructions in the event of danger or accident. The cost of the procedure must be borne by the holder and/or the producer of the waste, in accordance with the "polluter pays" principle.

Non-ferrous metal waste intended for re-use or recycling and solvent are exempted from the provisions set by the Directive.

2.6. Beverage Containers

Council Directive 85/339/EEC on containers of liquids for human consumption
(OJ No L 176, 27.6.85)

This Directive requires Member States to encourage the refilling or recycling of beverage containers (cans and bottles). More specifically, it requires Member States to establish programmes for the reduction of the volume of containers in municipal waste. All national measures and regulations should be in line with the Treaty of Rome and its dispositions on the free movement of goods.

2.7. Use of Sewage Sludge in Agriculture

Council Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture
(OJ No L 181, 04.07.1986)

This Directive aims to control the use of sewage sludge in agriculture by fixing limit values for concentrations of heavy metals in the soil and in sludge, and the maximum quantities of heavy metals (Cd, Cu, Ni, Pb, Zn and Hg) which may be added to the soil. These limit values are to some extent alternatives. The values for chromium have not yet been fixed.

The general rule is that sludge should be treated before being used, in order to significantly reduce its pathogenic potential and also the nuisance from the spreading for instance of odours. Other conditions are laid down for the spreading on specific crops.

Further information on the actions of DG XI in the field of Waste Management can be obtained from:
J.-M. Junger, DG XI / A3, CEC, 200 rue de la Loi, B-1040 Brussels. Tel. + 32 2 2351111.

3. Clean Technologies - "ACE" Programme

The Action by the Community relating to the Environment (ACE) is the object of the Council Regulation (EEC) N°2242/87 (OJ No L 207, 29.7.87). It was established in order to ensure the full realisation of the objectives formulated in the different action programmes of the European Community on the Environment.

The "ACE" programme provides grants to demonstration projects on the following subjects:

a) development of clean technologies;

b) development of techniques for recycling and reusing waste;

c) development of techniques for locating and restoring sites contaminated by hazardous wastes and/or hazardous substances;

d) development of techniques and methods for measuring and monitoring the quality of the natural environment.

Other fields covered, but under different conditions, are the maintenance of biotopes and the recovery of eroded and deserted land.

The term "demonstration projects" is considered as the setting up and operation of a full-scale facility in order to collect data on its technical and economic viability in order to proceed with the least risk to industrial and commercial exploitation of the technology. The ACE programme does not consider studies, research and development or pilot plant experiences, all of them prior stages to the full-scale demonstration project.

Of the four items considered, the one dealing with clean technologies is the most innovative as the term "clean technologies" refers to any technical measures to be taken in the various industries to reduce, or even eliminate, at source the production of any nuisance, pollution or waste, and to help save raw materials, natural resources and energy. Clean technologies can be introduced at the design stage, with radical changes in the manufacturing process, or into an existing process with separation and utilization of secondary products that would otherwise be lost as contaminants.

Applications for financial support can be sent when a call for tenders for any of the subjects is published in the Official Journal of the European Communities. Financial support granted to accepted projects is a maximum of 30% of the costs.

A call for tenders, dealing with items a) and b) mentioned above was published in the OJ No C 82 of 30.03.88. Before the closing date on 30.06.88, 101 proposals were submitted from eleven Member States. After selection 24 projects from nine Member States were retained. A new call for tenders, dealing with items c) and d) will be published in the course of 1989.

Further information can be obtained from:
J.-M. Junger, E. Murillo, DG XI / A3, CEC, 200 rue de la Loi, B-1040 Brussels. Tel. + 32 2 2351111.

Other Activities Relevant to EC Environmental Programmes

1. EC Biotechnology Action Programme (BAP)

The programme (1985-1989), managed by DG XII/F, is oriented towards medium and long-term objectives essential for the strategic strength of European industry and European agriculture. It deals with the two following aspects:

- establishment of a supportive infrastructure for biotechnology in Europe;
- elimination of bottle-necks which could prevent exploitation by industry and agriculture of the materials and methods originating from modern biology. This aspect can best be dealt with through scientific and technical research as well as training of expert personel.

The Commisssion services are presently preparing a programme proposal for the period 1990-1994 entitled Biotechnology Research for Innovation, Development and Growth in Europe (BRIDGE).

Research and training activities

These activities, managed by the Division of Biotechnology, DG XII/F2, include:

Sub-programme on contextual measures

- Bio-informatics: interface between biotechnology and information technology (data capture, data banks, computer-assisted design, etc.).
- Collections of biotic materials (upgrading and integration of existing collections, enhancement of techniques).

Sub-programme for basic biotechnology

- Enzyme engineering: bioreactors of 2nd generation, stability of enzymes, protein design.
- Genetic engineering: applied to microorganisms important for industries, to plants and soil microorganisms, to animal husbandry.
- Technology of cells cultured in vitro (microorganisms in continuous cultures, regeneration of plant cells, new methodologies for animal cells).
- In vitro tests to screen new molecules created by industry for their biological activity and ossible toxicity.
- Methods of assessing possible risks associated with modern biotechnology.

Research and training activities are implemented through:

- Long-duration training contracts available to both junior and senior research scientists involving travel from one Community country to another.
- Multiannual marginal- or shared cost research contracts with public sector or private research bodies.
- Regular meetings, dissemination of information and results, and on-site visits.

Concertation of national and Community policies

This activity, managed by the Concertation Unit for Biotechnology (CUBE), DGXII/F1, includes information, liaison, evaluation and initiation tasks to ensure that Community policies affecting biotechnology are both relevant and consistent within the Commission and in relation to the outside world.

Current Research Activities on Risk Assessment

The assessment of risks possibly associated to the release of modified organisms in the environment is being studied in the framework of the BAP programme (1985-1989).

The main topics of the programme are:

- Development of specific monitoring techniques, including:
  - development of techniques and markers, others than genes conferring potentially transmissible antibiotic resistance, for the rapid and precise detection of the released organisms in complex biotic systems;
  - development of methods (e.g. toxicological) for evaluating pathogenic properties and effects possibly brought about by modified organisms.
- Standardisation of model ecosystems and limited field trial experiments, including:
  - development of micro-ecosystems to be used at the laboratory and glasshouse level for predicting behaviour of modified organisms, standardisation of microcosm experiments;
  - development of small scale field trial experiments, checking with different soil and environmental conditions, evaluation of survival and location of genetically modified organisms under actual field conditions, determination of competitive differences with non-engineered organisms and of impact on other species, standardization of physical and biological barriers to field testing.
- Study of the stability and possible transfer of genes from released organisms (comprised recombinant vaccines), including:
  - evaluation of the possible transfer of genetic material from the modified organisms to other organisms (horizontal gene transfer), study of the expression of the inserted gene in microcosm and field trial experiments;
  - construction and evaluation of organisms with limited potential of survival in the environment (biological containment);
  - study of stability of vaccines obtained by recombinant DNA techniques and inserted into viable vectors, their possible spread to other related species.

In the framework of BAP more than 6.0 Mio ECU were allocated for supporting the research of 60 laboratories in the Member States involved in 20 transnational projects. These projects started in 1986 and 1987, and in the majority of cases were defined through the revision of BAP. They aim at answering fundamental questions related to safety assessment from the introduction of manipulated organisms in the environment.

International Biotechnology Environmental Release Database (BERD)

Currently, there exists no single collection of information on the release of genetically modified organisms. To fill this gap, the European Community, the United States and other OECD member countries planned the design of an international Biotechnology Environmental Release Database. The scientific content of such a database was discussed at a workshop held in Bethesda in March 1987, with experts from the US and the CEC. This meeting proposed a system architecture with seven classes of information, in interlinked files, including taxonomy, literature, organism, release events, guidelines, directory of related information sources, messages. Feasibility studies are in progress.

Further information can be obtained from:
D. de Nettancourt, I. Economidis, DG XII/F, CEC, 200 rue de lal Loi, B-1040 Brussels. Tel. + 32 2 2351111.

2. EC Community Bureau of Reference

The aim of the programme managed by DG XII/C is to improve analytical methods in the various fields of importance to the European Community i.e. agriculture, food and feed stuff, environment as well as medical analysis, physical measurements and technological tests. For each project the Commission calls upon the most competent laboratories in the Member States to collaborate in studies to improve analytical methods and agreement of results.

Very encouraging results were obtained in the field of environment where differences between laboratory results were drastically reduced in particular in the case of traces of heavy metals (Cd, Hg, Pb, Cu). Improvement of methodologies brought about by the BCR project made it possible to determine accurately Cd and Hg at levels as low as 1ppb, and Se below 1ppm. Obviously reference materials are of great importance to control the analytical methods, therefore many projects include the preparation of such reference materials which are certified by the Commission and can be purchased by any interested laboratory. A total of three hundred reference materials have so far been certified by the CEC.

Ongoing activies include organic compounds such as pesticides, PCB, PAH and dioxines. Particular attention is given to the determination of residues of these compounds in various substances (PCB in oils and fats, pesticides in milk powder, etc.)

In the field of environment the main lines of the present BCR programme are: traces of heavy metals, traces of organic compounds, chemical substances such as methyl mercury, tributyl tin, Cr3-Cr6, organic vapours on workplaces, water analysis and mutagenic tests.

Any laboratory in the European Community concerned by these analytical problems can not only apply to the Commission for complementary information or advice but also submit problems not yet solved.

Further information can be obtained from:
H. Marchandise, B. Griepink, DG XII/C6, CEC, 200 rue de la Loi, B-1049 Brussels. Tel. + 32 2 2351111.

3. OECD Chemicals Programme

The main objectives of the programme are:

- to assist Member Countries in their efforts to protect human health and the environment from the potentially harmful effects of chemicals,
- to facilitate the optimal use of available national resources for the control and prevention of hindrances in the trade of chemicals.

Major areas of concern and main activities cover:

Chemicals Data

This area covers activities to assist Member Countries to develop, acquire and circulate data on chemicals in order to facilitate the practical implementation of the Council Decision on the Mutual Acceptance of Data.

The main activity here is the updating of the OECD Test Guidelines. Special efforts are made to revise methods now used for chemicals safety testing so as to reduce the use and suffering of animals while ensuring the quality and rigour of results. Work on Good Laboratory Practice is also undertaken to promote a common understanding of, and harmonized approaches to technical and administrative matters related to testing and monitoring of compliance.

Chemicals Assessment

Activities grouped under this theme aim at promoting the improvement

of chemicals assessments as carried out in Member Countries and harmonizing related specific components, procedures and approaches. They include:

- the completion of the Compendium of environmental exposure assessment methods for chemicals, in particular methods for source, fate and pathways assessments;
- an information exchange and review of effects assessment methods, in particular methods for ecological effects and teratogenesis;
- the gathering of information concerning practical data estimations methods in use in Member Countries.

Chemicals Risk Management

Focusing on the exchange of information and experience, activities under this theme are designed to assist Member Countries in their efforts to examine and streamline their risk management policies.

They include an information exchange on administrative and legislative measures for chemicals control through the Complementary Information Exchange Procedure (CIEP) and the Chemicals Programme News-sheet issued quarterly.

Other activities, including case studies of risk management approaches to specific chemicals or groups of chemicals are carried out to assist Member Countries in using more comprehensive policies for risk management. Work is also undertaken to facilitate the implementation of the OECD Council Recommendation concerning Information Exchange related to the Export of Banned or Severely Restricted Chemicals.

Cooperation on Existing Chemicals

Activities designed to assist Member Countries to "share the burdens" of work on the systematic investigation of existing chemicals are directed towards identifying opportunities for cooperation, supporting the work among Member Countries to test, review or assess specific existing chemicals. They include:

- the regular updating and analysis of the EXICHEM data base;
- support of Member Countries' efforts to reach cooperative agreeements and to carry out investigations of chemicals of common concern;
- identification of further cooperative work which might be undertaken in OECD.

Accidents Involving Hazardous Substances

Drawing on the guidance provided by an OECD Conference on Accidents Involving Hazardous Substances held in France in 1988, activities in this area include: (i) an exchange of information and experience on accident prevention and effects; (ii) an analysis of specific issues of mutual concern; (iii) development of common principles, procedures and policy guidance (such as a code of goodpractice). They also include a follow-up to the OECD Council Acts in this area on the exchange of information among Member Countries concerning installations which may cause transfrontier damage in the event of an accident. Information to the public concerning hazardous installations, and participation in decision-making processes related to accident prevention and response are part of it.

Environmental Aspects of Biotechnology

An integrated OECD programme coordinates the activities of the Environment Directorate and the Directorate for Science, Technology and Industry. The two projects led by the Environment Directorate concern administrative and legislative aspects of the control of genetically modified organisms released in the environment and analysis of monitoring methods and data requirements to identify promising approaches for evaluating such releases.

Further information can be obtained from:
Dr. J. Brydon, Head of Chemicals Division,
OECD, 2 rue André Pascal,
F-75775 Paris Cedex 16.

4. FAO European Cooperative Networks (Escorena Programme)

These networks managed by the United Nations Organisation, Regional Office for Europe, consider problems of regional cooperation in the developed countries and their incidence eventually in developing ones. This programme is carried out through the cooperation and collaboration of several European and extra-European networks.

European Cooperative Network on Trace Elements

The study of trace elements has acquired importance in recent years considering the nutritional evolution of man, the necessity of finding more sophisticated feedstuffs for an ever-increasing agricultural production, the problems of industrial fall-out and that of absorption of these trace elements into soils. Elements considered essential for plants are Fe, Mn, Zn, Cu, B, Mo; while animals also need among others I, F, and Co. This list has been extended with Va, Cr, Ni, Se and others such as Li, Si, Al, Ti etc. which may also be beneficial. The study of their occurence and role is linked to the possibilities of analytical methods. As these become more sensitive, the larger context of environmental studies will include presence, mobility and impact on living organisms of these trace elements. Besides requirements and presence, as a result of industrialisation and population density increases, excessive applications have resulted in a pollution sometimes difficult to eliminate. Therefore the cycling of mineral elements, the control of the dispersion and their immobilisation are important subjects of research.

The following different aspects have been included in the European Cooperative Network Programme which started in 1977:

- Estimation of trace element status by chemical, soil and plant analysis.
- Evaluation of the effect of trace elements in animal and human nutrition.
- Passage of airborne trace elements to agricultural soils.
- Status of trace elements in food.

Each of these topics is the subject of a subnetwork of research with a liaison centre in different countries (Coordination centre: Dr. A. Gomez, Station d'Agronomie, INRA, Domaine de la Grande Ferrade, F-33140 Pont de la Maye.).

Collaborative relationships were established with the COST Project 681, especially through the organisation of joint workshops (see p. 10).

Further information on the European Cooperative Network on Trace Elements can be obtained from:
Dr. A. Gomez, address as above.

European Cooperative Network on Animal Waste Utilization

Fertilizer and energy values of animal waste are of great interest to many countries including the European Community concerned with production costs and improving the quality of the environment.

A Network on Animal Waste Utilization has been set up in 1976 by the Food and Agriculture Organisation of the United Nations to improve cooperation in this field. It considers:

- Influence of animal manure handling and utilization systems on animal and human health.
- Volatile emissions and their control in animal production.
- Technical aspects of animal manure utilisation.
- Economic use of animal manure as a fertilizer without causing environmental hazards.
- Soil capacity for animal wastes.

Each of these topics is the subject of a subnetwork of research with a liaison centre in different countries (Coordination centre: Dr. P.E. Lohm, Swedish National Board of Agriculture, Lantbruksstyrelsen, S-55183 Jönköping).

Collaborative relationships were estalished with the COST Project 681, through the organisation of joint workshops (see p. 10).

Further information on the European Cooperative Network on Animal Waste Utilisation can be obtained from:
Dr. P.E. Lohm, address as above.

5. WHO International Programme on Chemical Safety

The International Programme on Chemical Safety (IPCS) was established as a cooperative United Nations venture in June 1980 in order to respond to the needs of Member States for information and guidance in the safe use of chemicals.

The objectives of IPCS are:

- to carry out and disseminate evaluations of the risk to human health and the environment from exposure to chemicals, mixtures of chemicals or combinations of chemical, physical and biological agents;
- to promote the development, improvement, validation, and use of methods for laboratory testing, ecological and epidemiological studies as well as those for the evaluation of health, environmental risks and hazards from chemicals;
- to promote technical cooperation with Member States, in particular developing countries, including the strenghtening of infrastrutures related to production, importation, transport, storage, use and disposal of chemicals; and
- to promote training of the required manpower.

Much of the technical work is undertaken through a network of participating institutions officially designated by Member States in the Memorandum of Understanding (M.O.U.) signed by 21 participating countries. Official cooperation has been established with the CEC, OECD and other organizations.

Chemical safety covers the prevention and management of short-and long-term adverses effects to humans and the environment. The evaluations resulting from the Programme provide the scientific basis on which Member States may set their chemical safety regulations. These are contained in specific documents entitled

- *Environmental Health Criteria (EHC)* designed to establish policies for the safe use of chemicals; 81 such documents on potentially toxic chemicals have so far been published.
- *Health and Safety Guides (HSG)* containing toxicity information in non-technical language to provide practical advice on storage, handling, disposal, accident prevention, health protection measures, etc.; 23 HSGs have been published.
- *International Chemical Safety Cards (ICSC)* summarizing essential product identity data, health and safety information; 75 ICSC are in preparation.

The toxicological risks of chemicals in food, including additives and contaminants, pesticides and veterinary drug residues have been evaluated by IPCS in collaboration with FAO. Where possible, acceptable daily intakes (ADIs) or other enpoints of assessment have been set. Principles for toxicological testing and evaluation are also established. The Joint FAO/WHO Expert Committee on Food Additives has evaluated over 700 compounds used in industrial production as well as numerous contaminants. Two hundred pesticides which occur as residues in food have also been evaluated.

A computerized data base for chemicals currently being tested for toxic effects other than carcinogenicity is operated jointly by IPCS and the International Register of Potentially Toxic Chemicals (IRPTC) of the United Nations Environmental Programme (UNEP). A listing of these chemicals is issued twice a year.

Methodologies for risk assessment and related scientific principles are published in the EHC series, and so far 11 have been issued. Through the Programme, the scientific basis for harmonizing testing of chemicals is established and test methods are validated.

Chemical accidents are of growing concern in all industrialized developed and developing countries. An annotated check list has been produced to provide useful information concerning hazards during manufacture, storage and transport of chemicals.

Acute poisoning by chemicals is one of the survey topics undertaken jointly also with the CEC (report published in *Journal de Toxicologie clinique et experimentale, 1988, N° 5)*. Guidelines for setting up poison control centres have been prepared. In 1988 IPCS launched the preparation of a trilingual computerized poison information package for developing countries. A report has been prepared on the availability of antidotes giving advice on how to improve availability. A manual on analytical toxicology for hospital laboratories in developing countries and a hanbook on poisonings for primary health care workers are being drafted and will be available in late 1989.

Training programmes are organized, in particular, in risk assessment and in the interpretation of toxicological data in chemical safety, decision-making and regulation as well as in specialized areas of toxicology, such as clinical toxicology and poison control. Each year, 5-10 courses are held in different parts of the world.

Further information can be obtained from:
Dr. J.A. Haines, IPCS,
Division of Environmental Health,
WHO, CH-1211 Geneva 27.

Announcements

European Symposium on Science, Technology and European Cultural Heritage

Organised by the Commission of the European Communities in association with the National Research Council of Italy (CNR), the University of Bologna and the City of Bologna, it will be held in Bologna (Italy), on 13-16 June 1989.

The preliminary scientific programme includes:

- General overviews of the current state of and risks to European cultural heritage.
- Environmental, climatic, geographic factors and microclimate.
- Mechanisms, measurements and definitions of damage to cultural materials and items.
- The science and technology of environmental protection, conservation, restoration and maintenance of cultural heritage materials and items.
- Associated developments, e.g. in modelling, data banks, standards, training needs, the role of industry, etc.
- Multidisciplinary case studies from various parts of Europe will be used to illustrate the above issues.

Further details can be obtained from:
- A. Sors, DG XII/E, CEC,
  200 rue de la Loi, B-1049 Brussels,
  Telex 21877 COMEU B. Fax + 32 2 2363024.
- C. Sabbioni, CNR, Istituto FISBAT,
  via de' Castagnoli 1, I-40126 Bologna.
  Telex 511350 CNR BO. Fax + 39 51 229702.

Fifth European Symposium on Physico-Chemical Behaviour of Atmospheric Pollutants

Organised by the Commission of the European Communities within the framework of the Concerted Action Physico-Chemical Behaviour of Atmospheric Pollutants, COST Project 611, it will be held in Varese (Italy), on 25-28 September 1989.

The scientific programme covers the following topics:

- Development of analytical methods to measure trace components of the atmosphere.
- Atmospheric chemical and photochemical processes.
- Field measurements and their interpretation.
- Discussion meeting of the joint EUROTRAC-COST Projects LACTOZ and HALIPP.

Supplementary information can be obtained from:

- G. Restelli, CEC-Joint Research Centre,
  Ispra Site, I-21020 Ispra.
  Tel. + 39 332 789225. Telex 324878 EUR I.
  Telefax + 39 332 789001.
- G. Angeletti, DG XII/E1, CEC,
  200 rue de la Loi, B-1049 Brussels.
  Tel. + 32 2 2358432. Telex 21877 COMEU B.
  Telefax + 32 2 2350145.

Fifth European Conference on Biomass for Energy and Industry

Conference organised by the Commission of the European Communities in cooperation with Portuguese Authorities will be held in Lisbon (Portugal), on 9-13 October 1989.

The Conference will consider the following areas of particular interest to alternative agriculture:

- Biomass production and harvesting.
- Biochemical conversion processes.
- Conversion to industrial and chemical products.
- Thermochemical conversion technology.
- Biomass production implications in the European context.
- Biomass development and utilisation in decentralised systems.
- Biomass development and utilisation in integrated systems.
- Biomass production and utilisation in developing countries.

Further details can be obtained from:
G. Grassi, DG XII/F, CEC,
200 rue de la Loi, B-1049 Brussels.
Tel. + 32 2 2356801. Telefax + 32 2 2350145.

Intensive Course in Marine Biogeochemistry

The Course is organized jointly by the European Institute for Advanced Studies in Oceanography and the European Association of Marine Sciences and Techniques with the support of the Council of Europe and the Belgian Ministry for Education. It will be held in Villefranche sur mer (France) on 28 August-15 September 1989.

The course is of general interest and is intended to train scientists for the European River Ocean System Study Programme (EROS 2000) launched in the framework of the STEP (Science and Technology for Environmental Protection) Programme of CEC DG XII, for the International Joint Global Ocean Flux Study Programme (JGOFS) and for the International Geosphere, Biosphere Programme (IGBP).

Further information can be obtained from:

- A. Disteche, European Institute for Advanced Studies in Oceanography, Oceanology B6, University of Liège, B-4000 Liège. Tel. + 32 41 563320 or + 32 41 714080.
- R. Cuignon, AESTM Secretariat, Institut de Géologie du Bassin d'Aquitaine, 351 Cours de la Liberation, F-33405 Talence, Cedex.

Information

EROS 2000 Project

The Natural Environment Research Council of the UK has made available to the CEC-funded EROS 2000 Project the Royal Research Ship Discovery with Dr. R.F.C. Mantoura chief scientist responsible for the organisation and management of the first European research cruise to investigate the inputs, chemical and physical reactions and fate of riverine and atmospheric pollutants in contrasting coastal marine environments of Europe.

The cruise consisted of two legs of two weeks each (13 December 1988-17 January 1989) involving 32 marine scientists from 12 laboratories within 7 EC countries.

A report of important results obtained when all samples have been analysed in the laboratory will be available in due time.

European Environment Review

Multidisciplinary journal which aims to provide a forum for information and views on international environmental policy. It is dedicated to strengthening the links between persons working in government, industry, science, trade unions and non-governmental organisations to foster international progress in the protection in environment. It is published quarterly in English, French and German.

Information can be obtained from the Editor Cynthia Whitehead, 23 Av. Gl. Eisenhower, B-1030 Brussels.

Network for Environmental Technology Transfer (NETT)

Stemming from an initiative by the CEC within the framework of European Year of Environment, NETT has been formally established as an independent, non-profit association run by and for its members.

The aim is to help the exchange of know-how between companies and organisations in the rapidly developing field of clean and low-waste technologies. It will also supply information on more efficient and cost-effective pollution control technologies.

NETT seeks to stimulate the wider adoption of such technologies by bringing together producers and industrial users of these technologies in a network which includes scientific consultants, industry and trade associations, university research departments and chambers of commerce.

Further information can be obtained from:
NETT Secretariat, rue de la Science 5,
B-1040 Brussels.

Note from the Editor

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

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